Annex 4.6
Environmental Action Plan

Northern Powergrid: our business plan for 2023-28

Contents

Overview

Our Environmental Action Plan (EAP) builds on our strong performance in the current period to target improvements across the board in line with stakeholder feedback

We have a responsibility to protect our environment. Environmental Respect is one of our six core principles as a business and it is an obligation that we take very seriously. The presence of our assets and operations across the communities we serve mean that the decisions we take can have a significant impact on our stakeholders and the environment around us.

Our performance to-date demonstrates our strong environmental credentials and provides us with a reassuring track record to build upon during the 2023–28 period.

Our plan has been set to deliver cost-effective asset investments that reduce or eliminate environmental risk exposure backed by sound management processes and decision-making that drives us towards low pollution, low carbon and low waste operations.

National net zero targets and supporting legislation are driving positive changes in society. We are a key enabler for the net zero transition in our regions. Our objective is to keep all credible pathways to decarbonisation open whilst minimising long term costs for our customers.

Overall we will invest £135.0m to deliver our EAP across a wide range of initiatives[1]. This represents a 2.9 per cent decrease in expenditure compared to the 2015-23 period with our EAP being one of eight output areas of our plan where, taken together, we are delivering significantly improved outputs for customers at lower cost. To achieve this, our EAP deploys a range of innovative solutions to minimise our environmental impact whilst keeping costs low for customers. This includes deploying and developing technologies at scale and leveraging data analytics to optimise the targeting of our investments.

Enabling our region to decarbonise is a top priority for our stakeholders. Our ambition is to be a leader in the transition to net zero whilst protecting the environment.

Decarbonising the energy system represents the most significant change our industry has seen in decades and has been the biggest shaping force in our plan for the 2023–28 period. It is one of our stakeholders' top priorities and as the demand for electricity increases along with distributed energy resources, our system needs to adapt and become smarter and more flexible. We believe that by playing our part in a decentralised energy system, balancing locally connected renewable generation, electricity storage solutions and flexible demand we can keep costs low for customers and support pathways to net zero emissions.

Our role is pivotal in enabling our regions to decarbonise and meet the UK's interim target of reducing carbon emissions by 78% from 1990 levels by 2035. As our network is central to facilitating the necessary change required for decarbonisation, significant investment is required to support our regions in reducing their emissions. We set out in the Decarbonisation section of our plan, Scenarios and Investment annex and DSO strategy how we will develop the network and infrastructure around it so that all credible decarbonisation net zero pathways can be supported.

We recognise our role as an anchor institution in our regions. We are a major regional employer investing hundreds of millions of pounds per year through our supply chain and we have the opportunity to make a positive impact in the communities we serve by taking the lead and demonstrating good environmental practices. Our activities also have wider influences and support regional economic growth. We are committed to working with our supply chain to build capacity, encourage strong environmental practices including the adoption of low carbon technologies (LCTs) and supporting regional economic growth.

[1] Not including our investments to facilitate societal decarbonisation, which are covered in the Decarbonisation section of our plan.

Our Environmental Action Plan delivers an ambitious set of outputs at no extra cost to customers through the deployment of innovative technologies and solutions

The total cost of our plan is £27.0m per annum, which is £0.8m (2.9 per cent) per annum lower than 2015-23 cost levels. For this expenditure we will achieve significant output improvements whilst accommodating £8.6m per annum of unavoidable costs relating to the removal of polychlorinated biphenyls (PCBs) which accounts for 32 per cent of expenditure in our Environmental Action Plan (EAP). We achieve these outcomes at an efficient cost by harnessing innovative solutions throughout our plan, most notably perfluorocarbon tracer (PFT[2]) technology, which will allow us to save £8.2m per annum in cable replacement whilst achieving continued reductions in fluid loss.

We keep the environmental impact of our network and operations under continual review

Our approach to managing the environment is an integral part of our wider business planning processes. Environmental impact is considered as part of our company risk assessments and environmental risk management is an established factor in our investment decision-making processes.

We operate an ISO 14001 certified environmental management system (EMS) that provides a robust framework against which we continually assess our environmental impact, performance against our environmental plans and associated risks and opportunities. Regular internal and external assessments are undertaken on our EMS to ensure compliance. Significant risks and opportunities are addressed through asset risk management reviews and our Risk Advisory Board which is chaired by one of our Non-Executive Directors.

Regular working groups and stakeholder engagement allow for risks and opportunities to be identified and managed. We monitor progress against our plans and report annually on our performance to our stakeholders.

Our key environmental impact areas are shown below:

Environmental Action Plan – Impact areas

Business Carbon Footprint	Environmental protection
Scope 1 and 2 emissions	Resource use and waste
Sulphur Hexafluoride (SF_6)	Biodiversity
Losses	Fluid filled cables
Scope 3 emissions	Noise pollution
Embodied carbon	PCBs
	Visual amenity
Supply chain management[3]	

[2] Perfluorocarbon (PFT) tracers: an additive put into fluid-filled cables which can detect leaks by 'sniffing' the specific chemical structure of the additive in the ground above the leak, locating leakage from above the ground to target repair.
[3] Supply chain management cuts across our impact areas.

Our EAP considers each of these impact areas, setting out:

- Our plans for the 2023-28 period;
- What we heard from our stakeholders and how this impacted our plans;
- The options we considered;
- Key opportunities and challenges (more detail on our impact assessment, opportunities and challenges is set out in Appendix 2).; and
- Our choices and justification.

Our EAP contains six customer outcomes, with 23 supporting deliverables and 26 measures to track our progress. These are explained throughout the document and brought together in Appendix 1.

Customer Outcomes

EP1	**Reduce controllable internal BCF by 20% keeping us in line with the government's 2035 target and on a path to being a carbon-neutral operation by 2040, and introduce science-based targets to measure our impact**
EP2	**Efficiently manage and optimise losses from our network**
EP3	**Promote environmental management and decarbonisation of our supply chain, achieving 90% compliance with our responsible procurement charter**
EP4	**Reduce oil lost to ground by 15%**
EP5	**Remove PCB contaminated equipment from our network**
EP6	**Take proactive action to protect and enhance the environment in which we operate delivering 73km of undergrounding to improve visual amenity, biodiversity improvements at 200 sites and 90% of waste diverted from landfill**

Business Carbon Footprint

Long term objectives

- Become a carbon net neutral business by 2040[4]
- Achieve scope 1 and 2 emissions reduction in line with Science Based Targets *(aligned to 1.5^{o}C global temperature rise above pre-industrial levels)*
- Reduce SF_6 risk and losses from our network through adopting alternative technologies

Customer outcome (2023-28 period)

EP1	**Reduce controllable internal business carbon footprint (BCF) by 20% keeping us in line with the government's 2035 target and on a path to being a carbon-neutral operation by 2040, and introduce science-based targets to measure our impact**

Benefits

- Reduction in carbon emissions
- Improved air quality
- Contribution to wider climate change agenda

Deliverables

EP1.1	Install renewable energy at 50 sites, remaining receptive to technological advances
EP1.2	Adopt a verified science-based target to reduce scope 1 and 2 emissions in line with net zero (4.2% annual reduction to 2035, achieving a 21% reduction in emissions over 2023-28) and report on progress for scope 3 emissions
EP1.3	Implement BREEAM[5] initiatives and standards at 10 sites
EP1.4	Increase ultra-low emission vehicles (ULEVs) on fleet to 40% by 2028, reducing fleet fuel by 33%
EP1.5	Reduce sulphur hexafluoride (SF_6) losses by 15% including replacing SF_6-filled equipment with a leak rate in excess of 5 kg over a four-year period
EP6.5	Publish an annual environmental report for our stakeholders covering the delivery of our 2023 – 28 EAP commitments **(ODI-R)**

Measures	ED1 to date	ED1 forecast	ED2 target
Controllable internal BCF (excluding losses) (tCO_2e)	14,722	14,300	11,430
Science-based target Scope 1 and 2 emissions (excluding losses) (tCO_2e)	12,866	11,740	8,920
Science-based target Scope 1 and 2 emissions (including losses) (tCO_2e)	539,775	492,450	374,130
Report on Scope 3 BCF annually[6] (tCO_2e)	✓	✓	✓
Building and substation energy use (tCO_2e) (ODI-F)	7,312	6,480	5,520
Operational transport emissions (tCO_2e) (ODI-F)	4,186	4,110	2,750
Business transport emissions (tCO_2e) (ODI-F)	1,558[7]	2,560	2,160
SF_6 losses (kg)	73.1	50.3	42.7

Key: Output measures/*indicative inputs*

[4] Controllable emissions.
[5] Building Research Establishment Environmental Assessment Method (BREEAM) is a sustainability assessment method that is used to master-plan projects, infrastructure and buildings.
[6] We will factor in increased activity levels in 2023-28 to deliver net zero investment when assessing our performance in this area.
[7] Reported figure reflects the impacts of COVID-19.

It is important that we decarbonise our operations

Carbon footprint can be defined as the amount of carbon dioxide released into the atmosphere as a result of the activities of a particular individual, organisation or community. By lowering our carbon footprint, we can help contribute to the overall reduction of greenhouse gas emissions, supporting the wider climate change agenda.

Our controllable, internal sources of emission, as captured through the Regulatory Reporting Process (RRP), include our operational fleet, company car miles, other business travel and office, depot and substation energy use. Our supply chain also contributes to our overall carbon footprint as we use contractors to undertake work on our network and deploy generators to support our customers during power cuts. The components of our carbon footprint are shown in Figure 1 below. Our internal carbon footprint (excluding losses and contractors) is 14,722 tCO2e[8] with our contractor business carbon footprint (BCF) at a slightly greater level to this. Electrical losses make up over 94 per cent[9] of our overall total carbon footprint and are addressed within this document and annex 4.5 losses strategy.

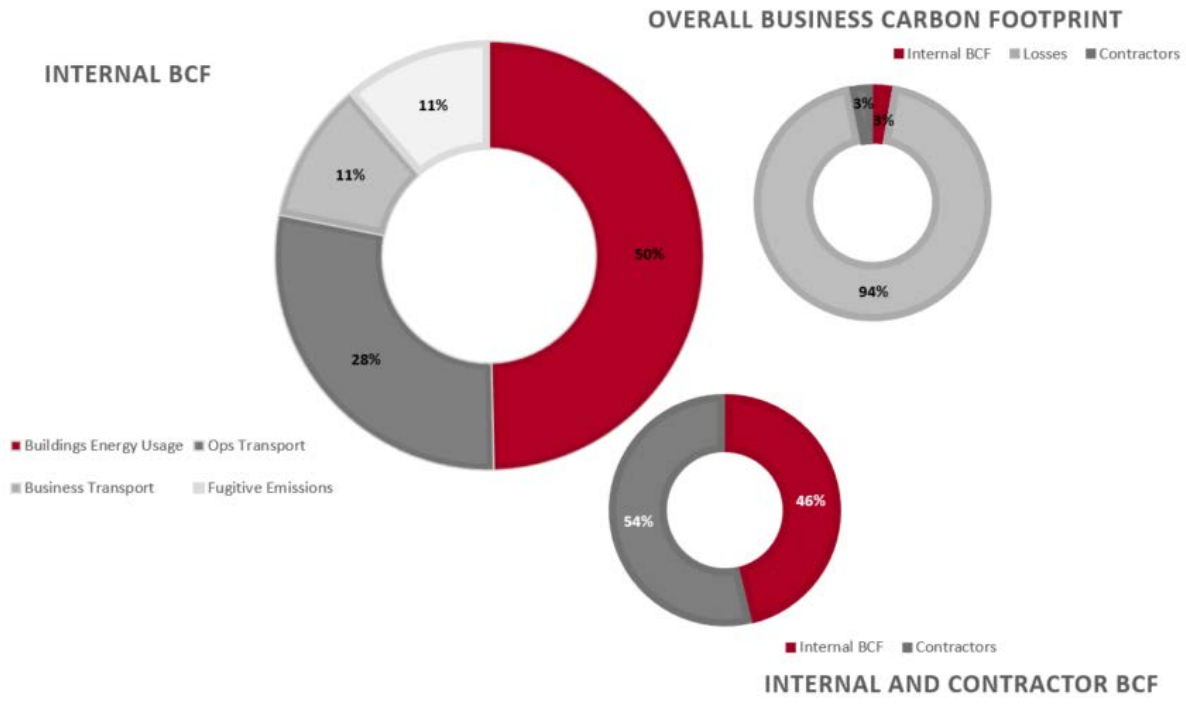

Figure 1: Components of our business carbon footprint

We will reduce our controllable business carbon footprint (excluding losses) by 20 per cent in 2023-28 to put us on a path to being carbon net neutral by 2040.

[8] Based on 2020-21 actuals.
[9] Emission contributions reflect the emissions reported through the Regulatory Reporting Process (RRP).

Our stakeholders want to see high levels of ambition when it comes to reducing our business carbon footprint

We presented stakeholders with a range of options in our 'emerging thinking' consultation and there was strong support for a plan that achieved carbon net neutral operations by 2040 by managing our controllable emissions. This is ahead of the government's commitment to be net zero by 2050 and balances ambition with long-term cost efficiency (see Annex 3.3 Detailed Engagement Findings - EAP). Our target trajectory aligns with the government's interim commitment to reduce emissions by 78 per cent from 1990 levels by 2035.

Stakeholders were supportive of introducing renewable generation across our property estate and electrifying our fleet and there was consensus that we should be leading by example, however the costs associated with these initiatives were raised as a concern alongside the maturity of low carbon technologies. Our net zero target allows technology and infrastructure to develop so we can execute our net zero operations transition at lowest cost to customers.

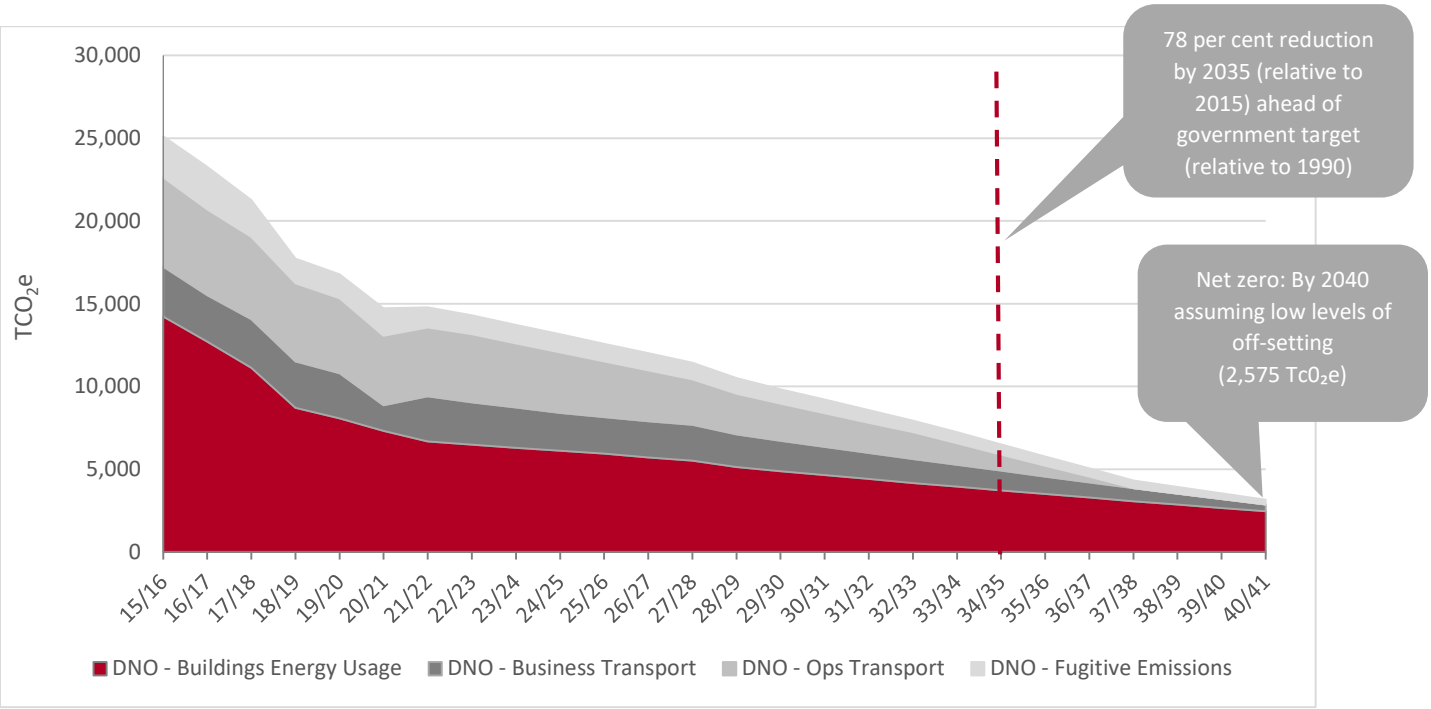

Figure 2: Northern Powergrid internal BCF transition to net zero by 2040 (78 per cent by 2035) [10]

We will not use carbon offsetting to achieve our targets in the 2023-28 period. Our stakeholders have told us that they would rather we focussed on reducing our own physical carbon emissions than off-setting (see Annex 3.3 Detailed Engagement Findings - EAP). An extra £1 of investment in our network to enable decarbonisation offers much better value to customers than incremental spend on carbon off-setting of our own emissions.

Our progressive but measured approach will balance technology readiness and cost impacts.

Our initiatives to reduce our controllable business carbon footprint include:

- reducing building and substation emissions through renewable generation at 50 sites and BREEAM[11] initiatives to make sites more sustainable;
- increasing Ultra Low Emissions Vehicles (ULEVs)/ Zero Emissions Vehicles (ZEVs) to 40 per cent of our fleet;

[10] Our internal emissions data split dates back to 2015 and so we have modelled our progress against the governments' performance from this point.
[11] Building Research Establishment Environmental Assessment Method (BREEAM) is a sustainability assessment method that is used to master plan projects, infrastructure and buildings.

- reducing business mileage by 15 per cent assisted by more flexible working; and
- reducing SF_6 emissions by 15 per cent.

Our BCF (excluding contractors), which considers emissions as a proportion of size, benchmarks well compared to other DNOs, ranking second in 2019-20 with a best-ever result. It is worth noting however that such comparisons are impacted by the differing in-source/out-sourced models adopted by network businesses.

Building and substation energy use

Building and energy substation use accounts for 50 per cent[12] of our total controllable internal BCF.

We considered a number of options to achieve a reduction in our building and substation energy use. Without any intervention, our building and energy substation use would see a natural reduction in emissions due to increased penetration of renewable generation in the UK reducing the overall carbon intensity factor; however, we have sought higher levels of ambition in our plan given this is the largest contributor to our internal controllable business carbon footprint (excluding losses). Our stakeholders were supportive of renewable generation to lower emissions but were cautious of the associated costs (as shown in Annex 3.3 Detailed Engagement Findings - EAP).

We considered a number of options:

- do not invest in renewable generation at our sites and defer investment to 2028-2033 period;
- implement energy efficiency measures by introducing BREEAM initiatives across 10 sites and implement substation energy efficiency assessments;
- take a steady approach to renewable generation in the 2023-28 period, with 4 kWh solar panels across 50 sites; and
- invest in 20 kWh solar panels across 10 substations and depots with battery storage.

We considered deferring investment in renewable generation completely into the 2028-33 period where we expect the technology to have developed and costs to have reduced significantly. This did not align to delivery of an ambitious EAP and ignored our stakeholder appetite for us to lead by example and introduce renewable generation onto our sites.

In order to reduce our building energy use we need to implement energy efficiency measures. Through introducing BREEAM initiatives at depots we are able to improve the efficiency of our sites through various cost effective solutions such as implementation of low carbon and low energy alternatives, as well as improving waste management. By monitoring and assessing our substation energy use we will be able to determine suitable measures to implement, such as the optimised management of the internal temperature of substations to drive a reduction in emissions.

We considered introducing renewable generation at suitable sites at a steady rate (50 sites in 2023-28 period). This level satisfies the appetite of our stakeholders who showed support for renewables balanced against the fact that solar installations will take 18 years to realise their investment and so there is a need to balance ambition and costs (see Cost Benefit Analysis-45: Renewable generation). Under this option we remain receptive to alternative technologies including heat pumps and thermal insulation.

Our final option considered was to introduce solar panels across substations and depots. This would be a costly strategy as our depots are not well equipped for solar generation and would require assessments to confirm structural integrity, together with the potential need for investment in electricity network reinforcement. An added complexity includes the

[12] Based on 2020-21 actuals.

requirement for costly battery storage for renewable generation over supply, as we are unable to export any generation back to the grid in line with our licence conditions.[13]

Our proposed approach to reduce building and substation emissions combines building and substation energy efficiency measures with a steady approach to introducing renewable generation onto our sites. This maximises the benefits of energy efficiency to reduce emissions and ensures best value for money for customers.

We will match the introduction of renewable generation across 50 of our properties to our consumption levels. We plan to adopt 4kW solar installations across suitable sites; unless a more suitable and efficient LCT is identified as technologies develop.

Operational transport emissions

Operational transport is our second largest contributor (28 per cent) of our controllable internal emissions (excluding losses). This is an area where we benchmark well compared to other DNOs, leading in terms of minimising its contribution to our overall BCF.

The government ban on the sale of new petrol and diesel vehicles by 2030 will eventually force a shift in the market to electric or other low and zero emission vehicles. Failing to take progressive steps now to adjust our business operations in line with the wider climate change agenda would defer investment into future periods and not respond to our stakeholders' priorities who want to see us adopting low carbon technologies onto our fleet without incurring inefficient costs (see Annex 3.3 Detailed Engagement Findings - EAP).

We considered various levels of ambition for the rate at which we should introduce ultra-low emission (ULEV) and zero-emission (ZEV) onto our fleet:

- defer investment in ULEVs/ZEVs until future periods;
- introduce 25 per cent of ULEV/ZEVs onto our fleet by 2028;
- introduce 40 per cent of ULEV/ZEVs onto our fleet by 2028;
- introduce 80 per cent of ULEV/ZEVs onto our fleet by 2028; and
- Introduce all commercially viable ULEV/ZEVs onto our fleet by 2028 (92 per cent)

In doing so we considered a number of factors:

- Costs of ULEVs and ZEVs: Ultra low or zero emission vehicles, including electric vehicles (EVs), are yet to become mainstream and currently carry a cost premium, making like-for-like replacements more expensive than our current fleet programme. We will require charging infrastructure across depots and substations to support the increased number of EVs including both charge points and reinforcement of the network to support the increase in capacity.
- Availability of public charge points: even with charging infrastructure at our depots and substations, our operations have a significant geographic span and therefore we need to ensure that we would be able to access public charge points at suitable locations, where charges can be completed in a timely manner. Public charge points are not yet readily available to support our geographic scope and we therefore need to balance the number of ULEVs/ZEVs against reliable running of our fleet and business operations.

[13] Condition 29 of the Standard Licence Conditions restrict a licensee from conducting any business or activity other than the activity of a distribution business. Renewable generation is permitted under a Category B exception under condition 43B as the generation would be considered to form part of our energy management programme.

- Make-up of our fleet: our fleet consists of a number of different vehicle types, shown in table 2. There are not currently commercially viable electrical alternatives for eight per cent of our fleet (i.e. heavy goods vehicles, HGVs, and specialist plant). We will closely monitor wider industry developments, particularly the £20m government investment in freight trials to pioneer hydrogen and other zero emissions lorries. Our fleet replacement cycle is currently between five to seven years and vehicle replacement is assessed on an individual basis to ensure we maximise value for money and enable a healthy turnover of vehicles.

Type	Commercially viable ULEVs available?	Fleet Numbers (2021)	ULEV fleet numbers (2028)
Light small vans	✓	19	19
Car	✓	13	13
Heavy Goods vehicle	×	27	0
Light commercial vehicles	✓	743	316
Specialist Plant	×	38	0
Total		**840**	348
			41%

Table 2: Make up of operational fleet

We are at the beginning of our journey with regards to developing the necessary charging infrastructure to support our operational fleet. We currently operate 22 charge points across our properties. As the number of ULEVs/ZEVs on fleet grows we will need to invest in the necessary charging infrastructure and reinforcement on the network. As our licence conditions make it clear that we cannot own and operate charging infrastructure unless solely for the purposes of the distribution business we are restricted to some degree in what we can do with regards to a collaborative approach with other utility providers in the region.

We are therefore considering tendering for the provision of a shared charging network with wider regional utility providers which would enable us to benefit from access to a wider network as well as achieving cost efficiencies through a joint approach. While this is still under development, in particular in relation to considerations around security of operational sites, we will initially focus our investment in developing depot charging and employee home charging infrastructure as well as using the existing electrical infrastructure to convert trial Vehicle 2 Grid (V2G) chargers into useable charge points.

Our plan targets 40 per cent of our fleet being ULEVs/ZEVs by 2028. This is aligned to stakeholder ambition levels taken from our engagement activity and strikes the right balance in respect of costs, technology readiness and charging infrastructure availability. We consider this delivers strong progress in the 2023-28 period and long-term value for money for customers. Investing too heavily during the 2023-28 period in ULEVs/ZEVs would lead to higher costs for customers during the period. Our plan balances the availability of charge points as well as the required investment in infrastructure that would be required to be largely dependent on ULEVs/ZEVs in our fleet.

We will explore opportunities to accelerate our fleet programme in the 2023-28 period where technology, infrastructure and funding allows us to do this efficiently for our customers (see Cost Benefit Analysis-46: ULEVs/ZEVs on fleet).

Business transport emissions

Our business transport emissions account for 11 per cent of our controllable emissions (excluding losses) and are made up of employees travelling to site or for business meetings by road, air, and train. Our business transport emissions are the lowest of all DNOs.

We considered a wholesale incentive programme for our employees to switch to ULEV/ZEV alternatives, however, front-loading this transition did not represent good value for money for customers as vehicles continue to carry a price premium and supporting infrastructure is not yet widely available.

We will leverage some of the organisational changes implemented during the COVID-19 pandemic including use of technology and increasing flexible working (see Annex 5.2. Workforce resilience strategy) to target a 15 per cent reduction in business transport emissions. We expect employees to begin transitioning to ULEV/ZEV vehicles and as the market shifts we will increase the availability and choice of these for colleagues on our company car scheme.

Our wider company travel policy includes rail and air travel. The impact of rail travel is minimal to our own emissions and railways are beginning to use greener energy so we expect our emissions from this to reduce as the sector moves towards net zero. There are limited circumstances in which we approve air travel and we will continue to keep our emissions to a minimum in this area.

Addressing building and substation energy use, operational and business mileage will cost customers £0.7m per annum in 2023-28, a £0.6m increase compared to the 2015-23 period, largely driven by the increase in ULEVs/ZEVs onto our operational fleet. These costs are offset by efficiencies achieved in other areas of our EAP.

Sulphur Hexafluoride (SF_6)

We have achieved significant reductions in SF_6 losses in the current regulatory period

Sulphur hexafluoride (SF_6) is a non-flammable, colourless and odourless synthetic gas. It is extremely chemically stable and is commonly used in electrical switchgear as an electrical insulation, arc[14] suppressing and cooling medium. It also prevents electrical accidents and fires. Unlike other insulating mediums, SF_6 gas has the unique ability to 'self-heal' with the atoms recombining after the electrical discharge, this is one of the reasons for its widespread use within the electrical industry.

The significant downside to using SF_6 is that it has one of the highest global warming impacts of any known substance. It is 22,800[15] times more potent than carbon dioxide (CO_2) and just one kilogram of SF_6 warms the earth to the same extent as 17 people flying London to New York return. Due to the chemical stability of SF_6 gas it has the potential to remain in the atmosphere for thousands of years. SF_6 gas has been identified as a greenhouse gas with limitations on the amount that can be released into the atmosphere.

We have 36,300 kg of SF_6 in our electrical equipment and despite the increasing volume of SF_6 on our network the amount of SF_6 we have lost to the atmosphere has decreased since 2015, as shown in Figure 3 below. We have the second lowest SF_6 loss amongst the other UK DNOs, a position we have maintained for six years. We have achieved this by implementing a robust SF_6 emission reduction strategy.

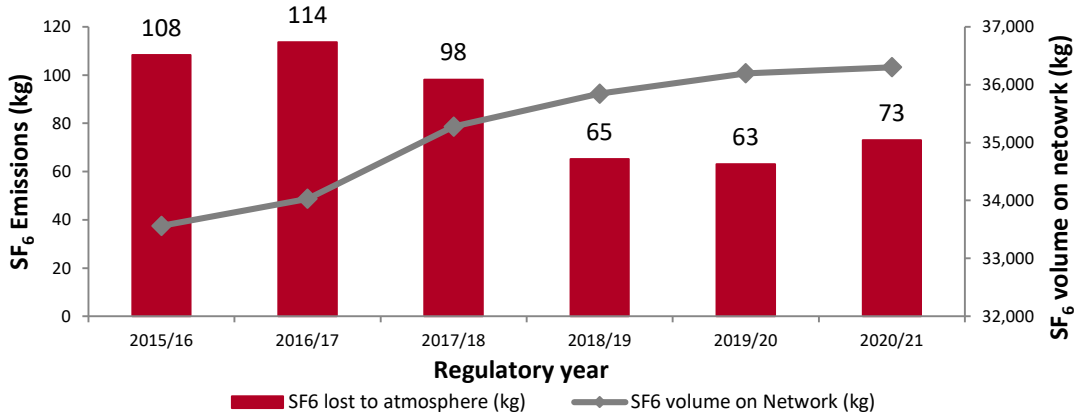

Figure 3: Track-record on SF_6 emissions 2015 – 2021

Our future strategy for the management of SF_6 ensures we lower emissions from the equipment, i.e. reduce SF_6 gas lost to atmosphere, and manage a physical reduction in volume of SF_6 on the network. We have strategies for SF_6 leak detection and repair (including gas handling) and how we source and introduce alternatives to SF_6 onto our network in line with known SF_6 emission management strategies.[16]

Our SF_6 strategy combines leak detection technology with repair and replacement of assets

SF_6 equipment has the potential to release gas into the atmosphere and so the quicker we can detect leaks and repair them, the less gas is lost, resulting in lower carbon emissions.

When stakeholders were informed of the potency of SF_6 they considered it a high priority. Some stakeholders were concerned that delays to investment would bear a cost to future generations in terms of climate change. There was an

[14] Electrical arcs are a discharge of light and heat and can be caused within electrical power systems such as switchgear when conductive channels facilitate their formation.
[15] Using the DEFRA conversation rate as reported in the RRP. Note the SSMD states SF_6 to be 23,500 times more potent than CO_2
[16] EPA 2017 Workshop for SF_6 Emission Reduction Strategies, January 24-25, 2017, San Francisco, CA

appetite for us to invest in more environmentally friendly alternatives when the technology becomes available, with proactive management of subcontractors to ensure they understand the impact of SF_6 equipment. However this was caveated with being mindful of the costs associated with replacing equipment prematurely before the end of its natural life cycle. (see Annex 3.3 Detailed Engagement Findings - EAP).

Our approach to SF_6 management prioritises the worst leaking equipment on the network for accelerated repair or replacement to keep emissions at or below our annual targeted leak rate. Where we are able to achieve synergies as part of our asset management programme to achieve further reductions, this is considered as part of the investment appraisal process to maximise our overall impact.

In 2017 we invested in a forward looking infrared (FLIR) camera. This technology is typically used on military and civilian aircrafts. FLIR technology uses thermographic cameras that sense infrared radiation and SF_6 emissions that are within its visible spectrum. Utilising the camera to detect leaks has enabled us to significantly reduce our SF_6 gas emissions, however with only one camera across two licence areas this inevitably means we have to focus on certain SF_6 equipment or known leaks. Part of our strategy for SF_6 leak detection and repair from 2023 onwards is to introduce another FLIR camera to continue the reduction in gas loss through accelerated SF_6 leak detection.

We have also de-risked the process of gas handling with installation and commissioning of new SF_6 equipment being undertaken by the manufacturer rather than our own staff. Similarly, decommissioning and de-gassing is fully managed by our electrical equipment recycling contractors. As part of our ISO 14001 management system we audit our contractors to ensure they are appropriately trained and certified.

The use of our FLIR camera enables us to identify SF_6 leaks and repair leaking switchgear where possible. Where it isn't possible to repair leaking SF_6 switchgear, the assets are included in our replacement programme. To-date we have not had a defined trigger level to replace leaking SF_6 switchgear but we are now introducing one. A defined trigger level for replacement will ensure consistency in approach to the replacement of leaking switchgear and maintain downward pressure on gas loss. We considered a range of options for trigger levels to replace leaking SF_6 switchgear considering their leak rate over a four year period, as shown in Table 3.

Circuit SF_6 leak rate	>3Kg	>4Kg	>5Kg	>6Kg
Total units to be replaced	22	14	**7**	3
SF_6 reduction expected	40%	30%	**15**%	8%
Total Cost	**£4.4m**	**£2.8m**	**£1.5m**	**£0.6m**

Table 3: Leak rate considerations

Replacing switchgear (that can't be repaired) with a leak rate in excess of 6kg over a four-year period did not match our stakeholders' ambitions for SF_6 reduction as most stakeholders, including the Environment Agency, supported higher levels of reduction.

Replacing switchgear with a leak rate of less than 5kg over a four-year period would mean higher expenditure and while we considered those options they were discounted as the 5kg option enables us to significantly reduce our SF_6 loss whilst also accommodating more ambitious investment in other areas of our EAP. This option balanced stakeholder insights to deliver an ambitious reduction level whilst remaining mindful of costs (see Annex 3.3 Detailed Engagement Findings - EAP).

We will also continue to explore alternatives to SF_6

To reduce the volume of SF_6 on our network we need to replace our circuits with non-SF_6 alternatives. While alternatives to SF_6 are being explored by manufacturers they currently have limited viability to be rolled out across the network. The feasibility of SF_6-free solutions depends on the voltage level.

- **Low voltage (LV) <1kV:** No solutions have been found to address assets at this level.
- **Medium voltage (MV) 1kV-52kV:** There are a limited number of products available in both primary and secondary distribution. Typically these cost 5 to 30 per cent more than SF_6 equipment, require additional maintenance and widespread production capabilities have not yet been developed.
- **High voltage (HV) and extra high voltage (EHV), >52kV>150 kV:** SF_6 free gas blends for gas insulated switchgear up to 145kV have been demonstrated with wide-spread commercialisation expected from 2025.

We are committed to exploring non-SF_6 alternatives in order to reduce environmental risk and to prepare for any future regulatory restrictions in respect of SF_6. We have recently become the first DNO to trial non-SF_6 indoor switchgear equipment on our network at distribution voltage level, demonstrating our commitment to lead the way in this area. ABB, one of our main distribution switchgear suppliers, has developed, tested and volume manufactured the first commercially available 12kV and 24kV non-SF_6 products. We identified two sites where we have commenced trials of these non-SF_6 ring main units on the 11kV and 20 kV system in order to support proof of concept of the products. In the expectation of successful trials, we believe that this positive step will position us to be able to smoothly transition to non-SF_6 alternative products from all major suppliers as they develop and offer products with comparable features to those that we benefit from today. At the present time there are no commercially available non- SF_6, non-oil outdoor ring main units; but we are actively supporting several manufactures in the development of these products.

We are also trialling installation of non-SF_6 equipment on our 132kV (EHV) network at Kirkstall, Leeds, to test our ability to introduce non-SF_6 equipment in future tenders and our readiness to embrace alternatives once they become technically and commercially viable.

Given the current development cycle of such alternatives, we will take a controlled approach to limit the impact of SF_6. To supplement our targeted asset replacement we will leverage data analytics to identify trends in problematic assets so that we can proactively manage these as part of our longer term asset replacement programmes, reporting on SF_6 leakage annually. We will also enhance our technical assessment process to build the cost of carbon into the procurement process. This will mean that when comparing SF_6 equipment with non-SF_6 equipment in tenders we will account for the cost of carbon associated with the equipment.

Our Cost Benefit Analysis (see Cost Benefit Analysis-44: SF6) shows that SF_6 alternatives are currently 30 per cent more expensive for both 132kV and 66kV equipment. Our investment decisions are based on economic viability, but we recognise we have a responsibility to take proactive action where we can to minimise our environmental impact, as doing nothing would undermine our long term goals to achieve net zero operations by 2040.

For further information see our engineering justification paper for switchgear replacement (3.1b Major Substations - Plant (Switchgear)).

We will target a 15 per cent reduction in SF_6 gas losses by 2028, reporting annually on our progress

We monitor gas loss on a daily basis from the SF_6 gas top-ups our staff put back into the equipment following a low gas alarm. Where previously we would report gas loss monthly and repair the leaks on those circuits that had lost the most gas, our strategy for 2023-28 is to replace any circuit that leaks in excess of 5kg per annum. To supplement this we will increase our use of proven-FLIR camera technology.

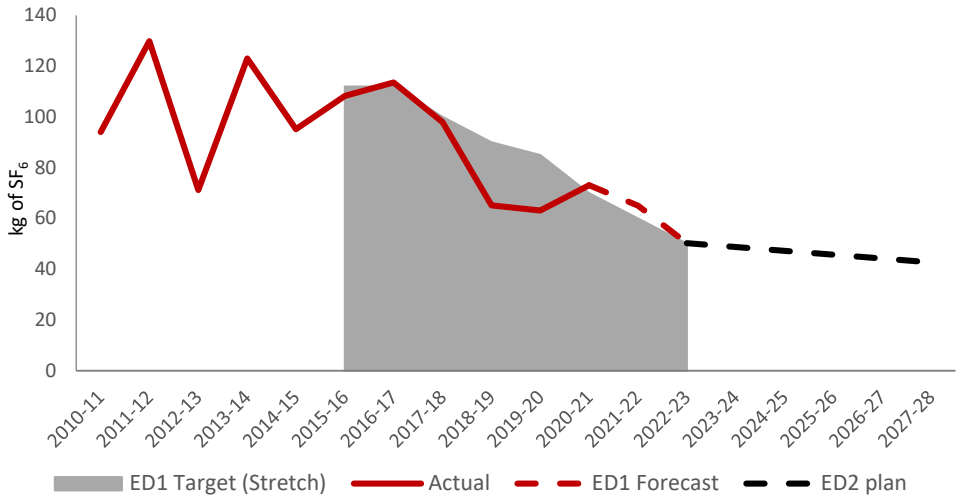

Figure 4: SF_6 emissions

This approach will enable us to target a reduction of 15 per cent in SF_6 gas loss by 2028 at cost of £0.3m per annum (25 per cent lower than in 2015–23).

Losses

Long term objectives

- Optimise whole system losses while facilitating net zero
- Achieve scope 1 and 2 emissions reduction in line with Science Based Targets *(aligned to 1.5^{o}C global temperature rise above pre-industrial levels)*

Customer outcome (2023-28 period)

EP2 **Efficiently manage and optimise losses from our network**

Benefits

- Reduction in carbon emissions

Deliverables

EP2.1	Develop and report on our losses strategy annually
EP2.2	Install super low-loss amorphous core transformers
EP2.3	Install low-loss (i.e. oversized) low voltage (LV) and high voltage (HV) cables
EP2.4	Improve the energy efficiency of our substations
EP6.5	Publish an annual environmental report for our stakeholders covering the delivery of our 2023 – 28 EAP commitments **(ODI-R)**

Measures	ED1 to date	ED1 forecast	ED2 target
Science-based target Scope2 emissions (losses only) (tCO_2e)	526,909	480,710	365,210
Low loss transformers (units)	*4*	*5*	*12,000*
Low loss cables (km)	*1,582*	*2,240*	*3,400*
Number of substations assessed for energy efficiency	*N/A*	*N/A*	*100%*

Key: Output measures**/***indicative inputs*

Stakeholders want to know more about losses and how they can support in reducing them

Our stakeholders want us to educate them on losses, including how both DNO and customer actions can impact the amount of network losses (see Annex 3.3 Detailed Engagement Findings - EAP).

From a whole system perspective, our actions can impact customer energy efficiency, whilst customer actions can impact system energy efficiency (i.e. losses). We are committed to whole systems thinking and a key part of this is actively engaging with our customers, particularly when it comes to helping them become more energy efficient. This will save them money and reduce carbon emissions associated with using less energy, whilst also reducing system losses.

Losses are simply the difference between the amount of energy entering the network and the amount of energy drawn out of it. No system can be 100 per cent efficient and losses are therefore unavoidable when distributing electricity.

The two main types of losses are:

(i) technical losses resulting in electricity converted into heat on the network; and

(ii) non-technical losses, generally resulting from metering errors and theft.

The magnitude of losses from our network equates to roughly 2TWh per year (over 94 per cent[17] of our total carbon footprint). When expressed as a percentage of the total energy entering the network, losses are approximately six per

[17] Measured as the emissions reported through the Regulatory Reporting Process (RRP)

cent. This energy that is 'lost' needs to be generated, and therefore has a financial and carbon impact. We take our role seriously in ensuring losses are as low as reasonably practicable.

There are aspects of losses management that we can control and aspects that we can only influence. The amount of losses is dictated primarily by the loading placed upon network equipment, and secondly by the characteristics of the network. Losses are therefore mainly determined by the energy requirements of our customers - the more electricity used, the higher the loading and so losses increase.

Decarbonisation will result in a significant increase in network loading and when taking into account that the majority of our existing network[18] will continue to operate well into the future; losses will generally increase[19]. We will therefore only be in a position to directly influence a small percentage of losses, primarily when we make changes to our network and install new equipment.

We recognise there is a significant opportunity for influencing customers and their energy usage (and therefore losses). We will work closely with our customers and stakeholders as part of our commitment to provide support to communities to become more energy efficient (see Our Communities section of our main plan – customer outcomes CO3.1 and CO3.2). Doing nothing in this area would lead to higher levels of emissions and increased costs for customers.

Our track record illustrates our commitment to managing losses. We have undertaken a range of innovation projects that have sought to better understand losses and have explored new technologies (such as very-low-loss amorphous core transformers) that could produce a step change in losses performance. We have undertaken actions that are improving losses performance now, and will continue in the future, such as the use of lower resistance cables at LV and 11kV, and the implementation of static voltage optimisation to reduce energy use behind the meter. We will be upgrading this to dynamic voltage optimisation during 2023-28 as part of our whole systems plans (see annex 4.3 - Whole systems strategy).

Our approach is to optimise whole system losses whilst facilitating net zero:

- Optimise: fully integrating losses into asset management decision-making and planning processes means that management of losses does not always mean minimising losses, but instead optimising losses.

- Whole system: a whole system approach is imperative, where increasing distribution network losses to obtain a reduction in transmission losses and overall carbon emissions reduction is a positive outcome.

- Facilitating net zero: we are committed to a flexibility first approach as part of our transition to distribution system operation (DSO). The use of customer flexibility and smart solutions will often lead to an increase in network losses. From a whole systems perspective this is the right outcome as this in turn unlocks wider decarbonisation at the lowest cost to customers. In turn, the carbon impact of network losses will diminish over time, as we facilitate increasing volumes of low carbon generation required for net zero.

- Forecasting losses is challenging; given the key driver of losses is our customers' energy requirements; which are subject to significant uncertainty and can vary year-on-year in line with economic activity and weather. As a result, we do not forecast losses. We do however measure losses as this is essential to understand performance levels and to target our actions to keep losses as low as reasonably practicable.

Our losses strategy (Annex 4.5 Losses strategy) outlines how we will efficiently manage both technical and non-technical losses on our network over the long term and how we will continue to collaborate with the wider industry to develop our understanding of losses and contribute to the evidence base on the proportion of losses that network companies can influence or control. The activities that we undertake during 2023–28 are estimated to provide total cumulative losses savings of up to 320.6 GWh during 2023-28[20]. This is driven through a number of initiatives ranging from the deployment of low-loss technologies to enhanced use of data for improved planning and operation of the system. As part of the

[18] Consisting of roughly 63,000 substations and over 96,000 kilometres of network.
[19] ENA Working Group Project: Impact of Low Carbon Transition – Technical Losses.
[20] Annex 4.5 Losses strategy provides further detail on the breakdown of this estimated counterfactual losses saving, and the split between activities categorised as a) 'not driven by losses' (184.6 GWh), b) 'opportunistic' (115.5 GWh), and c) proactive (20.5 GWh).

significant decarbonisation investment in transformers and our environmental investment to remove PCB-contaminated transformers, we will be adopting amorphous core technology[21] where it provides a net benefit to our customers, which is roughly 80 per cent of all units. We have undertaken trials and subsequent CBAs for amorphous core distribution transformers (see CBA 25 – 100kVA 1ph PMT – Amorphous, CBA 26 – 315kVA 3ph PMT – Amorphous, CBA 27 – 315kVA GMT – Amorphous and CBA 28 800kVA 3ph GMT – Amorphous).

We have also considered further optimal solutions to reducing losses in CBA 23 – LV cable sizing and CBA 24 – 11kV cable sizing.

Losses form a component of our verified scope 2 science-based targets which we will report on annually. Annual reporting will also include progress on our losses strategy. We will provide updates on how our asset management programme has captured synergies to reduce losses, including the number of amorphous core transformers installed and km of oversized cables installed over both our LV and HV networks. We will also report on the progress of our substation energy efficiency assessments; these assessments are planned for all of our substations over the 2023–28 period with initiatives implemented in response.

[21] Subject to final review of learnings from our Amorphous Transformer (AMT) trial.

Science-Based Targets

We are adopting science-based targets to reduce our emissions in line with Net Zero

Science-based targets are a set of goals developed by a business to provide it with a clear route to reduce greenhouse gas emissions. Emissions reduction targets are considered science based if they are consistent with keeping global warming below 1.5°C above pre-industrial levels. Targets are calculated by taking the world's carbon budget (consistent with 1.5°C) and taking the per cent reduction required each year to meet that carbon budget.

Science-based targets (SBT) are split into three categories of emissions.

- Scope 1: Direct emissions from owned or controlled sources. Our scope 1 emissions are office gas use, fleet fuel and SF_6 gas.
- Scope 2: Indirect emissions from purchased electricity used for offices and substations. This also includes losses from our electrical network.
- Scope 3: This encompasses all other indirect emissions that occur in our value chain. In our case that includes business mileage (land, air and train) plus emissions from our supply chain.

SBTs must include both scope 1 and 2 emissions. Scope 3 emissions, however, are only required to be included if they form greater than 40% of total emissions[22]. We contracted consultants, Anthesis, to determine our science-based targets and they calculated that our scope 3 emissions account for 28% of total carbon emissions and as such they are not required to be included in our SBTs (see Table 4 later in this section).

Our emissions need to reduce annually by 4.2 per cent to meet the carbon budget compared to our baseline of 2019-20. Our science-based target, covering scope 1 and 2 emissions, is therefore 63% lower by 2035 at 208,470 tCO2e, with an interim target of 374,130 tCO2e by 2028. Our science-based targets were submitted to the Science-based Targets Institute (SBTi) on 27 September 2021 and are in the process of being verified. We understand the SBTi is currently working through a significant backlog of targets for verification.

We will report on BCF reduction and progress towards our science-based target annually as part of our regulatory reporting requirements. This will also include our progress on scope 3 emissions.

We have set our plan for scope 1 and 2 emissions to deliver against our science based target

Our science-based scope 1 and 2 emissions target (excluding losses) is 4,970 tCO2e by 2035 (i.e. 8,460 tCO2e lower compared to our 2019-20 baseline). In order to be on-track for this trajectory our interim milestone target is 8,920 tCO2e by 2028.

[22] Based on science-based Targets initiative guidance.

As shown in Figure 6 below, our combined scope 1 and 2 emissions (excluding losses) are projected to be within the SBT pathway out to 2035 following the implementation of all initiatives in in our EAP.

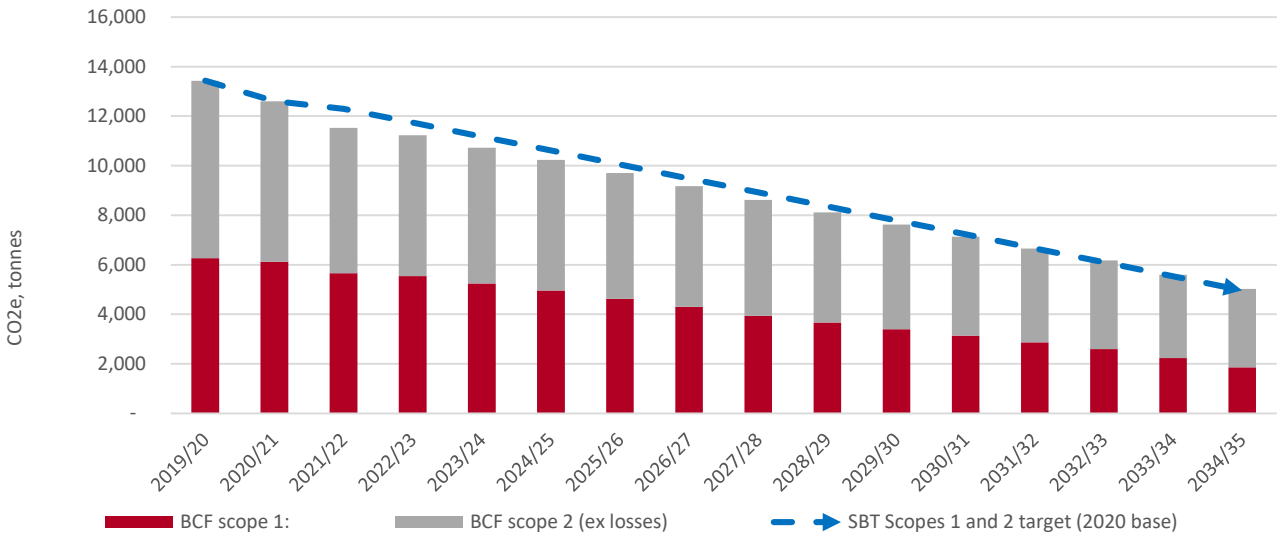

Figure 5: Projected scope 1 and 2 (excluding losses) emissions against SBTs

We have identified a range of potential pathways for scope 1 and 2 emissions (including losses)

Electrical losses bring an added layer of complexity to scope 2 emissions targets for a number of reasons:

- emissions associated with electrical losses are significantly greater than our other scope 1 and 2 emissions;
- they are not directly within our control; and
- they are heavily dependent on the rate at which the grid decarbonises.

We have modelled the emissions associated with electrical losses using our range of decarbonisation scenarios:

- We defined peak demand scenarios representative of potential decarbonisation pathways. For this, we used our five Distribution Future Energy Scenarios (DFES), our 2023-28 planning scenario and a linear demand growth scenario (using DEFRA conversion factors);
- Using peak loading for each year as a proxy for losses, we converted the load growth for each scenario to 'losses growth'[23].
- This then enabled us to estimate the annual (MWh) losses for each year of each demand scenario;
- We then aligned each demand scenario to the appropriate carbon intensity pathway[24] to estimate carbon emissions by combining the total energy losses and the carbon intensity for each pathway.

Figure 6 shows the output of this analysis as a range of possible scenarios for losses depending on the rate at which the grid decarbonises. The lower bound of the range represents losses based on load in our 'best view' planning scenario (see Annex 4.1 Scenarios and investment planning) combined with a carbon intensity factor that drops to zero at 2033[25] (meaning losses from this point onwards result in no carbon emissions). The key driver behind the spread is the

[23] Based on a high level assumption of 1% increase in peak load resulting in a 2% increase in losses.
[24] We used the NGESO Future Energy Scenarios (FES) Carbon Intensities for the DFES and Planning Scenario demand scenarios, and the (linear) Ofgem Carbon Intensity pathway for a linear demand growth scenario.
[25] In line with carbon intensity factors used in the Future Energy Scenarios.

difference in carbon intensities for each scenario. This modelling demonstrates that emissions associated with losses depend almost entirely depend on the rate at which power generation decarbonises.

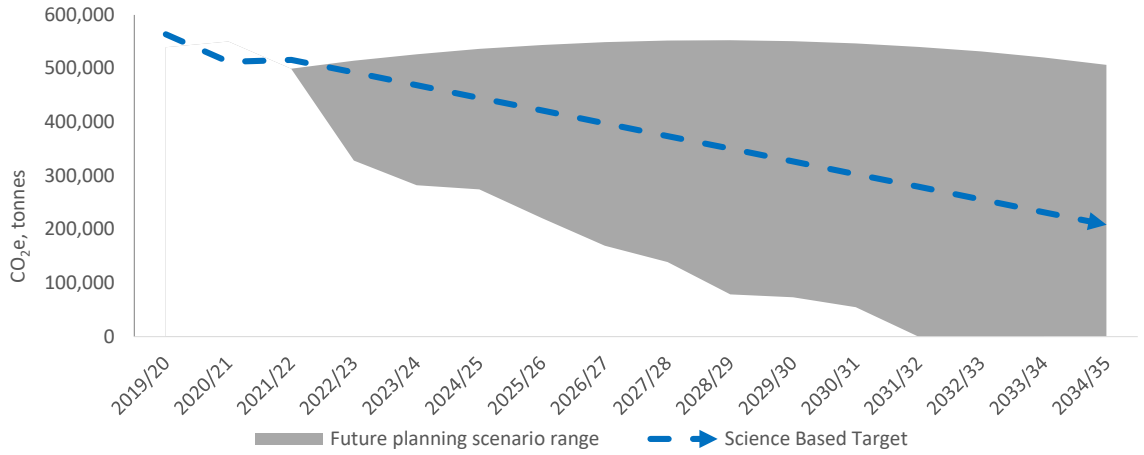

Figure 6: scope 1 and 2 emissions SBTs (including losses) showing a range of future pathways for losses

Our role is to support reduction in carbon intensity through accommodating the connection of low carbon generation to the network.

Scope 3 emissions

Long term objectives

- Support our supply chain to decarbonise to net zero operations
- Drive strong and consistent environmental standards across our supply chain
- Measure and report on all applicable scope 3 emissions

Customer outcome (2023-28 period)

EP3	**Promote environmental management and decarbonisation of our supply chain, achieving 90% compliance with our responsible procurement charter**

Benefits

- Reduction in carbon emissions

Deliverables

EP3.1	Introduce a Responsible Procurement Charter achieving >90% compliance
EP3.2	Deliver a funded programme of support for suppliers to enhance environmental competence including achieving ISO 14001 certification
EP3.3	Roll-out the use of low carbon fuel alternatives for our mobile generation fleet
EP3.4	Introduce an embodied carbon model in 2023 – 24 for new projects, and monitor and report on our embodied carbon through the period
EP6.5	Publish an annual environmental report for our stakeholders covering the delivery of our 2023 – 28 EAP commitments **(ODI-R)**

Measures	ED1 to date	ED1 forecast	ED2 target
% of suppliers compliant with our Responsible Procurement Charter	N/A	N/A	90%
Normalised contractor emissions rate (tCO_2e per £m of contractor capital investment)	68.0	62.0	47.1
Investment to support supply chain standards (£m)	-	-	*£1.2m*

Key: Output measures/*indicative inputs*

We will measure all scope 3 emissions so we can establish robust baselines for carbon reduction

Scope 3 emissions cover a broad range of categories. As part of the work completed by Anthesis during 2021 in establishing our SBTs they completed a data capture of all emissions resulting from our operations. Out of the total 15 categories of scope 3 emissions, six are applicable to our business (see Table 4).

Scope 3 emissions category	Applicable	% Total Footprint
Purchased Goods & Services	Yes	9%
Capital Goods	Yes	18%
Fuel & Energy Related Activities	Yes	<1%
Upstream transportation & distribution	N/A	N/A
Waste generated in operations	Yes	<1%
Business Travel	Yes	<1%
Employee commuting (and WFH)	Yes	<1%
Upstream leased assets	N/A	N/A
Downstream transportation and distribution	N/A	N/A
Processing of sold products	N/A	N/A
Use of sold products	N/A	N/A
End of life treatment of sold products	N/A	N/A
Downstream leased assets	N/A	N/A
Franchises	N/A	N/A
Investments	N/A	N/A
		28%

Table 4: Scope 3 emission categories

We have historically only measured some elements of scope 3 emissions; our own business travel, supply chain contractor operational fuel use and emissions from waste (which are de-minimis). Purchased goods and services, capital goods and employee commuting are currently not monitored or captured routinely.

We have, however, been monitoring our supply chain operational fuel emissions (contractor fuel) for a number of years and so this is an area where we are able to create a robust, multi-year baseline. We monitor and report on our business travel as part of the Regulatory Reporting Process (RRP) and we have included this within our internal controllable business carbon footprint target. We will continue to monitor the emissions resulting from waste generated in our operations and report on these are part of our scope 3 reporting - waste management is covered in detail on the resource use and waste section of our plan.

For the remaining scope 3 emissions, we will leverage the work completed by Anthesis as part of their one-off data capture exercise to start regularly collecting data for the remaining applicable scope 3 emissions categories so we can establish a robust, multi-year baseline. These will inform the actions we will take to drive meaningful and actionable steps to reduce emissions resulting from our operations.

We tested stakeholder willingness to pay for accelerated supply chain decarbonisation alongside consulting with our suppliers

We consulted with our stakeholders on whether we should set a supply chain emissions target in line with our own; however this was not supported. Stakeholders told us that they did not want to pay more for supply chain emission reductions. A collaborative approach was favoured whereby we provide support to our suppliers rather than imposing absolute targets at this stage.

In the development of our business plan we engaged a broad range of stakeholders and provided a range of costed options for consideration; this included varying levels of ambition on supply chain emissions. Stakeholders told us that they wanted us to lead by example on environmental initiatives and that they supported us in reducing contractor emissions. However, during our Willingness to Pay (WTP) engagement they ranked their preference of our

environmental initiatives and reducing contractor carbon emissions was ranked as the lowest priority amongst our environmental initiatives (see Annex 3.3 Detailed Engagement Findings - EAP).

Following publication of our draft plan we consulted our consumer panel who were supportive of us reducing supplier emissions but confirmed they did not want us to impose absolute targets on suppliers, recognising that our suppliers are of varying sizes and at different stages of their journeys to decarbonisation.

We also undertook a survey of 43 of our key suppliers to understand their decarbonisation plans. This allowed us to refine our views on supply chain decarbonisation trajectories and provided an insight on the support that might be required from us. Around 50 per cent of our suppliers have set decarbonisation targets in line with our own to reach net zero by 2040 or sooner, but others do not yet have well-developed plans and are likely to need considerable support to make the transition to net zero operations a reality.

We will introduce a package of measures to support the environmental performance of our suppliers

Our package of measures will include:

- Our Responsible Procurement Charter which will have a key focus on supporting our suppliers to reduce their emissions. In line with engagement feedback, our charter will not impose absolute targets onto suppliers but will set consistent standards and the framework for a collaborative approach.

- Changes to our procurement process to increase the extent to which environmental standards feature in our choice of supply chain partners.

- £1.2m of investment over the 2023-28 period to support our suppliers to enhance environmental standards, including achieving ISO 14001 accreditation. This will ensure that all our suppliers have consistent baseline environmental competences.

Our Responsible Procurement Charter (RPC) will drive consistent supply chain standards

During 2022, ahead of the 2023-28 period, we will be launching our Responsible Procurement Charter (RPC). This charter will form an integral part of our contractual relationships with our supply chain partners going forward. The charter will set out our expectations of our supply chain with respect to values, behaviours and ethical standards.

The RPC will ensure our suppliers have a positive environmental, social and economic impact, and will cover the following areas;

- Ethical and legal requirements: we expect our suppliers to share our commitment to ethics and compliance with legal requirements

- Health and safety standards: suppliers should align to our commitment to provide a safe and healthy environment for all workers and the public

- Customers and the community: our aim is to provide outstanding service to our customers. When delivering work on behalf of Northern Powergrid, our suppliers should deliver to established best-practice standards including providing enhanced support for vulnerable customers. We also expect our suppliers to strive to make a positive difference in the communities we serve.
- Employee standards and codes of conduct: we expect our suppliers to employ fair employment practices and comply with all related legal requirements.
- Environmental protection: environmental respect is one of our core principles and suppliers should abide by environmental laws and regulations as well as show ambition through their measures to protect the environment and decarbonise their operations.

- Asset and data protection: Suppliers are expected to protect our resources and safeguard data

- Corporate governance policy: Suppliers are expected to adhere to high standards of governance and are required to notify us of any violations to the charter

We will monitor the performance of our supply chain partners against the requirements set out in the RPC, and work collaboratively with them to support their journey towards compliance. We will target 90 per cent compliance (based on contract value) with our RPC by the end of the period. Our contract management routines will be adapted to accommodate enhanced performance monitoring required by the RPC, and we will adopt a technology based approach in establishing reporting channels so as to minimise the burden and maximise efficiency of the process. Measures suppliers will be required to report on will include carbon emissions resulting from their operations (BCF), progress against SBTs (if applicable), percentage of ULEVs on fleet and waste diverted from landfill.

Our tender processes will explicitly factor in environmental performance

We will update our tender processes so that environmental ambition becomes a factor in our choice of suppliers.

- At the pre-qualification stage we will consider the environmental competences of potential suppliers to identify whether suppliers are suitably qualified to undertake work on our network. Suppliers who have low environmental standards may be discounted from participation in our procurement processes.

- Once suppliers have met pre-qualification tests, at the contract award stage we assess their bids against our required award criteria, taking into account both commercial and technical aspects. Suppliers' environmental plans will be included as part of the technical assessment, tailored to each tender process.

Our procurement process will remain a transparent commercial process whereby we ensure we deliver best value for money for our customers. We will ensure our approach is inclusive such that it does not discriminate against smaller suppliers, rather using this as an opportunity to support positive change. Once contracts have been awarded, suppliers will be required to adhere to the conditions set out in the RPC.

Our suppliers will have access to a funded programme to achieve consistent baseline environmental standards

Once suppliers have been selected we will support them to establish the baseline standards required to set them on a path to environmentally sustainable operations and net zero. As part of our Environmental Action Plan we have identified £1.2m over the 2023–28 period to support this transition. This investment is funded through efficiencies in our plan and comes at no additional cost to customers.

We will make funding available to suppliers to obtain ISO14001 accreditation, where they do not hold this already. While we already select suppliers based on whether they hold ISO14001 accreditation, our future procurement approach will also consider suppliers who are taking positive steps to improve their environmental performance but may not yet have achieved the accreditation. We see this support as an important part of our role as an anchor institution in our region supporting local supply chains (See Openness and Transparency – customer outcome OT2).

Our investment will also cover the internal resource and IT costs associated with the increase in the data we will process and analyse on a monthly basis from supplier environmental returns to improve transparency around scope 3 emissions.

We will report on scope 3 emissions and track our supplier emissions rate over the period

We will report on our progress in relation to scope 3 emissions annually. For those data sets that we do not currently capture today we will implement tracking in order to create a data bank to be used to establish baselines from which we take further meaningful and actionable steps to reduce emissions.

We do however have well established data sets for contractor emissions which account for over half (53 per cent) of our overall carbon footprint (excluding losses)[26]. Comparison to other DNOs is difficult due to inconsistencies in the reporting bases. We report transparently, including emissions from contractors that undertake work across all of our operations.

[26] Based on 2020/21 actuals.

Through the Energy Networks Association (ENA) the industry will be developing a standardised model for BCF data capture for the 2023-28 period.

To track our progress in reducing the carbon intensity of our supply chain we will establish a supplier emissions target normalised for the level of contractor-delivered network investment. In our planning scenario, direct investment levels could increase by circa 40% in the 2023-28 period in order to facilitate decarbonisation. Whilst exact activity levels are not certain at this stage, it is likely that the majority of this additional investment will be undertaken by contractors which will increase activity levels from our supply chain and initially put upward pressure on emissions.

We believe it is important to establish a measure to demonstrate continuous improvement towards decarbonising our supply chain. We have therefore established a supplier emissions target normalised for the level of contractor delivered network investment. This way we can measure and demonstrate the impact of our initiatives in reducing the intensity of carbon emissions from our supply chain.

Our supplier emissions target is calibrated as follows:

- Supplier emissions (tCO2e) per £m of contractor capital investment (including connections activity)
- Set from a 3-year average as a baseline to normalise for the variations in annual mix of work
- Reported on a 3-year rolling average through the period
- Set to achieve a reduction of 4.2% per annum in line with SBT methodology (i.e. 21% reduction in total for ED2)

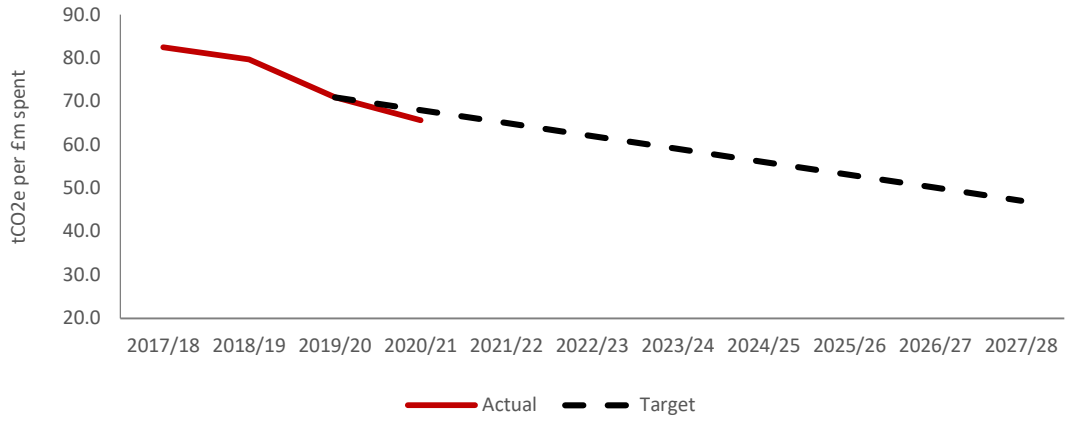

Figure 7: Supplier emissions target per £m of contractor capital investment

We anticipate a blend of the following initiatives will be required to achieve the targeted trajectory:

- Increase supply chain ULEV / ZEV penetration to at least 25% of fleet;
- Increase the use of low carbon generation to at least 10% of generators by the end of ED2;
- Transition at least 20% of our generator fuel to low carbon alternatives.

Greener alternatives are required for mobile generators

Red diesel is currently used to power the vast majority of mobile generation on our network keeping our customers on supply while we undertake necessary repairs and upgrades. During the 2015-23 period we have used an average of 3.2 million litres of red diesel per annum.

Changes to legislation regarding the use of red diesel (which comes into effect from 1 April 2022) will restrict the use of red diesel. This will require an alternative strategy for our generators with the nearest alternative, white mineral diesel, being 80%[27] more expensive.

We have factored this into our plan and intend to use this change to deliver environmental benefits. We plan to transition generator units to low carbon fuel where possible resulting in up to a 90% reduction in CO_2 emissions compared with traditional mineral diesel and increasing our deployment of battery generators where cost effective.

We will develop a model to assess and report on embodied carbon in new projects

Our stakeholders support us taking greater account of circular economies and carbon life cycles (see Annex 3.3 Detailed Engagement Findings - EAP) as part of our operations.

We instructed consultants to develop a methodology to calculate a baseline for embodied carbon along with a mechanism to monitor and report the impacts of new projects in the 2023-28 period. The method has been developed based on industry best-practice sources and methodologies while taking into account the limitations regarding data availability and data collection.

The high-level approach will be to establish a representative sample of projects that exist within defined categories. These categories will be broken down by voltage (i.e. LV, HV, EHV, 132 kV), by asset (i.e. transformer, switchgear, conductors, etc.) and by project type (i.e. refurbishment, reinforcement etc.).

For each sample project, the embodied carbon will be estimated using one of four defined calculation methods, depending on the data available:

- use of environmental product declarations (EPDs), specific to the project assets or activities;
- 'material-level bottom-up' method, using data broken down at the material and fuel level;
- secondary life cycle assessment, using representative data from published studies; and
- environmentally extended input-output factors for project activities.

This methodology will form the basis of a calculation tool where data can be inputted to monitor the embodied carbon of new projects during 2023-28. The development of the tool will start with an initial pilot phase to demonstrate the core functionality and usability on a single project. Following successful rollout of the pilot, development will then focus on increasing coverage in order to model the remaining project categories.

This provides a new opportunity to provide greater accountability in our operations and to collaborate with suppliers to deliver downstream benefits and transparency. At present we may choose to either accelerate investment or add incremental investment to a project in order to deliver wider societal benefit for example the reduction in electrical losses (and therefore a consequential reduction in green-house gas emissions from the production of that lost energy). This decision is currently made without including the carbon cost of carrying out that physical work. Having an embodied carbon assessment will enable us to more accurately assess the costs and benefits associated with these accelerated or incremental investments ensuring we make more accurate and better-informed investment decisions.

[27] Data taken from Platts (independent provider of benchmark prices for energy and commodities) wholesale monthly average fuel price per litre

We are currently working with our industry trade body – the Energy Networks Association – in collaboration with the other UK DNOs to tender for the:

- Development of an embodied carbon model;
- Development of a common database in line with the existing Transmission Database and share factors to form an 'Electrical Networks' database which will benefit all parties;
- Development of common assumptions for using 'generic' carbon factors and defining reporting scopes; and
- Establishment of a central Governance Group.

This will enable us to begin the process of regular data capture for additional scope 3 categories that we currently do not have benchmark data for and implement tracking.

Resource use and waste

Long term objectives

- Zero waste to landfill by 2035

Customer outcome (2023-28 period)

EP6	**Take proactive action to protect and enhance the environment in which we operate delivering 73km of undergrounding to improve visual amenity, biodiversity improvements at 200 sites and 90% of waste diverted from landfill**

Benefits

- Reduction in waste to landfill

Deliverables

EP6.3	Increase the number of recycling stations in our business
EP6.5	Publish an annual environmental report for our stakeholders covering the delivery of our 2023 – 28 EAP commitments **(ODI-R)**

Measures	ED1 to date	ED1 forecast	ED2 target
% of waste diverted from landfill **(ODI-F)**	75%	80%	90%
% of total materials recycled **(ODI-F)**	75%	78%	85%

Key: Output measures/*indicative inputs*

We will significantly improve our resource use, increase recycling and reduce waste

As part of our plan for 2023-28 we will target:

- diverting 90 per cent of waste to landfill by 2028 to set us on a path to be zero waste to landfill by 2035; and
- recycling and reusing 85 per cent of our total waste generated.

Little or no effective waste management would be extremely harmful to our planet. It would degrade our surrounding environments, increase demand for raw materials and as waste decomposes it would increase greenhouse gas emissions. As part of our emerging thinking consultation, stakeholders told us they wanted to see a reduction in our waste and for us to better manage the waste generated by our suppliers (see annex 3.3 Detailed engagement findings - EAP).

A circular economy is a model of production and consumption which involves sharing, leasing, reusing, repairing, refurbishing and recycling existing materials and products for as long as possible. In this way, the life cycle of products is extended. We operate circular economy principles but could increase our waste segregation to increase diversion from landfill and move our waste further upstream as shown in the DEFRA waste hierarchy model.

Our network operations are our largest source of waste generation and the production of waste arising from excavations and other network operations represents over 99 per cent of our total waste that is generated. During the 2020-21 regulatory year, our total waste generated was 311,487 tonnes of which we achieved a diversion from landfill of 75 per cent.

We will target a 15 per cent increase in our current landfill diversion rate from 75 per cent to 90 per cent from all of our operations by 2028. This will see us improve our waste management in line with our trajectory towards zero to landfill by 2035. Additionally, we will target a recycling and reuse rate of 85 per cent of total materials by 2028, while handling increased volumes of waste from the additional network activity required to deliver our 2023-28 investment plans and decarbonisation objectives.

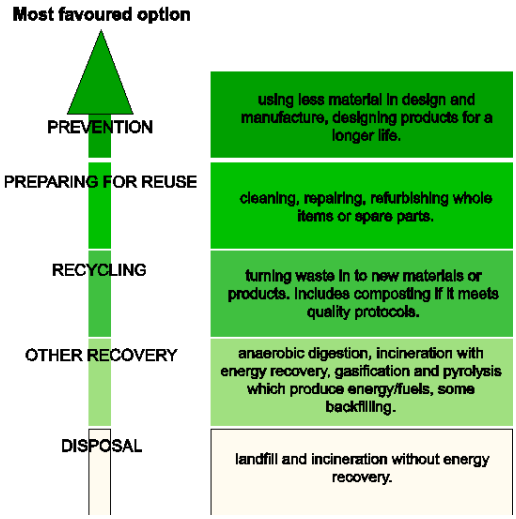

Figure 8: Defra Waste Hierarchy Model

We will be working with our supply chain to reduce packaging and ensure we use environmentally friendly alternatives where possible. We will also be utilising our embodied carbon model to support our investment decisions, which include the sourcing of raw materials. We will increase waste segregation facilities in line with circular economy principles and the waste hierarchy at our offices and ensure that our office supplies are low carbon, plastic free and are fully recyclable or reusable.

Issues relating to the assessment and classification (as hazardous or non-hazardous) of material arising from unplanned utility excavations, prior to transport from site and disposal, pose a significant challenge to our objective to reduce waste to landfill. The utilities industry is currently working with Streetworks UK and the Environment Agency to develop and implement a new industry-wide risk-based approach to managing waste excavation arising to combat these issues.

Biodiversity

Long term objectives

- Improve the natural habitats in the regions we serve to increase the variety and variability of species and ecosystems

Customer outcome (2023-28 period)

EP6	**Take proactive action to protect and enhance the environment in which we operate delivering 73km of undergrounding to improve visual amenity, biodiversity improvements at 200 sites and 90% of waste diverted from landfill**

Benefits

- Increase the variety and numbers of flora and fauna

Deliverables

EP6.2	Enrich local habitats through biodiversity initiatives to enhance conservation of our environment and species
EP6.5	Publish an annual environmental report for our stakeholders covering the delivery of our 2023 – 28 EAP commitments **(ODI-R)**

Measures	ED1 to date	ED1 forecast	ED2 target
No. of sites with net biodiversity gain **(ODI-F)**	11	11	200

Key: Output measures/*indicative inputs*

We will enrich local habitats through biodiversity initiatives at 200 sites to enhance conservation of our environment and species

We have an opportunity to enrich local habitats by implementing biodiversity initiatives across our sites.

Our plan contains biodiversity initiatives that will promote natural habitats and increase the variety and variability of species and ecosystems at 200 of our major sites in 2023-28. This relatively low cost initiative (£0.1m per annum) gained wide support from our stakeholders and includes working with partners such as Natural England and engaging our local communities.

We have a number of different biodiversity initiatives available to implement and this will vary across our sites. We will undertake assessments to implement the most effective schemes which will include mowing regimes, planting or seeding native shrubs and flower species to encourage pollination and soil disturbance to alter the utility of the land, measuring the biodiversity units gained at each site. By working in partnership with the Environment Agency and Natural England, we will gain access to specialist knowledge and extend the reach of our initiatives. Biodiversity initiatives offer a highly cost effective way to bring future benefits and doing nothing represents a missed opportunity.

In parallel, we will be working with the ENA to develop a natural capital tool to assess and monitor our impact from new connection and network projects on eco-systems and to monitor the provision of ecosystem services.

Fluid filled cables

Long term objectives

- Reduce fluid lost to ground and replace fluid-filled cable assets to remove leakage risk exposure

Customer outcome (2023-28 period)

EP4 **Reduce oil lost to ground by 15%**

Benefits

- Lower levels of pollution
- Improved ecosystems and biodiversity

Deliverables

EP4.1	Replace 40km of fluid-filled cables (FFC) to reduce fluid leaks
EP4.2	Dose > 250km of fluid-filled cables with PFT to reduce fluid leaks
EP4.3	Subject to successful trials, roll out self-healing cable solution
EP4.4	Undertake bund replacement and refurbishment to minimise pollution source
EP6.5	Publish an annual environmental report for our stakeholders covering the delivery of our 2023 – 28 EAP commitments **(ODI-R)**

Measures	ED1 to date	ED1 forecast	ED2 target
Oil/fluid loss (litres)	28,055	27,300	23,200
FFC replaced (km)	*176.5*	*224.4*	*40.0*
FFC dosed with PFT (km)	*81.9*	*109.2*	*267.0*

Key: Output measures/*indicative inputs*

Managing fluid lost to ground was one of our stakeholders' top priorities

Fluid lost to ground is one of the top concerns for stakeholders, in particular the Environment Agency, especially where this results in contamination of water supplies and impacts the wider environment. Stakeholders wanted us to minimise leaks from cables to ground and were receptive to investment in self-healing technology. Leaving cables unmanaged would result in oil seeping into the ground which would result not only in environmental damage but also cable failure leading to power cuts. The risk profile of the cables would increase which could threaten security of supply and the efficiency of our network.

During the 2023-28 period we will adopt a blended strategy, rolling-out innovation to deliver significant cost savings

We currently have the third longest fluid-filled cable (FFC) network in the UK and the second largest volume of fluid in our network, yet our overall fluid lost as a percentage of fluid on the network is lower than all but two DNOs[28]. We have significantly outperformed our 2015-23 targets, reducing our leakage by 47 per cent in the period so far and by 2023 we will have replaced over 224km of cable compared to our original plan of around 134km. This puts us in a strong position for the 2023-28 period.

[28] Taken from DNO regulatory return figures for 2019-20.

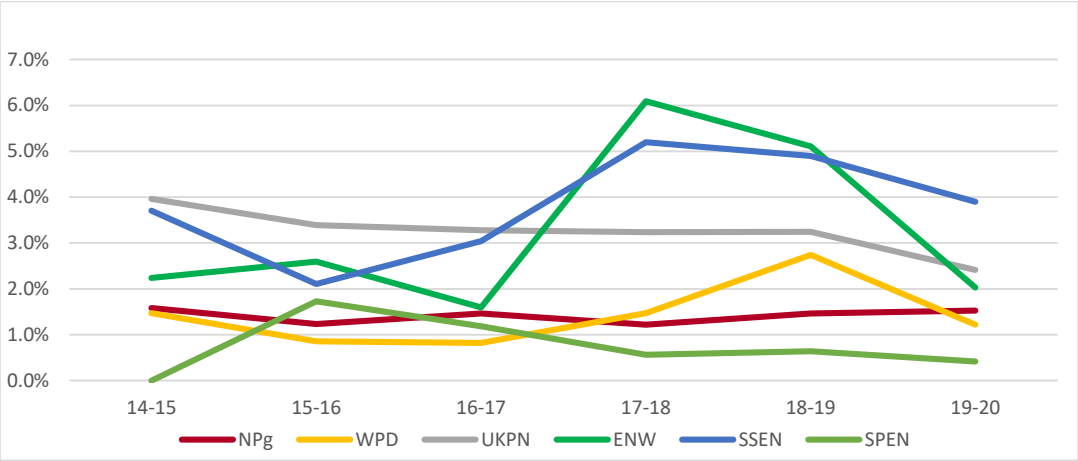

Figure 9: DNO oil loss (as a % of oil in service)

Tackling fluid filled cables can take a number of approaches including:

- replacement of the fluid-filled cable and associated equipment with new solid cables;
- refurbishment of the fluid-filled cable and associated equipment;
- injection of perfluorocarbon tracer (PFT) directly into the fluid-filled cable which is released to air through the leak hole. We can trace this gas and locate the leak via very sensitive 'sniffing' equipment enabling us to locate leaks up to five times quicker than traditional techniques; and
- injection of self-healing cable fluid directly into the fluid-filled cable which solidifies upon contact with air and can stop very small leaks from becoming larger.

Replacement of the fluid-filled cable itself has traditionally been the main method of reducing fluid loss. Asset replacement as the sole means of managing fluid loss is costly, although it does provide a permanent solution to the risk posed by fluid-filled cables.

Refurbishment has been discounted as the costs associated with refurbishing a fluid-filled cable circuit can be almost as much as the full cable replacement and therefore does not provide value for money to our customers.

PFT dosing and tracing is now a widely available and proven technology (the technology was less mature and less available in the early years of the current regulatory period). PFT allows us to locate leaks up to five times quicker than traditional dig and freeze techniques. It is also significantly less expensive than replacing an entire cable circuit.

Self-healing cable fluid is currently undergoing live trials on our network and the technology is very much still in its infancy. Whilst promising, this is not currently a viable option to support reduction of our cable fluid losses until the trials have proved successful and the technology cost effective.

We then considered the scale of each investment options available to use to determine the approach we should adopt:

- PFT and repair - no asset replacement (~£13m): PFT dose 179km of fluid filled cables and replace circuits under exceptional circumstances; Note this would only achieve a 10 per cent reduction in fluid filled cable
- High volume of PFT and repair combined with low volume of replacement (~£39m): PFT dosing of 267km of cable combined with replacement of 40kms of the worst performing circuits;
- High volume PFT and repair and higher volume of replacement (~£61m): PFT dosing of 300km of cable and replacement of 80km of the worst performing circuits; and

– High levels of replacement (~£90m): replace 179km of worst performing circuits.

Our plan targets a reduction in fluid loss of 15 per cent (compared to 2023 levels) by 2028. To achieve this we will utilise a blended strategy of fluid-filled cable replacement combined with significantly extended use of cost effective PFT[29] technology.

We discounted the PFT only solution as while this is a low cost option it ignores asset stewardship, increasing our asset risk profile. At the opposite end of the spectrum we discounted high levels of replacement due to the associated costs and the fact this ignores the benefits of PFT technology and cost efficiencies. Option two and three show significant cost differentials. Option three only delivered just over a 15 per cent reduction in oil loss which we could achieve for significantly less investment in option two.

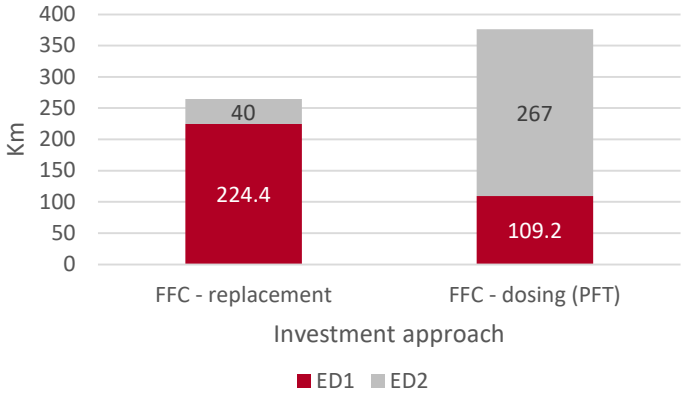

Figure 10: ED1 vs. ED2 FFC investment

Under option two we are able to leverage our investments during the 2015-28 period to generate cost savings in the period. We will provide oil containment for our transformers at major substations and subject to successful trials we will look to introduce self-healing cable fluid to our cable fluid network. This highly cost effective approach will achieve our target reduction in fluid to ground, minimising disruption to local ecosystems and agriculture whilst generating an annual £8.2m cost saving relative to our current levels of expenditure.

Our 2023-28 plan will reduce our cable replacement programme from an average of 28km per annum during 2015-23 down to 8km per annum during the 2023-28 period. To support this reduction in cable replacement we will be increasing our PFT injection rates from an average of 14km per year during 2015-23 to 53km per year during 2023-28. We will also introduce self-healing cable fluid additive to our network if live trials are successful, adjusting our PFT investment accordingly, see Engineering Justification Paper 1.3a: EHV & 132kV cables – Oil.

[29] Perfluorocarbon (PFT) tracers: an additive put into fluid-filled cables. We detect leaks by 'sniffing' the specific chemical structure of this additive in the ground above the leak, locating leakage from above the ground

Noise pollution

Long term objectives

- Address noise issues raised by customers

Customer outcome (2023-28 period)

EP6	**Take proactive action to protect and enhance the environment in which we operate delivering 73km of undergrounding to improve visual amenity, biodiversity improvements at 200 sites and 90% of waste diverted from landfill**

Benefits

- Improved customer service

Deliverables

EP6.4	Undertake site enhancements to mitigate noise from our assets
EP6.5	Publish an annual environmental report for our stakeholders covering the delivery of our 2023 – 28 EAP commitments **(ODI-R)**

Measures	ED1 to date	ED1 forecast	ED2 target
No. of noise pollution interventions	28	39	33

Key: Output measures/*indicative inputs*

We will undertake site enhancements to mitigate noise from our assets where noise levels exceed standards

Noise and other impacts from our activities such as dust, smoke, odour and disruption cause disruption to the communities we serve. Failure to act drives customer dissatisfaction.

We receive a low number of noise complaints each year as shown in Table 4 below, with investigation often showing that the cause is driven by other sources. We found that during the COVID-19 pandemic (reported in 2020-21 in the below table) the number of contacts regarding noise almost doubled from previous years. We suspect this can largely be attributed to many customers being at home due to furlough or remote working combined with lower levels of traffic and other ambient background noise.

	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
Total complaints received	25	34	44	39	35	67
Noise pollution interventions	7	7	4	2	5	3

Table 5: Noise complaints - 2015-23 to date

We will continue to ensure that we comply with noise and statutory nuisance legislation and respond swiftly to all complaints to reduce, minimise or eliminate noise from our equipment.

Polychlorinated biphenyls (PCBs)

Long term objectives

- Remove PCB contaminated equipment from the network

Customer outcome (2023-28 period)

EP5 **Remove PCB contaminated equipment from our network**

Benefits

- Removal of hazardous materials and risk

Deliverables

EP5.1	Remove PCBs from equipment
EP6.5	Publish an annual environmental report for our stakeholders covering the delivery of our 2023 – 28 EAP commitments **(ODI-R)**

Measures	ED1 to date	ED1 forecast	ED2 target
PCB units removed/remediated – Ground mounted transformers	*0*	*34*	*427*[30]
PCB units removed/remediated – Pole mounted transformers	*0*	*413*[31]	*8,401*[32]

Key: Output measures/*indicative inputs*

Legislation requires removal of a historically widely used material from the network

Polychlorinated Biphenyls (PCBs) are organic chemicals that were manufactured for use in various industrial and commercial applications from 1929 to the late 1970s. Attributes of PCBs include fire resistance, low electrical conductivity, high resistance to thermal breakdown and high degree of chemical stability. It is the thermal and chemical stability that made PCBs useful in industrial applications, however these attributes can potentially lead to impacts to the environment and human health.

PCBs are occasionally found in electrical transformers, an important component in many different types of electrical circuits, from small-signal electronic circuits to high-voltage power systems, such as on our network.

For most large transformers, the entire unit is filled with a dielectric fluid to increase the insulation between and to cool the electric coils. The fluid most often used for this purpose is mineral oil and although the transformers do not intentionally contain PCBs, they occasionally became contaminated by the use of common filling equipment or maintenance filling with used or recycled oil. Any damage to the transformer's outer casing therefore could potentially result in PCB-fluid leakage.

We have an obligation under the latest PCB regulations to identify and remove or remediate non-compliant equipment by 31 December 2025. As a result of PCB removal being a legal requirement we did not undertake stakeholder engagement to determine desired level of ambition however we will report annually on our progress.

The main assets that fall within the scope of the legislation are all pole mounted (PM) and ground mounted (GM) transformers that have been manufactured prior to 1987.

[30] Includes 15 units delivered synergistically via asset replacement
[31] Volumes completed in 2015 – 23 as part of our reinforcement programme due to high levels of utilisation
[32] Includes 500 units delivered synergistically via reinforcement

Within our ground mounted (GM) transformer population we have 461 PCB registered units

The insulating oil in a GM transformer is easily accessed for the purpose of oil sampling. From our oil sampling records we have identified 461 GM units that contain PCB contaminated oil and are currently registered with the Environment Agency.

To address non-compliance of these units the options are to either replace the transformers or remediate them through oil replacement. Oil replacement is a significantly cheaper solution than replacement of the units and allows the units to remain on the network for the remainder of their serviceable life. A cost benefit analysis (see Cost Benefit Analysis 40 PCBs; Engineering Justification Paper 8.3 PCBs) was carried out, which demonstrated, that where units have not already been identified for replacement in 2023-28 driven by condition, it is more beneficial to remediate via oil replacement.

We have identified a synergy of 15 units with our 2023-28 distribution transformers work programme and those units will be replaced through this work programme prior to the end 2025. The remaining 446 units will be remediated through oil replacement, with 34 of these being address prior to 2023.

The number of contaminated units is considerably higher in our pole mounted (PM) transformers

We have a total of 16,742 PM transformer units that were manufactured prior to 1987. PM transformers are not designed to be internally inspected and do not have any oil filler or drain valves from which an oil sample could be obtained. Actual PCB content is currently only measured when a transformer is decommissioned as part of the oil disposal process. ENA members are collaborating to try to identify methods to safely and economically sample the oil in PM transformers, but in the meantime the only certain way of knowing whether PCBs are present is by removing the transformer from service and sampling the oil.

A statistical model has been developed in conjunction with the Environment Agency for identifying high risk PCB transformers. The model identifies cohorts of transformers by manufacturer and age. It then classifies them as low or high risk based on oil samples taken from decommissioned units within the same cohort.

Our current best view based on this modelling show 1,969 units to be in the high risk category (high certainty of PCBs over threshold) which must be replaced by the 2025 deadline. So far 5,247 units have been classified as low risk and 9,526 are yet to be classified. The statistical analysis is ongoing and improves as the industry decommissions more transformers.

Our plan costs are estimated based on:

- 1,969 units currently classified as high risk;
- 1,821 units of the unclassified population which required in order to obtain statistically conclusive positions on the total unclassified population; and
- about 65 per cent of the remaining unclassified population, 5,024 units.

This would represent about 8,814 units in total of which 500 will be addressed through synergies with our condition-based asset replacement programme during 2023 – 28 and 413 will be addressed in 2015 – 23 as part of our reinforcement programme. As this is a substantial proportion of the total pre-1987 asset population (around 50 per cent), we are taking the opportunity to ensure that the units are replaced with more efficient amorphous core transformers. A cost benefit analysis has been carried out in our losses strategy that supports the use of these units, and our unit cost includes an uplift to account for this (see Annex 4.5 losses strategy).

We are actively working to identify other oil-filled equipment on the electricity network that may contain PCBs and is not subject to routine oil inspection. This equipment is expected to be primarily associated with equipment on the EHV and 132kV network, so the volumes are expected to be relatively small. We expect to have clarity on the potential volume of work by December 2021. This is currently excluded from our plan.

Successful delivery of our PCB programme is dependent on the supply chain being able to sustain the volume of pole mounted transformers required to deliver this programme. This challenge will not be unique to us and will impact all European distribution companies in compliance with the persistent organic pollutants legislation (see x-ref Annex 7.1 Delivery Strategy).

We will continue to work with the industry to share data, refine the population and investigate alternative methods to oil sampling for assessing PCB levels in PM transformers and we will modify our strategy if methods of testing become approved and are cost effective.

The cost of this programme, at £8.6m per annum, will be absorbed by cost efficiencies realised in other areas of our EAP, primarily fluid-filled cable replacement.

Further information on our plans and options reviewed can be found here - Cost benefit analysis 40. PCBs, Engineering Justification Paper 8.3 PCBs. For further information on amorphous core transformers see annex 4.5 losses strategy.

Visual Amenity

Long term objectives

- Improve the visual amenity across the National parks, Areas of Outstanding Natural beauty (AONB) and other designated areas to enhance the regions we serve

Customer outcome (2023-28 period)

EP6	**Take proactive action to protect and enhance the environment in which we operate delivering 73km of undergrounding to improve visual amenity, biodiversity improvements at 200 sites and 90% of waste diverted from landfill**

Benefits

- Improved visual amenity

Deliverables

EP6.1	Improve visual amenity by undergrounding 73km overhead lines inside and outside designated areas
EP6.5	Publish an annual environmental report for our stakeholders covering the delivery of our 2023 – 28 EAP commitments **(ODI-R)**

Measures	ED1 to date	ED1 forecast	ED2 target
Visual amenity – Overhead lines removed (km)	74.9	114.0	73.0
Visual amenity investment (% of allowances)	*103%*	*127%*[33]	*100%*

Key: Output measures/*indicative inputs*

We will improve the visual amenity in our regions

Within our regions we have four National Parks and five areas of outstanding natural beauty (AONB). By 2023 we will have undergrounded 114km of overhead lines in these areas, 16km more than we committed to in our 2015-23 plan. We are pleased to be industry leaders in this area and our stakeholder engagement highlighted an appetite for us to continue our programme (see Annex 3.3 Detailed Engagement Findings - EAP).

Stakeholder feedback guided us in considering how ambitious we should be with this programme. We concluded that a continuation at an equivalent run rate to the original ED1 plan represented ongoing commitment to improving the visual amenity in the regions we serve. We will target 73km of undergrounding of overhead lines both inside and outside designated areas in the 2023-28 period working in partnership with the National Parks, AONBs and local authorities.

We expect this programme to be funded by a 'use it or lose it' allowance from Ofgem. Our programme improves the reliability of rural electricity networks, enhancing customer service but also enabling our stakeholders to enjoy precious areas undisturbed by our assets on their horizon and removes potential dangers from the paths of birds and bats and so not to utilise this allowance would be a missed opportunity to enhance our local environments (see Engineering Justification Paper - 8.4 – Undergrounding overhead lines in designated areas).

[33] We are forecasting to invest £3.5m above our allowances – an additional 16km of overhead lines from AONBs.

Reporting

We will report annually on our progress in delivering our Environmental Action Plan including the use of an environmental scorecard

We will publish an annual environment report (AER) which will account for our progress in delivering every element of our EAP.

Reporting progress on our EAP through publication of an annual Environment Report will be a reputational output delivery incentive (ODI-R) providing greater levels of transparency to our stakeholders on the delivery of our plans. This will be supplemented with a financial output delivery incentive (ODI-F) in the form of an environmental scorecard to target specific areas with financial incentives.

We are committed to delivering on our promises.

The outcomes, benefits, deliverables and measures that we will report on along with our proposed environmental scorecard are shown in Appendix 2: outputs and incentives. For each of our customer outcomes we set out our current performance levels, our 2023 forecast out-turn position and our 2023-28 targets.

Appendix 1: Outputs and incentives

This appendix explains how our outcomes link to the range of outputs and incentives in Ofgem's 2023-28 price control framework.

Within Ofgem's framework there is a Reputational Output Delivery Incentive (ODI-R) to cover performance reporting commitments for our Environmental Action Plan in an Annual Environmental Report (AER).

Ofgem has also been working with DNOs to develop an environmental scorecard for the 2023-28 period as the basis for a financial output delivery incentive (ODI-F).

Output/Incentive	Type	Target/Mechanism
Environmental Action Plans	Common LO	This plan
Annual Environmental Report	Common ODI-R	Annual reporting
Environmental Scorecard	Common ODI-F	Performance scorecard proposed in our plan

Table 1: A summary of outputs and incentives

This appendix includes:

- A summary of our Environmental Action Plan
  - Outcomes → our commitments for the 2023-28 period
  - Benefits → how these outcomes benefit our customers
  - Deliverables → what we plan to do to support the delivery of our outcomes
  - Metrics → how we plan to measure our success, including:
    - Output measures to track the delivery of our outcomes – shown as Licence Obligations (LOs), Price Control Deliverables (PCDs) and Output Delivery Incentives (ODIs) as appropriate
    - Indicative input measures showing underlying input/volume assumptions (where relevant)
- Our proposed ODI-F environmental scorecard
- Mapping to Ofgem's baseline requirements
  - Details the relevant key actions in our plan
  - Highlights where our plan meets or exceeds baseline requirements;
  - Labels delivery through the ODI-F or ODI-R mechanisms (detailed above); and
  - Demonstrates where they are included in our plan outcomes and deliverables
- Key performance indicators (KPIs) phasing through the period and a glossary of terms

Customer outcomes

Environmental Action Plan outcomes	Benefits	Deliverables	Measure[1] (output/*indicative inputs*)	ED1 to date	ED1 forecast	ED2 target
EP1) Reduce controllable internal business carbon footprint (BCF) by 20% keeping us in line with the government's 2035 target and on a path to being a carbon-neutral operation by 2040, and introduce a science-based target to measure our impact	• Reduction in carbon emissions • Improved air quality • Contribution to wider climate change agenda	**EP1.1)** Install renewable energy at 50 sites, remaining receptive to technological advances **EP1.2)** Adopt a verified science-based target to reduce scope 1 and 2 emissions in line with net zero (4.2% annual reduction to 2035, achieving a 21% reduction in emissions over 2023-28) and report on progress for scope 3 emissions **EP1.3)** Implement BREEAM initiatives and standards at 10 sites **EP1.4)** Increase ultra-low emission vehicles (ULEVs) on fleet to 40% by 2028, reducing fleet fuel by 33% **EP1.5)** Reduce sulphur hexafluoride (SF_6) losses by 15% including replacing SF_6-filled equipment with a leak rate in excess of 5 kg over a four-year period	**Controllable internal BCF (excluding losses)** (tCO_2e)	**14,722**	**14,300**	**11,430**
			Science-based target Scope 1 and 2 emissions (excluding losses) (tCO_2e)	**12,866**	**11,740**	**8,920**
			Science-based target Scope 1 and 2 emissions (including losses) (tCO_2e)	**539,775**	**492,450**	**374,130**
			Report on Scope 3 BCF annually (tCO_2e)	✓	✓	✓
			Building and substation energy use (tCO_2e) **(ODI-F)**	**7,312**	**6,480**	**5,520**
			Operational transport emissions (tCO_2e) **(ODI-F)**	**4,186**	**4,110**	**2,750**
			Business transport emissions (tCO_2e) **(ODI-F)**	**1,558**	**2,560**	**2,160**
			SF_6 losses (kg)	**73.1**	**50.3**	**42.7**
EP2) Efficiently manage and optimise losses from our network[2]	• Reduction in carbon emissions	**EP2.1)** Develop and report on our losses strategy annually **EP2.2)** Install super low-loss amorphous core transformers **EP2.3)** Install low-loss (i.e. oversized) low voltage (LV) and high voltage (HV) cables **EP2.4)** Improve the energy efficiency of our substations	**Science-based target Scope 2 emissions (losses only)** (tCO_2e)	**526,909**	**480,710**	**365,210**
			Low loss transformers (units)[3]	*4*	*5*	*12,000*
			Low loss cables (km)[3]	*1,582*	*2,240*	*3,400*
			Number of substations assessed	*N/a*	*N/a*	*100%*

1. Measures are shown to track delivery of our customer outcomes. Whilst some measures may directly relate to deliverables, this may not be true in all cases. Numbers shown may be subject to rounding - see Annex 'A1.4 - key targets & measures' for profiled targets.
2. Cross-reference Communities C03.2) Community energy advisors.
3. Volumes align with our Planning Scenario and will differ in the period according to the decarbonisation pathway that emerges.

EP3) Promote environmental management and decarbonisation of our supply chain, achieving 90% compliance with our responsible procurement charter [1]	• Reduction in carbon emissions	**EP3.1)** Introduce a Responsible Procurement Charter achieving >90% compliance **EP3.2)** Deliver a funded programme of support for suppliers to enhance environmental competences including achieving ISO 14001 accreditation **EP3.3)** Roll-out the use of low carbon fuel alternatives for our mobile generation fleet **EP3.4)** Introduce an embodied carbon model in 2023–24 for new projects, and monitor and report on our embodied carbon though the period	**% of suppliers compliant**		**N/a**	**N/a**	**90%**
			Normalised contractor emissions rate (tCO_2e per £m of contractor capital investment)		**68.0**	**62.0**	**47.1**
			Investment to support supply chain standards (£m)		*-*	*-*	*1.2*
EP4) Reduce oil lost to ground by 15%	• Lower levels of pollution • Improved ecosystems and biodiversity	**EP4.1)** Replace 40km of fluid-filled cables (FFC) to reduce fluid leaks **EP4.2)** Dose >250km of fluid-filled cables with PFT to reduce fluid leaks 💡 **EP4.3)** Subject to successful trials, roll out self-healing cable solution 💡 **EP4.4)** Undertake bund replacement and refurbishment to minimise pollution sources	**Oil/fluid loss (litres)**		**28,055**	**27,300**	**23,200**
			FFC replaced (km)		*176.5*	*224.4*	*40.0*
			FFC dosed with PFT (km)		*81.9*	*109.2*	*267*
EP5) Remove PCB contaminated equipment from our network	• Removal of hazardous materials and risk	**EP5.1)** Remove PCBs from equipment	*PCB units removed/re mediated*	*Ground mounted transformers*	*0*	*34*	*427*[2]
				Pole Mounted Transformers	*0*	*413*[3]	*8,401*
EP6) Take proactive action to protect and enhance the environment in which we operate delivering 73km of undergrounding to improve visual amenity, biodiversity improvements at 200 sites and 90% of waste diverted from landfill	• Improved visual amenity • Increase the variety and numbers of flora and fauna • Reduction in waste to landfill	**EP6.1)** Improve visual amenity by undergrounding 73km overhead lines inside and outside designated areas **EP6.2)** Enrich local habitats through biodiversity initiatives to enhance conservation of our environment and species **EP6.3)** Increase the number of recycling stations in our business **EP6.4)** Undertake site enhancements to mitigate noise from our assets **EP6.5)** Publish an annual environmental report for our stakeholders covering the delivery of our 2023-28 EAP commitments **(ODI-R)**	**Visual amenity - Overhead lines removed (km)**		**74.9**	**114.0**	**73.0**
			Visual amenity - investment (% of allowances)		*103%*	*127%*[4]	*100%*
			No. of sites with net biodiversity gain (ODI-F)		**11**	**11**	**200**
			% of waste diverted from landfill (ODI-F)		**75%**	**80%**	**90%**
			% of total materials recycled (ODI-F)		**75%**	**78%**	**85%**
			No. of noise pollution interventions		**28**	**39**	**33**

Key: 🌐 - Data and digitalisation, 👥 - Workforce Resilience, 💡 – Innovation

Table 2: Environmental Action plan customer outcomes

1. Cross-reference Openness and Transparency OT2) Governance and sustainability frameworks.
2. Includes 15 units delivered synergistically via asset replacement.
3. Includes 500 units delivered synergistically via reinforcement.
4. We are forecasting to invest £3.5m above our allowances from efficiency savings – an additional 16km of overhead lines from AONBs.

Proposed ODI-F scorecard

Ofgem has been working with DNOs to develop an environmental scorecard for the 2023-28 period as the basis for a financial output delivery incentive (ODI-F).

Based on this work, and the direction given by Ofgem on the measures it expects to be included (and not included) on the scorecard, we propose the following measures that target areas of our EAP that otherwise would not specifically be incentivised, subject to bespoke funding mechanisms or addressed by other obligations.

Measure	Unit	2015-2023 Actual	Baseline (2015-2023 FOT)	Max incentive target
Building and substation energy emissions	**tCO_2e**	*7,312*	*6,480*	5,520 (15%)
Operational transport emissions	**tCO_2e**	*4,186*	*4,110*	2,750 (33%)
Business transport emissions	**tCO_2e**	*1,558*	*2,560*	2,160 (16%)
Per cent of waste diverted from landfill	**%**	*75%*	*80%*	90%
Per cent of total materials recycled	**%**	*75%*	*78%*	85%
Biodiversity sites delivered	**Count**	*11*	*11*	200

Table 3: Proposed ODI-F scorecard

Our proposed environmental scorecard has been developed based on Ofgem's sector specific methodology decision (SSMD), which excluded SF_6 from environmental scorecards as this could lead to incentivising investment where the environmental benefit is not justified and losses due to their difficulty in measurement. The SSMD also sought to avoid financially incentivising areas that are heavily investment driven, such as fluid filled cables.

We have therefore focused on value for money initiatives in areas traditionally not incentivised, where measurement will benefit stakeholders and incentivise outperformance to support delivery of environmental benefits in our plan.

Our six proposed measures are all areas that have been highlighted within our stakeholder engagement. We also considered National Grid's environmental scorecard that was accepted by Ofgem during the gas and transmission determinations and looked to develop this further taking into account the work of the DNO working group to-date.

We have excluded measures that are:

- difficult to accurately quantify;
- out of our control;
- already covered by a legislative driver within the period; and/or
- low materiality.

Mapping to Ofgem's baseline requirements

Ofgem baseline standard	Key actions[1]	Target/reporting mechanism	Meets/ Exceeds	Outcome Ref. [1]
Business Carbon Footprint (BCF)				
Adopt a science based target[2] for the company to reduce its scope 1 and 2 BCF by 20xx[3], without relying on international GHG offsetting, that is in line with net zero.	- Our science based target requires us to reduce emissions by 4.2 per cent annually. Our forecasts align to this reduction. - Losses, which are included in scope 2 are dependent on the rate at which the grid decarbonises; we will support the reduction in carbon intensity through accommodating low carbon generation onto the network.	**EAP, LO** - Reduce emissions by 4.2 per cent annually	Meets	**EP1**
Commit to efficient and economic actions to reduce controllable BCF in 2023-28.	- Reduce controllable internal Business Carbon Footprint by 20 per cent, putting us on a path to be a carbon neutral operation by 2040	**EAP, LO** - Controllable internal BCF emissions at 11,430 tCO_2e by 2028	Exceeds	
	- Install renewable energy sources at suitable sites - Implement BREEAM initiatives at 10 sites	**EAP; LO, ODI-F** - Building and energy substation emissions at 5,520 tCO_2e by 2028	Meets	
	- Increase ultra-low emission vehicles (ULEVs) and zero emission vehicles (ZEVs) on fleet to 40 per cent by end of 2028 to reduce fleet fuel.	**EAP; LO, ODI-F** - Operational transport emissions at 2,750 tCO_2e by 2028 - Business transport emissions at 2,160 tCO_2e by 2028	Meets	
Identify metrics, and associated targets, for 2023-28 to track the impact of implementing actions and the overall progress towards the science based target and net zero.	- We will reduce scope 1 and 2 emissions (excluding losses) by 4.2% each year in line with our SBTs.	**EAP, LO** - Scope 1 and 2 emissions (excluding losses) at 8,920 tCO_2e by 2028	Meets	
Commit to reporting on BCF reduction and progress towards science-based target and net zero using a common BCF methodology. Reporting should	- As part of our AER we will report on our BCF emissions, including SBTs for scope 1 and 2 emissions. - We will also report on progress on scope 3 emissions. - Normalised supply chain emissions target set reducing by 4.2% each year	**EAP; LO, ODI-R** - Scope 1 and 2 emissions at 374,130 tCO_2e by 2028. - Report on scope 3 BCF annually	Exceeds	

[1] Refer to page 23 for our plan outcomes, deliverables, targets and measures
[2] This should be verified by the science-based target initiative (SBTi): https://sciencebasedtargets.org/
[3] 20XX denotes that companies will need to specify a long term date to achieve the specified target. We would then expect companies to specify the associated RIIO-ED2 milestone.

include progress in reducing scope 3 emissions.[1]				
Sulphur Hexafluoride (SF_6)				
Commit to implementing a strategy in 2023-28 to manage SF_6 on their network. This should include economic and efficient actions to reduce leakage rates and where appropriate, economic and efficient SF_6 asset replacement.	- Our SF_6 strategy will include targeted asset replacement based on monitoring of our assets. - We will explore the viability of alternatives to SF_6 and build the cost of carbon from SF_6 emissions into our procurement process.	**EAP, LO** - SF_6 losses (kg) at 42.7kg by 2028	Meets	**EP1**
Adopt a target for SF_6 leakage reduction.	- Targeted SF_6 equipment replacement where leaks are over 5kg over a four-year period			
Commit to reporting on total SF_6 bank and leakage reduction rates using a common DNO methodology.	- Publish an annual environmental report for our stakeholders covering the delivery of our 2023-28 EAP outcomes	**EAP; LO, ODI-R** - Annual reporting	Meets	
Losses				
Develop and commit to implementing a strategy to efficiently manage both technical and non-technical losses on the DNO's network over the long term. This should include specific actions and performance measures to track the impact of actions in 2023-28.	- We will develop and report on our losses strategy annually, see Annex 4.5 losses strategy - As part of our transformer and cable replacement programme we will install low loss solutions to enable synergies - We will complete substation energy efficiency assessments to implement measures to reduce substation energy emissions	**EAP, LO** - We will report on our losses strategy annually	Meets	**EP2**
Commit to reporting on the progress of implementing the losses strategy and associated performance measures.	- Publish an annual environmental report for our stakeholders covering the delivery of our 2023-28 EAP outcomes	**EAP; LO, ODI-R** - Annual reporting	Meets	
Contribute to the evidence base on the proportion of losses that network companies can influence/control.	- We will collaborate with the wider industry to develop our understanding of losses and contribute to the DNO evidence base	**EAP, LO** - We will report on our losses strategy annually	Meets	
Embodied Carbon				
Commit to monitoring and reporting on embodied carbon in new projects.	- We will monitor and report on embodied carbon through appropriate channels	**EAP; LO, ODI-R** - Annual reporting	Meets	**EP3**
Commit to collaborating with DNO's supply chain on addressing challenges to reduce embodied carbon in the network.	- We will collaborate with our supply chain to deliver downward benefits. This will also enhance accountability and will inform our investment decisions for raw materials.	**EAP, LO** - Annual reporting	Meets	
Commit to establishing baseline and a target to reduce embodied carbon on new projects during 2023-28.	- We will establish a baseline for 2023-24 with a target for the period to reduce embodied carbon	**EAP, LO** - Model established for 2023-24	Meets	

[1] Scope 3 emissions are a consequence of actions which occur at sources which the DNO does not own or control and which are not classed as Scope 2 emissions. Although a DNO's science-based target does not include scope 3 emissions, DNO's reporting should include progress against reducing scope 3 emissions.

Supply Chain Management				
Adopt high standards of environmental management in supplier code, including requirements for public disclosure of metrics and cascading code to their suppliers that are material to company's inputs.	- We will develop a Responsible Procurement Charter to ensure sustainable work practices throughout our supply chain. - Contractors will be required to report on a variety of performance measures across their business. - Direct package of support for suppliers to achieve consistent environmental standards - Environmental competencies factored into our procurement processes	**EAP, LO** - 90 per cent of suppliers compliant - Emissions rate target of 47.1 (tCO_2e per £m of contractor capital investment)	Exceeds	**EP3**
Adopt target of more than 80% of suppliers (by value) meeting code in 2023-28	- We will target 90 per cent compliance (by value) with our Responsible Procurement Charter to ensure high environmental standards are embedded across our wider operations.	**EAP, LO** - 90 per cent of suppliers compliant	Exceeds	
Commit to reporting on actual percentage of suppliers (by value) meeting code.	- We will report on the number of suppliers compliant as part of our AER	**EAP; LO, ODI-R** - Annual reporting	Meets	
Resource use and waste				
Update procurement processes to embed Circular Economy principles.	- While we already adopt circular economy principles we will increase this to improve our waste segregation, improve recycling and re-use rates as well and embedding this in our supply chain.	**EAP, LO** - 90 per cent of waste diverted from landfill by 2028 - 85 per cent of total materials recycled by 2028	Meets	**EP6**
Adopt a target for: - Zero waste to landfill by 20XX. - Recycled and reused materials as a percentage of total materials by 20XX.	- We will be zero waste to landfill by 2035 - We will recycle and reuse 85per cent of our total waste generated by 2028.	**EAP; LO, ODI-F** - 90 per cent of waste diverted from landfill by 2028 - 85 per cent of total materials recycled by 2028	Meets	
Commit to reporting on actual waste to landfill, recycling and reuse as a percentage of total.	- Our AER will report annual progress on our waste to landfill and recycling and reuse rates	**EAP; LO, ODI-R** - Annual reporting	Meets	
Biodiversity/natural capital				
Adopt appropriate tool to assess net changes in natural capital from different options for new connections and network projects.	- Through our work with the Energy Networks Association (ENA) we have developed a natural capital tool to assess and monitor the impact we have on our eco-systems. We will use this on new projects.	**EAP, LO** - Annual reporting on biodiversity net gain	Meets	**EP6**
Adopt appropriate tool to monitor the provision of ecosystem services from network sites and report annually.	- Using the natural capital tool above, we will exceed the baseline standard as we will introduce biodiversity initiatives across 200 of our sites, monitoring the impact.	**EAP; LO, ODI-F** - No. of sites with biodiversity gain	Exceeds	
Fluid-filled cables				

Adopt a target for reductions in the volume of fluid (oil) used to top up cables.	- Replace 40km of fluid filled cable - PFT 267km of fluid filled cable	**EAP, LO** - Reduce oil/fluid loss (litres) to 23,200 by 2028 (15 per cent)	Meets	**EP4**
Noise pollution				
Commit to reporting on actions taken to reduce noise pollution.	- We will undertake site enhancements to mitigate noise from our assets where noise levels exceed standards and report on progress as part of our AER.	**EAP; LO, ODI-R** - Annual reporting	Meets	**EP6**
Polychlorinated Biphenyls (PCBs)				
Commit to reporting on the volume of PCB-contaminated equipment on the network.	- We are working with other DNOs to develop a statistical model to identify PCB contaminated equipment which is required to be removed from the network.	**EAP; LO, ODI-R** - Annual reporting	Meets	**EP5**

Table 4: Mapping to Ofgem's baseline requirements

Further detail on our key measures

Key measures		ED1 performance		ED2 performance Phased targets					Customer outcome
KPI	Unit	ED1 to date[1]	ED1 forecast[2]	2023/24	2024/25	2025/26	2026/27	2027/28	
OUTPUTS									
Business carbon footprint (DNO)	tCO_2e	*14,722*	*14,300*	13,720	13,150	12,580	12,010	**11,430**	EP1
Buildings energy usage	tCO_2e	*7,312*	*6,480*	6,300	6,120	5,940	5,720	**5,520**	EP1
Operational transport	tCO_2e	*4,186*	*4,110*	3,870	3,650	3,370	3,070	**2,750**	EP1
Business transport	tCO_2e	*1,558*[3]	*2,560*	2,420	2,280	2,200	2,180	**2,160**	EP1
Fugitive emissions	tCO_2e	*1,666*	*1,150*	1,130	1,100	1,070	1,040	**1,000**	EP1
Science-based target Scope 1 and 2 emissions (excluding losses)	tCO_2e	*12,866*	*11,740*	11,180	10,610	10,050	9,490	**8,920**	EP1
Science-based target Scope 1 and 2 emissions (including losses)	tCO_2e	*539,775*	*492,450*	468,790	445,120	421,460	397,790	**374,130**	EP1
Science-based target Scope 2 emissions (losses only)	tCO_2e	*526,909*	*480,710*	457,610	434,510	411,410	388,300	**365,210**	EP2
Contractor emissions rate target	rate	*68.0*	*62.0*	*59.0*	*56.0*	*53.1*	*50.1*	**47.1**	EP3
SF_6 lost	Kg	*73.1*	*50.3*	48.7	47.2	45.7	44.2	**42.7**	EP1
Responsible procurement charter	%	-	-	90%	90%	90%	90%	**90%**	EP3
Oil/fluid lost	Litres	*28,055*	*27,300*	26,500	25,700	24,900	24,100	**23,200**	EP4
Overhead lines removed inside and outside of designated areas	km^4	*74.9*	*114.0*	10.0	20.0	35.0	50.0	**73.0**	EP6
Biodiversity - improvement/facilitated on site	Count[4]	*11*	*11*	40	80	120	160	**200**	EP6
Waste - diversion from landfill	%	*75%*	*80%*	82%	84%	86%	88%	**90%**	EP6
Waste - recycled and re-used materials	%	*75%*	*78%*	79%	80%	82%	84%	**85%**	EP6
Noise pollution – interventions	Count	*28*	*39*	6	12	19	26	**33**	EP6
INDICATIVE INPUTS									
Losses - low loss cables	$km^{4,5}$	*1,582*	*2,240*	680	1,360	2,040	2,720	**3,400**	EP2
Losses - low loss transformers	Count[4]	*4*	*5*	2,400	4,800	7,200	9,600	**12,000**	EP2
Investment to support supply chain standards	£m	-	-	0.24	0.48	0.72	0.96	**1.20**	EP3
FFC – replacement	km^4	*176.5*	*224.4*	8	16	24	32	**40**	EP4
FFC - dosing (PFT)	km^4	*81.9*	*109.2*	53.4	106.8	160.2	213.6	**267.0**	EP4
PCB - pole mounted transformers	Count[4]	*0*	*413*6	*2,766*	*5,532*	*8,401*	*8,401*	*8,401*[6]	EP5
PCB - ground mounted transformers	Count[4]	*0*	*34*	*155*	*311*	*427*	*427*	*427*[7]	EP5
Visual amenity expenditure – versus allowances	%	*103%*	*127%*	*20%*	*40%*	*60%*	*80%*	*100%*	EP6

Table 5: EAP key measures and phasing of performance metrics

1. 2020/21 actual performance.
2. 2022/23 forecast performance.
3. This number is lower that the ED1 forecast and ED2 volumes as a result of minimal travel during the COVID-19 pandemic.
4. Cumulative, in price control.
5. Volumes align with our Planning Scenario and will differ in the period according to the decarbonisation pathway that emerges.
6. Includes 500 units delivered synergistically via reinforcement.
7. Includes 15 units delivered synergistically via asset replacement.

Glossary

KPI	Definition
OUTPUTS	
Business Carbon Footprint (DNO)	The total Greenhouse Gas Emissions tCO_2e (tonnes of CO_2 equivalent) from the operations of our distribution business.
Buildings Energy Usage	The total tCO_2e from energy use at our depots and substations – including gas and electricity.
Operational Transport	The total tCO_2e from our fleet fuel use.
Business Transport	The total tCO_2e from business travel – including road, rail and air.
Fugitive Emissions	The total tCO_2e from emission relative to sulphur hexafluoride gas (SF_6) lost.
Science-based target Scope 1 and 2 (excluding losses)	Targets are considered 'science-based' if they are in line with the goals of the Paris Agreement – limiting global warming to well-below 2°C and pursuing efforts to limit warming to 1.5°C.
Science-based target Scope 1 and 2 emissions (including losses)	Losses are the difference between the amount of energy entering the network and the amount of energy drawn out of it.
Science-based target Scope 2 emissions (losses only)	
Contractor emissions rate	The total emissions (tCO_2e) from contractor operations as a proportion of investment activity completed by the contractors – with a targeted reduction in line with our science based targets of 4.2% per annum
SF_6 lost	The total amount of sulphur hexafluoride gas (SF_6) lost into the atmosphere
Responsible procurement charter	Sets out the requirements that suppliers must adhere to from an environmental, regulatory, health and Safety and compliance perspective. Supports Northern Powergrid's Responsible Procurement Policy.
Oil/Fluid lost	The total discharge of insulating oil into the environment as a result of operational activities.
Overhead lines removed inside and outside of designated areas	The length of overhead lines removed from within areas of outstanding natural beauty and national parks in line with our ED1 programme. This now also includes a small number of schemes that will be completed outside of designated areas.
Biodiversity - improvement/facilitated on site	Biodiversity is the variety of plant and animal life in the world or in a particular habitat, a high level of which is usually considered to be important and desirable.
Waste - Diversion from landfill	The proportion of total waste that is not sent to landfill (landfill is the process of burying waste material).
Waste - Recycled and re-used materials	The proportion of total waste that is retuned to a previous stage in its life cycle and either re-used for its original purpose or converted into other usable material.
Noise pollution - interventions	The number of remedial works required to rectify noise complaints that are above the levels of normal operating characteristics of electrical assets.
INDICATIVE INPUTS	
Losses - low loss cables	The length of cable installation relative to Low voltage and High voltage circuits. The cable being installed results in a reduction of electrical losses.
Losses - low loss transformers	The count of transformers classed as low loss – see our losses strategy for more information.
Investment to support supply chain standards	The level of investment to support suppliers to obtain ISO14001 accreditation, where they do not hold this already. The investment will also cover the internal resource and IT costs associated with the increase in the data we will process and analyse on a monthly basis from supplier environmental returns to improve transparency around scope 3 emissions.
FFC - replacement	The length of fluid filled cable replaced.
FFC - dosing (PFT)	The length of circuits dosed with Perfluorocarbon (PFT) tracers. PFT tracers are an additive put into fluid-filled cables which can detect leaks by 'sniffing' the specific chemical structure of the additive in the ground above the leak, locating leakage from above the ground to target repair.
PCB - Pole Mounted Transformers	A high voltage electrical transformer located on a pole that contains Polychlorinated Biphenyls (PCBs). PCBs are organic chemicals that were manufactured with a thermal and chemical stability making them an excellent insulating material.
PCB - Ground Mounted Transformers	A high voltage electrical transformer located at ground level that contains PCBs.
Visual amenity expenditure –	The proportion of the 'use it or lose it' allowance used to remove overhead lines as part of our visual amenity programme. Where this exceeds 100%, we will have re-invested plan efficiencies in completing more work.

Table 6: EAP key measure definitions

Appendix 2: Further detail on our impact assessment

In the main body of our plan we discuss the key elements of our environmental impact assessment that has informed our Environmental Action Plan, including an assessment of opportunities and challenges. The tables below set bring the elements of our impact assessment together and provide further detail for each key component of our plan.

Business Carbon Footprint

Impact assessment

Our controllable carbon footprint is made up of four components:

2. **Building and sub-station energy usage** (Scope 1, 2 and 3)
   - Building energy usage accounts for ***50 per cent*** of our internal BCF (excluding losses)
   - There are 3 sub-components: substation electricity use (scope 2 & 3), office electricity use (scope 2 & 3) and office gas use (scope 1)
3. **Operational transport – fleet** (scope 1)
   - Our fleet emissions account for ***28 per cent*** of our internal BCF (excluding losses)
   - Around 8.1 million miles are driven annually
   - Currently 3 per cent of our fleet are low or zero emission vehicles and we are forecasting an increase to 8 per cent by Q1 2023
   - 8 per cent of our fleet (such as specialist off-road vehicles) currently do not have commercially viable low or zero emission alternatives
4. **Business transport** (scope 3)
   - This includes vehicles owned and driven by employees for business purposes, plus air and rail travel which contribute ***11 per cent*** of our internal BCF (excluding losses)
   - Around 5.7 million miles are driven annually
   - The COVID-19 pandemic has seen a reduction in our business road, rail and air travel
5. **SF_6** (scope 1)
   - SF_6 gas emissions account for ***11 per cent*** of our internal BCF (excluding losses)
   - They have a global warming potential 22,800 times that of CO_2
   - Our SF_6 bank is 36,300kg
   - Our SF_6 gas losses are currently 73kg per annum (0.2 per cent of bank)

Opportunities

- Low carbon technologies are available to support us to reduce our building and substation energy emissions as well as our fleet emissions. We are able to install renewable generation and low carbon technologies at our offices, depots and substations to reduce our carbon footprint. There are also some low carbon fleet alternatives available. Adoption of these technologies, where cost effective and value for money for customers has the potential to drive carbon reduction and efficiency.
- Data and digitalisation presents opportunities to reduce emissions. For example digital platforms are available to support remote working and we can drive benefits through data analytics (e.g. vehicle telematics).
- Innovative solutions are emerging as alternatives to SF_6. In the meantime, we can use technology including our FLIR[1] camera to identify leakages on the network as well as asset data analytics to support targeted replacement.

Challenges

- We will adopt low carbon technologies where this is cost effective for our customers. The cost of low carbon technologies at present carries a premium, and so our plans must balance ambition with associated costs as well as operational implications.
- Our current ULEV/ZEV fleet penetration is driven by our lease fleet replacement cycle, which is currently 5-7 years.
- Availability of charging points in our regions, vehicle range capabilities of low carbon vehicles and technological readiness in decarbonising larger vehicles, e.g. HGVs and specialist plant are also key challenges.
- Our adoption of new technologies must not impact our targeted operational performance levels.
- Our activity levels are set to increase in 2023–28 to deliver the investment necessary for decarbonisation; this will place upward pressure on emissions which needs to be managed.

[1] A forward looking infrared (FLIR) Camera is used to proactively detect SF_6 leakage from switchgear and target it for repair.

- We have embraced technology to manage and reduce our SF_6 emissions to-date. Our performance improvement will likely begin to plateau in the 2023-28 period as the benefits of our FLIR camera are fully realised.

Losses

Impact assessment

- Electrical losses from our network are classified as scope 2 emissions.
- We have a large and ageing asset base with ca.63,000 substations and over ca.96,000 km of circuit[1] on our network.
- Emissions associated with losses are 34 times greater than our other internal emissions levels (499,615 tCO2e) carrying environmental and financial impacts.
- Losses from our network can be categorised into two types:
    - Technical losses: these occur as a result of electrical energy being converted into heat which occurs naturally in power systems. This includes fixed losses (resulting from assets being switched on) and variable losses which result from the loading of the equipment (I^2R).
    - Non-technical losses: these relate to unidentified, misallocated and inaccurate energy flows in which the end user is unknown or the amount of energy being consumer is uncertain.
- The type of loss influences the level of control we have in reducing losses from the network, with some initiatives having a greater impact than others.
- External factors impact losses on our network; as society increases its dependence on electricity and shifts towards electrification of heat and transport, the demand for electricity will increase, increasing loading on our network and increasing losses, all other things being equal. Acting in the opposite direction however will be the rate at which the grid decarbonises; the more renewable energy on the network, the lower the carbon impact of any losses (although the financial impact will remain).

Opportunities

- Innovation and collaboration provide an opportunity to optimise losses. By working with academics, consultants and other industry players we can engage in research and innovation projects to enhance our understanding of losses as well as identify and share solutions that can support the reduction of losses.
- Data and Digitalisation allows for use of data analytics to improve investment decision making.
- Targeted intervention with wider business programmes also allows us to achieve synergies in our investments to reduce losses while investing in decarbonisation, reliability and the health of our network

Challenges

- Losses carry both an environmental and financial impacts for our customers.
- Losses are difficult to accurately quantify at any given time.
- Investment decisions we make to tackle losses also have a long-term legacy with assets on our network being in use for 45 years on average. Our long-term investment decisions today therefore have to balance costs, both financially and environmentally, with asset health and the impact of future emerging technologies

Scope 3 emissions

Impact assessment

- Scope 3 emissions cover a broad range of emissions in the value chain, some of which we regularly capture data for today and some that have come to light as part of the work we completed with Anthesis on our SCTs
- We track contractor emissions and these account for about half of our overall carbon footprint (excluding losses). This is made up of 44 per cent operational transport emissions and 56 per cent fuel combustion emissions (e.g. diesel from generators).
- Scope 3 emissions do not form part of our science-based target as they account for less than 40% of total emissions; nevertheless, they form an important part of our journey to decarbonising our operations.
- Activity levels on our network are forecast to significantly increase in order to deliver a network to support decarbonisation. As a large proportion of this increased activity will be delivered by our contractors this will initially place an upward pressure on emissions while our supply chain transition to low carbon technologies.

Opportunities

- Low carbon technologies offer solutions to reduce emissions from diesel-powered generators we use to keep customers on supply while we undertake network activity.
- Low carbon alternative fuels offer an opportunity to substitute the use of diesel which can reduce emissions by up to 90%.

[1] Circuits consists of overhead line and cable

- As an anchor organisation in the regions we serve we have the opportunity to develop and support our supply chain on their journey to decarbonisation delivering benefits to our customers and communities.
- Expanding our monitoring of other scope 3 emissions and developing robust baselines for measurement will further enhance our understanding of our wider environmental impact and enable us to identify further actions for our plan.

Challenges

- Achieving alignment in environmental standards across our supply chain must be balanced with commercial and financial implications, ensuring we do not disadvantage smaller suppliers who do not have the same resources as larger organisations.
- Increasing activity levels to support decarbonisation will initially put upward pressure contractor emissions and other scope 3 emissions as we source materials for network activity and develop our understanding of full-life carbon impacts.
- We must introduce new data capture processes to collect data from all scope 3 emissions, brought to our attention through our work on SBTs in order to demonstrate full accountability of the impact of our business and ensure data is available to develop robust baselines for scope 3 emissions that we currently do not capture today

Resource use and waste

Impact assessment

- We currently divert 75 per cent of waste from landfill and 75 per cent of our materials are recycled and reused.
- Changes by the Environment Agency (EA) will lead to waste management becoming challenging as RPS 211 guidance is withdrawn (governing small volumes of waste, up to $10m^3$, resulting from unplanned utilities works) and classification of all excavated wastes becomes mandatory

Opportunities

- Increasing prominence of the environmental agenda is enabling us to create a renewed focus on resource use and waste with our business and supply chain
- Our ambition and ongoing work with the EA, Streetworks UK and other DNOs will enable us to work with our suppliers to promote best practice within our supply chain and promote open discussions in the wider industry

Challenges

- Increasing activity levels within our investment programmes will see an uplift in absolute levels of waste generated
- We will need to develop new methods to divert certain types of waste, including hazardous waste, from landfill

Biodiversity

Impact assessment

- We have 11 sites (1 per cent of major substation sites) in various stages of re-wilding maturity
- As we substantially increase our biodiversity initiatives, we will look to extend the types of biodiversity initiatives delivered and look to increase the partners we engage with.

Opportunities

- Small investments can bring significant local benefits.
- We can work with partners to ensure we deliver maximum benefits from the initiatives we deliver (i.e. the highest biodiversity unit uplift possible).
- Additionally we can allow partners to access our land, where this can be done safely and securely, to extend the scope of their planned initiatives and deliver greater benefits to schemes outside of our plan.
- Engaging with our communities we can identify the types of initiatives they would like to see at local sites and encourage their own community biodiversity programmes.

Challenges

- Biodiversity initiatives need to be planned with asset management in mind; we need to protect our assets from damage or interference that could result from flora and fauna and additionally ensure we do not attract animals where our assets could endanger them.

Fluid filled cables

Impact assessment

- Fluid filled cables minimise the risk of cable failure due to their insulating properties, but also pose an environmental risk when fluid is lot to ground
- We have one of the largest fluid-filled cable networks in the country with 2.1 million litres of oil in service.
- We benchmark well compared to other networks on oil loss normalised for amount in service; in 2020/21 we lost 28,055 litres, 1.3 per cent of the total oil in service.
- By the end of the 2015-23 period we will have completed a very significant fluid filled cable replacement programme (224km) that has significantly reduced our risk exposure

Opportunities

- Innovative solutions provide a solution to address and reduce the environmental impact as an alternative to asset replacement.
- Our plan significantly increases our use of solutions such as PFT in 2023–28 to reduce the requirement for investment in asset replacement while exploring new solutions such as self-healing cables.
- We collaborate with industry players to share best practice and solutions which can minimise the risk posed by fluid filled cables.
- Data analytics is able to improve decision-making. As we collect more data on the network we are able to use this to inform and better target our investments.

Challenges

- Whilst innovation has been proven to deliver significant reductions in oil loss, while fluid filled cables remain on the network there will always be a risk of oil loss.
- Our ambition on fluid loss must be balanced with our wider asset programme considerations including cost and asset health.
- We will likely hit a plateau of performance using current innovative management techniques alone.

Noise pollution

Impact assessment

- Poor management of noise from our works and assets impacts our customers and communities
- As we see a societal increase in working from home, customers are becoming increasingly sensitive to their surroundings and less tolerant to disruptions in their local area as they spend more time at home
- In the past year we have seen a rising number of noise related enquiries[1] with ~11 per cent requiring intervention each year

Opportunities

- New technologies are developing that are quieter than older assets on our network. For example new transformers (including the low loss amorphous transformers to be rolled-out as part of our losses strategy) are quieter than the existing transformers on our network and so we can deliver synergistic benefits across our plan.
- Low carbon operational response units, including Silent power vehicles, provide not only a more environmentally sustainable solution but also benefit from electric generators being much quieter than diesel generators.

Challenges

- Our decarbonisation investment will increase activity levels and therefore increase the potential for noise impacts if not managed appropriately
- Increased levels of home building have moved customers closer to our substations and overhead lines

PCBs

Impact assessment

- PCB regulations to identify and remove or remediate non-compliant equipment by 31 December 2025.
- The exact number of units of equipment contaminated with PCBs on our network is unknown.
- Significant volumes of PCB-driven pole mounted transformer replacements are required (ca. 8,400 units) which are not currently able to be test prior to replacement.

Opportunities

- We will look to deliver synergies with our asset replacement programmes and decarbonisation investment
- We are able to upgrade transformers to use low loss amorphous technology which will provide additional losses benefits

Challenges

[1] In 2020-21 we received 67 noise enquiries, compared to an average of 35 for the previous five years

- The required PCB programme comes at significant unavoidable costs to our customers, in some cases replacing assets before the end of their useful life
- Identification of all contaminated assets remains a challenge as we rely on the statistical modelling, refined through collaboration within the industry, to identify potentially contaminated assets
- There is a narrowing window for compliance, requiring a significant programme of work to be undertaken during the 2023–28 period
- All network companies will be undertaking significant programmes putting unprecedented demands on the supply chain

Visual Amenity

Impact assessment

- The regions we serve contain four National parks, five AONBs and five heritage coasts
- We have 3,382km of our overhead lines running through these areas

Opportunities

- Improving the visual impact of our network in the areas we serve delivers benefits to our communities, the economy, local wildlife and in many cases improves network resilience.

Challenges

- While visual amenity does not physically harm the environment it is important to our stakeholders.
- We need to balance visual amenity with keeping costs low for our customers, only undertaking work where it is necessary and efficient to do so

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