

SP Energy Networks Distribution, Environmental & Innovation Report

April 2018 – March 2019



**SP ENERGY
NETWORKS**

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Executive summary

In this, our fourth Environmental and Innovation Report, we provide an overview of our environmental and innovation performance and give progress on our ED1 commitments.

The report highlights our work to manage the network and its impacts, deliver network improvements and enable the connection of low carbon technologies, whilst demonstrating how our progress is driven by our six Sustainability Drivers.

Following extensive engagement with stakeholders and expert organisations we released our updated SPEN Sustainable Business Strategy in March 2019.

2019 is SPEN's Year of Innovation. This will set the foundations of a three-year campaign to strengthen our culture of innovation and get more people actively engaged in innovation across our business.

During the 2018/19 reporting year SPEN registered 6 new Network Innovation Allowance (NIA) projects, along with 17 ongoing projects. Fundamental to the internal approval of each project was their alignment to our Innovation Strategy, built around three key aims:

1. **Faster, Easier Connection**
2. **Preparing the Network for Low Carbon Technologies**
3. **Network Flexibility and Communications**

Since our 2013/14 baseline year SPD & SPM have jointly achieved a 38% reduction in our business carbon footprint excluding losses. By reporting year 2015/16 we had reached our 2023 target of a 15% reduction in emissions.

At the start of ED1 we committed to reducing oil leaks by 50% through replacement of poorly performing 132kV cable in SPM. We have now exceeded this goal by reducing our oil leakage by 63% since our 2015/16 baseline year, far ahead of our 2023 target date. In tackling network losses we have invested in 270 new lower loss transformers since the start of ED1, resulting in estimated savings of 47,738 MWh equivalent to 17,911 tCO₂e. The MWh saved would provide enough energy to fuel 10,899 homes for a year.

During 2018, we prepared the organisation for the recertification of our Environmental Management System (EMS) to ISO14001:2015, which we successfully achieved in October 2018. We continue work to improve the quality and completeness of our data, allowing us to better report our progress towards our goals.

We strongly believe that involving our stakeholders in projects and initiatives is leading to improvements in our processes, a better understanding of the communities we work in and more ideas on the table. In 2018/19, an assessment by AccountAbility, owners of the AA1000 Stakeholder Engagement standard, placed us within the top 16% of companies assessed globally since 2012, with an engagement maturity score of 72%.

We are keen to explore your thoughts on the information presented within this report, and we welcome your feedback which will be invaluable as we progress towards our goal to become a Sustainable Networks Business.

Our six Sustainability Drivers



Sustainable Society



Carbon and Energy Reduction



Climate Change Resilience



Water Efficiency and Protection



Land and Biodiversity Improvement

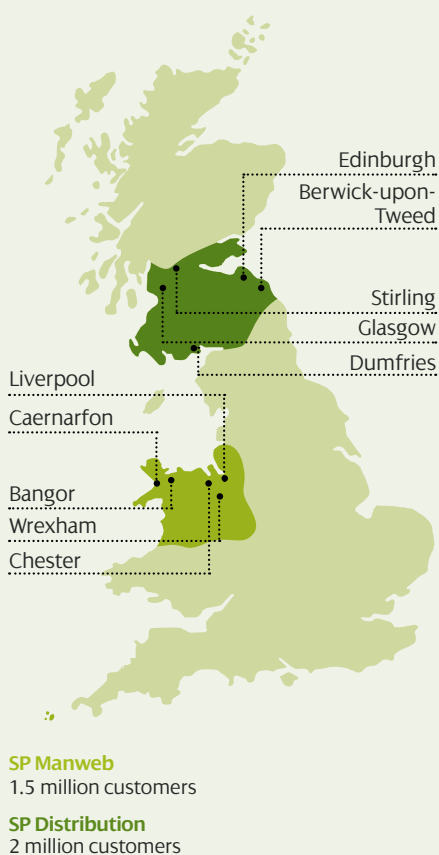


Sustainable Resource Use

Who we are

SP Energy Networks (SPEN) own and operate three regulated electricity network businesses in the UK: SP Transmission plc (SPT), SP Distribution plc (SPD) and SP Manweb plc (SPM).

Figure 1 – SP Energy Networks Distribution Licence Areas



This report focusses on our two distribution licences, SPD and SPM only. Further information on our Transmission licence, SPT is available on our website.

The electricity distribution network in central and southern Scotland SPD, covers an area of almost 23,000km, whilst the distribution network SPM, in North Wales, Merseyside, Cheshire, and North Shropshire in England covers approximately 12,000km. SPEN is part of the Iberdrola Group – a Dow Jones Sustainability Index and Global 100 listed company.

As a Distribution Network Operator (DNO) our role is to maintain, operate and invest in our Distribution Network to secure a safe, reliable and economic service to 3.5 million homes and businesses in our licence areas, regardless of who they pay their bill to. In our licence areas, we are the point of contact for all enquires relating to the electricity network. The safety and security of electricity supply is paramount to our operations.

Within this context of maintaining existing assets, we are continually expanding our network to support the connection of new low carbon generation as part of the transition to the low carbon economy whilst also reducing our environmental impact. We are undertaking a network renewal programme involving the renovation or creation of new substations and the rebuilding of hundreds of kilometres of overhead lines and underground cables.

During planning and completion of these works, our activities must meet the requirements of Government policies and legislation. We also have a responsibility to stakeholders to ensure a consistent and secure supply of electricity as we move towards being a Sustainable Networks business. We have been continuously certified to ISO 14001 since 1997 and successfully achieved recertification to ISO14001:2015 in October 2018.

We recognise that in the undertaking of our role as distributors of electricity we will impact upon the environment in a variety of ways, from the energy losses that occur in our equipment to the visual impact of our assets in the landscape. In fulfilling our ambition to be a Sustainable Networks Business, we strive to integrate fair and responsible environmental practices with socio-economic considerations. As a company, our reputation for excellence is valued and respected among stakeholders.

SPEN employs approximately 3,000 people directly, 2,500 contractors, and supports tens of thousands more jobs in our supply chain. By working together we are delivering our goals to reduce our environmental impact in areas such as Carbon, Waste and Water (see Table 1 overleaf). SPEN recognises the importance of acting responsibly towards the environment and we strive to maintain our reputation for doing so, enhancing it wherever we go.

Who we are continued

Figure 2

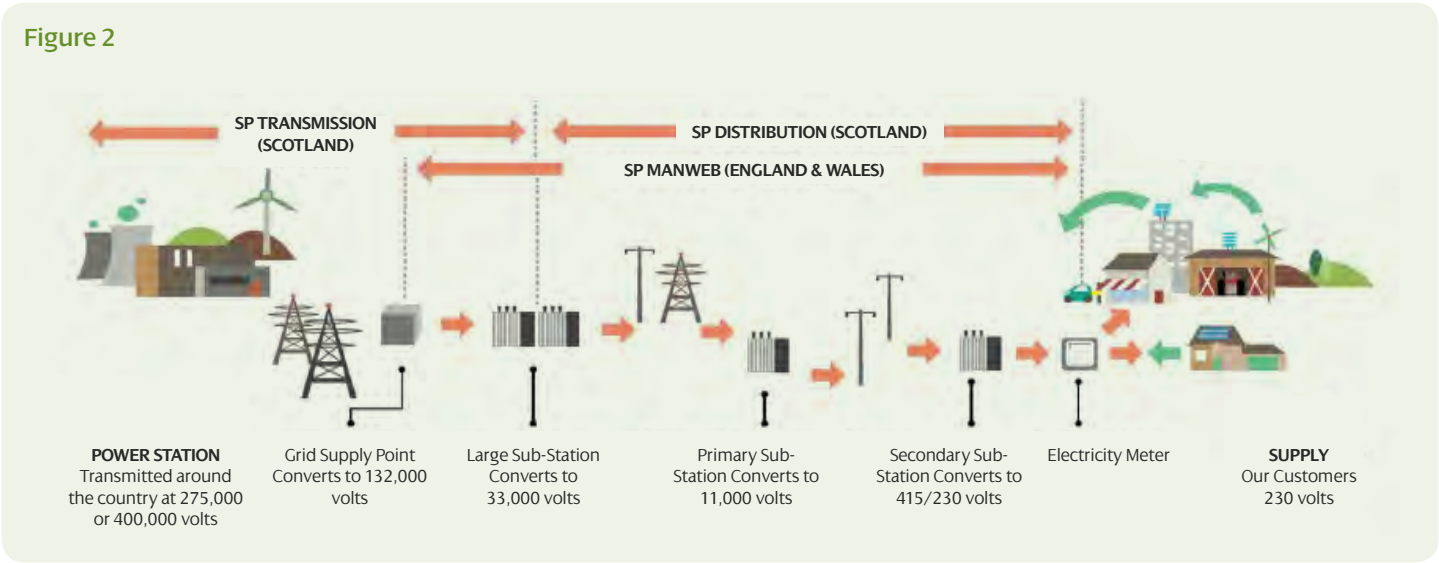





Table 1 – Key Goals and their Rationale

	 Carbon and Energy Reduction	 Sustainable Resource Use	 Water Efficiency and Protection
2023	-15% carbon footprint*	Divert 95% of waste from landfill	-10% in water use*
2030	-80% carbon footprint*	100% waste recycled or re-used	-25% in water use*
2050	Carbon neutral*	Zero waste	-50% in water use*
Rationale	Essential to meeting global and national CO ₂ reduction targets.	Essential to meeting landfill diversion targets particularly in Scotland where the Scottish Government has Zero Waste Strategy target of 5% to landfill by 2025.	Climate change models forecast reduced summer rainfall putting pressure on scarce water resources. Treating water to potable standards and transportation of water is costly and uses energy.

*Targets from a 2013/14 baseline (carbon footprint target excluding losses).

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 ED1 Business Plan 2015–2023 set out our goals and targets to reduce the impacts of our network in key areas.

These aims will be realised primarily through capital investment and innovation activity. This report will re-state these commitments (see Table 2) and provide an update to stakeholders on our progress in achieving them. This report will also update stakeholders on the development of our Sustainable Business Strategy and the other progressive changes we are making in pursuit of becoming a Sustainable Networks Business (please see Appendix 1 SPM, Appendix 2 SPD and Appendix 3 Reporting Table Commentary).

Table 2 – Business Plan Commitments

Managing our Environmental Impact

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.

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.

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 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 SF₆ 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 Meter technology to ensure all generation sources are supported quickly.

Reduce costs to customers by developing modern “Smart Grid” network solutions.

Stakeholder Engagement

Our engagement places our stakeholders and customers at the centre of what we do. With a tailored and locally focused approach, we will prioritise their wants and needs in a consistent manner across our business. We will deliver safe, reliable services, sustainable value, and a *better future, quicker*.

SPEN Stakeholder Engagement Strategy Mission Statement.

It's critical that we engage with our stakeholders to understand their challenges and help them to achieve their aspirations.

Since 2013, our robust Stakeholder Engagement Strategy has aligned to the globally recognised AA1000SE Stakeholder Engagement Standard. In 2018/19, we implemented a new Stakeholder Engagement Strategy, which makes our mission, principles, approach and processes much easier to understand. Our new strategy embeds at its core, the four principles of the AA1000 stakeholder engagement standard – Inclusivity, Materiality, Responsiveness and Impact.

These principles ensure we engage at all levels, (with a specific focus on those who are hard to reach), determine the most relevant and significant issues for us and our stakeholders, act on the outcomes of our engagement – making the necessary changes to our business – and then measure the results.

Embedding these principles is important to our business, as good engagement with stakeholders helps us to improve impact, reduce inefficiencies, create greater environmental and socio-economic value and reduce risk. Most importantly, effective engagement leads to tangible action in our business and benefits for customers and stakeholders.

The implementation of our new engagement strategy, alongside our existing robust engagement approach, has led to a 6% increase in our measured stakeholder engagement maturity this year, achieving 72% maturity, which puts us in the top 16% of companies assessed globally since 2012.

For full details of our stakeholder engagement strategy, see: https://www.spenergynetworks.co.uk/userfiles/file/SPEN_Stakeholder_Engagement_Strategy.pdf

For highlights of our engagement strategy development, see: https://www.spenergynetworks.co.uk/userfiles/file/SPEN_SECV_Distribution_2019_part1.pdf

This level of maturity is due to the significant management, staff and system resource we commit to carrying out in-depth engagement and changing our business strategies and plans in response. In 2018/19 we engaged with stakeholders across a wide range of subjects in three key strategic areas:

- **Better – A Sustainable Network**, reaching 3,984 stakeholders through 63 engagement events and delivering outcomes on city planning, electric vehicles, public transport, and building a green economy.
- **Future – Smart Communities**, reaching 97,517 stakeholders through 291 engagement events and delivering outcomes on smart cities, whole system planning, community energy and partnership working.
- **Quicker – An Innovative Network**, reaching 5,940 stakeholders through 64 engagement events and delivering outcomes on flexible network services, policy change, and smart meter rollout.

Our robust embedded engagement model means every team in our business has responsibility to identify and engage stakeholders to understand their needs and improve our service. This is underpinned by a strong annual programme of core engagement that looks at the big strategic issues facing our stakeholders and legitimises top-down changes in our strategic approach.

For a summary of stakeholder engagement carried out in 2018/19, see: https://www.spenergynetworks.co.uk/userfiles/file/SPEN_SECV_Distribution_2019_part2.pdf

Figure 3 – Stakeholder Engagement maturity ladder

Mature stage (76–100%)



Advanced stage (51–75%)



Early stage development (25–50%)



Beginner stage (0–25%)



Managing Our Environmental Impact



Introduction

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 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 of our strategic aims. We have held continuous compliance with ISO14001 since 1997 and in October 2018 we achieved recertification to ISO14001:2015. To achieve this we undertook a revision of our process to identify our Environmental Aspects and improved the methodology used to assess the risks. These measures allow us to continuously improve and meet our targets.

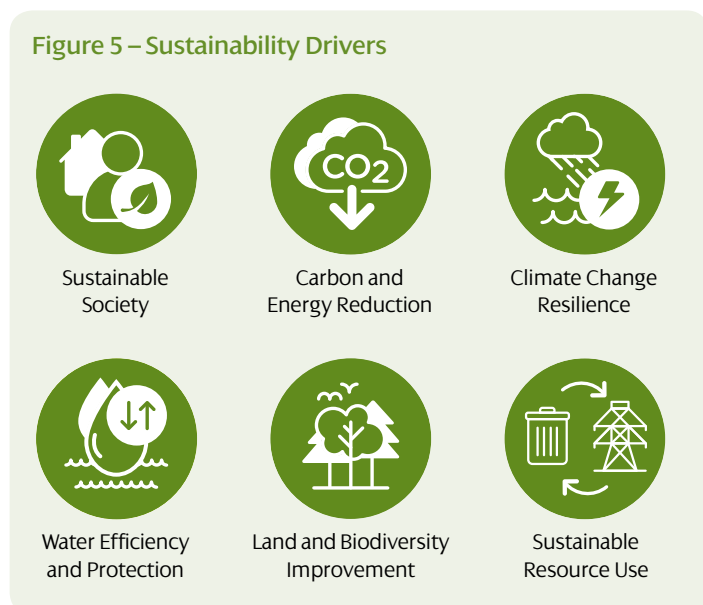
Our Depots are audited annually according to the Aspects and Impacts (A&I) Assessment Matrix and risk scores applied. We continue to use the reporting tool, Cintellate to assist in measuring and driving compliance for Health, Safety and Environmental issues. Cintellate is used to record environmental incidents and to track the actions taken to resolve issues, 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 easy to read graphs and pie charts. The data is further used to present and discuss specific trends at monthly director-level meetings to ensure lessons learned can be shared across the business.

Since their introduction in 2014, our Sustainability Drivers have underpinned our strategy for managing our environmental impact and delivering wider sustainability. The introduction of Driver Icons in 2016 has enabled us to communicate the drivers and their associated objectives to a broad audience, enabling improved understanding and greater recognition of environmental and sustainability successes. The Driver Icons are presented in Figure 5. As a result of stakeholder engagement, we updated our drivers in early 2019 to combine the Raw Materials Optimisation and Waste Management and Minimisation drivers into a single Sustainable Resource Use driver, in order to recognise resource use and waste as part of the same continuum.

Several of our Drivers are connected to reducing our environmental impacts, helping us to focus on key 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 how we manage our environmental impact through visual amenity initiatives and the management of oil leakage. For more information on enhancing biodiversity, please see **Biodiversity** within **Other Environment Related Activities**.

Figure 5 – Sustainability Drivers



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 607,000 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 users 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 ED1 period, assessing lines in the following locations:

In our SPM licence Area

- Snowdonia National Park
- Shropshire Hills
- Bryniau Clwyd A Dyffryn Dyfrdw
- Llŷn 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 4 projects in 2018/19, shown in table 3.

Our process enables key stakeholders to play a crucial role in the identification, planning and delivery of visual amenity enhancing projects, recognising their close relationship with the local landscape.

Local stakeholders including Local Authorities nominate potential projects, and work together with us to determine the best route forward based upon local expertise and knowledge with regard to these protected landscapes. The assessment of nominated projects is supported by SPEN and by experienced chartered landscape architects to ensure that proposed projects provide the maximum visual amenity benefit whilst continuing to ensure acceptable network safety, operability, fault rate and security of supply.

Table 3 – Progress of Visual Amenity Mitigation Projects SPM & SPD in 2018/19

Location of OHL	Designated Site	Licence Area	Lines removed	Underground lines installed
Bryniau Clwyd A Dyffryn Dyfrdw	Clwydian Range	SPM	0.080km	0.242km
Ynys Mon/Anglesey	Anglesey Lyn Peninsula	SPM	0.626km	0.451km
Nith Estuary	Nith Estuary	SPD	0.127km	0.172km
Eildon & Leaderfoot	Eildon & Leaderfoot	SPD	0.000km	0.005km

Visual Amenity continued

This collaborative activity results in an agreed priority list by the local community. SPEN 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.

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.

The pictures to the right show the main views onto the Horseshoe Falls of the River Dee from the viewing car park after undergrounding of the overhead line. Since the site's inclusion as a World Heritage Site, visitor numbers have increased from approximately 20,000 to 115,000 visitors per year. The overhead line which previously ran right across the River Dee has been removed to allow this beautiful view to be enjoyed uninterrupted.

Figure 6



Figure 7



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.

Though 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 reinforced concrete bunds to surround the oil containing equipment. Bund enclosures are designed to retain aqueous liquids to a volume of 125% of the oil contained in the equipment. A sump with a proprietary waterproof lining detects if oil is contained within liquids. The sump sounds an alarm to allow a staff member to arrive on site and assess what action to take on the oil leak.

Projects are presented in Table 4. Works are underway for the 4 SPD sites and at 16 SPM sites. Transformer replacement projects may take place over a number of years. The table shows work carried out in 2018/19 reporting year.

Table 4 – Summary of Oil mitigation schemes in progress


Site Name	Licence Area
Milliken	SPD
Bonnybridge	SPD
Telferton	SPD
Sherwood	SPD
Four Crosses	SPM
Lostock Grid	SPM
Egremont	SPM
Sherdley Road	SPM
Llandudno Junction	SPM
Manod	SPM
Pilkington Plat	SPM
Almatex	SPM
Caergeiliog	SPM
Litherland	SPM
Coppenhall	SPM
Buckley Cross	SPM
Rhyl	SPM
Marsh Brows	SPM
Lister Drive TX Modernisation	SPM
Lister Drive 132 Kv GIS	SPM
Total spend 2018/19	£1,723,993

Oil Leakage continued

In addition to carrying out the works detailed in Table 4, we also make use of MIDEL 7131 Synthetic Ester transformer oil at sensitive sites. Midel oil is fire safe, non-toxic and non-harmful to aquatic life 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 in close proximity to watercourses or those substations providing electricity at locations with an increased impact of fire.

SPEN owns and operates a number of underground fluid filled cables, which were historically installed as an alternative to overhead lines. There are 28.9km of fluid filled cables within SPD and 158.94km within SPM. Fluid filled cables are monitored by pressure alarm systems. An alarm from one of these systems indicates fluid loss from the cable and a potential leak. Once the alarm sounds, detecting the exact point of the leakage can prove difficult, especially when the leaks are small.

In SPM we had a number of small leaks resulting in a 2% leakage rate for the reporting year 2015/16. To combat this, we adopted an ongoing policy of strategic leak repair management and targeted asset replacement. Several methods were deployed to identify leaks quickly, including sniffer dogs, tagging with Perfluorocarbon PFT tracer and the 'freeze' method. Once identified, leaks were repaired promptly. This strategy has resulted in a leakage rate of 0.72% in 2018/19, a 63% reduction in leakage rate since 2015/16, far beyond our ED1 commitment of 50% reduction by 2023.



63%
reduction in
leakage rate

This strategy has resulted in a 63% reduction in leakage since 2015/16, far beyond our ED1 commitment of 50% reduction by 2023.

Carbon Impact and Climate Change



Introduction

Our Sustainable Business Strategy describes our aim to be a carbon neutral company throughout our value and supply chains, and will actively support our customers and local communities towards achieving this goal.

Our ambitious carbon impact and climate change targets are aligned with international agreements to restrict global temperature increases to less than 1.5°C. Our goal is to reach 15% reduction on 2013/14 levels by 2023, 80% reduction by 2030 and carbon neutrality by 2050.

In this section we report on our Business Carbon Footprint (BCF) excluding losses. This is covered in a separate section later on 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 considers three levels of data, in line with UK Government greenhouse gas reporting requirements:

- **Scope 1** – Activities owned or controlled by our organisation that release emissions straight into the atmosphere – direct emissions. Our Scope 1 emissions include fleet transport, SF₆ gas emissions and red diesel use.
- **Scope 2** – 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 activities but which occur at sources we do not own or control. Electricity losses, depot and substation energy use sit within this scope.
- **Scope 3** – 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 emissions. Business travel and the emissions reported from our contractors' activities sit within this scope.

This year we again obtained The Planet Mark™ certification for our Business Carbon Footprint, undertaken by Planet First 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.

The Planet Mark™ is partnered with Cool Earth, the award-winning charity that works to halt rainforest destruction in Central Peru. For every Planet Mark Certification delivered, a pledge is made to protect an acre of rainforest.

Our parent company, Iberdrola, has recently set a Science Based Target and we have started the process of agreeing a specific Science Based Target for our network in order to further validate our existing reduction targets.



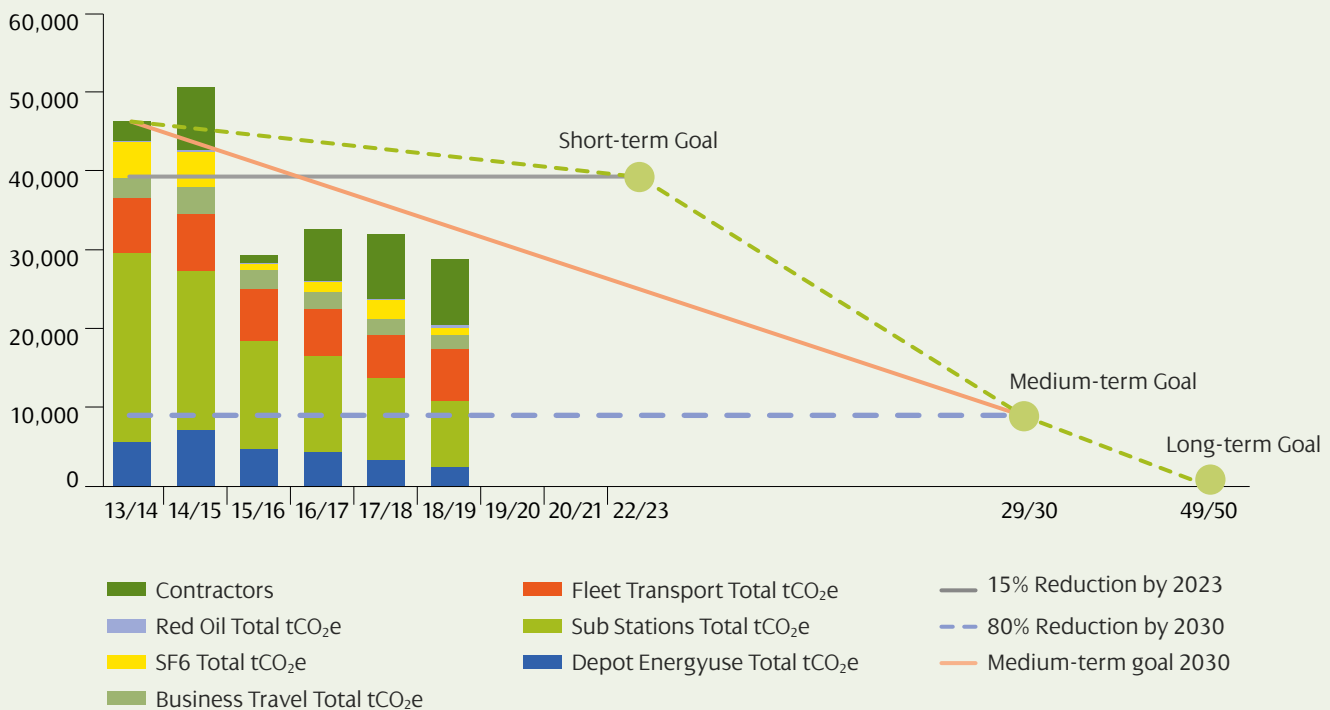
Table 5 – tCO₂e by Scope for SPEN Distribution 2017/18 & 2018/19 including losses

Year	Scope 1 (tCO ₂ e)	Scope 2 (tCO ₂ e)	Scope 3 (tCO ₂ e)	Total (tCO ₂ e)
2017/18	8,115.63	810,430.72	10,018.86	828,565.21
2018/19	7,767.96	631,436.61	9,985.93	649,190.50

Business Carbon Footprint

Since our 2013/14 baseline year SPD & SPM have jointly achieved a 38% reduction in business carbon footprint excluding losses.

Graph 1 – Business Carbon Footprint CO₂ Reduction



By reporting year 2015/16 we had reached our 2023 target of a 15% reduction in emissions. Electricity losses (energy lost or stolen from the network as it travels from source to user), is the largest category of our Business Carbon Footprint and also the most influenced by external factors. We describe this category in detail in the losses section of this report.

After network losses, our largest carbon footprint comes from the energy used in our buildings and substations, followed by contractor emissions, business transport, Sulphur Hexafluoride (SF₆) and lastly red diesel.

Our biggest decrease this year is from SF₆ emissions in SPM. As a result of fixing a leaking piece of equipment, SF₆ emissions reduced by 44% in the year. Further details are provided in the SF₆ section of this report.

This year we have worked with our corporate general services team to receive more accurate data on Business Travel for each of our licences. In previous years a single figure was provided for Energy Networks with no split between licences SPT, SPD and SPM, which was then apportioned by staff numbers. Under the new system, we now receive the actual data for each member of staff, enabling us to more accurately reflect the impact of each licence's travel and fuel consumption.

Our distribution licence business travel reduced jointly by 5.5% against 2017/18 reporting year figures. In SPD the decrease was from 854 tCO₂e to 826 tCO₂e and in SPM we have seen a decrease from 950 tCO₂e to 878 tCO₂e. This is largely due to the move away from staff apportionment between our licences and our continued encouragement for staff to use competitive rail travel in exchange for domestic air travel.



Business Carbon Footprint continued

Our operational fuel use reduced steadily over the past three years, mainly due to installation of our vehicle tracking system which monitors driving styles, idling and journeys taken, all of which have an impact on fuel consumption.

However, with the recent focus on nitrogen dioxide and particulate output in diesel engines we have moved to more petrol vehicles and replaced diesel with Euro6 engines. Whilst petrol and Euro6 engines produce cleaner fumes they are slightly less efficient and therefore can be attributed to an increase in fuel consumed.

As a result of this and corrected apportioning of fuel use between our licences since 2017/18. In 2018/19 The carbon impact from fuel use increased from 2,787 tCO₂e to 3,227 tCO₂e in SPM and from 2,710 tCO₂e to 3,308 tCO₂e in SPD from 2017/18 emissions.

Data for buildings energy use is supplied with building location, and requires apportioned by staff numbers between SP Transmission and SPD as they cover the same geographical area.

To measure actual changes in our buildings energy use we have looked at kWh consumed rather than tCO₂e equivalent. We recognise annual fluctuations in the energy to carbon conversion rate, which reduced by 19% in 2018/19 due to changes in the fuel mix consumed by UK electricity generators. Therefore we typically track the actual kWh of energy consumed in our buildings, rather than the carbon impact.

In this reporting year we have carried out energy efficiency upgrades at six of our sites. Five sites have received LED lighting and motion sensors. Three sites have new heating systems, and two sites have benefited from draft prevention measures including replacement windows and draft prevention doors.

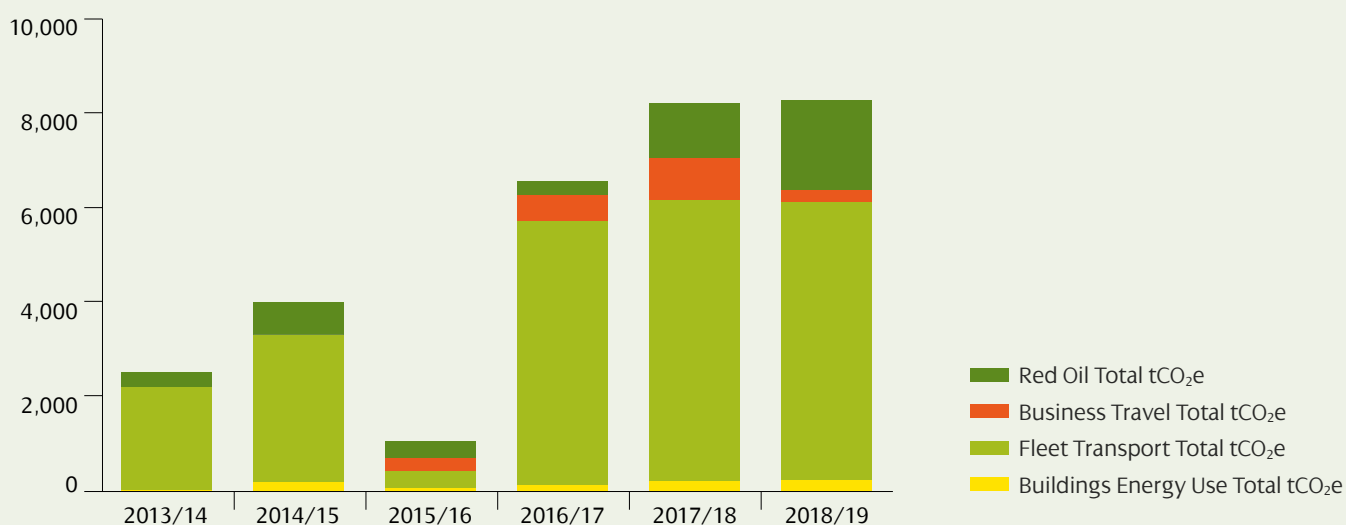
The energy use at our depots, substations and radio base stations has reduced in SPM from 17,865,786 kWh to 17,399,714 kWh and in SPD from 21,528,146 in 2017/18 to 21,506,411 2018/19.

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. This is evident in the improvement made this year to data received on fuel use and business travel for each licence rather than on figure for all of SP Energy Networks. 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 are able to record the impacts of our supply chain and begin to work with them to reduce their emissions.

Graph 2 below shows contractor data from 2013/14 to 2018/19. 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 accurate data, resulting in an increased figure.

Graph 2 – Contractor Business Carbon Footprint data



Business Carbon Footprint continued

Summary of 2018/19 carbon and climate change impact reduction initiatives:

In March 2019 we released the SPEN Sustainable Business Strategy for 2019. This included our six sustainability drivers, and set objectives for delivering annual action plans on the ground to improve sustainability and the environment.

Reduce our carbon footprint by 15% – This was achieved in 2015/16, in distribution our primary focus is now on reaching our stretching target of 80% reduction by 2030, in line with our target of carbon neutrality by 2050.

Reduce SF₆ – We are collaborating with suppliers to identify SF₆ alternatives and drive lower leakage rates. We continue our work to provide robust reporting systems for SF₆ equipment.

Undertaking planned transformer replacements and installed lower loss Transformers – Since the start of ED1 we have replaced 278 higher loss transformers with lower loss alternatives.

Incorporating energy efficiency measures in our buildings – In this reporting year we have carried out energy efficiency upgrades at six of our sites.

Reviewing our data and making improvements where required –

This year we have worked with our corporate general services team to receive accurate data for each of our licences. The improved data provides an accurate reflection of each licence's travel and fuel consumption.

Encouraging a reduction in business travel – As a combined result of travelling less, competitive rail pricing and increased staff awareness of carbon emissions from travel we have reduced our business travel reduced jointly by 30% since the start of ED1.

Reducing fleet emissions – We have now fully embedded our electronic vehicle management system TrackM8. We will continue to use this valuable tool to reduce emissions from our fleet vehicles, whilst investing in electric vehicles in our fleet.



Sulphur Hexafluoride Emissions

To increase the operating efficiency of our assets and to reduce the potential impacts through the leakage of oil, SPEN and other DNOs have been installing SF₆ switchgear when replacing oil containing network assets, such as transformers.

SF₆ is a colourless and odourless gas used to insulate electrical switchgear. Although it causes no detectable impact on the local environment if released, it is considered the most potent greenhouse gas with an intensity 22,800 times that of CO₂ and is capable of persisting in the atmosphere for thousands of years. It is expected that the quantity of SF₆ on our network, described as the 'SF₆ bank', will increase as the oil replacement programme proceeds. Therefore efforts to minimise escape of SF₆ from equipment to the environment is of paramount importance.

SPEN sought to drive the supply chain towards developing equipment with reduced SF₆ leakage rates. The International Electro technical Commission (IEC), the body responsible for setting international guidance recommends a leakage rate of 0.5% (indoor equipment) a more stringent maximum leakage rate of 0.1% for all indoor and 1% for all outdoor equipment each year.

SPEN is adopting a collaborative approach with suppliers to identify alternative insulating gases to SF₆. At present, one project related to our transmission licence is due to see deployment of an alternative gas, with others possible throughout our distribution and transmission licences if the outcome is successful. We are continuing discussions with other suppliers developing other alternatives to SF₆.

In order to reduce the risk of leaks during planned maintenance and improve data quality, we have provided specialist training to operational staff, covering methods for accurately measuring and recording leaks and processes for safe equipment refill.

It is important to make sure we capture all possible SF₆ leakage scenarios. Data for the SPM licence, which includes 132kV assets, is recorded by checking the volume of gas required to top up the tank to original capacity. However, in the SPD licence area, which covers voltages only up to 33kV, much of the equipment that contains SF₆ is sealed, thus top ups are not viable. When a piece of equipment is found to leak, we replace it and return it back to the manufacturer or to a SF₆ licenced scrap merchant.

In SPM we fixed leaking equipment at ICI Wade in early 2017 and recorded no further leaks at this site through 2017/18. In 2017/18 we reported that 67% of the SF₆ emitted in 2017/18 could be attributed to our site at Sankey Bridges. This equipment was successfully repaired by the manufacturer in July 2018 and led to a 44% drop in SPM's SF₆ emissions.

We are now working to fix the leak at our site at Conans Quay and will provide an update in next year's report.



Table 6 – Summary of SF₆ Information

	SF ₆ Bank	SF ₆ Emitted	Actual Leakage Rate
SPM	18,739.05	37.50	0.0020
SPD	15,274.38	5.45	0.0004

Summarised SF₆ information is presented in Table 6 and more detailed information is available in Appendix 1 SPM, Appendix 2 SPD and Appendix 3 Reporting Table Commentary.

Distribution Losses

Our published Losses Strategy is based upon a high-level vision that we will “Consider all reasonable measures which can be applied to reduce losses and adopt those measures which provide benefit for customers.”

We submitted our application for Tranche 1 of the Losses Discretionary Reward in January 2016, and were awarded £770,000 in July 2016.

In February 2018 we submitted our application for Tranche 2 of the Losses Discretionary Reward. Ofgem received 6 submissions for Tranche 2, one from each of the DNOs. Whilst it was noted that SPENs submission was strong, no DNOs were successful in securing a reward.

Work is well-underway for our Tranche 3 submission due early 2020, which takes a backward-looking view of the work and benefits realised within ED1 and considers the outputs of the SPEN chaired ENA Technical Losses Working Group. The working group has developed and shared best practice, and extensively reviewed, assessed and considered options for a fair and effective losses incentive mechanism in ED2, in recognition of the challenges of previous approaches.

To attain our goal of loss-inclusive network management, a good understanding is required of the causes of losses, their magnitude and location, and their impact and interaction with network users across the whole system.

Delivering cost effective loss mitigation activities will reduce customer energy bills, carbon emissions and help to reduce the pace of climate change.

Electricity losses are an inevitable consequence of transferring energy across electricity networks and carry a financial and environmental impact. Effective losses management can therefore reduce our environmental impact and protect consumers from increases to the distribution costs they pay.

About 6% of the energy entering the distribution system is not billed to customers. Much of this is lost in heat and noise as part of the electricity supply process. This energy is referred to as technical losses. In addition a small amount of energy is illegally abstracted, or lost to inaccuracies in the billing and conveyance process. This is referred to as non-technical losses. Electricity industry settlement

systems charge suppliers for network losses and they are therefore paid for by the consumers.

Technical losses

Our distribution networks convey energy from the interface with the transmission system to the low-voltage supplies used by our network customers. The system comprises overhead lines, underground cables, switchgear and transformers and operates at several different voltage levels. The design is based on the principle that as the load to be transferred increases so does the operating voltage. This design ensures that the electric current does not become excessive which would create uneconomic losses. Each of these network components generates heat or noise or both as electricity is transferred. Technical Losses can be described either as Fixed Losses or Variable Losses.

Fixed Losses occur because the system is electrically energised even if power is not being delivered to customers. Fixed losses include the energy consumed by the steel in a transformers magnetic core reversing polarity in every AC cycle. This causes the core to mildly pulse (emitting a humming noise) and to heat up. This steel inefficiency is called “Iron Losses”. In addition, there is some small level of current flow across electrical insulation used in transformers, lines and cables. Taken together, this energy consumption is the “No Load” or “Fixed Losses” on the system. Energy is also consumed by our equipment to ensure safe and reliable network operation. In our substations, energy is consumed for dehumidification and cooling equipment, oil pumps, air compressors and battery changers to maintain secure network operation and resilience.

All conductors, whether coils in transformers, aluminium or copper wires in overhead lines or cables and even in switchgear, have electrical resistance which causes them to heat when carrying electric current. This heat is lost to the environment. The amount of

heat losses rises as the square of the current and therefore if the peak current was 10 times the minimum, losses at peak would be 100 times as large as the losses at minimum load. Because these losses vary with the current flowing through system such losses are called “variable losses”.

Calculating the value of technical losses is complex because variable losses change with load on the circuit but the value of energy also varies with the time of day. In addition, a further type of loss categorised as a Technical Loss is Energy consumed by our equipment to ensure safe and reliable network operation. In our substations, energy is typically consumed for heating and lighting, dehumidification and cooling equipment, oil pumps, air compressors and battery changers to maintain secure network operation and resilience.

We recognise the importance and benefit of collaboration amongst DNOs and currently chair the ENA (Energy Network Association) Technical Losses Working Group which is aimed at facilitating the sharing of best practice within the industry.

Industry settlement data is used to estimate losses. At Extra-High Voltage (33kV) (EHV), site-specific loss adjustment factors are applied to metered units distributed, and for LV and HV estimated loss percentage is derived from the 12 month rolling average models which captures losses at the various stages of settlement reconciliation. The model calculates the average difference between the total energy entering the system minus the EHV purchases and the HV and LV billed sales. The objective of the methodology is to smooth short-term fluctuations in losses which are a natural result of settlement profiling which can obscure actual underlying losses. Settlement takes 14 months from the initial reconciliation where the majority of actual data is estimated to final reconciliation which includes actual data.

Distribution Losses continued

Non-technical losses

Non-technical losses primarily relate to unidentified, misallocated and inaccurate energy flows and not to a loss of energy to the environment. The three main types of non-technical losses are:

1. Energy Theft
2. Unmetered Supplies; and,
3. Conveyance.

Energy theft

Energy theft is the illegal abstraction of electricity by customers, achieved through tampering with supplier meters or interference with network assets.

Unmetered Supplies

Not all customer supplies are metered. Typical unmetered loads include street lighting traffic lights and road signs advertising hoardings and lighting in shared occupancy buildings. Such consumption is quantified by establishing accurate records for each supply and applying a representative profile. Losses typically arise as a consequence of incorrect or incomplete unmetered supplies records and inaccurate estimated annual consumption information.

Conveyance

Conveyance occurs when electricity is delivered but not accurately recorded in energy settlements. Typical reasons for energy not being accurately recorded include missing/ unregistered metering points, incorrect recording of metering point energisation and incorrect registration of metering systems which all result in inaccurate or missing consumption data.

Distribution Losses Strategy

In September 2015 we published our Losses Strategy. This strategy applies throughout the ED1 2015–2023 regulatory period and is subject to regular reviews and updates. We are committed to modifying processes and technical documents to ensure there is a culture of considering losses in every major investment appraisal we take, and to implement investment decisions which are justified after considering losses.

Specific Actions include:

- Accelerate replacement of more than 1,000 higher loss transformers that would have otherwise been replaced between 2031 and 2039.
- HV main line new builds throughout the RIIO-ED1 period will be constructed using larger than usual (100 mm²) conductor.
- Project Specific evaluation of installing larger cross section cables on new circuits, and review ongoing studies to inform policy revisions.
- To address transactional theft, increase our Revenue Protection team by 22% and consider the use of HV and LV network metering and smart metering to identify zonal problems.
- Proactively improve the accuracy of records for unmetered supplies by working closely with customers and settlement stakeholders.

Accelerate replacement of higher loss transformers

– To reduce losses we have brought forward the replacement of some of our highest loss transformer units, which were manufactured before 1962. Over the last 60 years, advances in materials and manufacturing techniques have resulted in the reduction of fixed losses in transformers. The continuing program has led to the replacement of 63 High Loss transformers in 2018/19 that would otherwise have remained in service for an additional 16 years.

We anticipate that the actions included in our strategy will lead to carbon savings of 23,835 tco₂e and 44,977 tco₂e in SPD and SPM respectively.

We have committed to providing an annual update to inform stakeholders of the work we are carrying out within this area.

Losses Discretionary Reward

The Losses Discretionary Reward encourages 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 Losses Discretionary Reward is managed in three tranches during ED1:

- Tranche 1 – submissions made in 2016
- Tranche 2 – submissions made in 2018
- Tranche 3 – submissions made in 2020

For our Tranche 1 Submission we established a portfolio of initiatives. These initiatives went beyond our Losses Strategy and allowed us to explore methods and processes to help improve our understanding and management of losses. Our initiatives recognised that a stakeholder and holistic approach is required when analysing and managing losses.

- Smart Meter Data to reduce non-technical Losses
- Smart Meter Data to reduce Technical Losses
- Voltage Optimisation to improve Network Losses
- Improved Modelling of Complex Networks to Consider Losses
- Improved Modelling of Rural Networks to Consider Losses
- Assessment of Power Factor to Improve GB Losses
- Improved Detection of Theft through Revenue Protection
- Improved Network Loading through Stakeholder Engagement
- Substation Efficiency – Waste Heat Recovery
- Substation efficiency monitoring and self-sufficient substations

Distribution Losses continued

Our Tranche 2 Submission has provided a review of the activities undertaken and their outputs and implementation into the business. The section below provides a summary of our actions. Our full Tranche 2 submission can be found on the SP Energy Networks website: https://www.spenergynetworks.co.uk/userfiles/file/SPEN_LDR_T2_Submission_Issued_27_02_18.pdf

Innovative use of smart meter and Network Data

– Throughout Tranche 1 we extended our understanding of technical losses on networks. We paid particular attention to losses in service cables, which can be calculated using smart meter data combined with our own systems data, through the innovative analysis of smart meter data has included engagement with suppliers via the TRAS Expert Group (TEG). These new developments will continue throughout the RIIO-ED1.

Improve Substation Efficiency – we plan to continue our work on understanding the scale and profile of energy required to operate our substations. We are exploring recovery waste heat from transformers to reduce substation heating demand. To better understand typical distribution substation thermal conditions, we installed temperature humidity monitors.

Improved detection of theft through revenue protection

– Our revenue protection team initiated and hosted a number of awareness sessions for stakeholders who may encounter meter tampering and safety issues during their work. We now have a permanently embedded member of staff with the Merseyside Police force resulting in a significant increase in the detection of energy theft. Consequently, we are actively pursuing a similar initiative with Police Scotland.

HV Phase Imbalance – Phase imbalance on long rural overhead 11kV circuits is a major contributor to 11kV network losses. We have developed a modelling tool to assess the extent and location of phase imbalance. This modelling tool utilises readily available network metrics to identify feeders which are likely to exhibit high imbalance. This has reduced the need monitoring and informed our understanding of this source of losses.

Customer and Stakeholder Engagement

This work is recognised the impact on the network loadings of customer/prosumer behavioural change and additional embedded generation. Where these changes result in higher loads on existing assets there is a consequential increase in technical losses. We have engaged with specific customers to assist them in understanding their usage patterns and their impacts on losses. We have engaged with specific customers to assist them in understanding their usage patterns and the impact on losses. Examples include our on-going work with Flintshire County, their supplier and the Welsh Assembly.

Preparing for RIIO-ED2

In our role as chair of the ENA Technical Losses Working Group we are working collaboratively with the other DNO's and NGET (National Grid electricity transmission) to provide recommendations for a regulatory approach in RIIO-ED2. We submitted a set of proposed Guiding Principles which have been accepted by the ENA working group to form the basis of ongoing optioneering, stress-testing and modelling exercises to identify effective and practical potential options for RIIO- ED2 losses regulatory mechanism.

Table 7 – Assessment of Losses (Technical and Non-Technical) 2018/19

	SPD	SPM	Distribution Total
Units Entering (GWh)	18,471	15,642	34,113
Units Exiting (GWh)	17,266	14,655	31,921
Losses (GWh)	1,205	987	2,192
Losses (%)	6.52%	6.31%	6.43%

Distribution Losses

continued

Table 8 – Summary of losses Costs and benefits (SPD) from activities in RIIO-ED1

Programme/Project	Distributed Losses – Justified Costs	Reduced Losses 2018/19	Reduced Emissions Associated with Losses	Cumulative reduced losses to date
Replace high loss transformers	£5.25m	3,910 MWh	8,027 tco ₂ e	21,402 MWh
Internal and External Revenue protection inspections	£0.04m	7,614 MWh	21,547 tco ₂ e	29,291 MWh
Theft in conveyance	£0.00m	463 MWh	1,310 tco ₂ e	1,340 MWh
Totals	£5.29m	11,987 MWh	30,884 tco₂e	52,033 MWh

Table 9 – Summary of losses Costs and benefits (SPM) from activities in RIIO-ED1

Programme/Project	Distributed Losses – Justified Costs	Reduced Losses 2018/19	Reduced Emissions Associated with Losses	Cumulative reduced losses to date
Replace high loss transformers	£11.21m	6,714 MWh	9,884 tco ₂ e	26,336 MWh
Internal and External Revenue protection inspections	£0.06m	6,313 MWh	17,865 tco ₂ e	27,196 MWh
Theft in conveyance	£0.00m	426 MWh	1,205 tco ₂ e	426 MWh
Totals	£11.27m	13,453 MWh	28,954 tco₂e	53,958 MWh

Table 10 – Summary of Amount of Losses Activities (SPD) in Regulatory Reporting Year and Estimate for the Following Regulatory Year

Programme/Project title	Description of unit	Volumes in Regulatory Reporting Year	Forecast volumes for Following Regulatory Year
Replace high loss transformers	Transformer Volumes	20	37
Revenue protection inspections	Visits made by revenue protection (metered supplies)	20,305 visits were conducted resulting in 1,501 irregularity cases	
Theft in conveyance	Investigations	143	

Table 11 – Summary of Amount of Losses Activities (SPM) in Regulatory Reporting Year and Estimate for the Following Regulatory Year

Programme/Project title	Description of unit	Volumes in Regulatory Reporting Year	Forecast volumes for Following Regulatory Year
Replace high loss transformers	Transformer Volumes	43	127
Revenue protection inspections	Visits made by revenue protection (metered supplies)	8,705 visits were conducted resulting in 1,172 irregularity cases	
Theft in conveyance	Investigations	114	

Other Environment Related Activities



Introduction

We recognise the need to record and monitor our environmental, social and financial impacts and take action where required to fulfill our ambition to become a Sustainable Networks Business.

This section contains a summary of the works underway in relation to the other Sustainability Drivers identified earlier in this report (please see figure 5). This includes waste management noise and air emissions, climate change adaption ecological enhancement and stakeholder engagement with communities, staff and other key groups to deliver this ambition.



Waste Management

In our Sustainable Business Strategy we describe a vision where the principles of a circular economy and efficient use of resources will be embedded in our businesses.

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 waste management – where we value resources both financially and environmentally – is key element of our vision of sustainability. In order to drive this vision, we have set ourselves the challenging goals to divert 95% of waste from landfill by 2023, to recycle or use 100% waste by 2030, then move to zero waste by 2050.

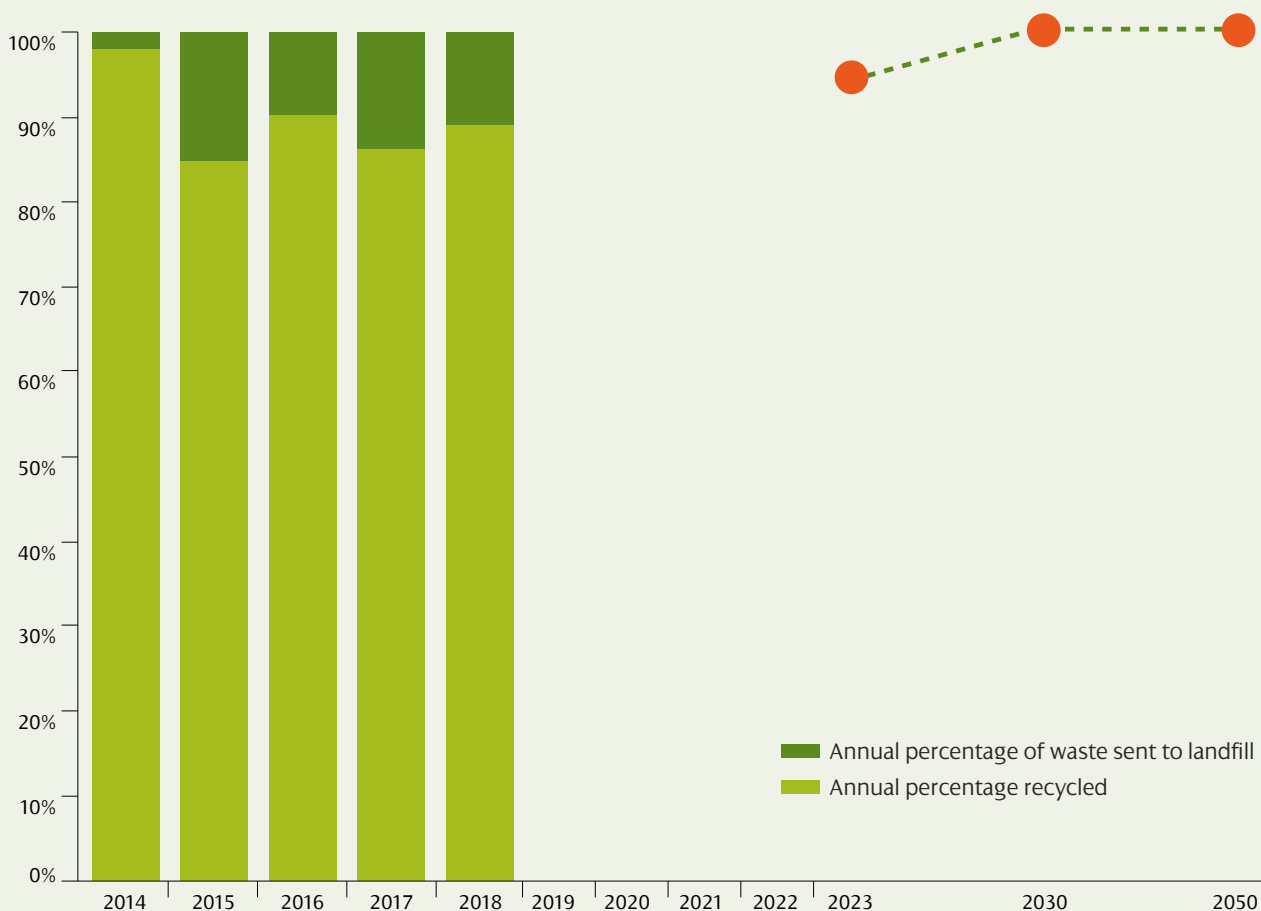
To meet these targets, we are focusing on ways to avoid, reduce, reuse and recycle our waste. Key to this is ensuring that the many inputs of data required become more robust year on year. Our approach is therefore twofold –

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 improve the ways in which waste resource is then processed.

Graph 3 shows our improvements in waste management since 2014. 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 the data recorded as they undertake projects on behalf of SPD and SPM.

Since 2014, we have consistently achieved over 85% of our waste diverted from landfill. We continue to work with our contractors and employees to make the final 10% push and reach our 95% landfill diversion goal by 2023.

Graph 3 – Waste to Landfill Reduction



Management of Noise Impact

The construction and maintenance of electrical infrastructure by its nature will result in some degree of noise.

Where our infrastructure is being constructed in the urban or rural environment, or where new settlements are built adjacent to infrastructure that is already present, this can result in negative effects on the amenity value of an area to society.

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 noise and dust complaints. Complaints regarding noise are logged in our Cintellate system and passed to regional contacts with actions and deadline dates.

In reviewing operational complaints with respect to noise, the majority of 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. The solutions are often relatively straight forward once these are known to us. In the 2018/19 reporting year, SPEN received no complaints in relation to noise.

When a noise complaint is received an inspector will visit the property and conducted a full investigation. Resolutions range from simply applying lubricant to doors and hinges to a full transformer replacement. We endeavour to keep customers fully informed at each stage of the process.



Climate Change Resilience

The planet's average surface temperature has risen approximately 0.9 degrees Celsius since the late 19th century, a change driven largely by increased carbon dioxide and other human-made emissions into the atmosphere.

Most of the warming occurred in the past 35 years, with the five warmest years on record taking place since 2010. Businesses and society are now moving to adapt to the costly impacts of climate change, as well as battling to reduce environmental impacts that could contribute to further climate change and even greater impacts.

In the UK, severe weather events will manifest in several ways with potential to impact on our network:

- More frequent and intense rain showers are predicted to result in localised flooding which could flood our assets or limit safe access for maintenance or emergency repairs.
- More frequent wind storms with higher wind speeds are predicted, which could cause overhead line faults and therefore power cuts.
- Sustained increased temperatures, which could cause a reduced operating efficiency of the network and an increase in vegetation growth which requires clearance from beneath and around our assets.

The challenges resulting from interdependencies of our network are also of key concern for SPEN and our stakeholders.

In June 2015 SPEN published a Climate Change Adaptation Report to record the vulnerability of our network to the effects of climate change and has identified measures to mitigate these adverse effects. This report is due to be updated in June 2020 and work is already underway with ENA working group.

Key Risks

The following risks were included in this report and the previous 2011 report:

Risk AR10: substations affected by river flooding due to increased winter rainfall, with loss or inability to function leading to reduced security of supply;

Risk AR11: substations affected by flash flooding due to severe rainfall, with loss or inability to function leading to reduced security of supply;

Risk AR12: There is a risk that due to extreme sea flooding a substation may be lost or unable to function leading to reduced system security of supply. A number of sites may be at risk from sea level rise/coastal erosion.

SPEN Operational Risks

Risk SP1: impact of increased temperatures on the network with warmer winters and hotter summers potentially shifting peak annual loads from the winter season into the summer months, therefore limiting the flexibility of the network and windows for undertaking maintenance work.

Risk SP2: extreme weather events may have led to a failure on the network, with repair and maintenance teams unable to reach the site, for example where it and/or access roads are flooded. This could result in extended periods of interruptions for customers.

Risk SP3: flooding impacts upon communication and control infrastructure affecting the ability to control and operate the network remotely.

We have completed our assessment of substations at risk of flooding from rivers and sea. We continue to assess substations at risk from ground surface water. The ED1 programme of mitigation at our substations includes where necessary the installation of flood proof doors, waterproof membrane applications and increasing the height of bunds around transformers. We are fully engaged with our Regulators and stakeholders on the next steps for making our whole network resilient to severe weather events based upon the most recent prediction models.

To increase the resilience of our overhead lines, we are continuing proactive tree management work and targeting the modernisation of assets in high weather areas. 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. There are now 25% fewer faults caused by winter weather than a decade ago.

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.

In addition to complying with the Biodiversity Policy of our parent group, Iberdrola, the principles by which we support biodiversity have been included within our Environment Policy, and our objectives within our wider Sustainable Business Strategy. The principles within the SPEN Environment Policy require us to: "Recognise and understand the value to society of biological diversity and natural and cultural heritage, striving within the scope of our operations to conserve, preserve, and enhance these resources and mitigate adverse impacts".

Protection of the environment in which we operate is a priority as we undertake work on our network. In recognition of the importance of biodiversity, we have identified land and biodiversity improvements as one of our six Sustainability Drivers.

During 2018/19, we have actively participated in government consultations and industry workshops on the introduction of new legislation on Biodiversity Net Gain. Biodiversity Net Gain aims to leave the natural environment in a measurably better condition than before. We will continue to be active in this area as the legislation is implemented.

The following case study provides an example of our approach to understanding the value of the environment in which we operate and supporting biodiversity.

North Wales Wind Farms Connection

During 2018/19, we kicked off work in partnership with the North Wales Wildlife Trust to deliver over £100,000 of environmental enhancements around our North Wales Wind Farms connection project. This project will deliver enhancements such as hedgerow improvements, woodland seeding and dormouse habitat creation and monitoring. Where possible, the removal of trees and hedgerows has been avoided along the route of the connection work. Where the removal of hedgerow is unavoidable, it is replaced and the length of the hedgerow enhanced with additional native species.

In total, over 13,000m² of woodland and scrub planting is proposed in areas where woodland removal has occurred and an area of over 7,900m² will be left for natural regeneration. Planting related to the project will be monitored for a period of five years to ensure that the enhancements delivered function as envisioned.



Employee Engagement

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

Including:

- Consideration of environmental, social and economic cost and benefits decision making;
- Collaboration with stakeholders;
- Transparency in decision-making processes and reporting of performance;
- Faster, Easier Connection;
- Preparing the Network for Low Carbon Technologies; and
- Network Flexibility and Communications.

Our employees and supply chain partners are experts on our network, with detailed knowledge of our assets and the operations undertaken to install, maintain and repair them. By raising awareness of sustainability and environment impacts and opportunities for innovation, our employees are better able to determine and address the priorities for change. In 2018-19, we have engaged with employees of all levels through a wide range of channels, including:

Year of Innovation – designed to mobilise all staff to identify opportunities for innovation and empower them to create solutions, this initiative has involved building a network of over 100 Innovation Champions and providing them with training to facilitate local engagement and empowerment for innovation.

Training – Year two of our extensive three-year environmental training programme delivered a wide range of courses to ensure that all our staff know how to reduce the specific environmental impacts and risks related to the distribution network. This significant three-year programme includes e-learning, in-house classroom training and externally audited training tailored to the needs of all staff.

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

Environmental Express and Tool Box Talks – a number of email publications highlighting legislative and behavioural changes to all front-line and management staff, topics including water discharges from construction sites, oil spillage risk mitigation, biosecurity and birds in construction.



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



Introduction

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.

There are two areas of our Sustainable Business Strategy that have aspects relating to the low carbon transition:

- How we operate our business and our network; and
- How we facilitate the low carbon transition.

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, SPEN's 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.

Many of our assets are approaching the end of their operational life, by embracing innovative processes and technologies we expect to manage the replacement of these assets in the most efficient manner possible. This approach requires the business to provide a high visibility platform to raise awareness of the need for innovation including the formation of specific innovation teams. The result of which is a staff body who view innovation as a normal part of day-to-day business.

Our engineers are engaged in developing and delivering industry leading projects to support the low carbon transition.

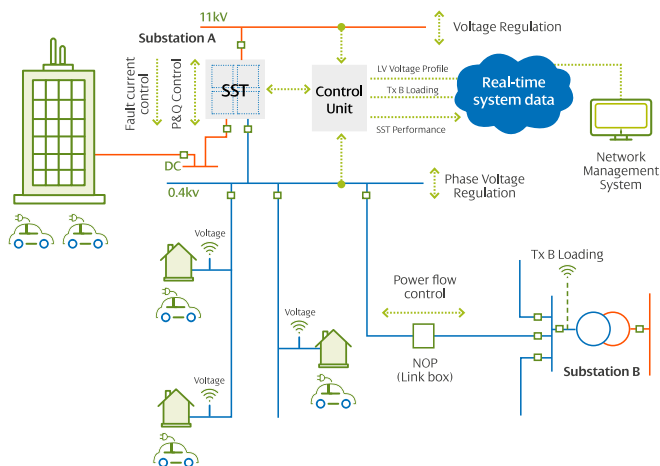


LV Engine

Our LV Engine project is a key enabler of a future DSO by bringing flexibility and controllability to LV Networks. Funded by Ofgem's 2017 NIC, this award-winning 5 year flagship smart grid project will carry out a globally innovative network trial of Smart Transformers to facilitate the connection of low carbon technologies whilst delivering value for money for our customers. We lead the project in partnership with UK Power Networks and a number of other external partners. We have developed the detailed technical requirements of the Smart Transformer and LV automation equipment. We will appoint the manufacturing partners designing and building the Smart Transformer for the installation in the trial sites which have been identified for the live demonstration of the LV Engine solution.

The project team has also successfully engaged with external stakeholders to reach agreement with LV DC customers to join the trial of the LV Engine project. If successful, LV Engine will demonstrate an alternative approach to conventional network design and operation providing the DSO with a number of tools necessary to operate more intelligently within the LV distribution network.

LV Engine



CHARGE

Our successful 2018 Network Innovation Competition (NIC), CHARGE, aims to engage with relevant stakeholders across network, transport, and planning to develop and trial electric vehicle (EV) charging solutions. The project will investigate the ability of smart control, storage, and active network management systems to provide lower connection and operational costs to customers. The project aims to develop a Distribution Network Operator led strategy to facilitate and accelerate the electrification of transport, and more specifically, the connection of charging infrastructure.

Project CHARGE will investigate several smart charging solutions which will enable easier and cheaper connection of high numbers of EV chargers to the electricity networks. The project will test EV charging technology in Liverpool, North Wales and parts of Cheshire and Shropshire that could then be rolled out across Great Britain.

The Smart Cities Award

We were delighted to receive The Smart Cities Award for our Glasgow Smart Street work in association with Glasgow City Council at the UK Network Awards. The Network Awards are the UK's first ever awards dedicated to the gas and electricity sectors. Judged by a panel of 10 industry leading experts.

The Smart Cities Award recognised our industry-leading partnership with Glasgow City Council to deliver an innovation programme which brings smarter cities to life through technological innovation and creating sustainable networks.

With Glasgow leading the way to become one of the most sustainable and smart cities in Europe, the judges were impressed by this outstanding example of collaboration. By working closely with our partners this project developed new technology for an intelligent integrated network and is helping us to create a flexible network of the future.

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.

Through the installation of Low Carbon Technologies 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 towards the more dynamic and proactive role of Distribution System Operator.

An effective system will reduce balancing costs and enable the flexibility required for customer use of Low Carbon Technologies. In 2018/19 we installed a total of 3061 Low Carbon Technologies (equivalent to 85.1MW). This includes the facilitation of Heat Pumps, PV and Electric vehicles. New G83 PV connections rose in comparison to the previous regulatory year, substantially so in the SPD network area from 671 to 1,164. However volumes remain impacted by the change in FITs tariffs in December 2015 and remain below ED1 forecast. The optimisation of existing assets over construction of new network infrastructure, will help us to deliver the required capacity to support this transition at a lower cost, in a reduced timeframe, using reduced quantities of raw materials and reducing environmental impact. In the context of ensuring quicker connections at lower cost, consideration of this approach is essential.

Table 12 – 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	5497	145	145.9
2016/17	45	226	0	468	139	438.5
2017/18	132	73	553	671	178	87.7
2018/19	63	42	671	1,164	227	33.8

Table 13 – Number of LCTs installed in SPM

Estimated Volumes of LCTs Installed SPM	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		7966	120	98.4
2016/17	70	229		579	74	150
2017/18	62	85	413	268	282	63.7
2018/19	132	43	362	347	354	51.3

Progress of the Innovation Strategy

2019 has marked the beginning of a drive to strengthen our culture of innovation; 2019 is SPEN's Year of Innovation! This initiative addresses the most fundamental element of innovation – People!

This will set the foundations of a three year campaign to strengthen our culture of innovation and get more people actively engaged in innovation across the business. To this end, we are creating opportunities for the wider business to engage in focused challenges, raising up champions (to date we have recruited over 90 Innovation Champions) who can drive local innovation and initiatives to enable our people managers to be more innovative and deliver a better future, quicker.

In March 2018 we launched our revised Distribution Innovation Strategy. We invested significant time and effort engaging with local and national stakeholders to deliver both a fully refreshed SPEN Electricity Distribution Innovation Strategy and the very first national electricity network Innovation Strategy. Both are now driving the types of innovation projects we take forward, fostering greater collaboration between licenced network operators (gas and electricity) and enabling more innovators to become involved in our industry.

Over the last six months we have taken the opportunity to review and enhance our internal processes for delivering innovation projects into business as usual. Through engagement with internal and external stakeholders and by benchmarking against other companies' innovation processes, we have identified a number of improvement opportunities. A detailed plan has been produced to implement new streamlined working practices, including a rigorous governance framework that will track innovation projects through the lifecycle of the project to ensure they remain viable.

SPEN Electricity Distribution Strategy

Since we laid out our strategy, we have cemented our position as leaders in innovation, delivering a broad and diverse portfolio of projects to deliver significant customer value.

With the energy landscape evolving at pace, we worked with stakeholders to refresh our strategy in order to continue to lead the transformation of the energy system.

This ensured our strategy would:

- become more accessible and understandable;
- enable greater collaboration from a wider range of partners;
- take a holistic view of challenges and opportunities;
- take an agnostic view of technologies and solutions; and to
- provide a clear plan for implementation with timelines.

We sought to understand stakeholders' network needs and expectations in ED1, ED2 and beyond. In parallel significant engagement was undertaken with each function of SPEN to identify new challenges and opportunities faced by the business. Through this engagement we identified three priority areas for innovation.

Delivering Value to Customers

This priority area focusses on maximising the performance efficiency and benefits delivered through our core business activities. This area identifies 20 specific opportunities and challenges split across four themes:

- Managing an ageing network
- Reducing the number and length of power cuts
- Network Control and Management
- Maximising benefits of data.

A Smarter Flexible Network

The inclusion of this priority area clearly demonstrates that the thoughts of our stakeholders and the challenges faced by our business have shifted considerably in recent years. The connection of Low Carbon Technology (LCTs) was only covered in two themes of the original strategy and the provision of flexibility was completely absent as it was not a priority of our stakeholders. Throughout our engagement, this priority area proved to be the closest to our stakeholders' current thinking and needs. Given this level of interest and input we were able to identify 16 specific opportunities and challenges identified split across three themes against this new priority area, namely:

- Faster, Easier Connection.
- Preparing the Network for Low Carbon Technologies.
- Network Flexibility and Communications.

Progress of the Innovation Strategy continued

Sustainable Networks

Similarly to the previous priority area, aspects of this were included as themes in our previous strategy but as a result of the feedback from our stakeholder and internal consultation it is now more prominent, featuring four themes:

- Socially Responsible member of the Communities we serve.
- Minimising the Environmental Impact of our Activities and Assets.
- Working Practices and Business Systems.
- Our People – Skills and Resources.

Accessibility

As well as refocussing the Priority Areas; Themes, Opportunities and Challenges contained within our Innovation Strategy have been rewritten in full and are in a new format. This new format and content has been written to make it accessible to all stakeholders. It aims to educate readers on who we are, the changing energy landscape and our changing electricity network.

Our Innovation Process

We have placed particular emphasis on our open door policy for innovators, including a transparent breakdown of how we innovate and how they can get involved. Each element of our innovation process is described in detail:

- **Inception** – The generation of ideas and their alignment with our Innovation Strategy.
- **Creation** – The creation of unique projects aimed at
- **Delivery** – The application of professional project management practices.
- **Transition** – The Business as Usual adoption and dissemination of the project.
- **Tracking** – The multiyear tracking benefits realised by the project.

The current SPEN Distribution Innovation Strategy is available here: <https://indd.adobe.com/view/7e04a310-b61e-4a56-8dd8-2b4c2d014b36>

During the 2018/19 reporting year SPEN has registered 6 new Network Innovation Allowance (NIA) projects, along with 17 ongoing projects. Fundamental to their internal approval of each project was their alignment to the Innovation Strategy:

- Faster, Easier Connection
- Preparing the Network for Low Carbon Technologies
- Network Flexibility and Communications.

Full details of SPEN led projects can be found in the NIA Annual Report from 2018/19: https://www.spenergynetworks.co.uk/pages/innovation_funding_incentive_annual_report.aspx

National Electricity Network Innovation Strategy

In 2017/18 the first ever Electrical Network Innovation Strategy and the corresponding Gas Network Innovation Strategy, was authored collectively through the Energy Networks Association (ENA). We are currently working on an update to the strategy due to be published early 2020.

The Electricity Network Innovation Strategy echoes the content of our own document, albeit with subtle differences in the terminology to describe the five innovation Themes, underpinned by a further 30 challenge categories:

- **Theme 1:** Network improvements and system operability
- **Theme 2:** Transition to a low carbon future
- **Theme 3:** New technologies and commercial evolution
- **Theme 4:** Customer and stakeholder focus
- **Theme 5:** Safety, health and environment.

As with our own strategy, stakeholder engagement was at the core of creating this document. SPEN played a leading role in the production of the Electricity Innovation Strategy, chairing the related working group and featuring prominently in several events arranged by the ENA.

Roll Out of Smart Grids and Innovation into Business as Usual

Strategy

The process of transition to business as usual is built into the fabric of every project we undertake. Our strategy for rolling out Innovative Solutions into business as usual lays out six essential elements for successful adoption:

- **Ownership** – At the start of each project, we identify the business and system owners for the solution, should it make the transition to business as usual. This assessment is reviewed throughout the life of the project.
- **Successful delivery** – Appreciating that the success of the project is a key driver in transitioning to business as usual, we continually review projects against their success criteria carrying out a final review prior to business as usual adoption
- **Realisation of benefits** – We measure actual benefits and findings of each project and undertake this analysis using an industry approved cost benefit tool to facilitate efficient transfer to business as usual by our organisation and other network operators.
- **Financial approval** carrying out stringent financial assessment to understand the benefits of the new solution over tried and tested solutions and processes, where long term costs are predictable
- **Policy standards and specifications** – providing a strong mandate for the business to absorb the new solution into business as usual.
- **Training and dissemination** – The transition of the business and wider industry to using the new solution is underpinned by the delivery of effective training and dissemination.

We engage with a wide range of innovation sources to identify opportunities for innovation and assess solutions with a view to adoption into business as usual. In addition to the Project Transition phase, opportunities to adopt innovative solutions into business as usual can arise at several other points in our innovation process.

During Project Inception, we engage not only with our people, partners and peers, but with other industries, manufacturers, academia and stakeholders in the UK and in other countries to identify viable options for progression. If at this stage, we discover an existing solution, we assess its readiness for direct adoption in line with the six essential elements above.

The Project Creation phase provides another opportunity to monitor the output of innovation trials, including those of other DNOs, as we seek to avoid duplication with our proposed innovation projects. We draw on information from the industry-wide Smarter Networks Portal, liaise with other DNOs and draw on experience from across the wider Iberdrola Group.

For smaller, day-to-day innovations which can nonetheless deliver significant benefits the Open Innovation process identifies opportunities through our "Hatch a Challenge" process, then draws on the expertise of a broad community of small-to-medium-enterprise (SME) and individual solvers to create dynamic solutions with strong routes into business as usual.

Deployment of innovative solutions into business as usual

We have deployed three innovative technologies into business as usual in scheme year 2018/19:

Virtual World Asset Management

In 2018/19 the first of SPENs major NIA projects made the full transition into BaU as the business adopted and recognised benefits released from the Virtual World Asset Management (VWAM) project. The business funded the continuation of the VWAM aerial surveys and commenced a tender process for an enduring solution / partner from the summer of 2019 onwards. VWAM has commenced generating significant benefits (primarily in SPM). With more expected in the following years. In 2018/19 VWAM data was responsible for the clearance of legacy OHL defects. The geospatial accurate model and associated analytics of the OHL surveyed being used to confirm the presence or clearance of a legacy defect, by doing so this avoided the cost of a labour intensive site survey, in SPM alone in 2018/19 it was estimated this saving equated to £0.6m.

Protean Steel Mast

One of two innovative solutions adopted by SPEN that have not necessitated NIC/NIA funding has progressed straight into BAU. This solution was borne out of the necessity to replace an extra tall spliced wooden pole, where the only traditional solution available was the construction of a new steel tower. Through the careful development of this project alongside our project partner, SPEN was able to install a revolutionary steel mast with helical screw foundations with a similar footprint to the existing wood pole. The estimated saving vs a steel tower solution was £0.43m.

Sniffer Dog UGC Oil Leak Detection and Location

As with the above, this has not necessitated innovation funding. The novel use of specially trained sniffer dogs to locate oil leaks on oil filled UGC has led to significant benefits in SPM, particularly at 132kV where the successful location of faults has avoided the cost of expensive surveys and additional excavations, with an estimated benefit of £78k.

Roll Out of Smart Grids and Innovation into Business as Usual continued

Roll Out of Smart Meters

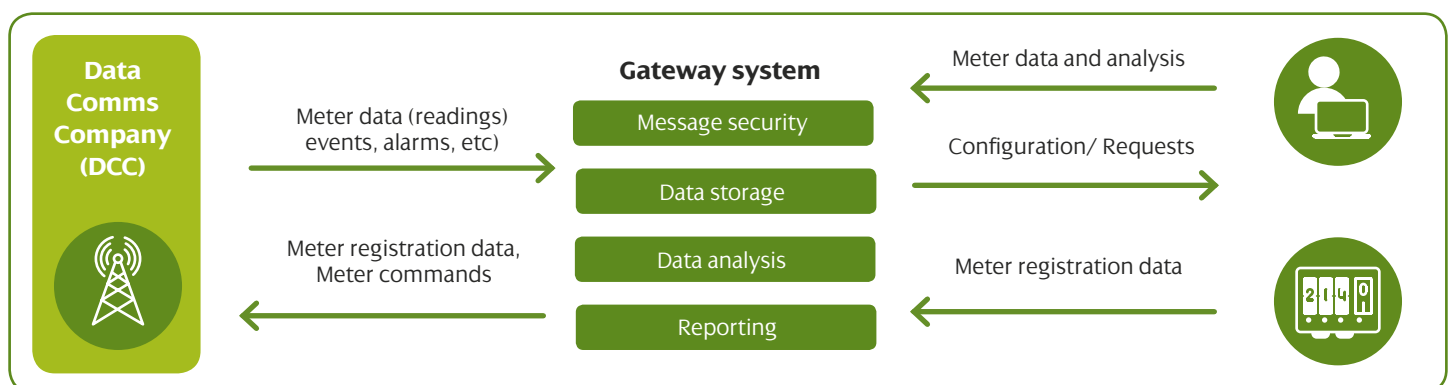
The Smart Metering Implementation Programme again experienced delays during the 2018/19 regulatory year. Most smart meters installed were SMETS1 type. However, we did see an increase in the volume of SMETS2 installations. By 31st March 2019, there were approximately 2.5k SMETS2 devices in our SP Distribution licence area (0.13%), with approximately 24k (1.7%) in SP Manweb area. As only SMETS2 meters currently contribute to DNOs, we received no benefit in 2018/19 in respect of these volumes. When SMETS2 meters are introduced we expect to receive the following benefits:

- The ability to accurately determine when a customer has lost supply, potentially before the customer themselves has realised;
- Once a loss of supply is identified we believe that smart meters will allow us to identify the location and nature of faults on the network with a much greater degree of accuracy, restoring power to customers more quickly and 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 SEPN believe we can become proactive in identifying and addressing voltage anomalies before they inconvenience customers.

During 2018/19 SP Energy Networks continued with refining our Smart Metering IT application. Some enhancements and new functionality were introduced, and we planned upgrades relating to the various forthcoming DCC software releases. Further enhancements are planned for 2019/20.

We continue our preparations to be ready for the time when stable data at volume becomes available. We do this through continuing the development of our systems and data modelling. In addition, we are making adjustments to our business processes in consultation with key stakeholders across the business, to ensure we are well placed for the time when SMETS2 meter installation gathers pace.

For the 2018/19 regulatory year, no benefits were achieved from the extremely low volumes of SMETS2 meters installed.



References

If you would like further information on SP Energy Networks please visit our website:
[spenergynetworks.co.uk](https://www.spenergynetworks.co.uk)

SP Energy Networks Stakeholder Reports:

https://www.spenergynetworks.co.uk/pages/stakeholder_reports.aspx

SP Energy Networks ED1 Business Plan:

https://www.spenergynetworks.co.uk/pages/distribution_business_plan.aspx

SP Energy Networks Stakeholder Engagement Strategy:

https://www.spenergynetworks.co.uk/userfiles/file/20170608_SPEN_SEStrategy_V4.7FINAL.pdf

SP Energy Networks Losses Strategy:

https://www.spenergynetworks.co.uk/userfiles/file/SPEN_Revised_Losses_Strategy_Final_Issue_1.pdf

SP Energy Networks Losses Discretionary Reward Tranche 1 & Tranche 2

https://www.spenergynetworks.co.uk/pages/what_are_we_doing_about_network_losses.aspx

Climate Change Adaptation Report:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/479266/clim-adrep-sp-energynetworks-2015.pdf

Iberdrola Biodiversity Policy:

https://www.iberdrola.com/wcorp/gc/prod/en_US/corporativos/docs/biodiversity_policy.pdf

Iberdrola Environmental Policy:

https://www.iberdrola.com/wcorp/gc/prod/en_US/corporativos/docs/responsabilidad_medio.pdf

SP Energy Networks NIA Annual Report:

https://www.spenergynetworks.co.uk/pages/innovation_funding_incentive_annual_report.aspx

SP Energy Networks Distribution Innovation Strategy:

<https://www.spenergynetworks.co.uk/pages/innovation.aspx>

List of Abbreviations

AC	Alternating Current
ANM	Active Network Management
AONB	Area of Outstanding Natural Beauty
ARC	Accelerating Renewable Connections
BCF	Business Carbon Footprint
CBA	Cost Benefit Analysis
CO ₂	Carbon Dioxide
dBA	A-Weighted Decibels
DC	Direct Current
Defra	Department of Environment farming and rural affairs
DNO	Distribution Network Operator
DSO	Distribution System Operator
DSR	Demand Side Response
ED1	Electricity Distribution Period 1
EHV	Extra-High Voltage (33kV)
ENA	Energy Network Association
FITS	Feed in Tariff
G83	Domestic LCT's
GB	Great Britain
GWh	Gigawatt Hours
HV	High Voltage (11kV)
kV	Kilovolt
LCNI	Low Carbon Network & Innovation Conference
LCNF	Low Carbon Networks Fund
LCT	Low Carbon Technologies
LV	Low Voltage (230/415V)
MVDC	Medium Voltage Direct Current
MW	Megawatts
MWh	Megawatt Hours
NGET	National Grid Electricity Transmission
NIA	Network Innovation Allowance
NIC	Network Innovation Competition
NSA	National Scenic Area
OHL	Overhead Line(s)
PV	Photovoltaic
RIIO-ED1	Revenue = Incentives + Innovation + Outputs Electricity Distribution Period 1
RSPB	Royal Society for the Protection of Birds
USEF	Universal Smart Energy Framework
SEPA	Scottish Environment Protection Agency
SF ₆	Sulphur Hexafluoride
SMETS	Smart Meter Equipment Technical Specification
SPD	SP Distribution Licence Area
SPEN	ScottishPower Energy Networks
SPM	SP Manweb Licence Area
SSSI	Site of Special Scientific Interest
tCO ₂ e	Tonnes of Carbon Dioxide Equivalent
UK	United Kingdom

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