



SP Distribution Environment & Innovation Report

2022/23

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Executive summary

In this, our final Environmental and Innovation Report for the last year of RIIO-ED1, we provide an overview of our environmental and innovation performance and give progress updates on our RIIO-ED1 commitments.

SP Energy Networks (SPEN) provides a critical service, and over the course of 2022/23 we worked tirelessly to ensure our network operates safely and reliably to deliver electricity to the 3.5 million customers spread across our SPD and SPM licences. As we conclude our RIIO-ED1 work programme, and begin RIIO-ED2, SP Energy Networks continues to plan the development of our network to ensure that we service all our customers, with a particular focus on those most vulnerable.

We must balance our role supporting the green revolution with our ambition to lead by example. We are committed to becoming a fully sustainable networks business and will play our part in enabling societal decarbonisation whilst ensuring our activities have a net positive impact on people and planet. We are proud to be leading the way towards a Net Zero Carbon future, and this report highlights our ongoing work to manage the network and its impacts, deliver network improvements and enable the connection of low carbon technologies, whilst demonstrating our progress on all aspects of sustainability. SP Energy Networks have now set validated Science Based Targets across all scopes to ensure we are reducing our direct and indirect carbon footprint in line with the latest climate science to ensure global warming is limited to 1.5°C above pre-industrial levels.

In 2022/23 we achieved a 42% reduction in our combined (SPD and SPM) carbon footprint, excluding losses, compared to our 2013/14 baseline, putting us firmly on track to reach our target of an 80% reduction by 2030. We

also continued to drive forward innovations to implement sulphur hexafluoride (SF₆) free technologies. We were recognised as the ‘Best Company’ in the 2022 Planet Mark awards, for continuous commitment to the green energy transition and outstanding results in reducing our carbon footprint.

Through the installation of Low Carbon Technologies in their own homes and businesses, our customers are increasingly becoming ‘prosumers’ opening up opportunities to manage flows of energy on the network in a more hands-on way. In 2022/23, we installed a total of 17,876 Low Carbon Technologies. This includes the facilitation of Heat Pumps, PV and Electric vehicles.

We are acutely aware that we can’t decarbonise without bringing our supply chain along with us. That’s why we have been working closely with the Supply Chain Sustainability School to support our suppliers and make sure they have the necessary tools to begin mapping out their own route to Net Zero Carbon.

We want to be the trusted partner our communities know have the best interests of people and the planet at heart. We are only at the start of the long journey to Net Zero Carbon, but we will continue to work in collaboration with all our partners, while taking bold actions to create a better future for all. We welcome your [feedback](#) on the information included as part of this report, which is invaluable as we look to deliver our vision to become a fully sustainable networks business.

Who We Are

It's our job to move electricity to and from homes and businesses over our network. We don't sell electricity and we don't issue electricity bills; that is the role of an electricity supplier.

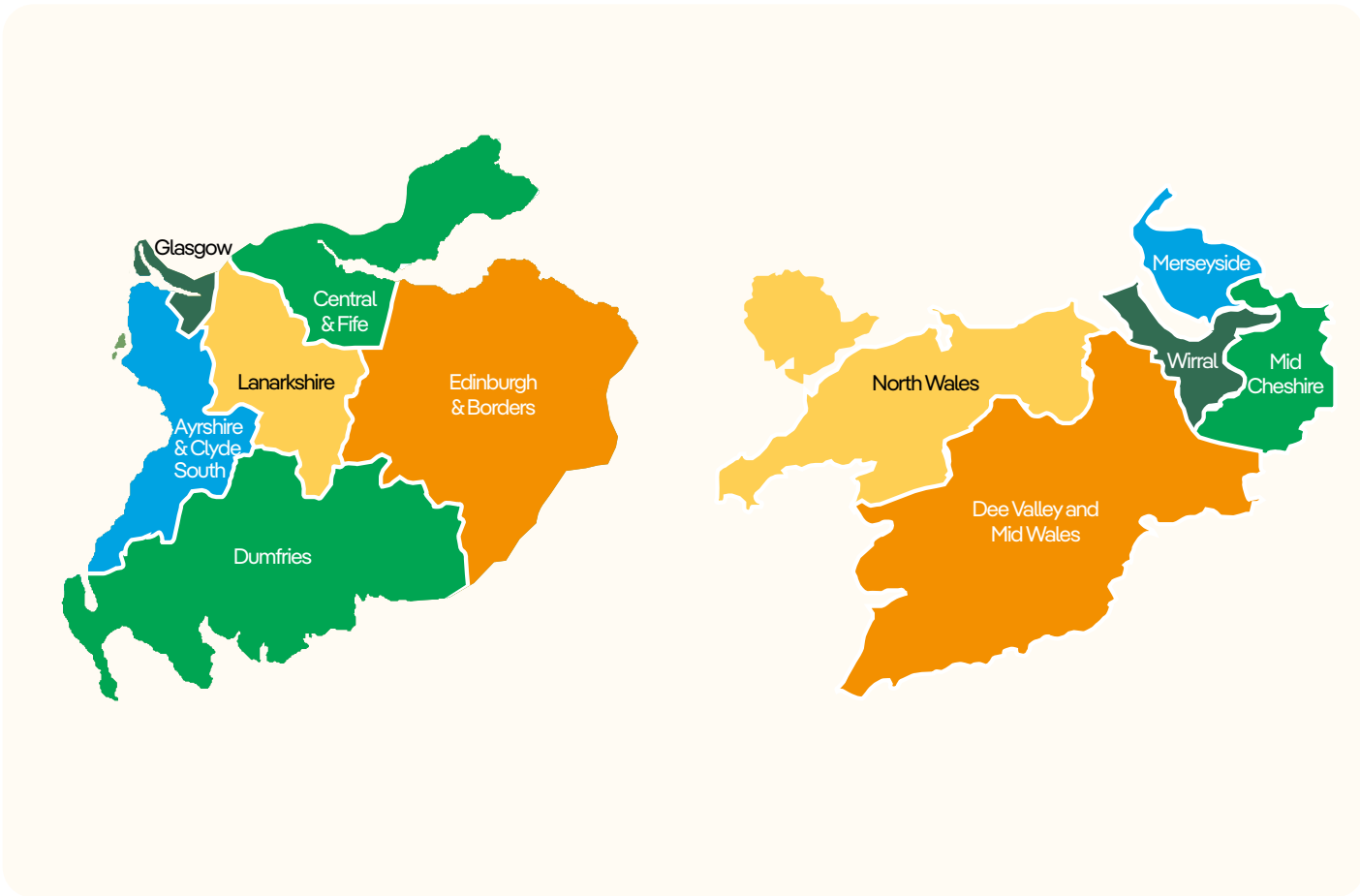
We have 34,000 substations (1 for every 100 customers), 38,000km overhead lines (that's once around the globe!) and 69,000km underground cables.

We operate in three of the UK's largest cities (Liverpool, Glasgow & Edinburgh) accounting for 1.6m (43%) of our customers, as well as three significant rural areas (North Wales, Scottish Borders and Dumfries & Galloway).

We are substantial employer with a distribution workforce of 2,600 internal employees made

up of field staff, engineers, technical specialists, customer service and support staff based at 17 locations in the South of Scotland and 17 locations in England and Wales. We utilise around 2,500 contractors across these areas.

Our highly trained and specialist staff work 24/7 to maintain the performance and safe condition of our electricity network, respond to customer enquiries and restore the supply as quickly as possible when a fault occurs on the network.



Sustainable Business Strategy

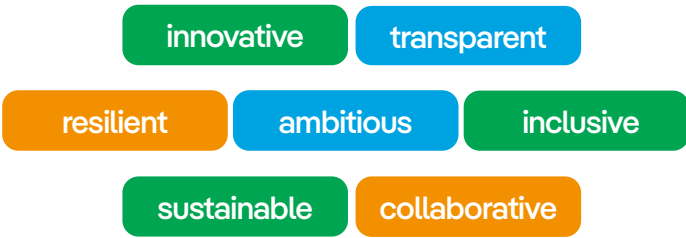
The SP Distribution Network sits at the heart of the UK's Net Zero Carbon transition.

As a distribution network operator, we have a clear role to play in developing and maintaining the smart network of the future, which will facilitate the decarbonisation of our society.

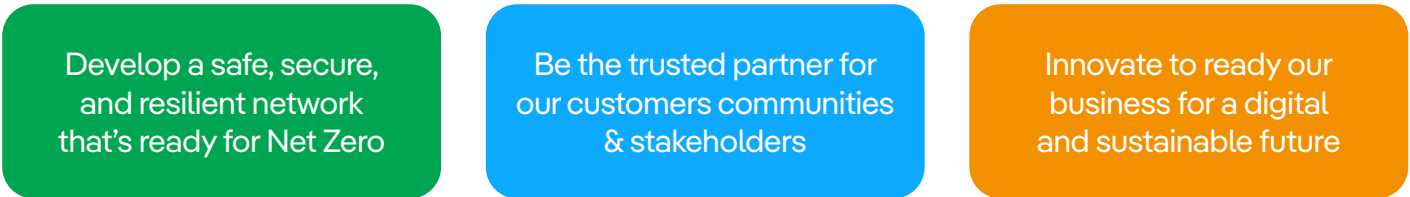
Our Sustainable Business Strategy has been developed through several years of collaboration with our stakeholders and is regularly updated in response to internal and external policy developments in order to ensure that our business continues to manage the transition to a low carbon energy system over short, medium and long-term timelines.

Sustainability Principles

While delivering the electricity network we commit to being...



These principles flow from our SPEN corporate pillars and are at the forefront of our vision, mission and goals.



Alignment with The United Nations' Sustainable Development Goals

As part of the global Iberdrola group, we align to the United Nations Sustainable Development Goals (SDGs) and actively use the SDGs to guide the development of our business plans and strategies.

As an electricity network operator, our core reason for being focusses on enabling the connection of clean energy generation to our network and transporting this to end users. Therefore, our greatest contributions are to goals:



However, when considering the breadth of our activities on areas such as net zero carbon work and skills, network construction and maintenance, working collaboratively, diversity and inclusion, digitalisation and customer service we make a significant contribution, directly or indirectly, to the wider SDGs. Through internal and external collaboration, we mapped the SDGs to our key sustainability priorities at the centre of the diagram below.

UN Sustainable Development Goals



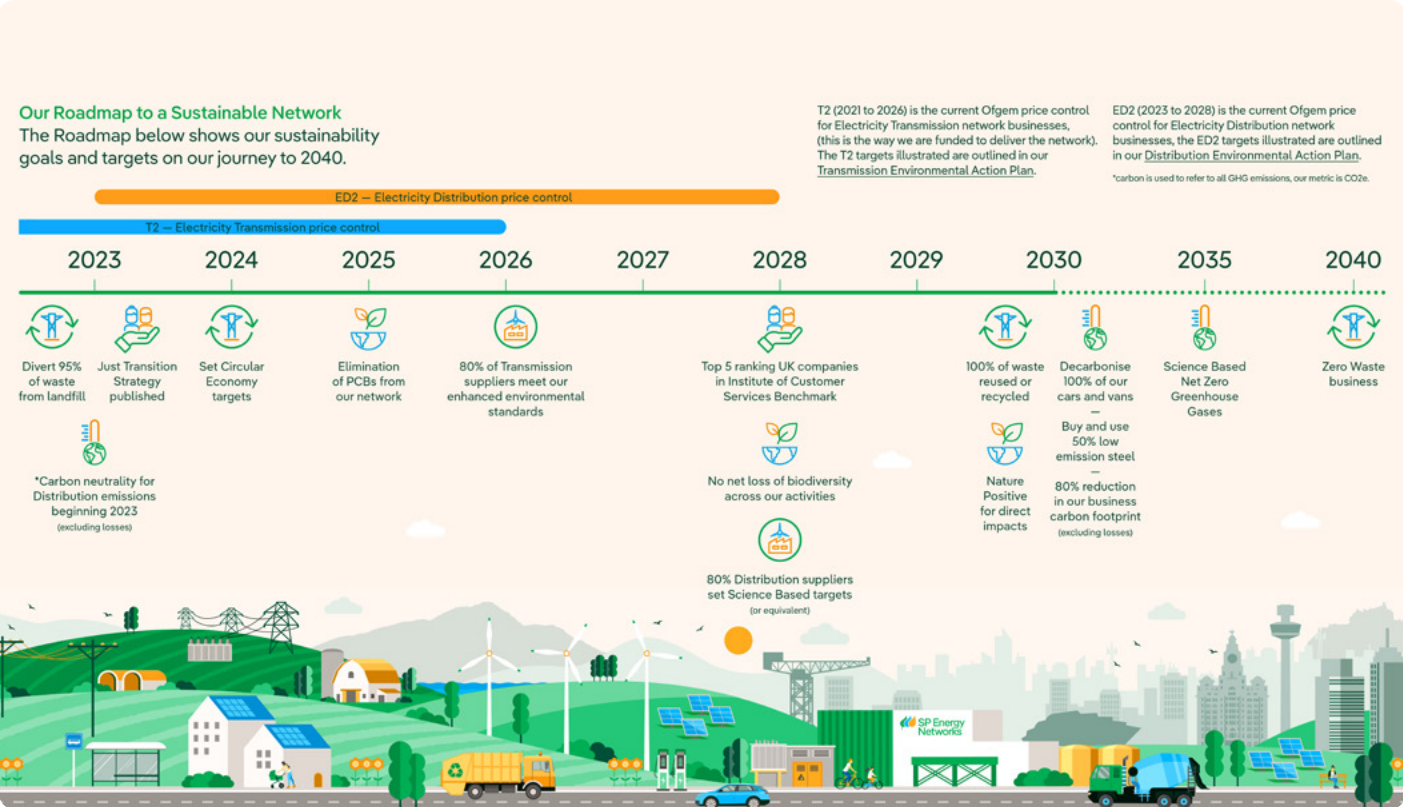
Purpose of this Report

We play a critical role in the Low Carbon Transition, efficiently managing and developing our network to support our stakeholders in meeting UK and devolved Government carbon reduction targets

We also seek to reduce our own impacts, aiming to achieve neutral or positive environmental and social impacts from our direct operations. Our RIIO-ED1 Business Plan for 2015–2023 set out our goals and targets to reduce the impacts of our network in these key areas (see Business Plan Commitments below). The delivery of these commitments is realised primarily through capital investment and innovation activity.

This report provides stakeholders with a transparent account of our commitment to environmental matters and a progress update on the delivery of these commitments. The report also updates stakeholders on the continuing development of our Sustainable Business Strategy and the other progressive changes we are making in pursuit of becoming a sustainable networks business (please also see [Appendix 1 SPM](#), [Appendix 2 SPD](#) and [Appendix 3 Reporting Table Commentary](#)).

Our Roadmap to a Sustainable Network



Business Plan Commitments

These commitments, and our progress towards meeting them, are discussed in the relevant sections throughout the report.

Commitment	RAG
Managing our Environmental Impact	
Install oil containment around all new and high-risk plant containing high volumes of oil.	●
Engage on the environmental impacts of our developments from a very early stage	●
Underground 85km of Overhead Lines in Areas of Outstanding Natural Beauty	●
Reduce oil leaks by 50% through replacement of poorly performing 132kV cable in SPM	●
Reducing Carbon Impact and Climate Change and associated environmental improvements	
Reduce our carbon footprint (excluding network losses) by 15% by 2023	●
Use electronic vehicle management system to optimise our vehicle utilisation keeping vehicle numbers, broadly similar in RIIO-ED1	●
Utilise low carbon alternatives to travel, through the use of technology and smarter ways of working	●
Increase the use of electric vehicles and charging points	●
Monitor and reduce energy used within our substations, invest in lower carbon buildings and reduce energy use in existing buildings	●
Install lower loss transformers to reduce losses by 50% at more than 1,100 of our secondary substations	●
Carry out “Smart” asset replacement –using future proofed assets where justified	●
Exceed the IEC international standards for SF ₆ switchgear by specifying a maximum leakage rate five times more stringent for 33kV and below, and twice as stringent for higher voltages	●
Our role in the Low Carbon Transition	
Connect 4.5GW of Distributed Generation by 2018 with 5.5GW of generation connected to our network by 2023	●
Identify Low Carbon Technology hotspots using network monitoring data from Smart Meters and Stakeholder Engagement	●
Utilise Smart technology to ensure all generation sources are supported quickly	●
Reduce costs to customers by developing modern “Smart Grid” network solutions	●

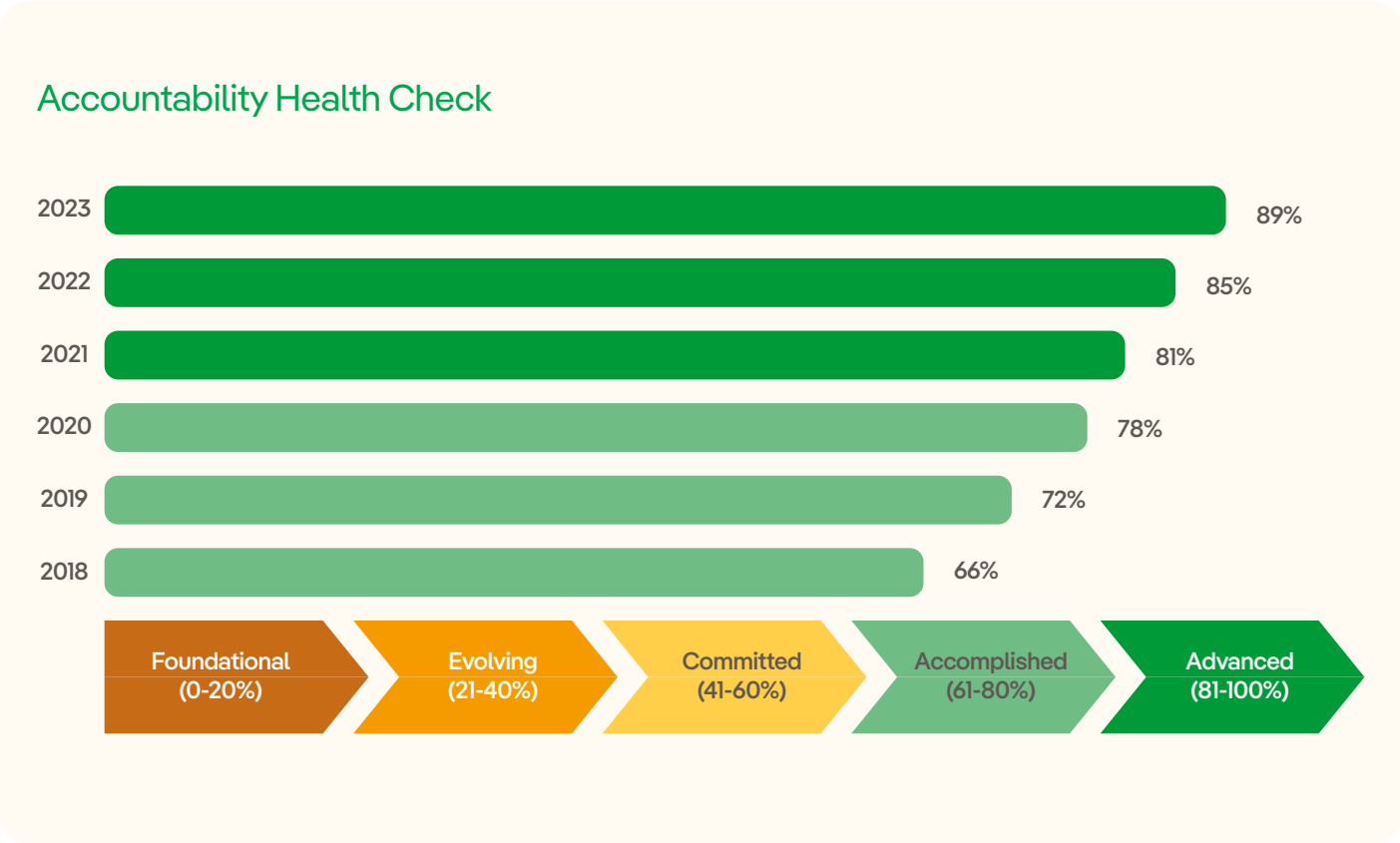
Stakeholder Engagement

Stakeholder engagement is central to everything we do. Our inclusive and proactive approach means we have a broad range of stakeholder contributions to our business plans, strategies and projects from the outset and throughout.

All of our strategies and businesses plans are developed in collaboration with our stakeholders, and we continue to engage throughout their duration to ensure our activities and approaches meet expectations. Our engagement strategy is driven by our CEO and Executive Team, supported by the Central Stakeholder Engagement Team and embedded across our entire organisation, regardless of the engagement topic.

Engaging in an effective and meaningful way means stakeholder feedback shapes our business decisions from Board level to our operational teams, with every decision we make aligning to our overarching strategic goals as guided by our customers and stakeholders. Together, we will ensure our efforts and investments are producing meaningful outcomes for a sustainable network and a better future, quicker.

Our strategic priorities as a business are developed through extensive engagement with our customers and stakeholders to ensure we are delivering a business in line with their needs and preferences. These priorities flow through everything we do, providing key focus and strategic direction to all our activities and business decisions and are directly embedded across our entire organisation.





We continue to align our stakeholder engagement strategy with the Stakeholder Engagement Standard AA1000 set by AccountAbility, the owners of the global standard. Every year we are audited against this standard, supporting our efforts to assess, design and implement our integrated approach to stakeholder engagement.

It involves providing material evidence and detailed interviews with employees across 10 areas of the business from Directors to external stakeholders. This year we scored Advanced, holding our place in the highest categorisation possible and in the top 10% of companies assessed globally. This demonstrates our strong commitment to stakeholder engagement and our efforts to embed engagement into our organisational strategy, governance and operations.

We were recognised as the ‘Best Company’ in the 2022 Planet Mark awards, for continuous commitment to the green energy transition and outstanding results in reducing our carbon footprint in all aspects of our processes.

2023 saw the launch of our Just Transition Strategy [Our Just Transition Strategy - SP Energy Networks](#)

Our Just Transition Strategy, the first of its kind for a UK electricity network company, summarises the steps we will take to embed the principles of a fair and equitable transition into everything we do. It lays out our track record and future plans to support customers and enable transformational change to ensure a more sustainable future for all.

Our robust embedded engagement model enables every team in our business to identify and engage with stakeholders to understand their needs and preferences. This is underpinned by a strong annual programme of core engagement that looks at the strategic issues facing our stakeholders and legitimises top-down changes in our strategic approach. For a summary of past and upcoming events, see [Events & Panels - SP Energy Networks](#).

For full details of our stakeholder engagement strategy, see: www.spenergynetworks.co.uk/pages/stakeholder_reports.aspx

Managing Our Environmental Impact

Our vision is to be a sustainable networks business, embedding the principles of sustainability in our decision making to efficiently manage and develop our network in support of the low carbon transition and to achieve neutral or positive environmental and social impacts

Key to this is our robust Sustainable Business Strategy, which supports our progression towards:

- Net positive impact on the environment and the communities in which we operate;
- Protecting and continually enhancing the biodiversity, land, and water around our assets, and in support of national and local strategies; and
- Incorporating the principles of Natural Capital Assessment in our decision-making processes to ensure that levels of natural assets are at least protected, if not enhanced.



Environmental compliance underpins the delivery of all our strategic aims. We have held continuous certification to the ISO14001 Environmental management standard since 1997 and in October 2021 we again achieved recertification. To achieve this, we continued to focus on our Environmental Aspects and Impacts, which enable us to identify our key environmental risks and improve the controls for these environmental risks from our activities. These measures enable us to continuously improve our environmental performance and to meet our targets. In 2021 and 2022, our depots were reviewed for the pollution prevention arrangements in place to ensure that we have the necessary controls and resources available for day-to-day operations and for responding to incidents. We continue to implement the actions that these reviews have produced, including substantial investment in the pollution prevention measures at our depots. We continue to use the reporting tool, OneHS to assist in measuring and driving compliance for Health, Safety and Environmental issues. OneHS is used to record environmental incidents and to track the actions taken to resolve issues, such as actions arising from audits, together with details of any intervention by an environmental regulator, where relevant. The data is then collated by our central Sustainability Team and provided to the relevant business areas in graphs and pie charts. The data is further used to present and discuss specific trends at Director-level meetings, in monthly environmental data packs to district staff, on monthly environment calls and via other options to ensure lessons learned can be shared across the business.

Key Priority Areas



Environmental
Management



Climate
Action



Action for
Nature



Circular
Economy



Supply
Chain



Sustainable
Society

Since their introduction, our Key Priority Areas have underpinned our strategy for managing our environmental impact and delivering wider sustainability.

Their introduction has enabled us to communicate the priorities and their associated objectives to a broad audience, enabling improved understanding and greater recognition of environmental and sustainability successes.

Several of our Key Priority Areas are connected to reducing our environmental impacts, helping us to focus on biodiversity, land, waste minimisation and water outcomes and driving our progress year on year. In this first section of the report, we will focus on key pollution risk reduction measures, biodiversity impacts of our operations, and waste minimisation. For more information on enhancing biodiversity, please see the Biodiversity section within Other Environment Related Activities. We have continued to provide environmental training courses, either in electronic form or trainer led, on the key environmental topics for our workforce.

A new course has been added in the past year, focussed on sharing key sustainability information and driving ownership of our sustainability commitments and we continue to review our training needs and expand our course content as required. As these courses are key environmental activities, we track the completion of the planned training and report it to our colleagues throughout the business along with the other environmental metrics that we track and report on.

We have begun a review of the training needs for key operational roles and started to develop an internal certification process that ensures environmental competency is managed in the same manner as health and safety.



Visual Amenity

Historically, Distribution networks in the UK have been constructed using overhead lines, taking the most expedient route towards electricity consumers. We have over 38,000km of overhead lines supported on over 600,000 poles and towers across our operating area. Some of these assets are located in or adjacent to protected sites such as National Parks, Areas of Outstanding Natural Beauty (AONB) and National Scenic Areas (NSA) as these areas have become designated in the passage of time. These overhead lines may impact upon the visual amenity of the sites and visitors' enjoyment of them. A fund is available to network operators for mitigating visual impacts associated with pre-existing electricity distribution infrastructure by removing selected overhead lines and replacing them with underground cables. Using this fund, our approach is to proactively underground overhead lines that have the greatest level of impact in nationally designated and protected landscapes, using the five-stage process:

1. Develop approach to initiation and identification of distribution infrastructure.
 2. Meet with relevant stakeholders.
 3. Review nominations from relevant stakeholders.
 4. Develop and implement undergrounding proposals.
 5. Review undergrounding work.

Using this process, we are engaging with stakeholders to consider and prioritise the undergrounding of lines located in AONBs, National Parks and NSAs during the RII0-ED1 period, assessing lines in the following locations:

In our SPM licence Area

- Snowdonia National Park
- Shropshire Hills
- Bryniau Clwyd A Dyffryn Dyfrdwr
- Llyn Peninsula
- Ynys Mon/Anglesey

In our SPD licence Area

- Loch Lomond & Trossachs
- Nith Estuary
- Eildon & Leaderfoot
- Upper Tweeddale
- Fleet Valley
- East Stewartry Coast
- Northumberland Coast

This prioritised list has resulted in the completion of five SPM projects in 2022/23, shown in the table below.

Progress of Visual Amenity Mitigation Projects SPM & SPD in 2022/23

Location of OHL	Designated Site	Licence Area	Lines removed (km)	Underground lines installed (km)
Rhoscolyn Anglesey	Ynys Mon/Anglesey	SPM	0.00	1.04
MYNYTHO COMMON	Lyn Peninsular	SPM	1.01	0.79
LV AONB Dolwyddelan	Snowdonia National Park	SPM	0.32	1.32
Bodorgan Est, Anglesey	Ynys Mon/Anglesey	SPM	0.29	0.26
ABERFFRAW	Ynys Mon/Anglesey	SPM	0.35	0.34

Our process enables key stakeholders to play a crucial role in the identification, planning and delivery of visual amenity enhancing projects.

This collaborative activity results in a priority list agreed with the local communities. SPEN staff then proactively meet with local authority planning teams to understand local opinion and to facilitate further engagement as projects are developed and delivered. Further information can be found in [Appendix 1 SPM](#), [Appendix 2 SPD](#) and [Appendix 3 Reporting Table Commentary](#).



Aberffraw in Ynys Mon/Anglesey before OHL removed

All sites benefiting from visual amenity programmes had intrinsic values including remote tranquil settings, high altitude exposure, and high visitor numbers due in part to their inclusions in national trails.

We fell short of our target of undergrounding 85km by the end of ED1. Only 17km were underground as many projects were scheduled towards the end of ED1 and were delayed due to the Covid-19 pandemic. However, we have a full programme of works heading into ED2.

Below are views before and after 0.35km of overhead lines were removed and replaced with 0.34km of underground cable in Aberffraw, located within the Ynys Mon/Anglesey designated site.



Aberffraw in Ynys Mon/Anglesey after OHL removed

Oil Leakage

Oil is traditionally used as an insulating medium for assets employed in the distribution of electricity, including transformers, circuit breakers and underground cables.

Although great care is taken to ensure oil does not leak from equipment through regular site visits and maintenance activity, some oil has historically escaped from equipment. This has the potential to cause pollution of nearby soils or watercourses or cause other related environmental damage.

To limit the release of oil in the environment we are undertaking a civil asset review in conjunction with the planned modernisation of our network. Based on the condition of the asset and nearby environmental receptors, the assets that pose the greatest risk of environmental harm are prioritised for replacement or mitigation works.

The modernisation or replacement of our transformers includes aspects of environmental mitigation such as building on low permeability concrete plinths and constructing bunds to surround the oil containing equipment. Bund enclosures are designed to retain liquids, particularly oil, to a volume of 110% of the oil contained in the equipment. A proprietary instrument detects if oil is contained within liquids. This activates an alarm, which a staff member will then attend site to investigate and assess what action to take on the oil leak.

Works are underway for the six SPD sites and at the three SPM sites listed. Transformer bunding replacement projects may take place over several years. The table adjacent shows work carried out in the 2022/23 reporting year. A significant number of upgrades are being planned for ED2.

In addition to carrying out the works detailed in the table, we also make use of MIDEL 7131 Synthetic Ester transformer oil at sensitive sites. Midel oil is fire safe and non-toxic but is more expensive than traditional transformer oil. We use Midel oil at sites with sensitive health and safety or

environment factors, such as substations located near watercourses or those substations providing electricity at locations with an increased impact of fire.

Site Name	Licence Area
Kilmarnock Primary 1	SPD
Kilmarnock Primary 2	SPD
Ardgour Drive	SPD
Craigendoran	SPD
Newton Stewart	SPD
Dollar	SPD
Huntington	SPM
Ferodo	SPM
Ffordd Las	SPM
Total Cost	£1.09M

SPEN owns and operates a number of underground fluid filled cables, which were historically installed as an alternative to overhead lines. There are 31km of fluid filled cables within SPD and 152km within SPM. Fluid filled cables have been part of the network since the 1930's and were traditionally filled with a heavy mineral fluid with low biodegradability. The fluid used has been improved and since 1986, top ups to cables have been made using a light synthetic biodegradable fluid.



Fluid filled cables are monitored by pressure alarm systems. An alarm from one of these systems indicates a drop-in pressure and a potential leak from the cable. Once the alarm is triggered, detecting the exact point of the leakage can prove difficult, especially when the leaks are small. Traditionally, fluid leak location has been conducted via freezing the cable fluid with liquid nitrogen and then monitoring the cable pressure either side of the freeze or by tagging with Perfluorocarbon PFT tracer. Oil sniffing dogs have also been used to successfully detect leak locations for some leaks.

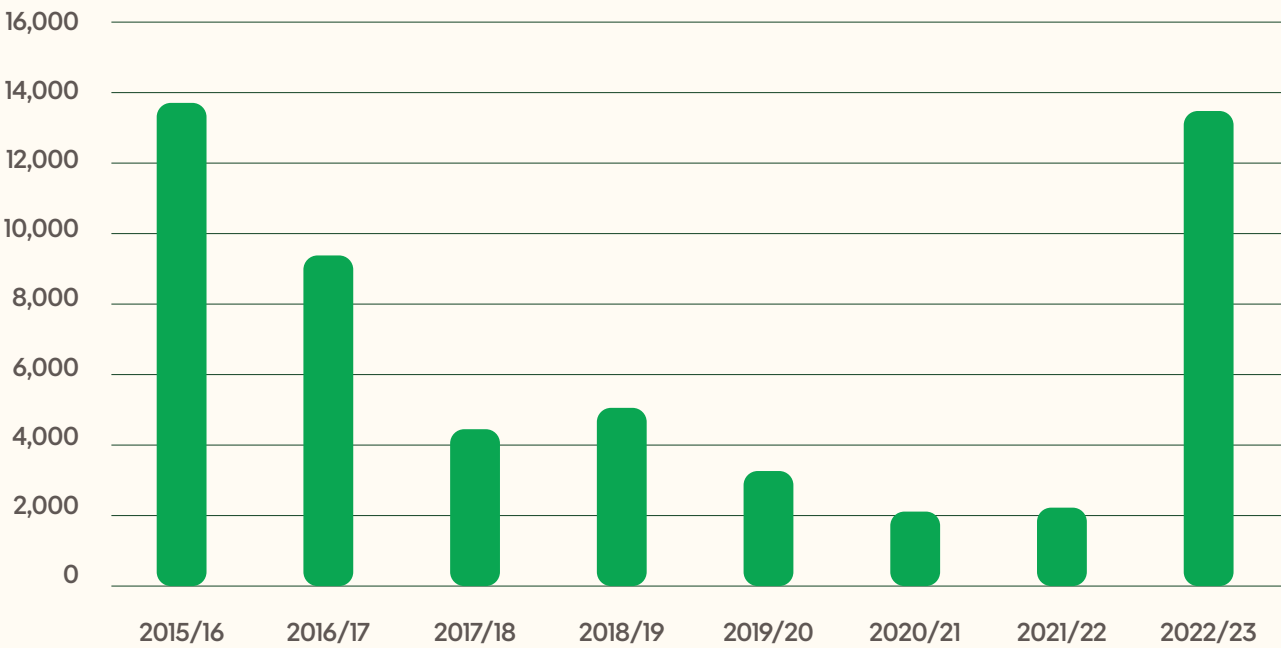
At the start of EDI we identified several small leaks within SPM which resulted in a 2% leakage rate. To combat this, we set ourselves an ambitious EDI commitment to reduce leakage by 50% and

adopted an ongoing policy of strategic leak repair management alongside targeted asset replacement.

The aforementioned methods were adopted with success as can be seen in the continuous reduction of leaks shown in the graph below until 2021/22.

By 2021/22, as a direct result of strategic repair and targeted asset replacement we had reduced leaks by 84% since reporting year 2015/16. However, in 2022/23 there were four significant leaks in Merseyside, all repairs were completed successfully, and 2,088 litres were recovered (not represented in graph).

Annual litres of leakage from Fluid Filled Cables



Carbon Impact and Climate Change

Business Carbon Footprint

Our Sustainable Business Strategy states our aim to be a carbon neutral company throughout our value and supply chains and describes the ways in which we actively support our customers and local communities towards achieving this goal.

Our goal is to reach 15% reduction from 2013/14 levels by 2023, 80% reduction by 2030 and achieve a 67% reduction across all scopes by 2035 in line with our validated Science Based Targets. Our ambitious carbon reduction targets are aligned with international agreements to restrict global temperature increases to less than 1.5°C across all scopes.

In this section we report on our Business Carbon Footprint (BCF) excluding losses. Losses are covered in a separate section in the report. Full details of our BCF reporting can be found in [Appendix 1 SPM](#), [Appendix 2 SPD](#) and [Appendix 3 Reporting Table Commentary](#).

Our carbon footprint is categorised into three scopes following the Greenhouse Gas Protocol Corporate Standard for Greenhouse Gas Reporting. Each scope is summarised below:

Scope 1 includes direct emissions from activities owned or controlled by our organisation which release emissions straight into the atmosphere. Our Scope 1 emissions include fleet transport, SF₆ gas emissions and diesel use.

Scope 2 includes emissions being released into the atmosphere associated with our consumption of purchased electricity, heat and cooling. These are indirect emissions that are a consequence of our organisation's energy use, but which occur at sources we do not own or control. Electricity losses and energy use within substations and depots sit within this scope.

Scope 3 includes emissions that are a consequence of our actions, which occur at sources which we do not own or control (and which are not classed as Scope 2). Business travel and the emissions reported from our contractors' activities sit within this scope

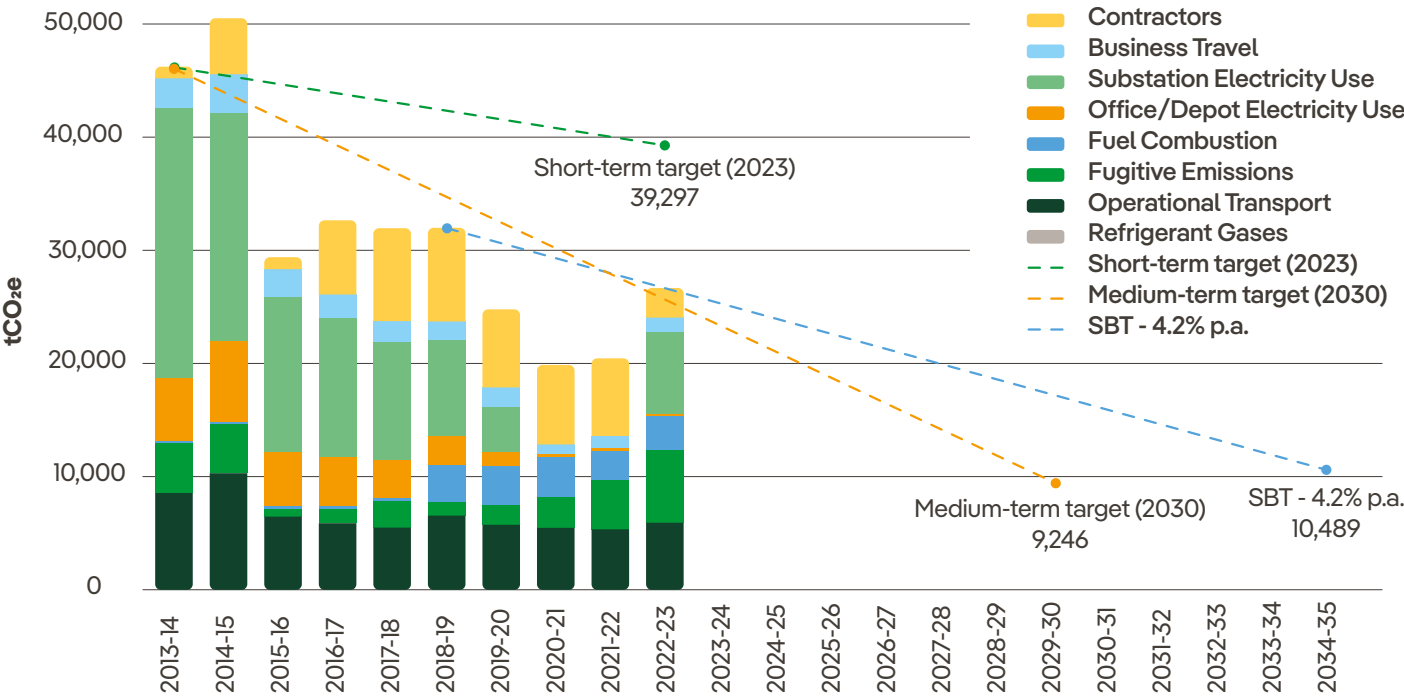
This year we achieved our 7th year of business certification with Planet Mark for our Business Carbon Footprint, in accordance with ISO 14064-3 (2006). The Planet Mark Code of Practice adheres to the highest of recognised standards and is administered by an independent Advisory Panel composed of leading academic and industry experts.

Planet Mark is partnered with Cool Earth, the award-winning charity helping rainforest communities to protect nearly 100,000 hectares of biodiversity rich rainforests across three continents.

In 2022/23, we received the Planet Mark Award for 'Best Company', recognising our continuous commitment to - and role in - the green energy transition, and outstanding results in reducing our carbon footprint in all aspects of our processes.

We also worked with Planet Mark to develop recommendations for how we can improve our Scope 3 emissions measurement. The accurate reporting of Scope 3 emissions is a significant challenge, particularly measuring impacts relating to products and services which we procure, given complexity and diversity of our global supply chain. We have embedded a number of recommendations into this year's analysis, and we will continue to improve the way we account for scope 3 emissions. This will ensure we actively measure and reduce all direct and indirect emissions in line with our Science Based Targets and bring our supply chain with us on our journey to net zero.

Distribution Business Carbon Footprint (excl losses) and Targets



tCO₂e by scope for SPD 2021/22 and 2022/23 including losses

Year	Scope 1 (tCO ₂ e)	Scope 2 (tCO ₂ e)	Scope 3 (tCO ₂ e)	Total (tCO ₂ e)
2021/22	5,983	270,890	1,409	278,282
2022/23	7,639	246,686	835	255,160

tCO₂e by scope for SPM 2021/22 and 2022/23 including losses

Year	Scope 1 (tCO ₂ e)	Scope 2 (tCO ₂ e)	Scope 3 (tCO ₂ e)	Total (tCO ₂ e)
2021/22	6,315	230,007	6,524	242,845
2022/23	7,793	188,785	3,082	199,660

We have measured our Business Carbon Footprint emissions since 2013/14. Since then, we have achieved a 42% reduction in our combined (SPD and SPM) carbon footprint, excluding losses. The Business Carbon Footprint graph shows our progress through EDI. This represents a 9% reduction in SPM and a 59% reduction in SPD. In comparison to 2021/22, our carbon footprint (excl. losses) has increased by 41% in SPM by 30% in SPD. The main reason for this increase is due to the unavailability of REGO tariffs for our unmetered substations between April and October 2022. This resulted in an increase of around 7k tCO₂e compared to previous year for

Buildings Energy Use. Despite this increase, our rate of decarbonisation has significantly exceeded our short-term goal of achieving a 15% reduction in emissions by 2023. We will continue to focus on our medium-term goal of achieving an 80% reduction in emissions by 2030. We will also focus on reducing our carbon footprint in line with our 1.5°C aligned verified Science-Based Target. Losses (energy lost or stolen from the network as it travels from source to user), is the largest category of our overall Carbon Footprint and also the most influenced by external factors. We describe this category in detail within the Losses section of this report.

Buildings Energy Use

When we started measuring our carbon footprint in 2013/14, energy consumed within our depots and substations was our second biggest emissions contributor after losses. It was therefore imperative that we worked to reduce the carbon emissions related to energy use at our sites.

Since 2020, the move to REGO tariffs '(Renewable Energy Guaranteed Origin)', which provides us with guaranteed zero emission electricity has significantly reduced overall emissions since we started measuring. In 2022/23 we continued to purchase electricity on a REGO tariff, although there was a period of 7 months where substation energy use was temporarily transferred to a standard tariff, resulting in an increase in annual emissions relative to the previous year.

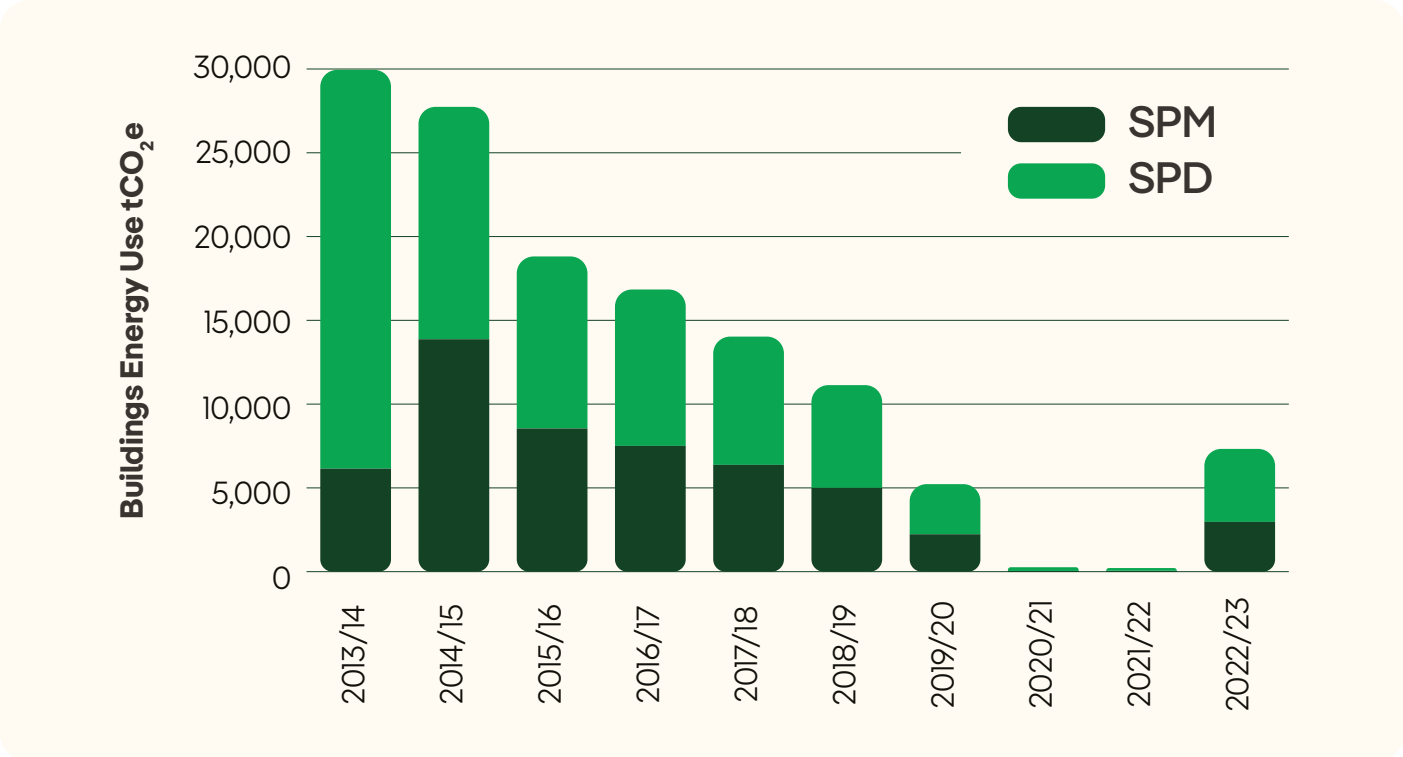
We are continuing to focus our efforts on reducing the overall energy consumption of substations and depots, recognizing that we should not rely on simply reducing emissions through our REGO tariff, but also take tangible action to reducing the kWh consumed to free up renewable energy elsewhere on the grid.

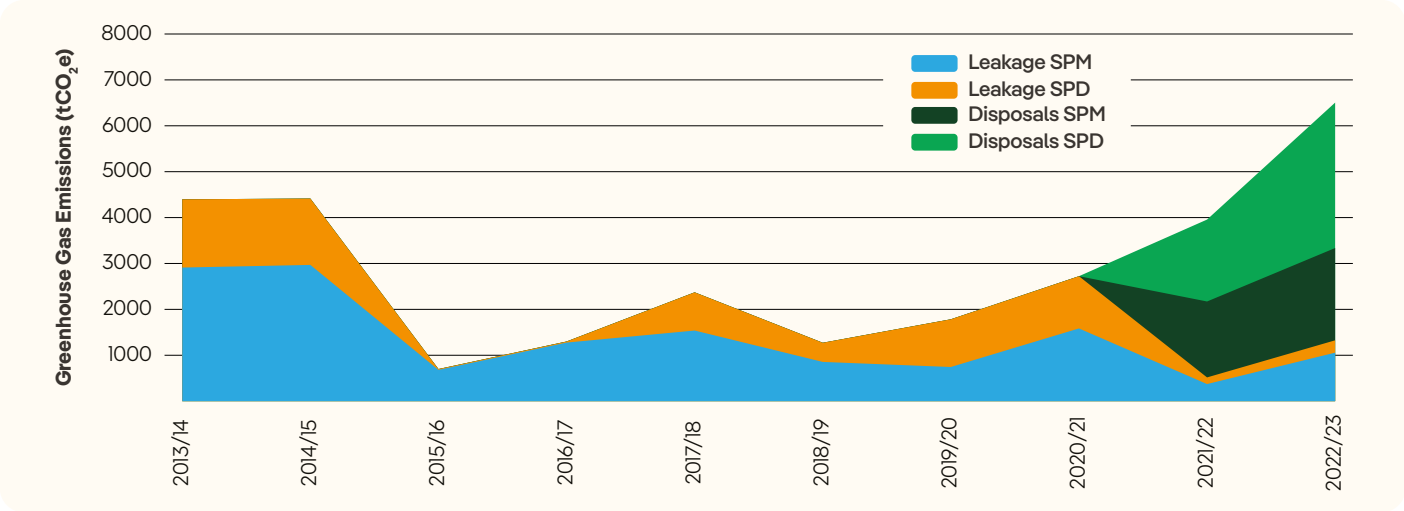
Improving energy efficiency in substations and depots

We are building LED light fittings into all new major capital expenditure projects, in line with the specifications we used as pilot projects in the ScottishPower Glasgow HQ and Aspect House Refurbishment projects.

There are pilot solar panel projects being carried out at three of our depots – Prenton in the Wirral, Lister Drive in Liverpool and St Vincent Crescent in Glasgow. There are all due for completion in 2023.

We will also be looking to introduce sustainable technologies such as solar panel installations, EV solar canopies, battery storage and rainwater harvesting where appropriate in the future.





Fugitive Emissions

In 2022/23 we reported further increases decreases in SF₆ leakage (top ups) in both SPD and SPM licences. However, since 2013/14 when we set our short and medium term targets, SPM and SPD have reduced leakage by 64% and 82% respectively.

In 2021/22 we started measuring and reporting the impact of SF₆ lost during disposal of SF₆ assets. This is in line with evolving F-Gas regulatory reporting requirements. In 2022/23, SPM and SPD recorded more than an additional 5,000 tCO₂e from disposals. Given the significance of SF₆ potentially lost during disposal, we will continue to work with our waste contractors to improve reporting and set up mechanisms to minimize emissions lost during asset disposal.

Despite good progress, SF₆ remains arguably the most challenging area of our business carbon footprint, especially given the volumes of legacy assets on our networks and the fact that, – at voltages lower than 132kV, SF₆ free solutions remain technically challenging. We will continue to work with our supply chain to drive innovation, piloting SF₆ free solutions where there are market ready and technically compliant options and continuing to replace the worst of our leaking assets. For further information please see the SF₆ emissions section later in the report.

Fuel Combustion

Direct Fuel Combustion is principally associated with the use of generators used to provide temporary power to customers in the event of a power cut. In 2018/19 we improved the way we reported fuel used in wider operations, so it is not possible to track our progress throughout RIIO-ED1. However, throughout this period, carbon emissions have generally increased or decreased relative to the amount of fuel used in generators.

In 2022/23, we continued to introduce Hydrogenated Vegetable Oil (HVO) as a direct substitute to diesel within our generator fleet. Although HVO produces emissions through combustion, overall, there is a c.90% reduction in net carbon impact. As we continue to roll out HVO, emissions from fuel combustion are anticipated to significantly decrease in future years.

We will also continue to pilot electric generators as our ultimate low-carbon solution, balancing the need to fully decarbonize with our primary responsibility of providing reliability of supply to the customers we serve.

Despite the introduction of HVO, our emissions increased annually compared to the previous reporting year. This was principally due to an increased requirement in generator use this year and the need to upgrade our reporting systems which did not capture the amount of diesel vs HVO used.

Case study

Transitioning to Hydrogenated Vegetable Oil (HVO)

In 2022/23, HVO was transitioned into our operations as a direct replacement for diesel when providing temporary power generation to customers during planned or reactive outages. The decision to transition to HVO was approved after extensive research and engagement with key stakeholders, including sustainability focussed stakeholders, external supply market, an independent fuel expert and fuel providers.

Although HVO has a significantly lower overall carbon footprint than diesel, there were concerns about wider environmental impacts associated with deforestation and land use change. It was also essential to work with stakeholders to understand these risks and ensure we are not solving one problem and creating another. In 2022/23, we worked with the Supply Chain Sustainability School to understand potential issues associated with HVO and how issues could be mitigated. One of the principal concerns relating to HVO is the use of palm oil as a raw material, which is a leading cause of deforestation. Our HVO contract therefore stipulated that palm oil would not be used in HVO supplied to us.

HVO was initially trialled as a substitute for diesel in our Ayrshire district between October and December 2022. Operationally, there are several logistical and practical challenges to consider when transitioning to a different fuel – such as sperate storage of HVO from diesel at our depots. To overcome this, we repurposed red diesel tanks which were made redundant in line with the government ban on the use of red diesel. This produced significant cost savings as we reused existing infrastructure.



The Ayrshire pilot focussed on overcoming the practical challenges of introducing HVO into our operations and to build our operatives confidence in a new product. HVO was trialled on planned outage works, which allowed a contingency plan in the event of unforeseen complications then moved to planned and reactive. Following successful trials, we transitioned HVO to other districts one at a time.

A mobilisation plan was created over several months which allowed our service partner GWF Generators to build up their knowledge and confidence using HVO within their generator sets. It also afforded them the opportunity to understand how we operate.

The success of the pilot was ultimately possible through close collaboration with our supply chain and districts, in addition to a carefully monitored roll out plan.



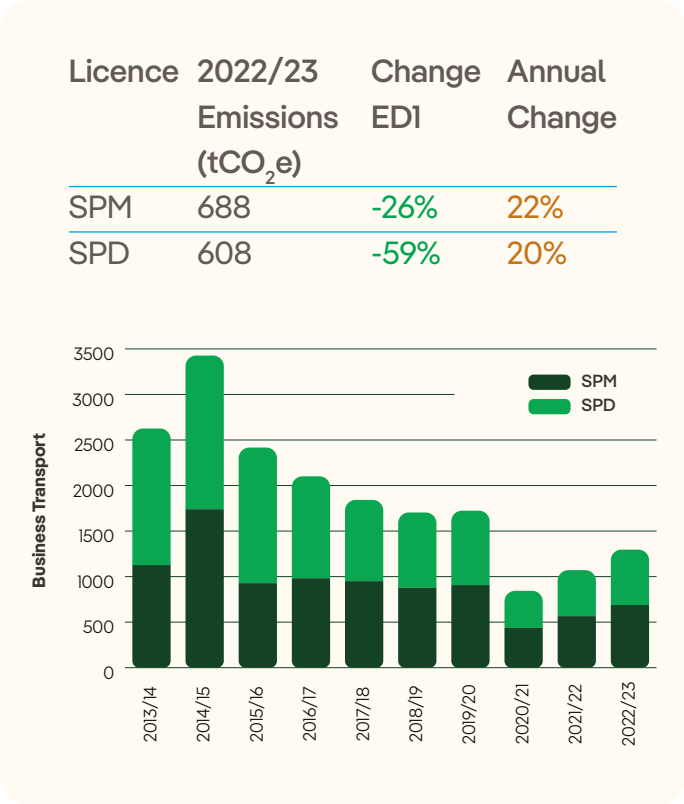
Working in partnership with



Business Travel

Emissions associated with business travel include indirect emissions associated with using vehicles not owned by SP Energy Networks and the use of public transport, primarily associated with trains and planes. Greenhouse gas emissions associated with business travel have reduced significantly since we started measuring our footprint. This is largely a result of a wider transition to remote working since the Covid 19 pandemic which has reduced the requirement for business travel with more meetings now carried out remotely. Although there has been a gradual increase in business travel since 2020/21, we do not anticipate a return to pre-pandemic levels.

Business travel emissions have also been reduced due to our Sustainable Business Policy which was introduced in 2018/19. This policy restricts short haul air travel in favour of other, less carbon intensive.

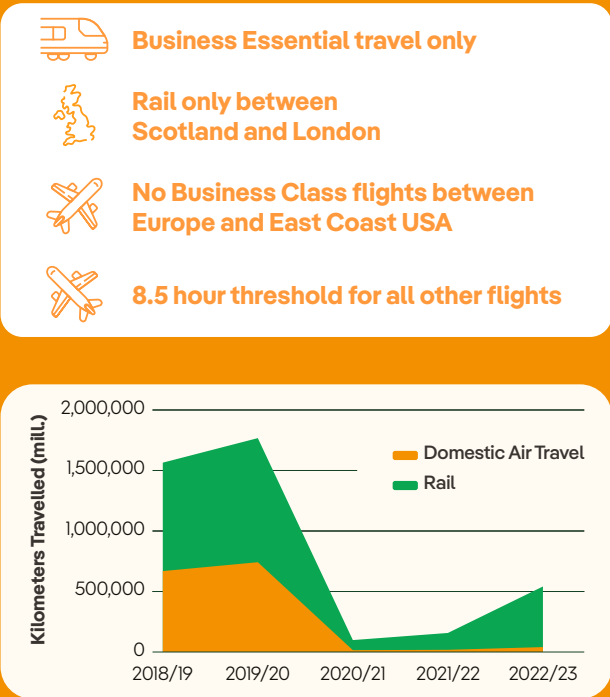


Case study

Measuring the impact of our Business Travel policy

In 2018/19 we introduced our Sustainable Business Policy which was introduced. This policy restricts carbon intensive short haul domestic air travel in favour of other, less carbon intensive forms of transport, such as rail.

Since the implementation of our Business Travel Policy, the way we use public transport for business travel throughout the UK has changed. In 2022/23, we undertook an analysis to measure the effect of our business travel policy. In 2018/19, 43% of domestic public travel (per kilometre) was air travel. In 2022/23 domestic air travel accounted for only 8%. Trains emit significantly less carbon emissions per passenger kilometre than planes, therefore our business carbon footprint is around 16tCO₂e lower as a result this year, compared to the 2018/19 profile.



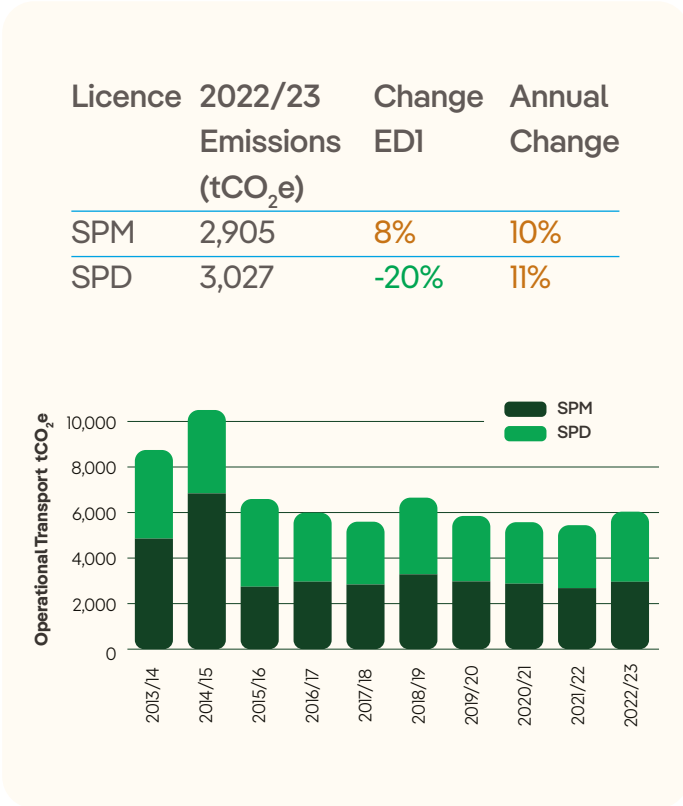
Operational Transport

Our operational fuel use is primarily associated with petrol and diesel used in company vehicles as we support the operation and maintenance of our network.

During the 2022/23 reporting year, we introduced another 5 electric vehicles to our fleet of pool cars. This brings our electric vehicle fleet to 32 in Distribution. Since the start of ED1, we have installed 32 charging points for Electric Vehicles at our Depots and Offices. Although we have installed no new charge points in the 2022/23 reporting year, we have plans to install 20 at Currie substation during 2023.

Since ED1, the emissions associated with operational transport have remained reasonably consistent.

We are committed to electrifying our fleet vehicles by the end of RIIO-ED2 and will see the effect of introducing EVs in our future BCF submissions as more of our fleet becomes electrified.



Case study

Going on a EV road trip with Liam O’Sullivan, Director of Manweb

Liam O’Sullivan, Director of SP Manweb, recently took one our EVs for a test drive to understand some of the challenges and benefits of going electric. This is part of an ongoing awareness campaign to ready our business and staff for a fully electric fleet.



Case study

Embedding employees to make greener travel choices

In 2022/23, SP Energy Networks fully rolled out our Salary Sacrifice EV scheme, allowing all full time, permanently employed staff to take advantage of leasing fully electric vehicles through our corporate benefits scheme. Although this does not directly impact the operational emissions associated with company operational vehicles, it is estimated that the scheme reduced carbon impacts by approximately 200tCO₂e with more than 100 employees replacing their own fossil fuel vehicles with electric alternatives.

Contractor Emissions

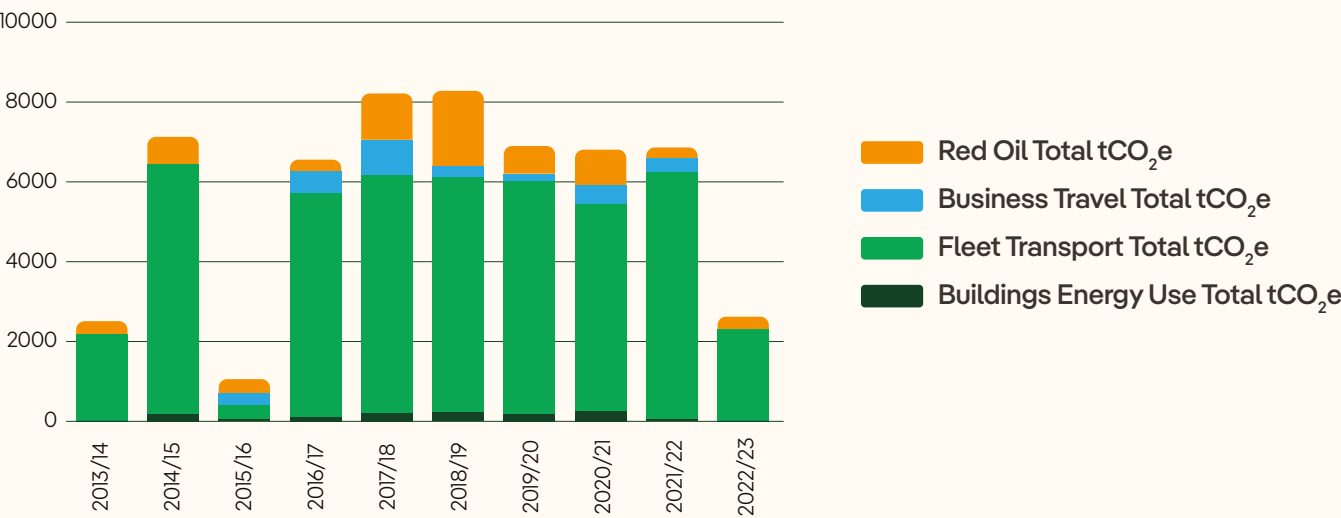
Since forming a Sustainability Team at the start of ED1, the team has worked to improve data collection by moving away from estimations and providing accurate data. Since the start of ED1, we have worked to increase the number of contractors reporting their emissions and continue to target our top 20 contractors for accurate records of data. In this way, we can record the impacts of our supply chain and continue to work with them to reduce their emissions.

In 2015/16 we moved away from estimated data, and provided actual data as reported by a small number of contractors. From 2016/17 onwards, we

have included a greater number of our contractors and reported more accurate data, resulting in an increased figure. We did see a drop in 2022/23 on the reporting of fleet transport, however with the addition of new Supply Chain Sustainability Managers and better controls in place, we are confident that the quality and robustness of contractor data will improve.

As we move to RIIO-ED2, we will increasingly focus on contractor emissions. We will develop robust baselines to track contractor performance, introduce further carbon reporting requirements as key performance indicators in our tenders and we will continue to work with our supply chain to pilot more sustainable construction practices.

Contractor Business Carbon Footprint Data

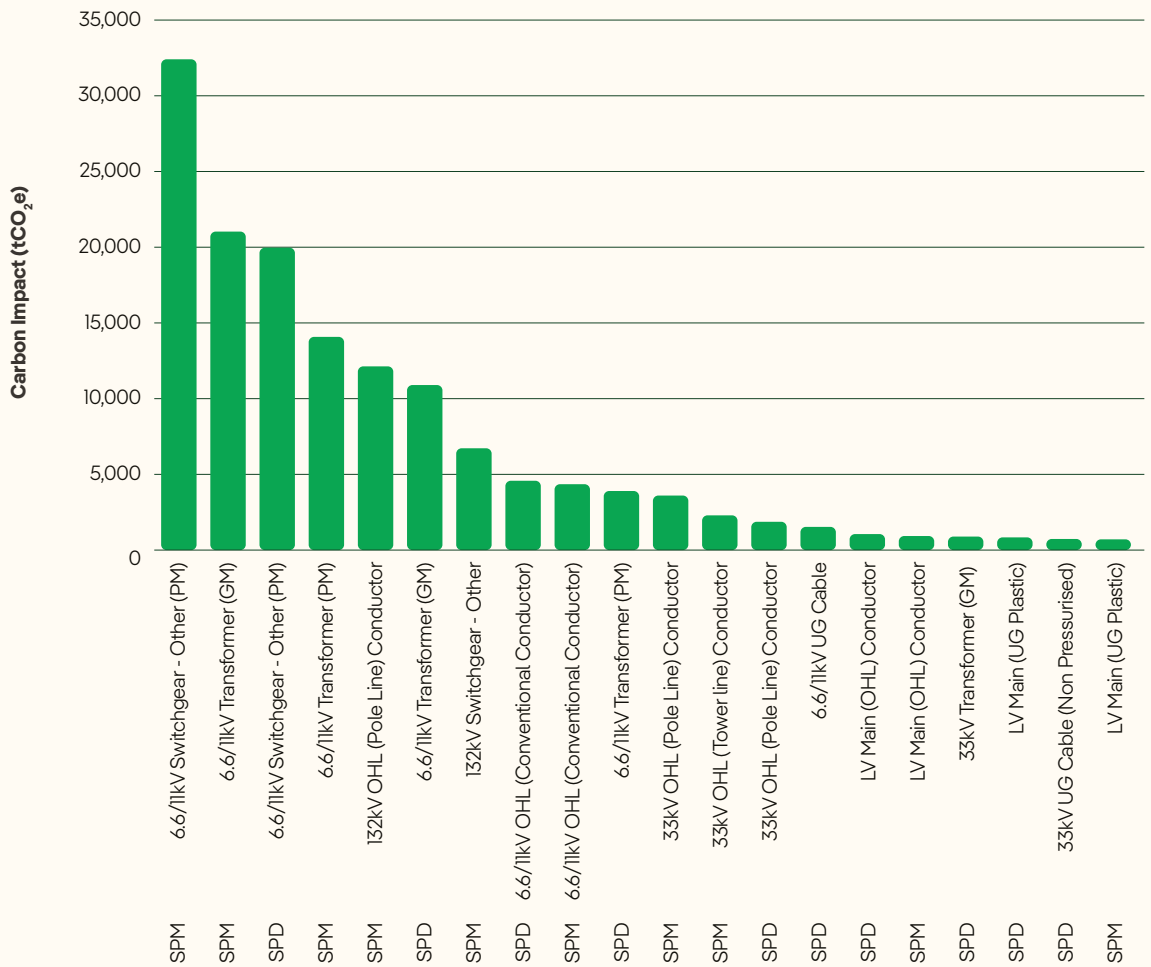


Case study

Carbon Management in Infrastructure

As we develop the critical energy infrastructure, which will support the net zero transition and allow the decarbonisation of energy, transport and heat, we know we will need to build more to strengthen and digitize our network. Therefore, it is critical that we understand and start to manage the carbon emissions associated with infrastructure. In 2022/23, we worked in collaboration with the Energy Networks Association (ENA) and other Distribution Network Operators (DNO) to undertake an analysis into the embodied

carbon impact of electrical assets installed on our network in 2022/23. Our initial results indicate that the embodied carbon associated with the manufacture and transport of electrical equipment is a significant source of emissions exceeding the emissions associated with SF₆ leakage in a single year. These emissions do not fall within our operational control and fall within our Scope 3 emissions (upstream) emissions associate with our supply chain. Embodied carbon will become a major focus of RIIO-ED2 as we look to collaborate with other DNOs, our supply chain and with stakeholders throughout the built environment to address this challenging area.



Sulphur Hexafluoride Emissions

Switchgear filled with SF₆ is one of the predominant solutions offered in the electricity industry for new switchgear applications and the replacement of legacy switchgear. In some applications, it is the only viable solution available.

By installing modern SF₆ filled switchgear, SPEN have been able to enhance the operational safety of our asset base and reduce ongoing plant maintenance costs.

SF₆ is a colourless and odourless gas used for both insulation and arc interruption in switchgear applications. It has exceptional insulating properties which enable safe, compact and low-cost switchgear solutions. Although it causes no detectable impact on the local environment if released, it is a highly potent greenhouse gas with a global warming potential of 23,500 times that of CO₂.

We anticipate that in the short term, the quantity of SF₆ on our network, described as the ‘SF₆ bank’, will increase as the replacement of end-of-life oil-filled switchgear programmes proceed. Efforts to minimise the escape of SF₆ from equipment to the environment are therefore highly important. Repairs and replacement of leaking assets is now vitally important to reducing our business carbon footprint. There are many challenges involved in the development of solutions utilising alternative gases and they vary by voltage level and application; there are also no commercially available gases that match the electrical insulation properties of SF₆.

We are progressing an industry leading solution using GE Green Gas for Grid (G3) as the insulating medium within a 132kV Gas Insulated Switchboard (GIS) solution at our Lister Drive substation in SP Manweb. We are also continuing to work with industry to support the implementation of other SF₆ free solutions with a view to adopting suitable alternatives on our network wherever practicable, including tendering exclusively for

non-SF₆ equipment where possible. We will continue to prioritise works where we can achieve the greatest curtailment of SF₆ volumes to the SF₆ Bank possible wherever this is feasible and in our customers interests.

It is also important that we ensure we capture all possible SF₆ leakage scenarios. The design leakage rates of some SF₆ equipment is such that ‘topping up’ the asset during its service life may be required. Fugitive emissions are recorded as the volume of gas required to top up the equipment to its original capacity. However, most equipment containing SF₆ is hermetically sealed and not designed to require a top-up. Where SF₆ equipment reaches the end of its service life; either due to condition or the presence of leaks, we replace it and capture the volume of gas recovered at end-of-life via approved disposal providers.

Our networks in SPD are all below 132kV, while SPM includes networks up to and including 132kV. This results in SPM managing larger equipment with greater amounts of SF₆. Since the equipment held by SPD is generally smaller and has much of its SF₆ held in sealed containers with no facility

	SF ₆ Bank (kg)	SF ₆ Emitted (kg)	Actual Leakage Rate
SPM	22,787	134.5	0.60%
SPD	23,098	150.6	0.65%

to top up, these pieces of equipment must be replaced when SF₆ levels are shown to have dropped below a defined threshold. In SPM, top ups are managed by either routine checking of assets or through alarms that are generated onsite.

In SPM, our SF₆ top ups have increased from 16.3kg in 2021/22 to 46.3kg in 2022/23. However, we are now including final disposal emission values which are the value from the nameplate mass (original gas in the item) minus the gas recovered at end of life. The value of these emissions is 87.6kg, increasing our total emissions to 134.5kg.

In SPD, top ups have increased from 6.35kg in 2021/22 to 11.6kg in 2022/23. We have followed the same methodology for disposals as in SPM this year, resulting in an increase from 78.3kg in 2021/22 to 139kg in 2022/23, increasing our total emissions to 150.6kg.



Distribution Losses

About 7% of the energy entering the distribution system is not ultimately billed to customers, this energy is known as distribution losses. Much of this energy is lost in heat and noise as an inherent result of power flowing through network assets.

In addition, a small amount of energy is illegally abstracted, or lost due to inaccuracies in the billing and conveyance process. More detail on the types of losses is given below.

Electricity industry settlement systems charge suppliers for distribution losses and this cost is passed on to all consumers as part of their bill.

Electricity losses are an inevitable consequence of transferring energy across electricity networks, but they carry a financial and environmental impact. Delivering the right, cost-effective loss minimisation activities will lead to a more efficient network, reducing customer energy bills and carbon emissions. Therefore, our Losses Strategy is based upon a high-level vision that we will consider all reasonable measures that can be applied to reduce losses and will adopt those measures which provide benefit for customers.

Managing losses is complex: losses are difficult to measure and are influenced by factors outside of DNO control. Furthermore, loss management must be considered within the Net Zero context. The electrification of heat and transport, greater levels of decentralised renewable generation, and the need to operate the network more flexibly will increase network power flows, leading to higher network losses.

Technical losses

Whilst our networks are designed to avoid excessive losses through the principle of increasing voltage with increased load transfer, some loss is an inherent outcome of power

flowing through our networks as components generate heat, noise, or both. Technical losses can be described either as fixed losses or variable losses.

Fixed losses occur because some parts of the system must be continuously electrically energised. Fixed losses include “iron losses” in transformers, the small level of current flow across electrical asset insulation, and the energy consumed by our equipment to ensure safe and reliable network operation, including through cooling, oil pumping, and battery charging. Variable losses are those which vary with the current that flows through any conductor in the system due to electrical resistance, causing heating which is lost to the environment.

Non-technical losses

These are the losses that occur due to unidentified, misallocated, or inaccurate energy flows. They can be thought of as electricity that is consumed but not billed, where the end user is unknown, or the amount of energy being consumed is uncertain. The three main types of non-technical losses are energy theft, unmetered supplies, and conveyance errors (electricity delivered but inaccurately recorded in energy settlements).

Calculating Losses

Identifying where technical losses occur is complex because variable losses change with changes in load, increasing with the square of the electrical current. Likewise, it is challenging to calculate non-technical losses due to their nature in arising from unknown or uncertain energy flows. To calculate the value, location and type of losses with complete accuracy, the detailed power flows of every inch of the network would need to be known in real-time.

The reported losses are typically calculated using top-down models of energy entering and

existing the system, relying on settlement data. This approach to determining distribution network losses has several limitations:

- Difficulty in distinguishing between technical and non-technical losses,
- Sensitivity to data quality and accuracy,
- Reliance on estimates to determine energy use from unmetered supplies and to apportion losses across customers.

Therefore, over ED1 we have committed to improving our understanding of losses. Significant progress is being made to make our network smart, and this is helping us learn more about technical and non-technical losses and improve our losses calculations.



Distribution Losses Strategy

In September 2015 we published our ED1 Losses Strategy. This strategy has applied throughout the ED1 2015–2023 regulatory period and has been subject to regular reviews. Underpinning this strategy is our strategic vision to *Consider all reasonable measures which can be applied to reduce losses and adopt those measures which provide benefit for customers.*

Specific actions have included:

Accelerating the replacement of more than 1,000 higher-loss transformers with lower-loss, modern alternatives. These transformers would have otherwise been replaced between 2031 and 2039, but the significant reduction of fixed losses over the period is such that it offsets the cost of early replacement. The continuing programme led to the replacement of 392 high-loss transformers in 2022/23 – as shown in Tables 11 and 12, along with forecasts for 2022/2023. The latest figures bring the estimated total losses benefit to over 40 GWh or over 16,000 tCO₂e for ED1 – as shown in Tables 1 and 2.

Given some challenges with delivery of ground-mounted secondary transformer replacement in SPD in 2022/23, we identified a new opportunity to replace high-loss pole mounted transformers. Although these are smaller units and consequentially have lower losses per-unit, we have been able to carry out a higher volume of replacements. In SPD, the total volume of replacements comprised 56 ground-mounted transformers and 205 pole mounted transformers.

Increasing our Revenue Protection team by 22% to target energy theft, the illegal abstraction of electricity by customers achieved through tampering with supplier meters or interference with network assets. The continuing programme of Revenue Protection services led to the discovery of 3,032 irregularity cases in 2022/23 – as shown in Tables 3 and 4, along with forecasts for next year. The latest figures bring the estimated total losses benefit to over 213 GWh or over 95,000 tCO₂e throughout ED1 – as shown in Tables 1 and 2.

Continuing our Theft in Conveyance programme to investigate inaccurately recorded energy, such as missing consumption data from unregistered or misregistered metering points, or incorrect metering recordings. A further 595 investigations have been carried out in 2022/23, as shown in Tables 11 and 12, although no interferences were detected this year. Tables 3 and 4 also show forecasts for next year. The latest figures bring the estimated total losses benefit to over 20 GWh or nearly 9,000 tCO₂e in ED1 – as shown in Tables 1 and 2.

Proactively improving the accuracy of records for unmetered supplies by working closely with customers and settlement stakeholders. Such consumption is quantified by establishing accurate records for each supply and applying a representative profile. Losses typically arise from incorrect or incomplete unmetered supplies records and inaccurate estimated annual consumption information, and can thus be reduced through improved accuracy.

Assessment of losses (technical and non-technical) for regulatory year 2022/23

	SPD	SPM	Distribution Total
Units Entering (GWh)	16,723	13,982	30,705
Units Exiting (GWh)	15,470	13,021	28,491
Losses (GWh)	1,253	961	2,214
Losses (%)	7.49%	6.87%	7.21%

Losses Policy

To support our Losses Strategy, we have developed a Losses Policy and supplementary material to ensure that losses information and our strategic vision are simply and easily communicated. The Losses Policy articulates the actions we expect our staff to take in their day-to-day activities where they can have an impact on reducing both technical and non-technical losses. In addition to providing a generic methodology for loss assessment, the Policy also provides methods, and examples, where a more detailed assessment may be required, for example:

1. Line loss factor calculations
2. An approach for selecting conductors
3. Transformer loss calculations
4. Practices in Network Operations to:
 - control losses, e.g., load balancing,
 - correct phase imbalance, and
 - optimise voltage levels.
5. Furthermore, supporting both the Losses Policy and Strategy, we have completed our commitment to review and amend our design and operational guidelines to align with our losses vision. Many of our technical policies and procedures have been updated with references to aspects of the Losses Policy where appropriate.

Losses Discretionary Reward

The Losses Discretionary Reward (LDR) was set up to encourage DNOs to work towards a better understanding of how to manage electricity losses and to identify ways of reducing losses and therefore reduce costs for customers. The LDR was managed in three tranches during ED1, and our submissions are available at: spenergynetworks.co.uk/pages/what_are_we_doing_about_network_losses.aspx

Over RIIO-ED1 we established an ambitious portfolio of initiatives and have led considerable advances in the four key areas of the LDR scheme – understanding losses, customer and stakeholder engagement and sharing best practice, processes to manage losses, and losses innovation and incorporation as BAU.

Some examples include:

- Increasing understanding of network losses in the context of the low carbon energy transition.
- Progressing our readiness for smart meter data and improving processes for advanced modelling tools and techniques.
- Convening and chairing the Technical Losses Working Group (TLWG), providing an ongoing platform for DNOs to discuss and share best practice.
- Continuing to have a full-time member of staff working with Merseyside Police as part of Revenue Protection, significantly impacting energy theft detection and increasing understanding of energy theft in our network.
- Continuing to consider losses holistically

- across the transmission and distribution systems, including through engagement with NGESO and NGET.
- Incorporating into BAU our initiatives for improved modelling of both complex network and rural networks to reduce losses, and improved detection of theft through Revenue Protection.
 - Undertaking a deeper analysis into technical losses across various areas of the network – building a more detailed cost-benefit analysis of upsizing cables and transformer replacement that will help us optimise delivery of our ED2 plans (see next section on Preparing for RIIO-ED2).
 - Innovating by developing our investigations into contact voltage detection into a plan (see next section on Preparing for RIIO-ED2) and trialling localised LV voltage optimisation to develop our understanding of how to treat losses in LV networks.
 - Having been effective in achieving greater understanding and collaboration in losses management across GB, the LDR scheme has been discontinued by Ofgem for RIIO-ED2. However, the learnings and activities established through the LDR scheme have helped shaped our plans for ED2, outlined in more detail below.



Preparing for RIIO-ED2

In RIIO-ED2 and beyond, we anticipate that under an efficient Net Zero transition distribution network losses will increase as a result of the electrification of heat and transport, and the increase of low-carbon distributed generation. As the mix of electricity generation in GB becomes increasingly low carbon, so do the losses. Therefore, while losses still have a cost implication to the customer linked to energy prices, the carbon cost of losses is changing. It is crucial any loss management activities do not disincentivise the connection of LCTs.

Our focus in RIIO-ED2 is to build upon systems that enable whole system, whole life assessments to be made when making design and operational decisions ranging from domestic service cables to 132kV connections.

We have worked collaboratively with the other DNOs and Ofgem to design a strong reputational losses incentive in RIIO-ED2, and we proposed this as part of our Business Plan. This builds upon the independent reports we commissioned as chair of the TLWG, which compared international regulatory approaches for managing network losses and proposed potential future incentive mechanisms in the context of the low carbon transition.

We have also taken key learnings from the LDR programme to shape both our Losses Strategy and plans for enhanced losses consideration in RIIO-ED2.

Some examples include:

- Use our complex modelling tools to identify the network assets with disproportionately high losses and optimise our proactive replacement programmes.
- Continue to assess the use of network management and nearer-real-time information to improve real-time understanding of losses (levels and locations) in development of our Engineering Net Zero platform and use this understanding to inform operational policies.
- Continue to use our new processes and



discovered losses management innovations. Specifically, Central Voltage Control System technologies, Seasonal Normal Open Points (NOPs) routines, reactive power control technology for distributed generators and continued work into use cases to minimise losses as part of our flagship innovation projects into the use of DC distribution.

- Continue to work with the TLWG and Ofgem to monitor relevant international regulatory mechanisms and to develop future incentive mechanisms for losses management. We will also continue to present on and raise the profile of network losses at key industry events, and with international partners.

As part of our updated RIIO-ED2 losses strategy, we will maintain our strategic vision to *Consider all reasonable measures which can be applied to reduce losses and adopt those measures which provide benefit for customers.*

Acknowledging that losses are likely to increase in RIIO-ED2, we will optimise the levels of losses through comprehensive cost-benefit analyses such that the whole lifecycle costs to the customer are minimised. This includes continuing with our early replacement programme of high-loss transformers, and continued Revenue Protection and Theft in Conveyance activities.

Furthermore, we are developing a programme to detect exposed voltages (called contact voltages) as a Consumer Value Proposition (CVP), following collaborative support from our customers and stakeholders and based on our LDR initiative. In this programme we will employ a purpose-built Mobile Asset Assessment Vehicle, or MAAV, that detects contact voltages that can occur due to faults in LV networks or electrical equipment connected to it. By providing early identification of faults, this vehicle can lead to a wide range of benefits, notably losses detection and intervention.

Work is now underway to develop a contact voltage detection policy to help set up new businesses processes and communication channels in preparation of vehicle use.

analytical tools to further our understanding as more smart meter and LV monitoring data becomes available in RIIO-ED2. We will install over 14,000 LV monitors in RIIO-ED2, which we estimate could help us save an additional 15GWh per year by the end of the period.

- Our Revenue Protection services will continue to explore the use of smart meter data to establish voltage pattern recognition algorithms to define phase connectivity and distinguish between technical and non-technical losses in the LV network using network impedance data. This will continually refresh our understanding of the scale of electricity theft.
- Conduct further modelling of specific LV network assets using the new tools, including service cables and LV mains. We will maintain processes for service cable upgrade and replacement setting out exactly how to analyse the network and conduct losses-informed cost benefit analysis.
- As a DSO responsible for delivering the Net Zero transition we will continue to engage with stakeholders including TOs, NGESO, aggregators and customers to ensure that DG and LCT load growth is accommodated through holistically optimised system design and operation, inclusive of losses.
- Reduce technical losses by replacing faulted LV fuses; identified using LV main voltage drop profiling where there is sufficient smart meter data.
- Keep abreast of national and international innovations, and actively investigate and seek to reduce the barriers to adoption of newly

Table 1- Summary of losses activities costs and benefits - SPD

Programme/Project	Distributed losses-justified costs 2022/23 (£m)	Reduced losses 2022/23 (MWh)	Reduced emissions associated with losses 2022/23 (tCO ₂ e)	Cumulative reduced losses in ED1 (MWh)	Cumulative reduced emissions associated with losses in ED1 (tCO ₂ e)
Replace high loss transformers	2	3,781	1,518	1,518	6,208
Internal and External Revenue protection inspections	0.8	8,984	3,606	3,606	41,392
Theft in conveyance	0	639	257	257	1,335
Totals	2.8	13,404	5,380	5,380	48,935

Table 2- Summary of losses activities costs and benefits - SPM

Programme/Project	Distributed losses-justified costs 2022/23 (£m)	Reduced losses 2022/23 (MWh)	Reduced emissions associated with losses 2022/23 (tCO ₂ e)	Cumulative reduced losses in ED1 (MWh)	Cumulative reduced emissions associated with losses in ED1 (tCO ₂ e)
Replace high loss transformers	1.3	5,877	2,359	21,589	9,297
Internal and External Revenue protection inspections	0.5	18,660	7,490	120,555	53,752
Theft in conveyance	-	2,397	962	17,088	7,658
Totals	1.7	26,935	10,811	159,232	70,707

Table 3 - Summary of volumes of losses activities - SPD

Programme/Project	Description of unit	Volumes in 2022/23 Regulatory Reporting Year	Forecast volumes for following regulatory year
Replace high loss transformers	Transformer volumes	261 - 56 ground mounted units and 205 pole mounted units	104 ground mounted units
Revenue protection inspections	Visits made	11,815 visits were conducted resulting in 1,554 irregularity cases. (At 952 of these cases there was an ability to assess units.)	17,039 visits 3,212 cases detected
Theft in conveyance	Investigations	365 investigations, no significant interferences deemed appropriate to pursue	113 Investigations 27 Interferences detected

Table 4- summary of volumes of losses activities - SPM

Programme/Project	Description of unit	Volumes in 2022/23 Regulatory Reporting Year	Forecast volumes for following regulatory year
Replace high loss transformers	Transformer volumes	131 - all ground mounted units	36 ground mounted units
Revenue protection inspections	Visits made	5,376 visits were conducted resulting in 1,478 irregularity cases. (At 616 of these cases there was an ability to assess units.)	9,559 visits 3,046 cases detected
Theft in conveyance	Investigations	230 investigations, no significant interferences deemed appropriate to pursue	134 Investigations 26 Interferences detected

Other Environment-Related Activities

Resource Management

In our Sustainable Business Strategy, we describe a vision where the principles of a circular economy and efficient use of resources are fully embedded in our business. The materials required for network construction and operation will come from sustainable sources. We will produce ‘zero waste’, with the components of all end of life assets being reused or recycled into new products.

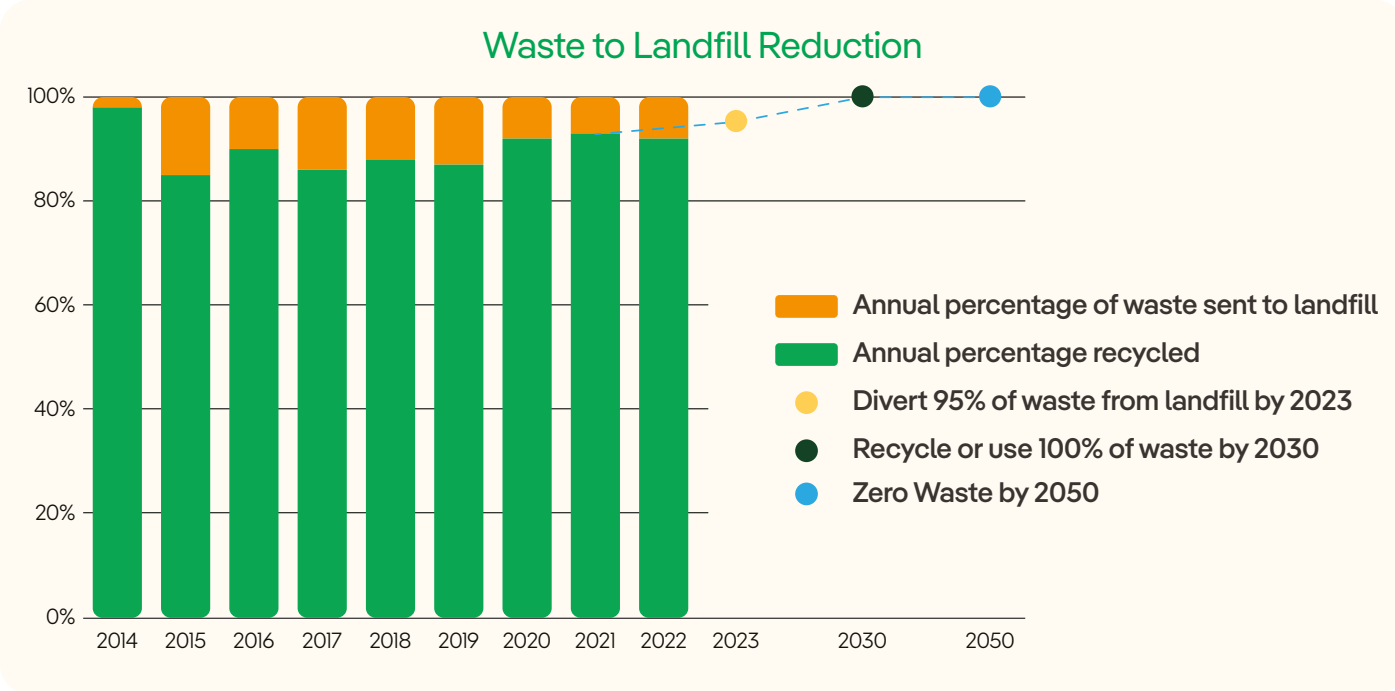
Efficient resource management where we value resources both financially and environmentally is a key element of our vision of sustainability. To drive this vision, we have set ourselves the challenging goals to divert 95% of our waste from landfill by 2023, and 100% by 2030 (excluding compliance waste).

To meet these targets, we are focusing on ways to avoid, reduce, reuse and recycle our waste. Key to this is ensuring that the many data inputs required become more robust year on year. Our approach is therefore twofold: working with our own staff and supply chain to gain better insights into the quantities, types and treatments of waste resources; and collaborating to develop ways of

reducing waste and improving the ways in which waste resource is then processed.

In 2014, the relatively high percentage of waste diverted from landfill recorded was due in part to incomplete recording as we began to examine all waste streams in detail. Since 2014, we have worked closely with our contractors to increase and improve data collection. Key to this has been the implementation of SmartWaste - an online digital tool which allows contractors to upload their waste data directly to the system each month. We work alongside contractors, providing instructional videos and making ourselves available to assist in the data upload process when needed to ensure our data is reliable and up to date. Uploading the data to SmartWaste allows us to view and report on the data at different levels, whether that’s by project, district or license area.

In 2022/23 we diverted 92% of our waste from landfill. We continue to work with our contractors and employees to make the final push and reach our 95% landfill diversion goal by 2023.



Management of Noise Impact

We seek to minimise the impacts of noise resulting from the construction, maintenance and operation of our electrical infrastructure.

When we build new infrastructure or when the local environment changes around our existing infrastructure this can sometimes result in a negative effect in the local area.

Substation Transformers typically generate a noise level ranging from 60 to 80 dBA. Transformer noise will transmit and attenuate at different rates depending on the transformer size, voltage rating and design and can cause a nuisance to nearby neighbours in some circumstances. The SPEN strategy is both proactive and reactive in mitigating and avoiding these impacts. SPEN operates a 24-hour customer helpline where customers, contractors and staff can report problems on the network including issues related to noise and dust. Enquiries regarding noise are logged in our customer complaints system and passed to regional contacts with actions and deadline dates.

In reviewing operational complaints with respect to noise, most issues relate to the use of temporary power generators that power emergency maintenance works and customers who are off supply, rather than ongoing issues related to static assets.

Where issues are highlighted with our static assets, SPEN has a good track record in mitigating the effects, which we do by assessing the noise at the complaint location and then identifying the appropriate mitigation to reduce the impact of asset related noise. The solutions are often relatively straightforward once these are known to us but can take some time to design and construct, requiring temporary mitigation in some circumstances.

This reporting year, we have received one enquiry in SPD in relation to noise from our equipment and eleven in SPM.

Climate Change Resilience

In December 2021, we published our Climate Resilience Strategy for RIIO-ED2 and beyond. Here we can share some of the top risks and associated mitigation measures from that strategy that will ensure we will continue to operate a safe, resilient and sustainable network and enable the Net Zero Carbon transition

SP Energy Networks worked with the Energy Networks Association (ENA) to finalise the identification of climate change risks based on the latest UK Climate Projection 2018 (UKCP18). The UK Met Office, author of UKCP18, was tasked with undertaking an electricity and gas network specific analysis based on UKCP18 with the final report completed by November 2020. The highest priority hazards identified from Met Office analysis and stakeholder engagement with network companies are:

- Extreme high temperatures
- Heavy rainfall/drought cycles
- Prolonged rainfall leading to flooding

Bespoke analysis of the UKCP18 data has been undertaken for each of these hazards and the impact on networks evaluated for the key operational risks.

Operational Risks

The following are some of the most highly ranked risks in our strategy due to high relative likelihood and impacts.

Fluvial, pluvial and coastal flooding: Substations affected by river or coastal flooding due to increased winter rainfall, or flash flooding due to severe rainfall, with loss or inability to function leading to reduced security of supply. There is also an impact on other types of work being prevented due to safety issues (including flooding of office buildings).

Summer drought: Underground cable systems and surface infrastructure foundations affected by summer drought and consequent ground

movement, leading to mechanical damage/failure. The drying out of the soil surrounding underground cables will also lead to an increased thermal resistivity, reducing heat transfer from cable to surrounding soil/backfill, resulting in a reduced current (load) carrying capacity.

Prolonged growing season: Overhead lines affected from interference from vegetation.

Hurricanes and high winds: Impacting overhead line structures, resulting in increased frequency of extreme events causing additional faults and a strain on resources.

Ice and snow in winter: Major incidents increased due to increased frequency of ice events. Heavy snowfall leading to excessive loading on buildings. Increased heating demand causing additional load on network, leading to additional faults.



Increased temperature in summer: Increased cooling demand, causing additional loadings placed on network, leading to additional faults. Heat waves resulting in increased staff absence due to sickness, safety concerns for field staff.

Flooding remains our principal risk with the highest impact. SP Energy Networks is working to ensure full network compliance is attained with existing flood resilience standards through adoption of flood protection barriers, “tank-lining” civil assets and raising substation doors. Flood resilience measures have been installed at substation sites deemed at risk of flooding following detailed flood surveys. In 2018, the underlying flood resilience standard has been augmented (ETR 138 Resilience to Flooding of Grid and Primary Substations). We will work to that standard in RIIO-ED2 (2023-2028) to address the risk management of flooding at grid and primary substations in England, Scotland and Wales from coastal, river and surface water flooding.

We will also continue to engage with the environmental agencies Environment Agency (EA), Scottish Environmental Protection Agency (SEPA) and Natural Resources Wales (NRW) to undertake collaborative efforts in flood protection/mitigation schemes.

For our overhead networks, as part of RIIO-ED2 planning, we will continue to rebuild, modernise and refurbish our assets with the long-term plan of achieving storm resilience for 40% of all interconnected 11kV and 33kV overhead networks by 2034. We are also continuing our proactive tree management work (in line with ENATS 43-8 and ETR 132). Our vegetation management work has highlighted the opportunities to reduce the cost of damage and disruption to assets and property, and the positive impacts that adaptive investment can deliver. Ahead of RIIO-ED2, we will incorporate the analysis of potential impact from ground movement on poles/towers within the statutory 6-yearly inspection cycles and overhead line condition assessments.

Biodiversity

We aim to have a net positive impact on the environment and communities in which we operate, protecting and enhancing the biodiversity around our assets in support of national and local strategies.

Human activity is driving a decrease in biodiversity across the globe. Worldwide, around 25% of species are threatened with extinction and natural ecosystems have declined by almost 50% in relation to their previous conditions.* The biodiversity and climate crisis are interlinked: climate change negatively impacts biodiversity, and this ecosystem decline then impacts the Earth’s ability to remove carbon emissions, exacerbating climate change even further.

SPD and SPM mitigate biodiversity loss most significantly through our actions to connect low carbon generation for societal decarbonisation. This leads to benefits in terms of climate change mitigation, avoidance of additional land use and reductions in pollution. While we do this, we also protect and enhance the ecosystems we operate within, mitigating the ecological impacts of construction by aiming for ‘no net loss’ of biodiversity by 2028, and avoiding the introduction or spread of invasive non-native species. As part of the Iberdrola group, we join them in their commitment to have a net positive impact on the ecosystems and species where we operate by 2030.

Stakeholder Engagement

We consulted with our stakeholders and received widespread support for the development of a Biodiversity and Natural Capital Action Plan (to be completed in 2023) with feedback highlighting the need for a longer-term view of implementing the actions in our processes to develop rich biodiversity. The other key messages from stakeholders were setting ambitious future targets for biodiversity restoration and enhancement and

*Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) report 2019.

developing our approach to carbon offsetting to maximise biodiversity and natural capital benefits.

Status Update

Our ambition goes beyond mitigation to create a positive legacy, by restoring and enhancing habitats and biodiversity. We recognise our maturity in this area is low and uncertainty lies in how this can be achieved across our distribution network, some of which will be challenging due to the distinctiveness of the habitats in many of the areas we work. Our current focus is to quantify our impact and trial enhancement approaches, working collaboratively to ensure the right solution for the right place, providing cost effective results to deliver value to customers.



Employee Engagement

Effective employee engagement is vital in order to achieve our vision as a sustainable and innovative network business of the future.

It is essential that our staff understand the environmental processes, programmes and targets contained in our Sustainable Business Strategy, RIIO-ED1 Business Plan and Environmental Management System. Our internal engagement strategy and plan are designed to ensure that all members of staff have the requisite knowledge of environmental aspects and impacts, and the awareness to be able to identify and solve issues as they arise and are better able to determine and address the priorities for change. Training and awareness raising is delivered via a suite of training courses, monthly team briefs, workshops, toolbox talks and online materials.

The *Executive Sustainability Steering Group (ESSG)* continued to meet quarterly, group membership includes SPEN Chief Executive, Chief Operating Officer, Directors and SPEN Sustainability Team.

The main areas of focus in the reporting year:

- Identification of barriers or areas for improvement.
- Best Practice and how this can be replicated across the SPEN Directorates.
- Discussion around key priorities and strategic planning.

Transformation Milestone Plan – There is a significant level of business change required as we prepare for ED2. SPEN Sustainability Team, SPEN Directors and the Chief Operating Officer have developed a change management plan, around the Prosci change model, to deliver the people side of this change. The plan addresses the key areas of awareness, desire, knowledge, ability and reinforcement.

In the reporting year the plan focused on the following areas:

- Internal sustainability best practice calls, with attendance from across the organization. There are two calls, an SPM South call and a North call covering SPD and SPT. The call discusses sustainability and environmental initiatives, shares observations, highlights processes/ procedures, and strengthens responsibilities in controlling and reducing our environmental risks and impacts.
- Environmental roles and responsibilities updated and republished.
- Sustainability personal goals for all SPEN staff.
- An internal campaign focused on identifying opportunities to improve the waste management of wastes at our 25 depots. This included staff nominating their own ideas for improvements and we are now working to implement several of the suggestions.

Training – Staff undertake a range of mandatory environmental training tailored to specific job roles, these include environmental awareness, spillage control, resource management, SF₆ awareness and wildlife and countryside. These bespoke courses were developed with an environmental consultant to provide an awareness and understanding of environmental risks encountered in activities: how to identify risks; mitigate against them and ensure environmental compliance. In the reporting year 647 e-learning courses were completed by SPD staff and 654 by SPM.

New training: A new course on Sustainability was developed and implemented, seeking to share the sustainability challenge that SPEN and our wider society share and to engage staff in the steps that we now need to take to deliver our vision of a sustainable network company.

SPD and SPM joined the Supply Chain Sustainability School (SCSS) in 2020, a collaborative online school with a catalogue of free resources that offers extensive training in different areas of Sustainability. SPEN is a Partner of the School, enabling CPD accredited training both for internal staff and

supply chain. SPEN specific learning pathways were created in 2020, providing more targeted topic specific training pathways in key areas of focus where upskilling is required, such as Carbon Management, Biodiversity and Natural Capital and Circular Economy. Staff engagement with the school has led to achievement of gold accreditation

The ScottishPower group also launched a new climate e-learning course to increase climate literacy across the organisation

Future Networks Learning Lunches – Learning Lunches to inspire innovation and sharing of best practice continued in the reporting year and they continue to be well attended by staff from across SPEN, including our Distribution Licences, SPD and SPM.

Regular face to face engagement – Discussing sustainability and environmental compliance and improvement through regular engagement with senior managers, their teams and other groups

of staff, including staff away days, graduate and apprentice inductions and regular meetings with licence directors and their management teams.

Environmental Express and Toolbox Talks – A number of email publications highlighting legislative and behavioural changes to all front-line and management staff. Topics included waste oil disposal and consignment; biosecurity focussed on avian flu, environmental training, environmental responsibilities and environmental incident reporting.

iCAN – Employee Climate Action Network – Our Employee Networks are created and run by people with a drive and a real interest in bringing people and teams together. Supported by ScottishPower and led entirely by employees, the growing number of employee networks help build our business and help us to attract and retain diverse talent. The iCAN network is a fantastic vehicle for employees to share and build knowledge on sustainability, taking personal action and driving enthusiasm for climate action across the ScottishPower group.



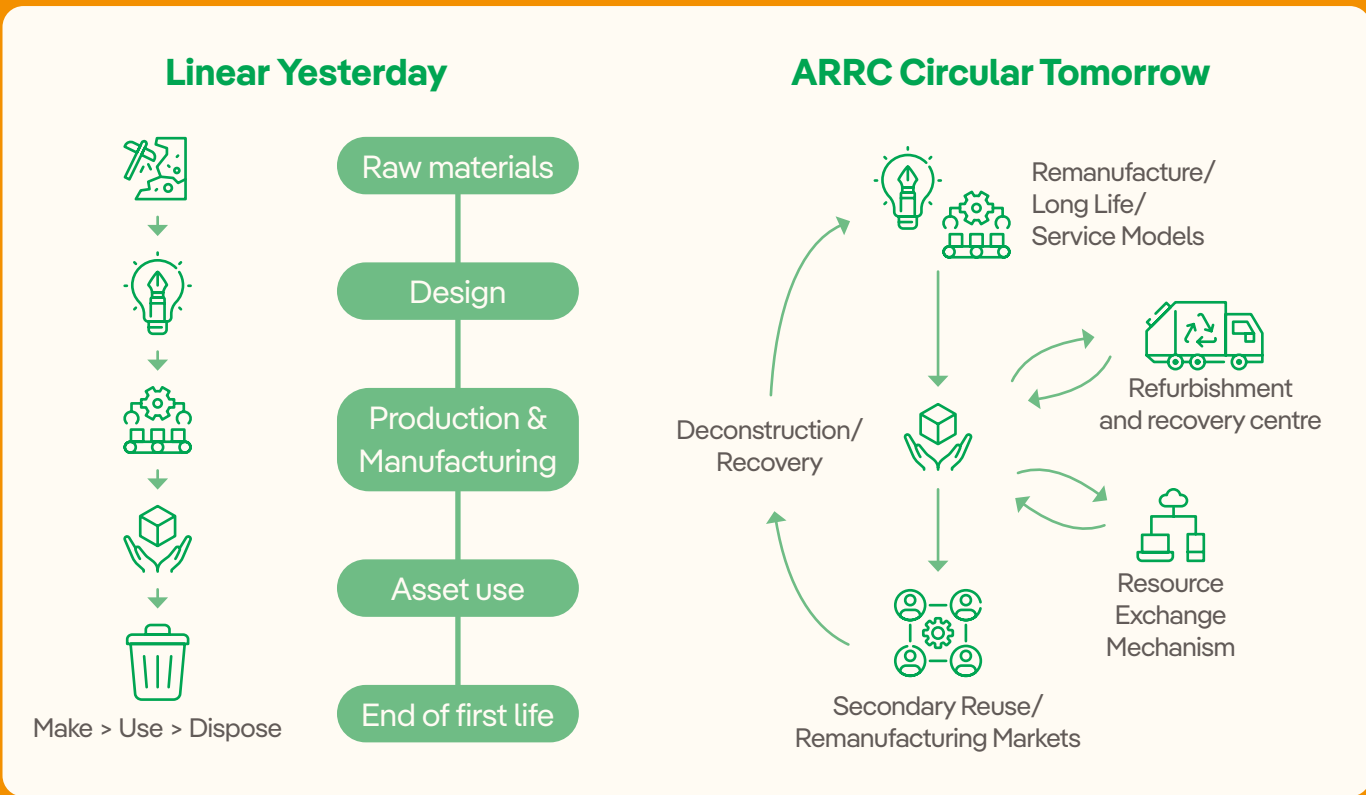
Case study

Embedding the principles of the Circular Economy

In 2022/23, SP Energy worked in collaboration with a range of whole system partners to deliver the Asset Reuse and Recovery Collaboration discovery phase. This innovation project, which received funding through Ofgem Strategic Innovation Fund, aimed to investigate the environmental and cost impacts for purchasing high value and high volume assets across electricity generation, transmission and distribution and consider current procurement, commissioning, use, and disposal practices.

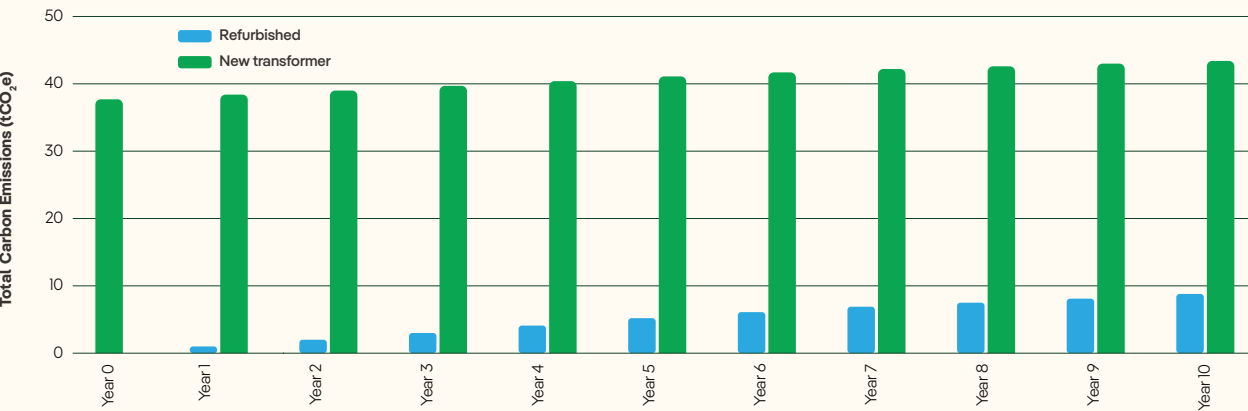
The project assessed the feasibility of different asset models, refurbishment centres, resource exchange mechanisms and secondary reuse / remanufacturing markets which are necessary to extend the use of an asset, maximizing value. In addition to financial advantages, this circular model would have the effect of reducing resource consumption associated with new equipment manufacture and reducing waste associated with asset disposal.

This project has now been incorporated into the Truly Sustainable Substation Network Innovation Allowance project, which aims to assess sustainability opportunities in substation design and operation. The first phase of this project will be complete in 2023.

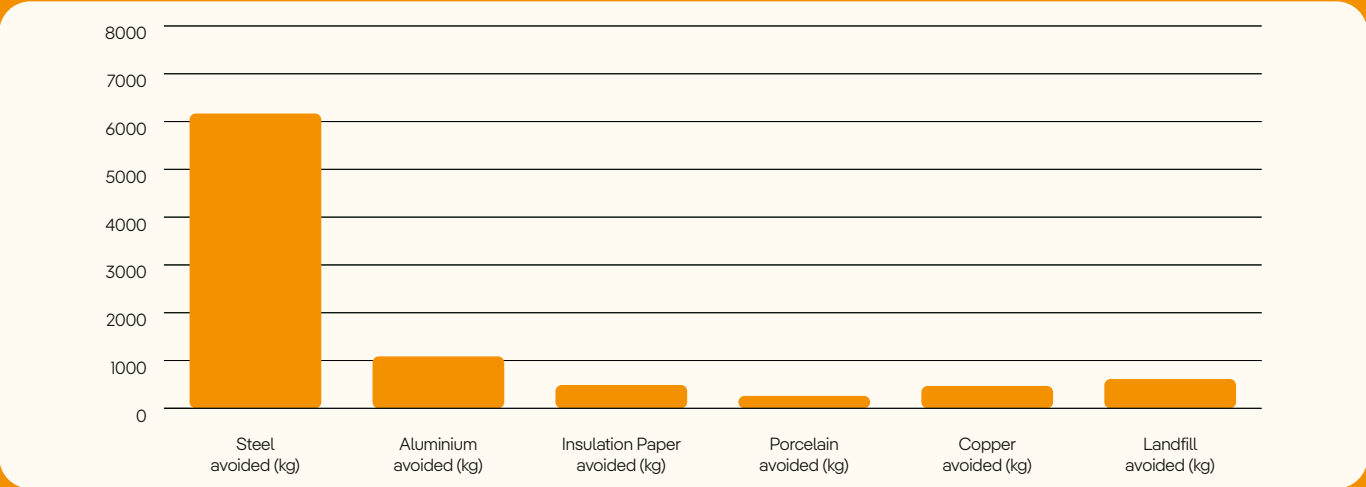


We put circular economy principles into practice with our Pole Mounted Transformer (PMT) Refurbishment Project which was piloted in 2022/23. In order to comply with PCB legislation, a number of transformers were removed from the network and originally selected for replacement. The PMT refurbishment project tested and identified suitable pole mounted transformers which could be repurposed and added back to the network.

PMTx Project 10 Year Carbon Footprint- Comparison to New Transformer



In total, 114 pole mounted transformers were tested at our centre in Cambuslang to determine their suitability for reuse. From the models tested, 28 suitable models have been refurbished and either reinstalled on our network or kept as spares for future installations. Analysis indicated that, along with cost savings, significant sustainability benefits were achieved, summarized below.



The first graph shows the carbon emissions saved from installation of new equipment over 10 years. An estimated 28 tCO₂e have been avoided from the manufacturing of new equipment. The analysis also considers the carbon emissions over a 10 year asset lifecycle, by estimating losses associated with refurbished vs new equipment. Despite refurbished equipment potentially having higher losses (e.g. for older equipment) there are still expected to be significant carbon reductions. The second graph outlines the materials avoided from manufacturing new equipment. The consumption of significant volumes of metals, insulating paper and porcelain have been avoided, and approximately 612kg of material have been diverted from landfill.

The success of this project has resulted in plans to create a centralised workshop at Cambuslang which will focus on the refurbishment of assets such as pole mounted transformers, gas insulated switchgear and oil filled electrical equipment. This project is currently under development, and it is expected that there will be significant cost saving benefits to creating such a workshop in addition to lower carbon emissions and increased circularity benefits like reduction of waste and reduction of resource use.

Smart Grids, Innovation and Our Role in the Low Carbon Transition

SP Energy Networks is committed to delivering the low carbon transition in the UK and are proud to be a part of Iberdrola's global leadership on climate change.

Our Sustainable Business Strategy identifies that we must support the low carbon transition in two key ways:

- By adapting how we operate our business and network; and
- By facilitating the low carbon transition ambitions of our customers and stakeholders.

Driving the transition to a low carbon energy system while minimising the impact of our activities on the environment is the underpinning concept behind our Business Plan, the focus of which is on:

- Delivering fast, efficient and innovative low carbon technology connections, and;
- Ensuring the efficient delivery of additional capacity where there is no available capacity.

As a regulated DNO, our priority is to provide a safe reliable supply of electricity to homes and businesses. Through innovation, we can continue to provide this safe, reliable supply whilst also facilitating decarbonisation and managing our environmental impact.

Our role in the Low Carbon Transition is to:

- Connect Low Carbon Technology;
- Develop our Innovation Strategy and culture of innovation;
- Develop Smart Grid solutions;
- Bring developments proven in innovation projects into business as usual; and
- Facilitate the roll-out of Smart Meters to homes and businesses. This approach is underpinned by mature business processes and delivery platforms which enable all SP Energy Networks

staff to be involved in the identification, development and delivery of industry- leading projects to support the low carbon transition.

Connecting Low Carbon Technology

One of the biggest opportunities and challenges for all distribution network operators is that networks were built for traditional one-way flow of energy, mainly from power stations.

Through the installation of Low Carbon Technologies (LCTs) our customers are increasingly becoming 'prosumers' (both consumers and producers of electricity), opening up opportunities to manage flows of energy on the network in a more hands-on way. Taking on these new opportunities to support the low carbon transition whilst maintaining system reliability and availability means a shift from the traditional role of Distribution Network Operator.

An effective system will reduce balancing costs and enable the flexibility required for customer use of Low Carbon Technologies.

In 2022/23, we installed a total of 17,876 Low Carbon Technologies (equivalent to 500MW). This includes the facilitation of Heat Pumps, PV and Electric vehicles.

The uptake of heat pumps remains slow in comparison to Distribution Future Energy Scenarios 1 (DFES) forecasts. Whilst the volume of recorded new EV charge points (slow and fast charge) in both SPD and SPM have seen steady increases during 2022/23, it remains lower than DFES indications. It's likely that reported volumes particularity relating to EVs is much less than the actual uptake, the information here is reliant on notification from customers or accredited installers.

Stronger incentives and/or national registration systems need to be put in place to encourage customers to notify network companies of newly installed LCTs, ensuring that all LCTs connecting to the network are captured. Accurate reporting of these volumes will assist DNOs and Ofgem in planning and forecasting activities throughout RIIO ED1 and ED2.

The volume of other LCT DG connections during 2022/23 increased significantly on last year's published figures. We have not forecast any material changes to our longer term LCT uptake forecasts at this time due to (i) the continuing uncertainty regarding the impact of government subsidy mechanisms and broader economic forecasts; and (ii) expectation of increased connections as a result of opportunities afforded by our flexible connection policies.

Number of LCTs installed in SPD

Estimated Volumes of LCTs Installed SPD	Heat Pumps	Electric Vehicle Slow Charge	Electric Vehicle Fast Charge	Solar Panels	Other Distributed Generation including Biomass & Wind Generation	Total MW Connected
2015/16	20	405	0	5,497	145	146
2016/17	45	226	0	468	139	438
2017/18	132	73	553	671	178	88
2018/19	63	42	327	1,164	227	34
2019/20	79	30	968	287	111	17
2020/21	57	2	1,260	495	172	117
2021/22	200	0	3,027	793	485	180
2022/23	795	8	2,128	2,196	1,155	239

Number of LCTs installed in SPD

Estimated Volumes of LCTs Installed SPD	Heat Pumps	Electric Vehicle Slow Charge	Electric Vehicle Fast Charge	Solar Panels	Other Distributed Generation including Biomass & Wind Generation	Total MW Connected
2015/16	42	437	0	7,966	120	98
2016/17	70	229	0	579	74	150
2017/18	62	85	413	268	282	64
2018/19	132	43	362	347	354	51
2019/20	182	102	426	64	94	116
2020/21	239	3	2,048	757	255	93
2021/22	469	35	2,432	1,585	924	146
2022/23	1,258	0	4,782	3,378	1,890	275

Progress of the Innovation Strategy

We have challenged ourselves to deliver an ambitious innovation programme and have built a strong portfolio of projects which are impactful and deliver benefits for customers as we move into RIIO-ED2.

Innovation is going to continue to be critical to tackling climate change. Our project portfolio puts us at the forefront of finding smarter, more agile ways to manage our network and to find solutions to challenges like the decarbonisation of heat and transport, and in enhancing network resilience and security of supply.

It's also why we've incorporated significant innovation investment and specific deliverables in our ED2 Business Plan. This includes a dedicated Innovation Strategy, focusing on key areas such as the electrification of heat and transport, hydrogen, and consumer vulnerability. We recognise the scale of the challenge faced by our industry and are committed to ensuring we bring everyone along on that journey as we drive a just transition for all. We're proud of what we've achieved so far and excited by what is yet to come as we build a greener energy future for all.

We are passionate about innovation and cultivating new ideas into business improvements that help our customers; ensuring they receive value for money. We are eager to demonstrate how our customer-funded NIA activities deliver on their priorities. As the current RIIO-ED1 period draws to a close, we reflect on an innovation track record that has contributed to £27 million of benefits and a 6% fall in our customer's bills since 2015-16. We have transitioned industry-leading innovative solutions across our ED1 strategic priorities of safety, reliability and availability, environment, connections, and customer service into business as usual.



NIA PMO Update

Our NIA funding helps us target early opportunities in an agile manner, supporting technology development and improving our practices. This has afforded us the in-house knowledge necessary to lead exciting innovation projects, with support from our delivery partners, which provide direct benefits to our customers and align with the strategic realities of our business. Some key highlights from this year's NIA activities which demonstrate this include:

Our 'Network Constraint Early Warning System 2' project which improves our understanding of low voltage demand whilst visualising alarms in real-time. This project won an Institute of Engineering and Technology E&T magazine silver award for innovation last year and enhances oversight of our low-voltage network; allowing us to release capacity for electric vehicles and distributed generation, benefitting our customers.

Our 'Real Time Fault Level Monitoring' project developed a proof of concept that demonstrated real-time fault level detection and is now undergoing evaluation for business rollout. This is an important capability for lowering barriers to additional renewable generation on our network.

The transition into business as usual of our 'SINE Post' project which successfully demonstrated a solution to locate 11kV faults more effectively and provides customer benefits via greater efficiency in our operations and improved network performance.

For details of SPEN led projects can be found in the NIA Annual Report [distribution] from 2022/23 [HERE](#)

Innovation Project - Predict4 Resilience

Challenge
Distribution Network Operators (DNOs) have a regulatory duty, as well as recommendations from the Storm Arwen Report, to improve their performance during severe weather events. However, their ability to do so is currently limited by existing systems and practices. Predict4Resilience (P4R) will provide accurate fault forecasts and insights for its users during adverse weather events. By predicting both where network faults are most likely to occur and their expected volume up to 7 days in advance, networks can pre-emptively allocate resources and materials to the right locations ahead of time. The changes associated with the successful trial of the P4R proposal will be significant and could profoundly improve readiness by enabling more pinpointed resource planning prior to the events, as opposed to incremental improvements in reactions. This represents a significant shift in approach that could lead to a more effective response to severe weather events, ultimately benefiting customers and the wider community. The project is funded under the Ofgem Strategic innovation fund (SIF) which seeks to find and fund ambitious, innovative projects which can help shape the future of the energy networks and accelerate the transition to net zero, at lowest cost to consumers. This consists of 3 phases: Discovery, Alpha, and Beta, each with increasing scope and budget.

Annual achievements
Through Discovery phase we demonstrated the potential benefits of the solution. In the Alpha phase the project utilised data science capabilities and experience in design and software development to further refine the prototype, resulting in a Fault Forecast Engine which uses cutting-edge statistical methods and an Interface that closely meets the user needs.

The prototype fault forecasting model and accompanying data infrastructure was implemented which verified the feasibility of the P4R's innovations. These statistical models have shown forecasts are highly accurate in days 1-7, a key timescale for operational planning for the Control Room. It was also found that the model successfully predicted severe weather events resulting in large numbers of faults. There was also a strong focus on engagement with users and User Experience (UX) experts to co-design the solution's UX to ensure that it meets the UK DNO's user requirements, such as the display of the entire fault probability distribution instead of the RAG status to aid decision-making.

Expected benefits

By accurately predicting how many and where network faults are likely to occur up to 7 days in advance, P4R will have resources onsite earlier, enabling power supply to be restored sooner than is currently possible and minimising disruption for customers to bring about financial, social and environmental benefits. Having established those faults where P4R would enable an earlier restoration time, the size / scale of that time saving was applied to potential benefits. The impact of the new restoration time was modelled for the relevant faults and the new value compared against the counterfactual. The benefits will include significant cost savings for the consumers, cost reduction for the network operators (savings from customer minutes lost (CML), Guaranteed Standards of Performance, storm support, fuel savings), and direct or indirect carbon reduction.

Timescale and Next Steps

Following the successful demonstration of the prototype's efficacy, Beta phase will evolve the prototype into a commercial solution that can be rolled out across GB DNOs and beyond, improving power system resilience with data-driven fault forecasting and decision-support. In Beta Phase, we are therefore turning our attention to industrialising the solution and improving the fault forecasting, utilising a broader range of data from both other networks as well as new weather

sources to provide a higher resolution reanalysis. Previous user engagement and literature reviews have demonstrated that an improvement in fault forecasting capability is achievable with further iterations and this broader data input. By running trials with two DNOs in parallel with the modelling enhancement, the project team can integrate novel solutions and validate any findings during the trials. The ambition is not only a robust software solution that is interoperable with each DNOs IT architecture but also the evolution of a range of additional, complimentary novel features before the solution is adopted into BAU.



Roll Out of Smart Grids and Innovation into Business as Usual

NCEWS2

We continue to rollout smart grid technologies to understand and monitor our network. NCEWS2 – Network Constraint Early Warning Systems (Phase 2) is a great example of this.

As Smart Meters (SMs) are rolled out across the UK, it is expected that this greater visibility of the LV network will provide sufficient intelligence to trigger Smart Grid dynamic network control, which in turn will release more capacity on the network for increased levels of Low carbon technologies (LCTs).

As part of the NIA funded innovation project NCEWS (Network Constraint Early Warning System), we developed an LV Connectivity Model which will allow us to annotate Smart Meter, EV,

and other internal/external data sets in order to allow users to better understand the operation of SPEN's LV Network via the NAVI (Network Analyse and View) Platform and associated data exports. Our ambition is for this to become our central data management tool.

Both the NAVI and LView platforms are outputs of NCEWS2 and are transitioning into business as usual (BaU). Pending a successful field trial, LView for field operatives will also become part of our BaU and a wider rollout.

The LView platform consolidates the view of all potential low voltage (LV) alarms/data into a single view, including smart meters, PowerOn incidents/calls, and LV substation monitors, etc for near-real-time visualising of their LV alarms. This has allowed SPEN to internally manage this data and move away from several third-party platforms and display 'our own' data via a single platform.



Onload tap changer

We have built on a number of innovation initiatives carried out by SPEN to establish a business as usual solution for smart voltage control schemes in LV networks. The solution is to use of a Distribution Transformer fitted with onload tap changer, this was developed by considering learnings gathered through our NIC funded LV Engine and a Green Recovery Fund project on LV voltage control. The following activities carried out during last reporting period for BaU integration of this solution:

- Finalised design and manufactured the transformers;
- Trialled and monitored the performance of the solution;
- Developed internal documentations facilitating project replications;
- Developed asset models within the internal asset management systems;
- Carried our training where required across the business;
- Considered the solution in our existing transformer supply frameworks

The solution successfully demonstrated the effectiveness for alleviating the statutory voltage violations.



Roll Out of Smart Meters

Installations under the UK's Smart Metering Implementation Programme continued at pace during the 2022/23 regulatory year, showing sustained recovery after the Covid-19 pandemic impacts seen in previous years. By 31st March 2023 there were approximately 391k SMETS2 devices in our SP Distribution licence area, with approximately 390k in SP Manweb area.

In addition to the SMETS2 devices, more of the SMETS1 devices were enrolled into the UK's Smart DCC infrastructure, allowing us to connect and retrieve data from these older devices. By the end of the year, we were able to communicate with 434k SMETS1s in the SP Distribution area, and another 306k in SP Manweb.

Both the SMETS2 installation and SMETS1 enrolment programmes are coordinated by the Supplier/Retail organisations in the UK.

Continued installation and enrolment throughout 2022/23 means that we were able to retrieve data from 1.5 million smart meters by the end of the year, around 43% of our customer base. These growing numbers contributed to increased benefits this year. The roll-out is expected to run until 2024/25, and as the volumes increase, the benefits we anticipate from communication with connectable smart meters include:

- The ability to accurately determine when a customer has lost supply, potentially before the customer themselves has realised.
- Early warning of potential faults through identification of network components under stress.
- Once a loss of supply is identified we believe that smart meters will allow us to react and restore power to customers more quickly.
- Reducing the number of unnecessary site visits made by us each year.

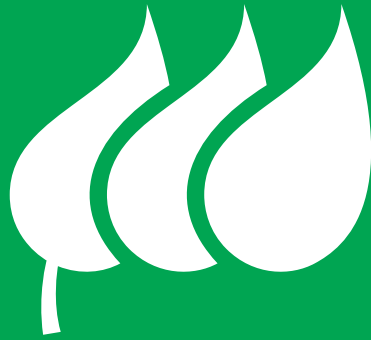
- Smart meters will allow us to identify when an individual customer's power has not been restored, allowing us to ensure we act swiftly to rectify outstanding faults.
- Avoided voltage complaints – in this area SPEN believe we can become proactive in identifying and addressing voltage anomalies before they inconvenience customers.

We continued to refine our Smart Metering IT application, as well as processes which use the retrieved data. More development and refinement is planned for 2023/24.

The ongoing growth in smart meters results in ever-increasing volumes of data. We regularly review the best opportunities to store this data securely and process it to best effect for the benefit of our customers and other key stakeholders.

As noted above, for the 2022/23 regulatory year, we identified a financial benefit from the smart meters currently installed and enrolled in Smart DCC's infrastructure. We have been able to reduce fault costs by avoiding unnecessary visits to premises where the smart meter data confirms the electricity supply to be on.





**SP Energy
Networks**

SP Distribution Environment & Innovation Report 2022/23