NORTHERN POWERGRID

Our business plan for 2023-28

December 2021

Who we are

At Northern Powergrid we are proud to provide an essential service to eight million people in our region. We take that responsibility seriously and believe that our customers should get a service that is second to none. In short, our aim is to be the best at what we do.

Where we are in the process

Developing our plan with you → **Refining our plan with you** → **Ofgem determinations** → **Start of the 2023-28 price control**

- **October 2019** — Our DSO v1.1 publication
- **August 2020** — Our Emerging Thinking publication
- **July 2021** — Initial business plan submission
- **December 2021** — Final business plan submission — **WE ARE HERE**
- **June 2022** — Draft determinations
- **December 2022** — Final determinations

This is our business plan for the RIIO-ED2 price control period, which runs from 2023 to 2028.

We have been building our plan through an extensive programme of engagement with our stakeholders over the past two and a half years. As part of this we released our Emerging Thinking consultation in August 2020 where we engaged on a range of costed options with stakeholders. In July 2021 we published our draft business plan and we have been refining our plans with stakeholders. This feedback has shaped the outputs that we plan to deliver in RIIO-ED2. Our plan sets these out along with how much they will cost, the benefits they will provide and how we will measure our success.

8m people served

63,000 substations

3.9m homes and businesses

96,000 km of overhead lines and underground cables

25,000 sq km of network

2,600 people in our workforce

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Supporting documents:

+50 Annexes

+61 Engineering Justification Papers (EJPs)

+47 Cost benefit analyses (CBAs)

To see our list of annexes, EJPs and CBAs, visit ed2plan.northernpowergrid.com

A fantastic opportunity and a significant responsibility

We are proud to be the team that provides the North East, Yorkshire and northern Lincolnshire with the electricity network that powers everyday life for more than eight million people across 3.9m homes and businesses.

Efficiently delivering a top-class service where the lights stay on, the network stays healthy and our customers enjoy outstanding, ever-improving levels of personal service has always been both a rewarding challenge and a considerable responsibility. Living up to those demands already makes us one of the biggest investors in our region. Those challenges and responsibilities have become even more significant given the importance of energy to the global, national and regional challenge of decarbonisation.

The future presents an opportunity to power our region with sustainable, long-term investments that unleash the potential of innovation, digitalisation and our people to:

- lead the drive towards decarbonisation;
- operate a highly reliable and resilient network;
- delight our customers with outstanding service;
- provide remarkable value for money;
- ensure world-class levels of safety and security; and
- be a force for good throughout our region and beyond.

The plan we have put together, with our stakeholders' help, for the 2023-28 regulatory period, means changing the way we run our business. We must take a leading role in enabling our region to play its part in meeting the UK's target of reducing carbon emissions by almost 80 per cent by 2035. Our network will be instrumental in facilitating this change, as it sits at the heart of a decentralised, low carbon energy system, and we will be working across that whole system to find innovative ways to deliver on that target. That will be enabled by a significant increase in investment, centred on enabling customers to participate in finding flexible solutions that make for a more efficient transition to the lower carbon world.

There are also a whole host of other improvements we are going to make for our customers across every area of our business. These include higher levels of reliability and resilience, more targeted support for those members of our community who need it the most, and even better levels of customer satisfaction than the 9/10 rating we already deliver.

Our stakeholders have made it clear to us that all of these priorities matter to them, but decarbonisation is the biggest and most important challenge. Although we know what the end result must be, and the broad changes that will have to be made to achieve it, the specific pathway to net zero is inevitably uncertain.

We believe that our task is to embrace that uncertainty and chart an optimised course through it. We will do that by building on a track record of being among the industry leaders on efficiency, ensuring that we develop an increasingly flexible and innovative approach to running and investing in the network that opens up all the credible pathways to decarbonisation as affordably as possible.

Although this is a five-year plan, it has to begin to solve problems where the answers will manifest themselves over the next 25 years. In that respect, the long-term horizon of our owner – Berkshire Hathaway Energy – has been a real strength. We have been able to take decisions to make investments now that will make the overall transition both more likely to succeed and cheaper in the long run. They will also help to power the economy in the region as, together, we work to drive economic growth, supporting the government's ambitions to spread prosperity across the country and repair the damage done by the pandemic.

Phil Jones
Chief executive

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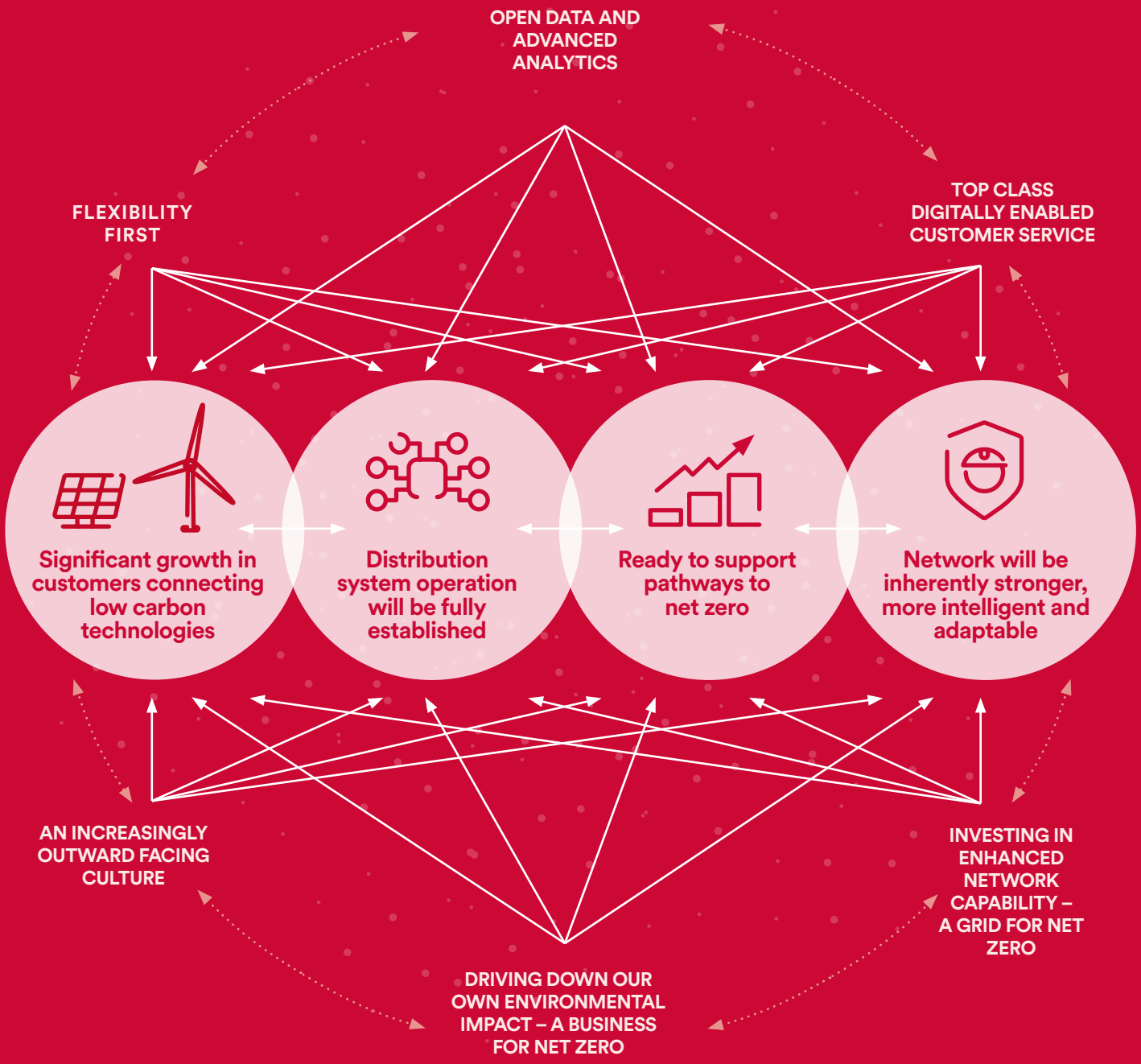
- Provide remarkable value for money
- Ensure world-class levels of safety and security
- Be a force for good throughout our region and beyond

What success will look like

Delivering an ambitious plan for our customers means setting and hitting a wide range of goals and targets. But, for us, success depends on more than that. Although our performance in any one dimension means something in its own right, every element of our operation influences and is influenced by our performance across all the others. Getting the blend of those combinations right releases potential that makes the value of the whole greater than the sum of the parts.

Our plan is built such that the initiatives will combine to change the landscape of what we deliver for our customers. Customer satisfaction and reliability will reach levels that would have been unimaginable only a few years ago; the support we provide to vulnerable customers will break new ground and we will become increasingly active in enabling and facilitating whole system real-time energy balancing. Different people will have different views of what stands out for them as most significant.

We think that the most prominent outcomes of this new strategic landscape will be that there will be much more **low carbon technology (LCT) integrated into the network, distribution system operation will be fully established**, our business and the system will be **ready to support the potential pathways to net zero**; and our customers will be served by a **network that is inherently stronger, more intelligent and adaptable.**



Big ambitions mean big changes

These critical outcomes are interlinked – and so are the initiatives that create them. They cannot be achieved in isolation of each other. For example, the DSO business unit will be instrumental in building a flexibility market that will complement investment in physical infrastructure needed for improved reliability, increased LCT uptake and open up the pathways to net zero. Equally, higher LCT uptake requires sufficient capacity on the grid, which in turn depends both on our investment in availability and resilience, but also on the flexibility contracts customers take up. These interdependencies are reflected in the wide range of enabling activities and initiatives that will be needed to deliver these outcomes, which almost always serve multiple purposes and to a large extent depend on each other.

A fundamental change to our business

These outcomes are transformational. And the initiatives and activities needed to create them are very different from those we have traditionally used to run our business. Therefore innovation and change are required in every major aspect of our business to meet these challenges. We need to invest in new processes and technologies, which in turn will require new skills and capabilities. Securing those will demand a culture that attracts and retains a more diverse group of people with skills that allow these operational initiatives to work seamlessly and interdependently with everything else we do. Only then will the whole be greater than the sum of the parts.

Our plan addresses both of these aspects: a clear-headed assessment of the operational journey we need to undertake to meet these demands at the lowest total cost to customers; and an equally robust plan to develop our own culture and capability so that these operational plans are turned into reality.

The linkages are vital

Orchestrating the overall endeavour and adapting as we go will be vital to success. For example, our **Flexibility First** programme will be one of the core elements of our DSO business unit, but it will also enable a more rapid uptake of LCTs, help make the network stronger and open up new potential pathways to net zero.

941k
electric vehicles

309k
heat pumps

20%
reduction in connections lead time

None of that can happen without good quality, accessible **open data and analytical toolkits** being available to customers who will then have the information and insight they need to make the right flexibility and connection decisions for their situation.

In fact, our **data and digitalisation** programme will impact every area of our business. The transformation in how we produce, share and use data and information that serves the need for greater flexibility is also essential to our intentions to transform the customer experience. For example, our 'one-stop-solution' app for vulnerable customers will enable faster and more convenient access to our services. And development of sophisticated self-service options, such as our AutoDesign connections tool will give customers greater insight and control over their connection decisions in real time, reducing both the time and cost to connect. The investment in data and digital capabilities will also improve the way our engineers are able to manage the system thanks to the insight provided by 10,000 additional low voltage (LV) network monitoring points.

£156m
of flexibility and smart grid solution savings

£465m
of decarbonisation synergy savings beyond 2028

45%
of data products and services refreshed in real time

+10,000
LV monitors

Helping us make our **investment** programmes more efficient by targeting the expenditure that will make the network stronger, more intelligent and more adaptable is one of the most significant uses of the valuable data that will be gathered by the fleet of LV monitors. In particular, it is the foundation of the increasingly sophisticated optimisation routines that we will put in place to maximise the benefits to our customers as we blend flexibility, smart grid solutions and reinforcement to enable them to decarbonise at the lowest possible cost. The same technology will also add automation capabilities and in some situations enable the detection of the early onset of potential failures, allowing a repair to be carried out before the problem develops into a power cut.

We have always put a lot of emphasis on rigorous investment appraisal, because it enables us to deliver more for less for our customers over the long term. The additional insights that our data and digitalisation programme will bring will make that analysis even stronger, which gives us confidence that we can efficiently develop a grid for net zero that is reliable, resilient, safe and secure.

INVESTMENT

>£500m
capacity

>£1.1bn
resilience

POWER CUTS

12%
fewer

25%
shorter

Looking further ahead into an uncertain future, while we can be sure that we need to decarbonise, we don't yet know how our nation will use all the different technologies that exist (wind, solar, heat pumps, LCTs, hydrogen, and new as yet untested technologies). Keeping those pathways open for our customers and our region is an important part of our role in the net zero journey.

That means we need to make the right **strategic investments** to make sure that when we get to 2028, we have not only kept pace with what has already happened, but we are ready for what might come next.

Without careful and conscious management of the system, with our customers as partners, all relying on high quality data to make good decisions, the cost of keeping these pathways open to existing and potentially new technologies could be enormous. It's our job to find and realise synergies that **keep all potential pathways to net zero open** at the lowest possible cost for customers.

>1,000
green job opportunities in our region

There is more to this than technology and complex project management: it needs a shift to a more **open and outward-facing culture**. That has started in our business but has much further to run. The significant value created by enhanced data and digitalisation cannot be fully realised unless we become more outward facing as a company so that the information is effectively used.

And we can't achieve that without people who bring new skills and capabilities into our business. Some of these skills will be analytical. For example, our DSO business unit will require skills that we simply haven't needed before. And the increased complexity of network design, planning and operations means there will be many opportunities for our colleagues to broaden their skills. We will also have to employ additional people who have different types of analytical skills to deliver the increased levels of investment.

However, the skills we need aren't just analytical: our customers will be directly engaging with us far more than they have needed to in the past and we will need to rise to their expectations for excellent service, engagement, accessibility and empathy. That means we have to bring in new people with different capabilities and enable our existing colleagues to grow their skills.

To do that on the scale that is necessary, we will need to broaden our appeal so that a wider group of people see Northern Powergrid as a place for them to forge a career. We are determined to strengthen our connection with under-represented groups, so that our workforce better reflects the communities we serve, particularly in relation to gender, ethnicity and social mobility. We believe this will make us a stronger business. That demands that we become more open, inclusive and diverse, opening up opportunities to a wider range of people, and allowing their talents to flourish as our team works together to deliver the targeted outcomes for our customers.

It's our job to make it all come together

Every aspect of our plan has a role to play in creating success for our customers. We have big ambitions that require a wide range of initiatives and programmes. Our job as system integrator is to bring all the separate streams of activity together to create successful outcomes.

Making it happen

	LCTs	DSO	NET ZERO PATHS	GRID
FLEXIBILITY FIRST				
Optimise the use of flexibility to defer network reinforcement	●	●	●	◕
New online flexibility services platform	●	●	●	◑
New Active Network Management zones for flexible connections	●	●	●	◕
OPEN DATA AND ADVANCED ANALYTICS				
Data analytics and machine learning capabilities in decision support	●	●	●	●
New LV analytical capability to guide efficient investment	●	●	●	◕
Open data platform to provide data and insights into network operation CVP2	●	●	●	◑
New skills in data management, analysis and use of new technologies	◕	●	●	◕
£11m investment in cyber-security upgrades	◑	●	◔	●
TOP CLASS DIGITALLY-ENABLED CUSTOMER SERVICE				
New digital communication channels and more personal contact	◑	◕	◔	◕
'One-stop-solution' app for vulnerable customers CVP1	◑	◔	◔	◑
Digitally enabled connections self-service for quotes and network information	●	●	◕	◔
New automated systems to process LCTs	●	●	◑	
On-site support where customers are experiencing long-running power cuts				●
AN INCREASINGLY OUTWARD FACING CULTURE				
Support for local authorities on the development of local area energy plans	●	●	●	●
Complementary energy needs open register	◔	●	◔	◔
Community energy advice to assist the low carbon transition	●	●	●	◕
Independent audit and open reporting on investment decision process	●	◑	◑	
Attraction, development and retention through diversity and inclusion	●	●	●	●
DRIVING DOWN OUR OWN ENVIRONMENTAL IMPACT - A BUSINESS FOR NET ZERO				
40% of fleet ultra-low emission vehicles	●	◑	◔	
Low loss cables and transformers		◑	◔	◔
Responsible Procurement Charter and support for supply chain decarbonisation	◑	◑	◔	
INVESTING IN ENHANCED NETWORK CAPABILITY – A GRID FOR NET ZERO				
£516m investment in creation of network capacity	●	◑	●	●
10,000 LV monitors to provide enhanced network visibility	●	●	●	●
£65m automation programme to improve reliability of supplies		◔	◕	●
Fault-sensing technology to allow proactive early detection and repair		●		●
30 innovative microgrids CVP4	◔	◑	●	●
Voltage optimisation driving bill savings for 1.2 million customers CVP3	◔	◑	●	●
Upgraded control systems	●	●	●	●
£1.1bn of investment in asset health and resilience, driving decarbonisation synergies	◑	◑	●	●
Increased delivery capacity through expansion of our workforce	●	●	●	●

Building a business plan that responds to your choices

Our most extensive stakeholder engagement programme ever

Right from the start, we have been developing our plan with you around 12 output areas supported by three key enablers. Each output area represents an aspect of our business that delivers tangible outcomes for customers. In reality, the areas are all interdependent; however, simplifying what is a complex, multi-faceted business in this way has helped us engage with our stakeholders to gain a detailed understanding of their priorities. With that done, we put the pieces of the jigsaw back together to create a coherent and integrated business plan.

Our Emerging Thinking consultation, launched in August 2020, enabled us to understand stakeholder priorities, calibrate relative ambition levels, explore trade-offs and understand willingness to pay across the performance areas. We were the first DNO to publish costed plan options with over 250 million permutations available to stakeholders in our interactive online optioneering tool. For each of our output areas we provided stakeholders with five costed options across a calibrated scale of ambition. Our stakeholders were able to build their own packages and understand the impact of their choices on customer bills. We followed this up with even more detailed waves of engagement to test and refine what we heard into our final plan proposals.

>65
panels

>63,000
stakeholder interactions

82%
stakeholder acceptance
(domestic customers)

>420
events

You told us to balance ambition with affordability

Engaging with more than 63,000 stakeholders at hundreds of events allowed us to hear the message clearly that decarbonisation was the top priority and that our plan needed to balance ambition with affordability. The transition to net zero is the most significant change our industry has faced since the grid was built. So it is no surprise that decarbonisation is the most significant shaping force on our plans. You also told us that the overall reliability and resilience of the network remains very important and that this is set to increase with the greater reliance people will have on electricity as they decarbonise. You want us to deliver on these priorities while keeping bills low.

To achieve this we intend to increase investment in relation to four of the output areas.

An increase in **Decarbonisation** expenditure is required to provide significant amounts of new capacity to cater for growth in technologies such as heat pumps and electric vehicles, and to add DSO capabilities that will support a smart, flexible energy system.

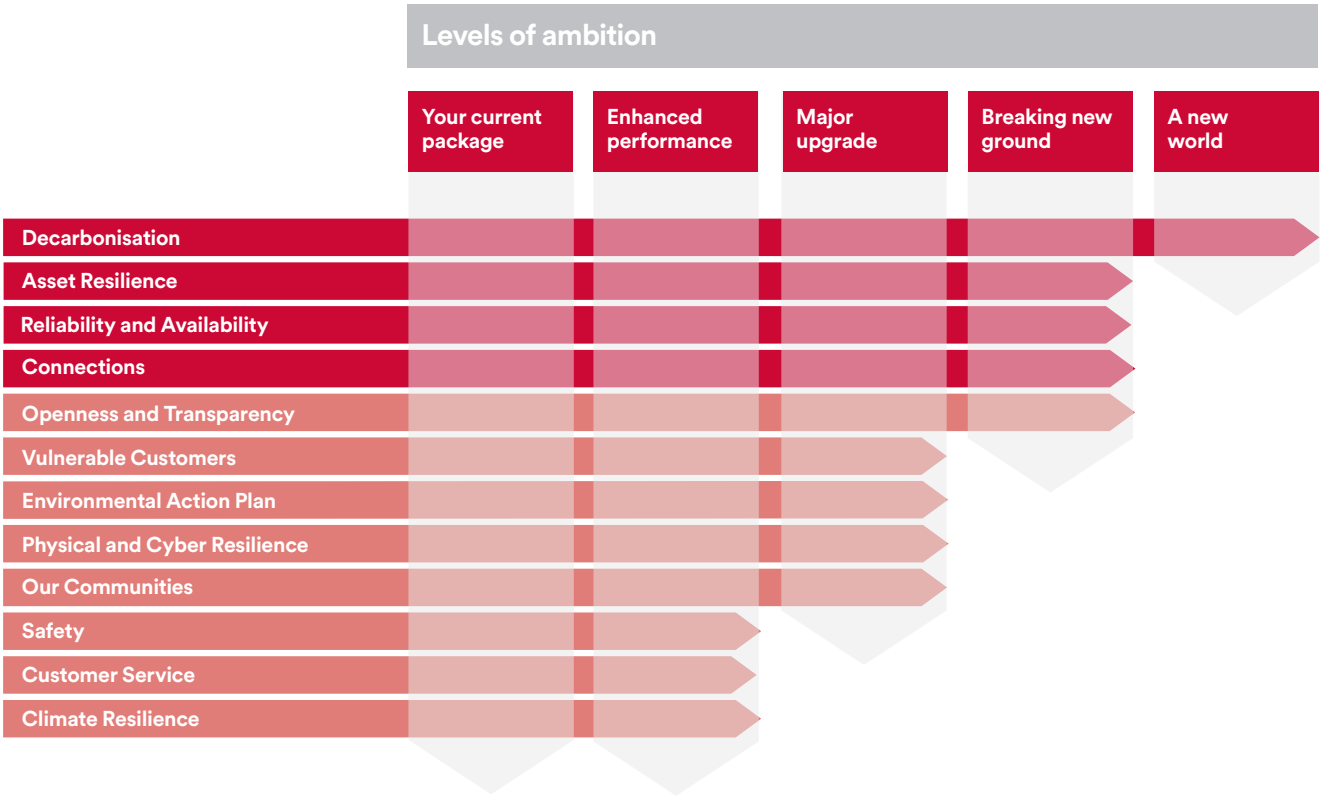
Our **Asset Resilience** plans continue to provide what is needed to maintain the long-term health of the asset base, while also delivering 'two-for-one' investment opportunities to deliver long-term value for our customers where we can take advantage of the overlap between required decarbonisation and asset replacement investment.

To improve the **Reliability and Availability** of our network we need to install significantly higher volumes of remote switching and network automation so that our customers get the service they deserve.

We must also support a just transition to net zero and our **Connections** plan includes investment to socialise the cost of upgrades to customers' properties to make them net zero ready, ensuring they can charge an electric vehicle and install a heat pump.

In the other eight areas, we will do more for less, meaning costs reduce while delivering significant service improvements:

- Outstanding levels of **customer service**
- Significant enhancements in our services for **vulnerable customers**
- Energy industry leaders in **safety**
- Protecting the **environment** decarbonising our operations and supply chain
- Adapting to the effects of **climate change**
- Strengthening our **cyber and physical security**
- Being a force for good in our **communities**
- Being **open and transparent** in how we operate



Major investment to support decarbonisation and improved reliability

Decarbonisation

- All credible **decarbonisation pathways** supported
- **On track for net zero** by 2050 or sooner
- Network positioned for mass uptake of LCTs:
  - **831k more electric vehicles**
  - **251k more heat pumps**

- **Open energy system data**
- **70% increase** in the number of available data products and services
  - **45%** refreshed in real time via automated processes
- **Data portal** – new analysis and self-serve tools
- **Support for local authorities** on the development of local area energy plans

- **£156m of flexibility and smart grid savings**
- **Flexibility-first approach** – monitor, manage, reinforce
- **50%** ground-mounted substation-fed LV networks covered by monitoring
- Online **flexibility platform**
- Dedicated team to support green **market development**

- **£263m of whole system value**
- Estimated **£20** reduction in customer energy bills and lower carbon emissions by **dynamically managing voltage** on our LV network
- **30** innovative new microgrids

Asset Resilience

- **Long-term health** of the network maintained
  - **1,200km** of overhead line rebuilt and **52,000** poles replaced
  - **550km** of underground cable, **10,700** transformers and **8,600** items of switchgear replaced
- Up to **£465m** of synergy savings between asset renewal and decarbonisation investment in the period to 2050

Reliability

- **12% fewer and 25% shorter power cuts**
- **£65m** automation programme targeting the worst-performing parts of our network
- Roll-out of **LV fault-sensing technology**
- **£4.3m** investment for **2,835 worst-served customers**
- **Reduce multiple and long-duration power cuts**

Connections

- Socialised costs to **upgrade to net zero ready homes** (100 amp services)
- **20%** reduction in small works lead times
- More **self-service options**, greater **support** and more **flexibility** over delivery
- Expanded **capacity heat maps**
- Support for smarter solutions and expanded range of **flexible connections**

Delivering more for less

Openness and Transparency

- **Open reporting and independent auditing** on investment appraisal processes – demonstrating **flexibility first**
- Retain our Customer Engagement Group (CEG) to **scrutinise** the delivery of our plan and on-going engagement
- Drive **sustainability standards** throughout our supply chain

Vulnerable Customers

- **New app** to support our vulnerable customers
- Provide **enhanced support** during power cuts
- Support **100,000** customers in fuel poverty with affordability services unlocking up to **£40m** of benefits

Environmental Action Plan

- **20%** reduction in internal business carbon footprint
- On a path to **carbon net neutral operations by 2040**
- **15%** less oil lost to ground
- Compliance with **PCB**[1] legislation
- **73km** of overhead lines removed to improve visual amenity
- **200 sites** with biodiversity improvements
- **90%** of waste diverted from landfill
- **Responsible procurement charter** and **support for supply chain decarbonisation**

Physical and Cyber Resilience

- **Continued cyber investment** to maintain high levels of protection for our network and customer information
- **Physical security upgrades** to defend against attacks

Our Communities

- **50%** of our major investment schemes with tailored social impact programmes
- Support for **science, technology, engineering and maths (STEM) subjects and careers**
- **Community energy advice** for local stakeholders

Safety

- Maintain **industry-leading safety performance**
  - **50%** reduction in workforce accident rate
  - **50%** reduction in contractor accident rate
- Improve **health and mental wellbeing** in our workforce
- **55,000** school children engaged on electrical safety p.a.
- Fleet vehicles equipped with **defibrillators**

Customer Service

- **>93%** customer satisfaction
- New contact channels, greater **on-site support** and **choice** in booking slots for planned services
- **≥ 90%** complaint resolution within one day
- Support for **flexibility providers and data users**

Climate Resilience

- **Maintain** all high-risk major substation **flood defences** to national standards
- **Collaborative** work with regional infrastructure providers on interdependences

1. Polychlorinated biphenyls.

Unleashing the potential of...

Data and Digitalisation

64
initiatives underpinning our plan

70%
increase in no. data products and services

45%
of data products and services refreshed in real time

— **Open and transparent**
Enabling innovation and development of new markets while delivering net zero at the lowest cost

— **Whole energy efficiency**
Preparing for both a cost- and carbon-optimised whole energy system

— **Service excellence**
Delivering seamless, efficient service with more choice and personalisation

— **Cyber secure**
Responding to and mitigating the cyber threats of increased digitalisation

— **Reduced cost**
Driving lower cost, efficient operations, front and back office

Innovation

73
initiatives underpinning our plan

£263m
of totex savings from innovation

— **Charting the best course to net zero**
Developing and deploying technologies and creative solutions that enable faster, lower cost pathways to decarbonisation

— **Collaboratively unlocking the value of open data**
Working with partners to open up new channels that significantly, efficiently and effectively increase the exploitation of data flows across the whole energy system

— **Achieving next-level energy system dependability**
Increasing the reliability, resilience and security of the power grid to improve not only its own dependability, but also that of the overall energy system

— **Ensuring all customers benefit**
Promoting and safeguarding the interests of customers, particularly those who may otherwise be significantly disadvantaged or left behind in the energy system transition

Our People

>1,000
new job opportunities

>45
new roles created linked to DSO

— **Creating more than 1,000 jobs**
Renewing and growing our workforce with high-quality job opportunities to meet the significant increase in work volumes driven by decarbonisation and to meet future energy needs

— **Upskilling and multiskilling**
Increasing our skills capacity and capabilities through investment in upskilling and multiskilling to provide rewarding career paths and develop the new capabilities required for DSO

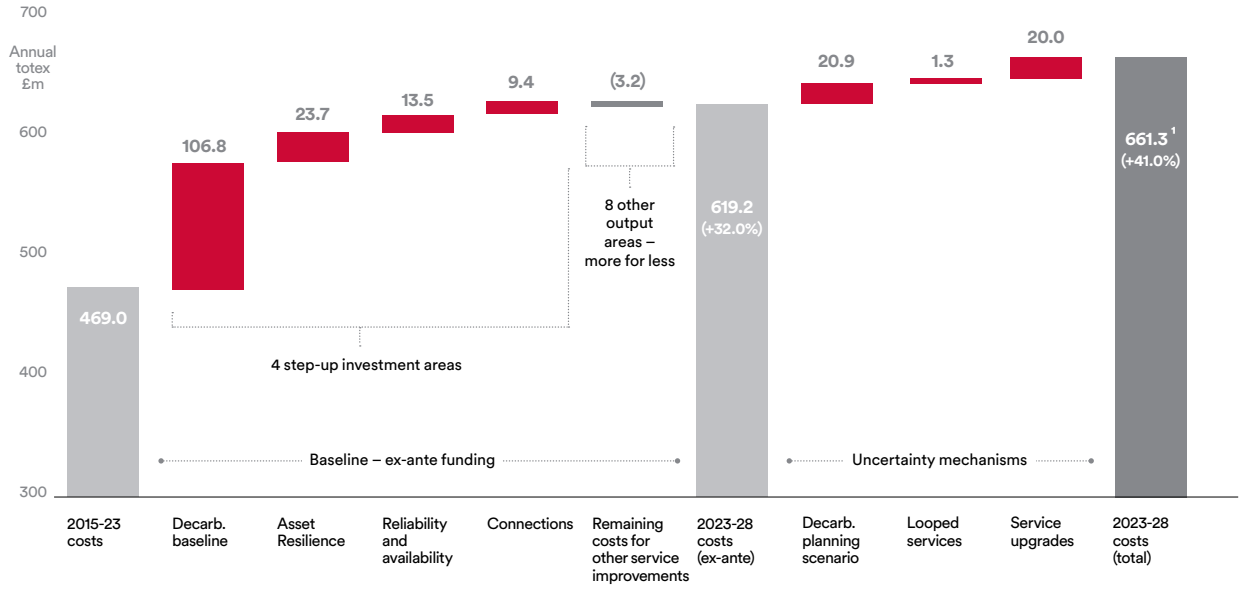
— **Increasingly diverse and inclusive**
Service excellence delivering seamless, efficient service with more choice and personalisation

— **Increasing engagement, partnerships and satisfaction**
Enhancing how we engage with our colleagues and trade unions to continually improve our safe workplaces and operations

A significant step up in investment...

We are looking to commit to a significant increase in investment to support the decarbonisation journey. Our projections show that the scenario we have proposed, which matches the Government's 10-point plan, would require investment to increase by around 40 per cent relative to current levels. Of course, it remains to be seen whether things will actually go at that speed in the early years – and there is a reasonable chance that they may not, although we are already seeing a significant growth in the connection of electric vehicles and heat pumps. But what we must not do is get into a situation where we leave too much to do in too short a time in the later years of the net zero journey.

Consequently, we are proposing that we commit upfront to an increase of 32 per cent, with a mechanism that will flex to provide additional funding if the demand exceeds that baseline. On the other hand, if one of the less aggressive pathways emerges, we would still be able to deliver on that upfront investment commitment, making strategic investment to avoid the risk of network constraints becoming a serious barrier after 2028.

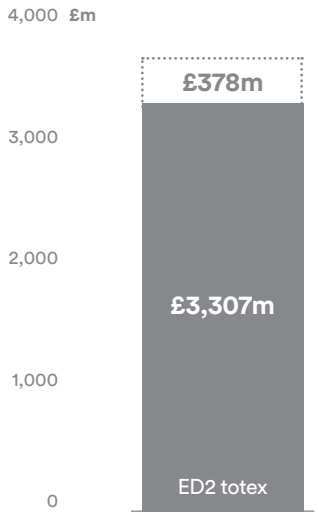


...while driving efficiencies to take pressure off customer bills

£378m (11%)[2]

of totex efficiency savings embedded in our plan

— Our plan builds on our sector-leading efficiency position.
— We have embedded a further £378m of efficiency benefits in our plan, 11 per cent of our total cost base. Of these, 69 per cent are driven by innovation.



	£m
Volume efficiencies	94
Unit cost efficiencies	32
Flexibility and smart grid solutions	156
Core asset plan synergies	66
Service improvements offset by efficiencies	31
Embedded efficiency	**378**
% of ED2 totex	**11%**

£465m

of decarbonisation synergy savings beyond 2028

— We will optimise our asset renewal investments to deliver capacity for decarbonisation pathways; investing an additional £124m in the 2023-28 period to save an estimated £589m in the period from 2028 to 2050.

£136m[3]

of financing savings

— Key financial parameters for 2023-28, including cost of debt and cost of equity, will reduce allowed revenue compared to the current period.

1. Excludes additional costs that would be incurred as a result of Ofgem's minded to decision on changes to the connection charging boundary (access charging reform).
2. Excludes ongoing efficiencies.
3. Assuming 2.09 per cent cost of debt and 5.80 per cent cost of equity at 60 per cent gearing.

Great value for our customers

The increase in upfront investment we need to make is driven by the additional £107m p.a. required to enable the decarbonisation transition and ensure that the potential pathways to net zero remain open beyond 2028. We will spend an extra £24m p.a. to keep our network in good condition and maintain its resilience. This increase is entirely driven by 'two-for-one' synergistic investment opportunities, where we will efficiently add extra capacity required for the future as we replace or refurbish degraded parts of the network, saving customers money in future periods.

There is also an increase of £14m p.a. relating to the investment needed to deliver the significant reliability improvements our stakeholders are looking for and £9m p.a. more to support the connections to the network through the net zero transition. Set against that, the cost of delivering the material service improvements in all eight other areas of our business falls by £3m p.a. Beyond that, uncertainty mechanisms may add a further £42m p.a. of expenditure in our planning scenario dependent on low carbon uptake on a pay-as-you go basis.

The cost of financing our business has also fallen significantly. When that is added to the more efficient ways we've found of deliver our outputs, we take pressure off our customers' bills, which helps keep them affordable at a time where a significant increase in investment is needed.

There's no getting away from the reality that the increased investment has an impact on your energy bills. Taken in isolation, that additional investment would increase an average domestic customer's bill by around 11 per cent, which is 83 pence per month, or £10 a year. But the other savings help offset this. The overall impact on the bill depends on some important decisions our regulator needs to make about how to bring forth the investment that is needed for decarbonisation and how the responsibility to pay for that investment should be shared between this generation of customers and the ones that follow.

Under Ofgem's current working assumptions, our charges in 2023-24 would only be about £1 higher than in 2022-23, increasing from about £91 to £92 p.a.

We don't believe Ofgem's approach is sustainable. It's important that Ofgem does not risk underinvestment when upgrading the network is more important than ever. And Ofgem must resist the temptation to push too much of the costs onto our children's generation just to keep current bills artificially low.

Under our proposed approach – with an appropriate return on investment and where costs are fairly shared between current and future customers – our charges would increase by about £8 in 2023-24, from about £91 to £99. That's a 41 per cent increase in investment for an eight per cent increase on the bill.

41% increase in investment for an 8% increase on the bill[1]

the average domestic bill will only increase by[1]

+£7.65 to £98.58

+£6.65
to facilitate decarbonisation

+£1.30
to keep our network in good condition

+£0.70
to make the network more reliable

+£1.52
to support connections to the network

-£0.15
delivering more for less

Lower financing costs and other parameters reduce the bill by

-£2.37

We will keep on listening

We have built this plan on an engagement programme that is much bigger than anything we have done previously in that respect. And that process will never end. As we strike out on this journey, we will continue to work hard to engage with our stakeholders and let them shape our plans as they adapt. We will:

- ensure that our engagement reaches and includes a diverse range of individuals, groups, experts and locations that represent the communities we serve;
- increase the use of new communications channels, remove engagement barriers, and increase cooperation with a wide range of local organisations so innovative thinkers and future customers access and contribute to our engagement;
- provide additional ways to discuss complex topics and tailor communication approaches so that we deliver engagement that promotes an understanding of priority topics such as decarbonisation and an inclusive energy transition; and
- continue to mature the skills, processes, infrastructure, and capacity of communities, customers and our own teams to ensure engagement is two-way, measurable and transparent.

Support for our plan

"I have been delighted to be involved in the very broad and all-encompassing engagement process that Northern Powergrid has undertaken, which has been extremely impressive and inclusive."

Maggie Bosanquet
Low carbon economic development team leader, Durham County Council

1. Under our proposed financial parameters – see page 196.

TRACK RECORD AND BUSINESS PLAN COMMITMENT

Our track record underpins the credibility of our plan.

We believe our track record in 2015-23 and prior regulatory periods provides confidence in our business plan for 2023-28. Given our responsibility to our customers, and the importance of the next decade in society's transition to net zero, it is key that we deliver on our promises to support the needs of our customers and local economies on this journey.

You can count on Northern Powergrid as a company with...

- a reputation for making robust plans and delivering on them;
- demonstrable adaptation to the changing energy landscape and progress to Distribution System Operation;
- a proven track record of innovation and collaboration;
- evidence of strong financial management and efficiency; and
- committed and responsible investors with a long-term outlook.

Our plan involves a step change in activity levels relative to today to enable decarbonisation. Details of our delivery plans to support this are set out in our Delivery section.

We have a demonstrable track record of making robust plans.

We take a long-term outlook to our planning. Distribution Network Operators (DNOs) have a responsibility to appropriately manage risks on behalf of their customers and we believe in incentive regulation as the most effective way to ensure this occurs.

The business plan we developed back in 2012-13 and are delivering for the current eight-year period has proven to be robust. Our costs have tracked closely to our forecasts year-on-year and we have effectively managed risks that have emerged in the period.

In the 2015-23 period to-date...

Safety

58% reduction in our accident rate

690 days without a lost time accident

Reliability

27% fewer power cuts

37% shorter power cuts

Customer Service

90.5% satisfaction

+8.2 percentage point improvement

Connections

Allowed customers to **connect more easily** than ever

88.9% satisfaction

+10.2 percentage point improvement

Social Obligations

>450 partnerships to support the most vulnerable in our region

Environment

48% lower business carbon footprint

47% lower oil/fluid leakage

We are on track to deliver our current business plan

We will fulfil our promise to customers to deliver 'more for less'.

We made 53 commitments in our 2015-23 business plan and we are on track to deliver these, and in a number of cases go significantly further, keeping costs low and delivering our asset health targets (see figures 1 and 2).

Our output performance is strong, in many cases ahead of Ofgem targets.

Safety is, and will always be, a priority. We are proud to be exceeding our commitment to halve our accident rate, most recently achieving 690 days without a lost time accident. Another highlight for us has been our **Reliability and Availability** performance. So far we have achieved reductions of 27 per cent and 37 per cent in customers interrupted (CI) and customer minutes lost (CML), substantially outperforming what we committed to in our 2015-23 business plan (eight per cent and 20 per cent respectively).

We have achieved significant improvements in **Customer Service** performance over the current regulatory period, securing an eight percentage point improvement that means we are now consistently delivering satisfaction of over 90 per cent. We have achieved this through a major expansion of our digital service offerings, investment in our front-line services and responding to customer feedback. Despite this improvement, we rank fifth in a tightly grouped industry, two percentage points behind the industry leaders, and we are targeting further improvement for the remainder of the period to close the remaining gap.

We have improved our **Connections** small works lead times by 18 per cent since the start of the period,[2] and satisfaction levels with our services have increased by 10 percentage points to 88.9 per cent. Our primary focus is on delivering a personalised service to maximise customer satisfaction. As part of this we offer on-site visits for customers where required, which can extend lead times for quotations. Our lead times in 2020-21 (shown in figure 3) were impacted by COVID-19 lockdowns, in particular where non-domestic customer sites were closed. We have been working to recover the backlogs during 2021 and we are targeting significant improvements in our delivery lead times in the remainder of the period. For major works connections, we have delivered on our incentive on connections engagement (ICE) plans and received no penalties. Continuing and strengthening this performance is central to our approach for the next regulatory period as we accommodate more low carbon technologies (LCTs) onto our network, as is prioritising a personalised service to meet customers' specific needs.

Our Social Obligations performance has been strong in the 2015-23 period so far, ranking in the top three DNOs in four out of the six years of 2015-23 in Ofgem's Stakeholder Engagement and Customer Vulnerability (SECV) assessment, most latterly ranking fifth in 2020-21.

Figure 1: actual and forecast expenditure versus allowances (2015-23)[1]

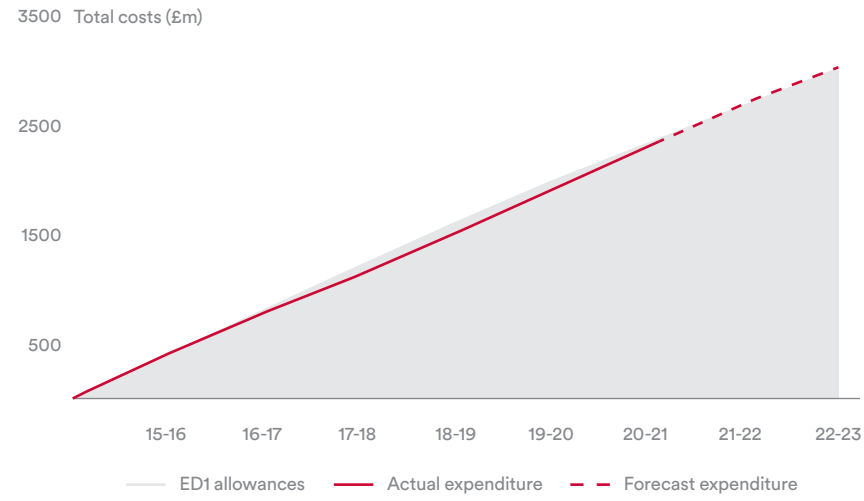
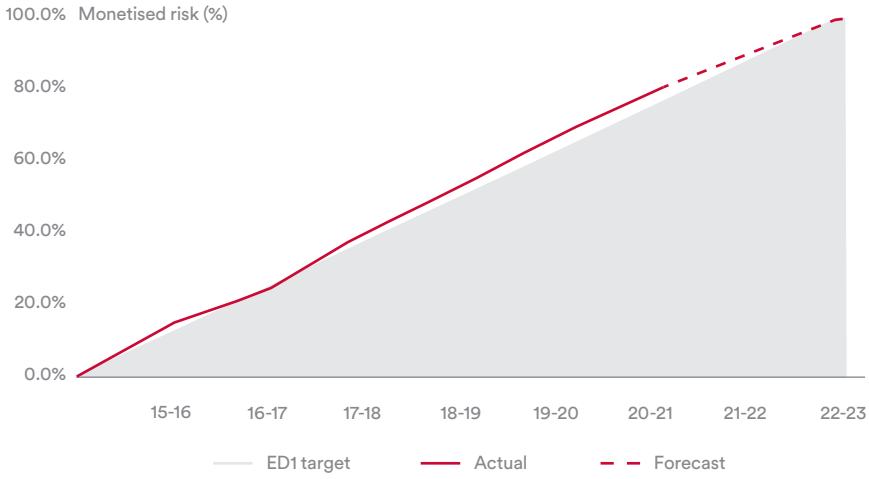


Figure 2: actual and forecast network output delivery (2015-23)[3]



1. All costs shown in the track record section are stated in 2012-23 prices unless otherwise stated. Excludes incremental Green Recovery investment.
2. Based on our 2015-23 average reduction versus our business plan baseline.
3. Network asset secondary deliverables.

In a similar vein, we have exceeded the **Environmental** commitments in our current business plan and have set stretch targets to go further. We have achieved significant reductions in our business carbon footprint (BCF) and sulphur hexafluoride (SF_6) losses, by 48 per cent and 23 per cent respectively. We have continued to effectively manage losses on our network by implementing our losses strategy.

Our action plan has reduced annual losses by about one gigawatt-hour (GWh),[1] and we have undertaken a number of initiatives to further our understanding and management of losses including trialling innovative amorphous core transformer technology, which we plan to roll out as business as usual during 2023-28. We committed to reducing oil and fluid leakage by 15 per cent and we have already surpassed this, achieving a 47 per cent reduction to date. We also committed to removing around 100km of overhead lines from National Parks and Areas of Outstanding Natural Beauty (AONB) and, following engagement with our stakeholders, we have committed a further £2.1m for an additional 16km, which has been funded from efficiencies in other parts of our plan.

Figure 3: 2015-23 output performance

Northern Powergrid			Unit	2020-21 actual	2020-21 target[2]	Status	2022-23 target
Safety	Occupational Safety and Health Act (OSHA) accidents		Rate	**0.18**	0.27[3]	●	0.14
	Health and Safety Executive (HSE) compliance		Hit/miss	✓	✓	●	✓
Reliability[4]	Customer Interruptions (CI)	Northeast	CI	**44.10**	58.60	●	43.60
		Yorkshire		**51.70**	61.30	●	50.00
	Customer Minutes Lost (CML)	Northeast	CML	**35.00**	49.20	●	32.00
		Yorkshire		**38.70**	53.40	●	35.40
Customer Service	Overall survey		Score	**9.05**	8.20	●	9.20
	Complaints metric			**2.76**	8.33	●	1.80
Connections	Time to quote (LVSSA)[5]		Days	**6.60**	4.80	●	3.40
	Time to quote (LVSSB)[6]			**14.30**	7.80	●	5.50
	Time to connect (LVSSA)[5]			**48.70**	39.30	●	28.30
	Time to connect (LVSSB)[6]			**78.50**	47.90	●	36.50
	ICE penalty		£m	**Nil**[7]	Nil	●	Nil
Social Obligations	SECV		Rank	**5th**	N/A	●	N/A[7]
Environment	Oil leakage		Litres	**28,055**	47,540[3]	●	27,300
	BCF[8]		tCO_2e	**31,241**	55,975[3]	●	28,760
	SF_6 emissions		kg	**73.10**	112.00[3]	●	50.30
	Fluid-filled cable replaced		km (cum)[9]	**176.5**	122.8[3]	●	224.4
	Visual amenity investment (versus allowance)		£m (%)	**11.7 84%**	11.4[10] 82%	●	17.6 (127%)

For more information on our delivery of our 2015-23 business plan commitments, see our SLC50 Stakeholder Report.

1. See page 16 of our Environment Report 2019-20.
2. Ofgem targets unless otherwise stated.
3. Northern Powergrid ED1 business plan target.
4. All figures are unplanned, excluding exceptional events.
5. LVSSA customers are those seeking single domestic connections requiring no mains work at low voltage.
6. LVSSB customers are those seeking between two and four domestic connections or one-off commercial connections at low voltage.
7. No 2022-23 business plan target set.
8. Figures include contractor emissions and exclude losses.
9. Cumulative.
10. Cost allowances for visual amenity.

We are evolving with the changing energy system

Our transition to DSO has been in progress for some time. As the only DNO to submit and receive funding for a specific smart grid enabling plan at the start of the current price control period, we are confident that we are well on the way to laying the foundations of a more active, flexible and dynamic digitalised energy network. We have also kept pace with reinforcement requirements on our network, putting us in a particularly strong position with higher voltage headroom on our network.

We set out our vision for DSO in our development plan in 2018. This was revised following dialogue with stakeholders and our updated DSO development plan, DSO v1.1, was released in October 2019 as the basis for further engagement in the period leading up to our business plan.

Accommodated by 2023:

5.8GW

of distributed generation (including both generators and storage)

c. 110,000

electric vehicles (EVs)

c. 58,000

heat pumps (HPs)

1. 2012-13 prices.

Preparing our network

Our flagship smart grid enablers programme is transforming our ability to monitor, control and communicate with more than 860 major substations and 5,500 distribution substations. We are upgrading the control units in our substations to make the network compatible with modern digital communications along with establishing the communications network from our control centres to those units. This includes:

- upgrading or replacing remote terminal units (RTU) control points at our substations;
- upgrading or replacing automatic voltage control points and transformer relays at all of our supply points and primary substations;
- upgrading our telecoms communications network from our control centres to our substations (both primary and secondary supervisory control and data acquisition (SCADA) networks); and
- installing low voltage (LV) monitoring across our network (2,700 units by 2023).

This investment is giving us greater ability to control and analyse how our network is operating in real time, enabling us to respond to the uptake in LCTs.

We have also been replacing looped-service cables (the cable used when two properties share a single electricity supply). In the period to date, we replaced circa 15,000 of these at a cost of around £12m.[1]

We have made good progress with active network management (ANM) with four zones providing 433MW of contracted flexibility. We have developed an approach that can be rolled out to further areas and we have accepted customer connections for six further suitable areas, three of which are progressing through the engineering phase. In addition, building on learnings from our customer-led network revolution (CLNR) project, we are actively managing voltages at major substations using automatic controllers. This has released 4.4GW of capacity in the period to date for multiple small-scale generators to connect to our local network.

We have been a key player in working with other DNOs and Ofgem to mobilise the Green Recovery scheme that is providing economic stimulus and accelerating investment for decarbonisation. In phase one we committed £30m of investment within our existing allowances to enable domestic customers to more easily adopt LCTs, and in phase two, we will be delivering incremental investment across a portfolio of 14 projects with a combined value of £53m.[1]

Case study

Our innovation portfolio has also been focused on targeting DSO-enabling capabilities. For example our Boston Spa Energy Efficiency Trial (BEET) has been developing capabilities to optimise voltage at customers' meters to reduce energy consumption while maintaining reliability. See our Customer Value Propositions (CVP) Voltage Optimisation.

Engaging flexibility markets.

In close collaboration with the Energy Networks Association's Open Networks project and flexibility providers, we have been seeking opportunities to deploy customer flexibility to maximise efficient use of the network for three key use cases: deferral of traditional reinforcement, planned maintenance, and emergency support.

Our flexibility work to date has provided meaningful lessons about the still-emerging flexibility market that are informing our plans, although in our region the widespread need for flexibility has not yet been present. We have experienced a reduction in peak demand and units distributed as a result of the economic impacts on heavy industrial demand, increased energy efficiency, and increasing embedded electricity generation. While this has limited reinforcement requirements (and therefore flexibility) to date, in specific areas and at lower voltages, clustering of LCTs is creating constraints that require ongoing intervention either through flexibility or reinforcement. And as LCT uptake continues to accelerate, so too will the need for flexibility services.

During 2019-20 we ran our first e-auction for 100MW of emergency support customer flexibility. This resulted in no services being procured as the market feedback was that there was insufficient value in this product where the use is uncertain. Instead, it is being viewed by flexibility providers as an additional product that could be provided alongside the reinforcement deferral product that would provide a more certain revenue stream.

In late 2020 we ran a flexibility expression of interest exercise for 15 substations where we saw a potential need for intervention in the 2023-28 period. We identified larger customers that could engage in providing the required flexibility in 20 per cent of the locations tested. Further, we are in discussions with national aggregators of local network (LV) flexibility about the role that they could play.

Alongside developing the market for flexibility we are developing our people, processes and systems to enable us to promote and operate flexibility services in a standardised manner that benefits our customers. An example of this is our partnership with other DNOs on the flexible power project, a system that gives flexibility providers a direct path to participate in flexibility on multiple networks.

Data and digitalisation.

Over the course of this business plan period we have made significant improvements in our systems and data-handling capabilities. This has laid solid foundations for our Data and Digitalisation plans for 2023-28.

We have made strategic investments in transitioning to a digital and fully vectorised set of asset records. This multi-year programme has transitioned 40m asset records and 400m attributes providing a platform for future digitalisation initiatives. We have also delivered projects to make use of smart meter data and implemented an end-to-end customer relationship management (CRM) system. This has given us better access to customer and network information and enabled more seamless outbound and inbound communications with our customers, which has been reflected in our customer satisfaction scores.

In developing our business plan we have been engaging with the local authorities and other stakeholders in our region on our Distribution Future Energy Scenarios (DFES) on an open data platform enabling them to interact and exchange data with us in a way that suits them.

> **Our plan for 2023-28 builds on the smart grid enablers we are putting in place in the current period.**

Alex Jones
Director of performance and planning

Examples of data and tools available for our customers

Power cuts:
live maps and tabular views of planned and unplanned powers cuts by postcode.

Connections:
live network information offering views of available capacity (heat maps), asset positioning for public safety and self-service for small works budget quotations (AutoDesign).

System planning and investment:
technical information that enables the security and safety of our GB transmission network and views of investment plans and load growth by substation and local authority (DFES open data).

A proven track record of collaboration and innovation

Innovation is embedded throughout our business, consistently driving benefits in our business-as-usual activities.

Our 2015-23 business plan promise of 'more for less' meant improving outputs and reducing costs. In order to achieve this, we have been finding and deploying innovation across our business. Regulatory-funded innovation has generated an estimated £24m of cost savings so far in the period, including the managed connections offered to generators, which have saved our customers £14m in connection costs. This is based on a narrow definition of innovation in line with regulatory reporting to Ofgem, with wider benefits being significantly more.

Our CLNR project was one of the most significant UK smart grid projects ever undertaken; it was a £31m four-year project that generated learnings, which we are using to evolve into DSO. Learning from this project enabled us to develop a smart grid route map for our 2015-23 business plan, and as a direct result we made changes to our business, and recommendations to other network operators to do the same, so that they and their customers could benefit.

Collaboration is now more important than ever, and we intend to build on and expand our existing strong relationships with partners.

We are proud of the role we play in delivering essential services to those we serve across the region. Collaboration is integral to how we deliver for our customers and, without our partners, we would not be able to achieve the same level of impact. Some of our key relationships include:

- Northern Gas Networks, Yorkshire Water and Northumbrian Water as fellow active members of the Infrastructure North collaboration established in 2013.
- Academic partners, including universities – Bath, Durham, Hull, Imperial College London, Newcastle, Sheffield and Strathclyde – and the Centre for Energy Systems Integration, all of whom underpin and contribute to our innovation activities.
- Local partners such as NHS Trusts in Yorkshire, Hull's Affordable Warmth Strategy service and the British Red Cross, with whom we work to deliver our social programmes that support customers who need us the most.
- Citizens Advice and local authorities – we have strong, long-standing relationships to identify and offer support to those in areas of social deprivation.
- Open Innovations (formerly ODI Leeds), a pioneer node of the Open Data Institute, with which we collaborate to deliver open-source DFES data, encouraging data-driven stakeholder engagement and supporting future net zero planning.
- the Federation of Small Businesses and a wide range of local businesses, with whom we have joined forces to develop the Zero Carbon Business Partnership, which provides information to support small- and medium-sized enterprises (SMEs) that are starting their net zero journey.
- North East Energy Catalyst, which we are supporting as a key partner as it helps interested groups and SMEs develop solutions to resolve energy issues in the North East.

Innovation driving benefits throughout our business-as-usual activities:

- **Safety** – vehicle telematics is improving driver safety in our fleet and helping us to incur fewer accidents. We registered 33 preventable vehicle accidents in 2020-21 in a fleet covering around 14m miles.
- **Reliability and Availability** – our Foresight fault-prediction project has made hundreds of thousands of pre-fault identifications prior to them becoming permanent faults. This, along with our network automation programmes of automated power restoration system (APRS) and LV smart fuses are making our network more reliable for all customers.
- **Environment** – the use of perfluorocarbon tracer (PFT) additives has sped up cable oil leak detection, contributing to a 47 per cent reduction in fluid/oil losses in the current price control period so far.
- **Customer satisfaction** – SilentPower, our mobile battery generator vehicles, has proven useful during the COVID-19 pandemic, helping us get customers' electricity supply back more quickly and cleanly than a traditional diesel generator.
- **Social obligations** – our 'powergrid cares' programme includes a number of initiatives, including our data project in collaboration with Experian that combines existing priority service information with regional demographic mapping. This programme has delivered £2.9m in financial benefits so far.
- **Connections** – our award-winning AutoDesign project has created a web-based self-service design tool, offering those looking to connect EV chargers and other LCTs access to high-quality designs in real time, at a lower cost. The system provides information in 10 minutes, as opposed to up to 10 working days previously.

Investing efficiently to deliver outputs

Our delivery has been consistent throughout the period, with our expenditure in the period to date tracking closely to allowances at 99 per cent. At a cost category level there are offsetting variances:

Network reinforcement is forecast to be £13.8m (five per cent) lower than allowances driven by lower requirement for fault-level reinforcement and deferral of a major scheme (£11m) in the Northeast due to generation projects not progressing. This is partially offset by the Green Investment 'net zero ready homes' initiative accelerating low voltage reinforcement to support decarbonisation.

Replacing and refurbishing equipment is broadly in line with allowances (£2.6m higher; within one per cent). Within our programme we have increased investment in fluid-filled cable (FFC) replacement and LV switchgear to maintain asset health and manage environmental risks. Higher expenditure on service and cut-out replacements driven by the smart meter roll-out and greater refurbishment to manage network safety risks has been partially offset by unit cost improvements through procurement, particularly in relation to LV work. Cost allocation changes in line with the Ofgem guidance has also seen certain costs in this area reclassified as maintenance.

Other non-load expenditure is forecast to be £37.3m (13 per cent) lower than allowances driven by efficiencies. We have re-engineered our flood defence programme enabling us to expand our programme and reduce costs. We have also delivered efficiencies in visual amenity projects and asbestos abatement whilst we have experienced lower levels of metal theft on our network supported by enhanced security measures.

Network faults expenditure is forecast to be £63.1m (12 per cent) higher than allowances. Allowances set for faults were insufficient for this cost category across the entire sector. Expenditure relating to extreme weather events has been higher than expected due to increased frequency of events and we have increased our use of generators to meet 12-hour restoration standards. We have experienced lower than predicted levels of faults volumes on LV underground cables with the remaining costs offset by efficiencies in other plan areas.

Tree-cutting expenditure is expected to be £13.2m (18 per cent) lower than the allowances due to efficiency savings from renewing our tree-cutting contract and realising synergies with our inspections programme.

Inspections, repair and maintenance expenditure is forecast to be £22.3m (21 per cent) higher than allowances largely as a result of the cost definition changes by Ofgem reallocating costs from network investment alongside savings from unit cost efficiencies.

Other network operating costs (NOCs) are £3.5m (16 per cent) lower than allowances due to lower substation electricity costs and contract efficiencies.

Operational support and business support expenditure is £20.2m (two per cent) lower than allowances. Increased expenditure to support customer service improvements has been more than offset by lower business support costs including energy efficiency savings at our properties, lower insurance claims and reduced fuel costs.

We have identified £283m of efficiencies across the business in the current planning period.

To ensure we could deliver our business plan efficiently, we mobilised a significant cost efficiency programme across all areas of our business and as a result we significantly rephased our capital programme.

- A key element of our programme was re-engineering of solutions. This involved changing the scope of our activities and identifying resource efficiencies, which has delivered savings of £129.9m in the period. An example of this is our modular high voltage (HV) primary switchgear rebuild programme, which enables works to be completed 12 weeks quicker at 10 per cent lower costs.
- We have driven £60.5m of efficiencies across the period through the application of technology such as targeting cable repairs using innovative fault-sensing equipment, voltage regulation and deployment of automatic power restoration systems.
- Finally, we have delivered £92.2m of procurement and productivity efficiencies including the renegotiation of service contracts and internal resource efficiencies.

These efficiencies have been built into baseline costs in our plan for 2023-28.

Figure 4: eight-year plan period totex cost category split – 2022-23 forecast

	Current business plan totex to 2022-23 (2012-13 prices, £m)	Forecast	Allowances	Variance	%
1	Network reinforcement	255.5	269.3	(13.8)	(5%)
2	Replacing and refurbishing equipment	755.0	752.5	2.6	0%
3	Other non-load	261.0	298.3	(37.3)	(13%)
4	Network faults	580.3	517.2	63.1	12%
5	Tree cutting	61.0	74.2	(13.2)	(18%)
6	Inspections, repair and maintenance	129.9	107.6	22.3	21%
7	Other NOCs	18.6	22.1	(3.5)	(16%)
8	Operational support and business support	977.0	997.2	(20.2)	(2%)
	Totex	**3,038.4**	**3,038.4**	**(0.0)**	**0%**

Our cost efficiencies have enabled us to accommodate additional investment to drive benefits for customers in the period and offset cost pressures

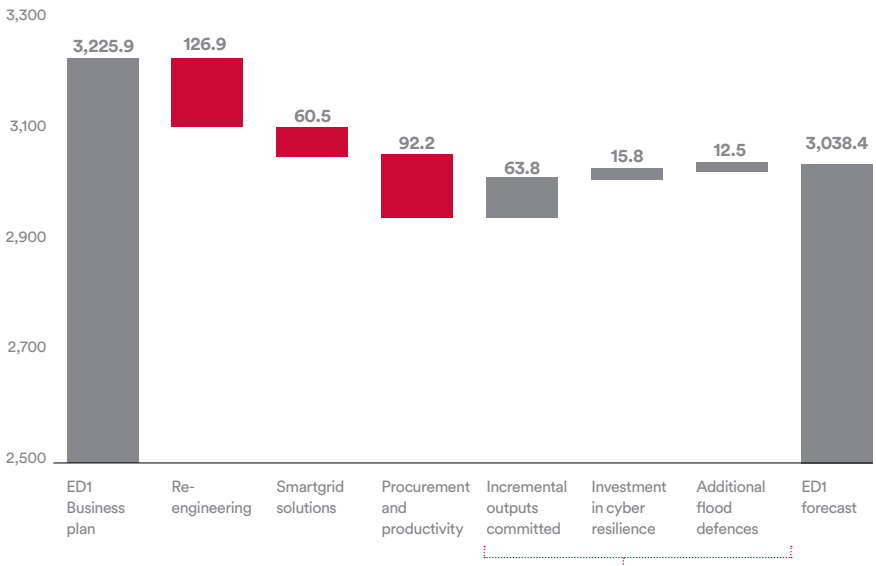
We have accommodated £92.1m of additional investment in the period while absorbing cost pressures to hold our costs steady. We have done this where efficient and required by the asset base, responding to key stakeholder priorities. In a number of key areas this means that we can reduce costs in the 2023-28 period. These benefits are reflected in our plan, most notably in relation to flood defence investment, extra high voltage (EHV) cable replacement and cyber security.

Our owners are committed investors with a long-term outlook.

Berkshire Hathaway Energy (BHE), our parent company, is committed to our business and our region. In the current regulatory period more than £996m has been reinvested into the business. See our Financing section.

There has been significant scrutiny on network company returns in recent years. Our returns are at the lower end of the range of UK network companies with our forecast return on regulatory equity (RoRE) for the regulatory period at 6.5 per cent based on our actual debt to equity (gearing) ratio (see figure 6). The primary contributor to this is incentive revenue from the interruptions incentive scheme (IIS) which generates a 1.5 per cent return. We are also forecasting to achieve around 69 per cent of the available broad measure of customer service (BMCS) reward, generating a return of 0.4 per cent. This is offset by 0.5 per cent lower returns as a result of debt financing as the debt that we took out many years ago at prevailing rates is more costly than Ofgem allows.

Figure 5: current business plan period efficiencies and additional investment



Additional investments in 2015-23[1]

+£63.8m
network resilience, including:

- 58 additional flood defences;
- replacement of an additional 90km of EHV/132kv fluid-filled cables; and
- investment to address safety risks on our network such as fire suppression blankets in link boxes.

+£15.8m
cyber resilience

- to significantly upgrade our cyber defences against the evolving threat of online and software attacks.

+£12.5m
customer service improvements, including:

- upgrading our contact centre telephone platform to latest technology;
- modernisation of our web interfaces; and
- enhancing our enterprise asset management (EAM) spatial asset system and underlying data.

Figure 6: forecast return on regulated equity (RoRE) for the plan period 2015-23

RoRE	Notional gearing	Actual gearing
Allowed equity return	6.0%	5.3%
Totex outperformance	(0.0)%	(0.0)%
Information quality incentive (IQI) penalty	(0.1)%	(0.1)%
Broad measure of customer service	0.4%	0.4%
Interruptions incentive scheme (IIS)	1.7%	1.5%
Incentive on connections engagement (ICE)	-	-
Time to connect incentive	0.1%	0.0%
Other incentives and penalties	(0.1)%	(0.1)%
RoRE – operational performance	**8.0%**	**7.0%**
Debt performance	(0.8)%	(0.5)%
Tax performance	(0.0)%	(0.0)%
RoRE – including financing and tax	**7.2%**	**6.5%**

1. Excluding incremental investment committed as part of Ofgem's national Green Recovery scheme.

Business plan commitment and assurance

We have well-established pay, reward and incentive frameworks that are coupled to the delivery of business plan commitments and our overall company performance. We will continue with this approach in 2023-28.

For our management team, rewards and incentives are determined by both the company's and their own performance against the Company Scorecard. Our Company Scorecard is calibrated annually with our shareholder BHE. It sets out targeted, measurable and stretching key performance indicators that are directly linked to the commitments in our plan.

Our collectively bargained pay deals all feature arrangements that link recognition and reward to our targets, and particularly the outcomes that customers value. We work with our colleagues and their trade union representatives to focus those incentives on the areas that those employees can impact most directly. For example, our technical group's rewards are set in part by our Gainshare incentive. This links a component of that group's pay directly to improvements in the reliability of the network. We will continue to review and improve these incentive mechanisms in consultation with our colleagues and their trade unions throughout the period.

We explain our approach to remuneration in more detail in annex 5.2 Workforce Resilience strategy.

Assurance statement for the business planning period 2023-23:

The boards of Northern Powergrid (Northeast) plc and Northern Powergrid (Yorkshire) plc, including the sufficiently independent directors, confirm that the plan and associated costs have been tested for accuracy, ambition and efficiency.

The licensees would not meet Ofgem's financeability criteria on a notional capital structure basis (using the Ofgem working assumptions for cost of capital allowances and expected out performance). More information is provided in the section on Financing.

> "The business plan has been scrutinised and challenged by the board and by various external groups to provide assurance around its accuracy, ambition and efficiency."
>
> **Alison Marshall**

Board members

Northern Powergrid (Northeast) plc

Northern Powergrid (Yorkshire) plc

Phil Jones

President and CEO, Northern Powergrid

Tom France

General counsel, Northern Powergrid

Andrew Maclennan

Commercial director, Northern Powergrid

Alison Marshall

Non-executive director chair – Gateshead Health NHS Foundation Trust

Phil Taylor

Non-executive director, pro vice-chancellor for research and enterprise, Bristol University

Board of directors

- Regular reviews
- Scrutiny and sign-off
- Sub-committees chaired by non-executive directors for innovation and risk

Technical panel

- Independent panel of industry experts to scrutinise and challenge the technical aspects of our plan
- See annex 2.2 Technical Panel letter

Customer Engagement Group (CEG)

- Group of 10 independent experts charged with scrutinising our plan and the quality of our engagement
- See our CEG website

Plan development and engagement

- Plan development and stakeholder engagement led by business unit executives and their teams

Assurance plans

- Structured assurance plans in line with Data Assurance Guidance
- See annex 2.1 Data Assurance

Social issues expert group

- Independent group of six experts to provide feedback on how well our plan addresses social issues in our region

External challenge

- Targeted use of external consultants to challenge our plans
- External benchmarking

Outputs and incentives

We are committed to delivering on our promises. Throughout our plan we clearly set out the outcomes we will deliver for our customers, with the associated benefits, deliverables and measures we will use to track our performance. In each section of our plan we show how our customer outcomes link to the range of outputs and incentives in Ofgem's RIIO-ED2 price control framework.[1]

Output categories

- Deliver an environmentally sustainable network
- Maintain a safe and resilient network
- Meet the needs of consumers and network users

Overarching framework for outputs and incentives

1. **Licence obligations (LOs)** Set minimum standards of performance that Ofgem will impose
2. **Price control deliverables (PCDs)** Capture outputs directly associated with baseline funding
3. **Output delivery incentives (ODIs)** Where these may be in the interest of customers and other network users

Common: outputs and incentives arrangements that apply to all DNOs

Bespoke: outputs and incentives arrangements that are proposed by the DNOs

Output delivery incentive – financial (ODI-F): outputs and incentives that have associated payments/penalties

Output delivery incentive – reputational (ODI-R): outputs and incentives of a reputational nature

A summary of outputs and incentives in our plan.

In addition to the common outputs and incentives in Ofgem's framework, our plan contains one bespoke PCD and three bespoke ODI-Rs.

— Our bespoke PCD covers our commitment to deliver £65m of investment in HV network automation to deliver the substantial improvement in network reliability required to meet Ofgem's IIS targets, see Reliability.

— Our three bespoke ODI-Rs cover performance reporting commitments for our DSO, Vulnerable Customers and Major Connections strategies to supplement Ofgem's strategy delivery ODI-F. We propose this as a sector-wide mechanism to ensure we account for our performance in areas that cannot be easily measured by quantitative metrics. Where robust metrics are available we have proposed performance scorecards in our strategies, through the common ODI-F mechanism, to further incentivise our delivery in the period.

> **Our targets and proposed incentives support the ambitious customer outcomes in our plan. Our proposed incentive framework demonstrates how we will hold ourselves accountable to stakeholders for how well we deliver those outcomes.**

Dave Wilkins
Policy manager

1. Unless specified otherwise, target dates for delivery throughout our plan are the end of March 2028. For phasing of the performance metrics, see annex 1.4.

Our proposal for outputs and incentives

Output category	Plan section	Output/incentive	Type	Target/mechanism
Delivering an environmentally sustainable network 	Decarbonisation			
	Scenarios and Investment	-	-	-
	DSO Strategy	DSO Strategy delivery incentive	Common ODI-F	Performance scorecard proposed in our plan in annex 4.2 DSO strategy
		DSO Strategy delivery report	Bespoke ODI-R	Annual reporting
	Enabling Whole System Solutions	-	-	-
	Environmental Action Plan	Environmental action plans	Common LO	Included in our plan
		Annual environmental report	Common ODI-R	Annual reporting
		Environmental scorecard	Common ODI-F	Performance scorecard proposed in annex 4.4 Environmental Action Plan
Maintaining a safe and resilient network 	Safety			
	Reliability and Availability	Interruptions incentive scheme (IIS)	Common ODI-F	Provisional targets for our plan. Final targets to be set by Ofgem
		Guaranteed standards of performance	Common LO	Meet standards
		Worst-served customers (WSC)	Common PCD	£4.3m investment included in our plan to address 2,835 customers
		HV automation	Bespoke PCD	£64.8m investment included in our plan to deliver substantial improvements in network reliability, see annex 4.8 investment in HV automation
	Asset Resilience	Network asset risk metric	PCD, ODI-F	Included in our plan
	Climate Resilience	Environmental resilience plan	Common LO	Strategy included in our plan
	Physical and Cyber Resilience	Cyber resilience information technology (IT) plan	Common LO	Included in our plan
		Cyber resilience IT	Common PCD	£4.5m investment included in our plan to reduce risk by 35 per cent
		Cyber resilience operational technology (OT) plan	Common LO	Included in our plan
		Cyber resilience OT	Common PCD	£5.1m investment included in our plan to reduce risk by 30 per cent
Meet the needs of network users 	Customer Service	Customer satisfaction survey	Common ODI-F	Targets to be determined by Ofgem
		Complaints metric	Common ODI-F	Targets to be determined by Ofgem
	Vulnerable Customers	Obligation to treat customers fairly, including those in vulnerable situations	Common LO	Meet standards
		Improving service standards for vulnerable customers	Common ODI-F	Performance scorecard proposed in annex 4.11 Vulnerability strategy
		Vulnerable customers delivery report	Bespoke ODI-R	Annual reporting
	Our Communities	-	-	-
	Connections	Time to connect	Common ODI-F	Targets to be determined by Ofgem
		Connections guaranteed standards of performance	Common LO	Meet standards
		Improving service standards for major connection customers	Common ODI-F	Performance scorecard proposed in annex 4.12 Major connections strategy
		Major connections delivery report	Bespoke ODI-R	Annual reporting
	Openness and Transparency	-	-	-
Enablers	Innovation	-	-	-
	Data and Digitalisation	Digitalisation Strategy and Action Plan (DSAP)	Common LO	Included in our plan
		Data best practice	Common LO	Requirements reflected in our plans
	Workforce Resilience	-	-	-

Our approach to setting out our proposals

In the following sections of our plan we unpack our stakeholder engagement approach, our plans for the 12 output areas of our business and the three supporting enablers (Innovation, Data and Digitalisation and Workforce Resilience). In each of our output sections we set out the commitments we are making in the form of customer outcomes, supported by benefits, deliverables and measures to track our progress. We also show how the feedback you have given us has directly shaped our plans and the impact on costs.

1 Our plan

How the output area contributes to our overall vision

Outcomes → Our commitments for the 2023-28 period

Benefits → How these outcomes benefit our customers

Deliverables[2] → What we plan to do to support the delivery of our outcomes

Metrics[3] → How we plan to measure our success, including:

- Output measures to track the delivery of our outcomes – shown as LOs, PCDs, ODIs (where applicable)
- Indicative input measures showing underlying input/ volume assumptions (where relevant)

We will report on progress against our plan in the 2023-28 period

2 How engagement with you has shaped our plans

Who we have engaged

How we have engaged

What we have heard from you

How this has impacted our plan

3 How much it will cost

How much it will cost[1]

2023-2028 expenditure (annual)	**£m** % of totex
versus 2015-2023	**+/-£m** +/- %

In July 2021 we published our draft business plan. Since then we have been consulting and receiving feedback from stakeholders including our CEG, the Challenge Group, and Ofgem. We have updated our plan in light of the feedback received.

The fundamentals of our plan remain unchanged, and overall there is a high degree of consistency between our draft and final submission. Some of the targeted areas where we have updated our plan include:

- detailed work to reflect our view of uncertainty mechanisms within our total expenditure forecasts;
- analysis of the impact of Ofgem's proposed changes in access and charging rules; and
- updating our plans to add detail to our proposals and improve our justification, for example in relation to data and digitalisation.

A summary of the main changes to our plan between draft and final submission, along with a reconciliation of changes in our cost forecasts, is set out at Annex 1.10: Changes made to our plan between draft and final submission.

For mapping of our plan to Ofgem's Business Plan Guidance please see annex 1.3 Mapping to Ofgem Business Plan Guidance

> **Stakeholders have provided valuable input throughout our plan development, shaping the customer outcomes we are committing to deliver.**

Philippa Williamson
Planning manager

1. All ED2 costs are in 2020-21 prices and include real price effects and ongoing efficiencies unless otherwise stated. All 2015-23 costs are shown in 2012-13 prices, unless otherwise stated.
2. Target dates for all deliverables are the end of the period (March 2028), unless otherwise stated.
3. See annex 1.4 Key measures in our plan for the phased profile of our targets and forecasts over the 2023-28 period.

GIVING CONSUMERS A STRONGER VOICE

Our enhanced engagement process is central to the development of our plan

Our plan has been developed with our customers and stakeholders. In building our plan, we have conducted our most ambitious, comprehensive and representative engagement programme ever. We have provided multiple opportunities for our customers and stakeholders to engage, shape and challenge our proposals.

We have taken on board feedback from over 63,000 interactions with stakeholders, customers and future customers. We held more than 420 events, including more than 70 focus groups, 65 panels and seven regional conferences, and delivered engagement at flexible and varied times to enable the greatest participation from the broadest group of stakeholders. We established six new, targeted challenge panels to gain key insights, with a particular focus on ensuring good representation from all stakeholders in our region. We conducted 53 surveys, published two consultation documents and ran extensive communication campaigns reaching 2.7m consumers to ensure that a high proportion of our customers and broader stakeholders were aware of our engagement and could have a voice in developing our plan for 2023-28.

Co-creating this plan with our stakeholders started with early engagement. We held deliberative sessions with an open dialogue to discuss what our priorities should be; this shaped our thinking from the very start. This led to the publication of our Emerging Thinking in the summer of 2020, supported by a dedicated microsite and the ability to 'build your own plan' based on costed plan options with five levels of ambition to consider across each of our business plan areas. This enabled our customers and wider stakeholders to design the plan they would like to see delivered in 2023-28. We then tested this insight and the emerging options through further qualitative engagement. Wide-ranging efforts such as consumer panels, customer research and co-creation focus groups helped to evaluate our thinking as our plans progressed, including the setting of stretching targets. We believe this approach has resulted in a plan that has been truly stakeholder-led.

We carried out our engagement in accordance with our stakeholder charter.

To ensure we fully integrated stakeholder and customer views into our plan, we carried out all our engagement according to the principles set out in our stakeholder charter and this was used as a yardstick by our Customer Engagement Group (CEG) to assess the effectiveness of our engagement.

We built our enhanced engagement approach on the solid foundations developed from 2013 onwards, while becoming more responsive, agile and innovative to meet the ambitions of our region's stakeholders.

The COVID-19 pandemic created a unique and challenging situation for our stakeholders, customers and communities during the earlier stages of the business plan development period. In response, much of our engagement activity moved online – changing the pace and dynamic of our interactions. Where possible, we took action to engage with the digitally excluded and vulnerable and, as the pandemic eased, we worked with our community partners to engage face-to-face with these groups.

We structured our plan into four broad waves of engagement activity. A comprehensive stakeholder segmentation model supported this, ensuring our engagement was fully representative of the customers and stakeholders we serve. This was supported by an ambitious communications and outreach strategy to ensure that our engagement programme was accessible and would boost areas of low representation or participation.

An important aspect of our engagement programme has been to conduct further research during both wave three and wave four with a representative sample of our customers to provide assurance that our business plan is both acceptable and is supported by our customers, including vulnerable customers, future consumers and stakeholders. These exercises followed on from our 'willingness to pay' research, where our customers placed a value on our proposals of £21.46 p.a. above their current bill.

We initially undertook a robust and comprehensive acceptance research stage for our draft plan during wave three, which in total included 1,272 customers. This measured customers' acceptance of each of the plan areas, our enablers, and the plan in its entirety. Domestic customers gave an 89 per cent acceptance score for the plan.

We have robust processes, planning, governance and assurance in place to make sure business plan decisions are clearly responding to customers' and stakeholders' feedback, and that our plans adapt to meet their needs.

- An annual audit assesses our work to the stakeholder engagement standard AA1000 and ensures that we continue to build and develop our engagement processes. We commissioned additional audits during plan development and this approach will continue as an integral part of our process from 2023-28.

- We developed a weighting methodology to measure engagement and insight based on multiple factors. It helps us plan engagement and is particularly useful for any stakeholder tension or contradictory opinions between groups. This approach indicated where further testing or discussion is required, and with which groups of stakeholders. For further detail of our methodology and examples application see annex 3.4 Our stakeholder engagement methodology.

- Where opinions were changing or unclear through waves of engagement, our citizens panel was convened (over 19 sessions) to discuss, debate and vote on more complex issues. 50 customers from the consumer, future consumer, rural and SME panels made up the group. They looked at the issues within the wider context of the overall plan to help us to reach consensus on our customer outcomes.

- Our assuring partners, Sia Partners and Impact Research, completed independent quality assurance reports to assess engagement at the close of wave two, wave three and wave four to ensure that it was representative and aligned with the emerging propositions, with feedback we received and with the emerging customer outcomes. See annex 3.3 Detailed engagement findings.

We sought to test the actual impact on annual bills for our customers for 2023-28 and beyond with our citizens panel, cognisant of the backdrop of rising energy bills and also through two acceptance research exercises. The first included a representative sample of 1,451 domestic customers, of whom 765 were vulnerable, 197 were fuel poor and 131 were future bill payers. The second, an open consultation with domestic customers, received 8,141 responses with a spread of representation including fuel-poor and vulnerable customers.

Assimilating both exercises, customers gave an 82 per cent acceptance score for our final plan. Further information about the research and acceptance levels by plan area is available in annex 3.3 Detailed engagement findings.

Building on our established engagement programme with annual stakeholder priorities research, we found a series of prominent priorities stakeholders would like us to focus on.

Stakeholder priorities formed from early, deliberative engagement and became richer in detail as the engagement programme progressed. These have shaped our business plan outcomes and ambition levels throughout our plan.

- **Decarbonisation is an urgent priority for most of our stakeholders and customers, reflecting heightened concern about the impact of climate change.** As a result, we will play a significant role in facilitating the transition to net zero, including providing access to energy system data.
- **The safety, reliability and resilience of our network remains** a top priority, as day-to-day life comes to rely more and more on electricity.
- **Stakeholders expect us to show leadership in environmental protection,** including reducing the carbon footprint of our operations.
- **Stakeholders want us to continue supporting vulnerable customers** and to go further, including facilitating a socially inclusive transition to net zero.
- Stakeholders and customers want us to seriously consider affordability and **continue to focus on keeping bills low.**

Our governance approach is robust. It includes senior management accountability and responsibility in each area of the business for engagement planning and delivery, coupled with regular reporting to the Board and clear escalation processes in place.

We have long-standing external expert groups who hold us to account, such as our enduring stakeholder panel and social issues expert group. Within the plan development period we have established four additional panels representing vulnerable customers, community energy, future consumers and a collective consumer group including SMEs and domestic customers, our citizens panel. These have now become an essential part of our enduring engagement approach.

1 Stakeholder-led	We are flexible, proactive and responsive. Early deliberative engagement informs our plans and allows for testing with stakeholders.
2 Representative and inclusive	We will not leave anyone behind. We hear all voices from across the diverse region we serve.
3 Open and transparent	Explaining what, why and how we work. Encouraging active participation from customers and stakeholders to aid planning and decision making.
4 Accessible	Employing a range of engagement methods to engage all ages and capabilities. Educating stakeholders, so they could make better-informed decisions and provide a richer input.
5 Responsive and adaptive	Best practice leads us. Experience shapes us. Our programme is continuously evolving as we learn more about the needs of others.

Building our plan with you

October 2019

DSO V1.1

August 2020

Emerging Thinking (ET)

July 2021

Draft business plan submission

December 2021

Final business plan submission

WAVE 1 – open engagement…

- Regional model of representation and inclusivity
- Key themes and priorities from ongoing engagement
- Tailored engagement plans
- Initial open consultation – early views and areas for further exploration

…provided us with very clear messages that helped us shape our plan options

1. **Decarbonisation** is top priority – facilitate the transition to net zero and provide access to energy system data
2. **Safety, reliability and resilience** remain highly important, increasingly so as more reliance is placed on electricity in day-to-day life
3. Show leadership on **environmental protection**, including reducing the carbon footprint of our operations
4. Support vulnerable customers and facilitate a **socially inclusive transition** to net zero
5. **Keep bills low**

WAVE 2 – optioneering…

- Emerging Thinking (ET) consultation launched in August 2020
- Ambitious stakeholder optioneering exercise – 'build your plan'
- Five fully costed service levels for our nine output areas

Stakeholder feedback used to balance ambition with affordability

1. **High levels of stakeholder ambition**
   - Most ambitious option (level E) was the preferred choice in 75 per cent of our output areas
2. **Decarbonisation reinforced as the clear imperative** and top stakeholder priority…
3. **…but affordability remained at the forefront**

WAVE 3 – refinement and finalising…

Citizens panel established and utilised Energy Champions to ensure effective communications with customers to raise understanding and increase participation. Draft plans shared and tested for support, adapting where required.

89%[1] acceptance score

WAVE 4 – finessing and finalising

Further research to understand customer and stakeholder views on more complex areas including net zero costs, bill impact and overall acceptability testing of the final plan.

82%[1] acceptance score

1. Domestic customers.

>63,000
stakeholders engaged

>420
events

1st
DNO to publish costed plan options

250m
Permutations in our interactive optioneering tool

10
Challenge panels

Strengthening governance and challenge

The establishment of our Customer Engagement Group (CEG) in September 2019 has further strengthened our governance approach.

The CEG, our independent scrutiny panel, has played a crucial role in ensuring that stakeholder and customer needs have been considered and reflected within the business plan.

Following a robust appointment process, ratified by Ofgem and conducted openly by an independent agency, Justin McCracken was appointed chair of the CEG in July 2019. Justin then led the recruitment of the wider CEG members with the group first meeting in December 2019. We established an independent secretariat function to provide dedicated support for the CEG, manage their induction and provide intensive training to assist with navigating the energy industry.

The CEG held both full group meetings and additional sub-group sessions each month to ensure sufficient focus and scrutiny on each plan area aligned to the expertise of the different group members. All CEG members assessed the planning and execution of engagement by directly observing activities and reporting back to the full group.

In support of the CEG's scrutiny roles, our subject matter experts and members of our leadership team joined the CEG to discuss emerging plans at every stage of the development process. We shared plans at the outline stage to facilitate early challenges through to full plan development. To ensure a robust process, subject matter experts took the CEG through the underpinning justification, supporting data, engagement feedback and benchmarking materials and responded directly to CEG challenges. Supporting information was provided in an agreed format and at appropriate time frames before discussion to enable the CEG to prepare for plan section reviews.

The CEG has reviewed, observed and raised over 130 issues and six challenges during the development of our business plan. We have amended our final business plan proposals in light of these issues and challenges. The group observed the broadest range of engagement activities across our four waves of engagement, feeding back its experience of 110 events, highlighting areas of good practice and areas for improvement. This included scaling up our engagement with future consumers, challenging how we ensured propositions were understandable for stakeholders and clearly describing how bills would be impacted and over what time period. The group held us to account against the stakeholder charter and the scope and scale of engagement necessary to develop a considered business plan that reflects customers' needs and preferences.

The CEG has published and reported monthly updates throughout the course of the process and will publish its final report on our plan in January 2022. You can find out more on our CEG web page.

Ofgem's RIIO-ED2 challenge group has also engaged as our plan developed.

We met with the RIIO-ED2 challenge group as part of their formal engagement process.

- In March 2021 members of our executive, including our chief executive officer (CEO), met with the challenge group to discuss our delivery track record and historical performance.
- In April 2021 executive representatives met with the challenge group again to discuss our plan. The challenge group sought to understand our approach, planning assumptions and levels of ambition.
- In August 2021, we met with the challenge group to discuss its feedback on our draft business plan. We have updated our final proposals in light of this feedback.
- This was followed up with further information exchanged by correspondence.

Our Customer Engagement Group:

10

independent experts

121

formal interactions

Delivering best practice engagement

Action required to decarbonise our economy and society, coupled with the impact of the COVID-19 pandemic, means it has never been more critical to ensure that nobody is left behind in the energy transition. We, therefore, use the UN-approved 'no one will be left behind' framework approach of 'examine, empower, enact' as the bedrock for our enhanced strategic approach (see annex 3.2 Our strategy for engagement 2023-28) to support hard-to-reach and seldom-heard stakeholders.

We continually challenged ourselves to deliver a 'best in class' engagement programme for our region. We were never satisfied, reflecting on what could be better and making improvements after every interaction, supported by feedback from the CEG. Customer and stakeholder feedback on the effectiveness of engagement was routinely gathered and analysed, shaping areas of focus to optimise all engagements.

- **Education:** a central focus throughout our engagement programme was providing tailored and targeted educational material for customers to ensure they could navigate the energy industry and our plan to help them feel confident in giving feedback on and challenging our plan assumptions. We commissioned 23 'What is' animations to explain complex terms and topics. We also held introductory sessions and webinars in complex subjects to help with participants' understanding. Breakout groups were organised based on participants' levels of understanding. We took feedback from stakeholders at the end of each engagement to check on understanding and satisfaction with the event. We sought to continually learn and listen to our stakeholders' needs.
- **Communication:** the development of our dedicated microsite for engagement, Engage, provided a hub for all business plan materials, with event recordings as well as future events registration information. Our Emerging Thinking (ET) document was published on Engage providing an interactive 'build your own bill' and dashboard for further digital engagement with customers and stakeholders. Stakeholders were able to vote on the plan priorities and on our engagement approach. We provided a further update to our plan in April 2021 to feedback to stakeholders on how their views had shaped our priorities and to test their acceptance and satisfaction. We then published our draft business plan on a website with promotional campaigns linking to our site.
- To raise awareness of our plans, we ran extensive monthly communication campaigns, which led to more than 2.7m digital opportunities to contribute to the development of our plan with more than 25,000 direct interactions.
- **Representation:** our segmentation and representation approach ensured that we regularly updated our data, capturing new and emerging groups to remain relevant and fully representative of the regions we serve. Alongside domestic consumer panels, new specialist panels established included SMEs, rural customers, future consumers and the community energy customer panel. With input from our CEG, we recruited our future fairness panel, to encompass all current vulnerabilities in our region and to help us to identify new and emerging issues from groups who are hard to reach and vulnerable in nature.
- **Future bill payers** played an important role in shaping our plan. We set up four university panels to gather in-depth insights about decarbonisation from their perspective. We also developed an innovative future consumer online panel of 16- to 21-year olds recruited from across our region, who reviewed the developing plan and whether it aligned with their ambitions and priorities for future generations.
- **Citizens panel:** as we refined our plans, we established our enduring citizens panel, bringing together existing members of the SME panel, rural panel and consumer panels to build a more diverse, collective body with 50 representative members. This amalgamation of panels brought together customers with very differing experiences and alternative perspectives, which enabled more in-depth discussion and robust challenge to our plans. Over 19 deliberative sessions held during wave three and four, the panel helped our engagement leads refine their customer outcomes. Particular areas of challenge from this panel were plan ambition, the bill impact of the proposed plan over 45 years, and how we can balance affordability with proactivity in support of network decarbonisation.
- **Energy champions:** hand in hand with our citizens panel and coupled with our focus on ensuring stakeholders understand the materials and topics we were sharing with them, we recruited 12 individuals – our energy champions – including domestic customers (urban and rural), SME customers, representatives of vulnerable groups and our colleagues to improve how we are educating our customers on the energy transition. In meeting 12 times and reviewing 22 topics, the focus for our champions was to improve complex customer communications, helping us see it through their eyes. The champions helped us to explain our most complex topics by coaching engagement leads and improving our materials by adding accessible language and imagery, enabling our customers to make informed decisions based on increased understanding.
- **Responding to regional needs:** we serve a diverse region, taking in large cities, post-industrial and historic towns, coastal communities and vast swathes of rural England across Yorkshire, the North East and northern Lincolnshire.

> **With some 63,000 interactions with our customers and stakeholders to date, our extensive engagement programme has ensured that our consumers have a strong voice in the development of our plan.**

Siobhan Barton
Head of stakeholder relations

- Recognising that engagement is everyone's responsibility and that we serve our communities better when we are closer to them, we restructured our business around six geographic regions, with a greater focus on local accountability.
- Our engagement programme has also sought to uncover localised need through our membership of regional leadership groupings such as the North East England Climate Coalition and Yorkshire and Humber Climate Commission and regular engagement with experts and stakeholder leaders in a series of localised workshops and panels.
- Recognising that elected leaders within our region represent localised interests, we conducted an extensive engagement programme with councillors, MPs and elected mayors. We spoke with over 130 local government stakeholders representing a diverse range of communities. 16 MPs attended our dedicated briefing sessions and we have, to date, directly briefed over 75 per cent of local authorities in the region on our plans, either through one-to-one meetings with council leaderships or regional presentations and discussions. At each stage, elected stakeholders have been given the opportunity to ask questions, express their views and challenge our plans.
- As an industrial region of the UK, our area contains a diversity of different business interests, from steel and glass making, to shipping, logistics and manufacturing. We also have a large financial sector and a wide range of SME businesses. To ensure our plan continues to meet their diverse needs, we have engaged with both sectoral groups, other utilities to identify synergies and interdependencies and industrial customers. These were through bilateral sessions and dedicated forums for energy intensive industries as well as setting up a SME panel to give a representative group of small business owners a chance to shape our plans.

Our enduring stakeholder engagement approach

The pace of change in today's world means customer and stakeholder engagement is becoming even more critical, especially as our customers will be living through the formative stages of the energy transition during the next business plan period.

Our plans must therefore reflect what we know now, but also have the capacity to adapt quickly to emerging priorities. Our engagement must support and enable ambitious economic development for our stakeholders involved in net zero and local area energy planning (LAEP). For hard-to-reach and vulnerable stakeholders, it must facilitate access to available support through a growing partnership network, to ensure a just and inclusive transition.

Working in an agile and efficient way, we will continuously improve how we collaborate with individuals, communities and wider society, and strive to include diverse voices in our planning. Building strong engagement with individuals, communities and broader society helps us make better decisions, and it also helps us better prepare to meet their needs and aspirations. Our engagement plan for 2023-28 reflects these priorities.

During 2015-23, we have developed a strong core of engagement to build upon in the future.

Our plan's foundations are the successes of our existing engagement programme. The advisory panels, in place for more than eight years now, sit alongside new groups established as part of the planning process, ensuring we reflect the diverse interests and needs of all stakeholder voices in our regions.

We will further strengthen the customer voice in our work, and make sure that our organisation remains externally focused and accountable. Our engagement strategy for 2023-28 is set out in annex 3.2 Our strategy for engagement (2023-28) and more detail around our stakeholder processes and governance is set out in annex 3.4 Our stakeholder engagement methodology.

To further strengthen our robust governance approach, we will maintain the scrutiny of the annual AA1000 audit, publish our commitments annually, report progress on our Engage microsite and establish our CEG as a standing body to scrutinise stakeholder engagement activities and delivery against our promises – see our Openness and Transparency section.

Throughout our organisation, our decision-making processes encompass the insights gathered from well-planned stakeholder engagement and can track these key decisions and actions back to clearly defined stakeholder insight.

Alongside our understanding of our customers' priorities and needs drawn from engagement and research, we also conduct extensive benchmarking to identify and utilise best practice to ensure our plan is robust and future-proofed.

Technology and new ways of working have dramatically changed the way we engage over these last two years. We will build from this, creating new channels, engagement mechanisms and communications assets to enable our stakeholders to better interact with us and empower them to shape the future of our services. This will be sensitively balanced with an understanding of, and provision for, the digitally excluded or hard to reach.

Echoing our customers' ambition, we will accelerate and expand our regional approach, doing even more to understand the granular differences that make up the communities we serve so that we can better and more swiftly respond to their specific needs.

We will build on our established engagement channels.

Our engagement approach during 2023-28 will combine the engagement building blocks currently in place, along with the extended engagement channels we have established in developing our business plan. We will ensure that we do not lose our current momentum and continue to build mature relationships with our existing stakeholders and customers while further extending our reach.

Our approach will be inclusive, accessible, relevant and continuously improving, bringing customers' voices forward and actively enabling stakeholders to influence our plans.

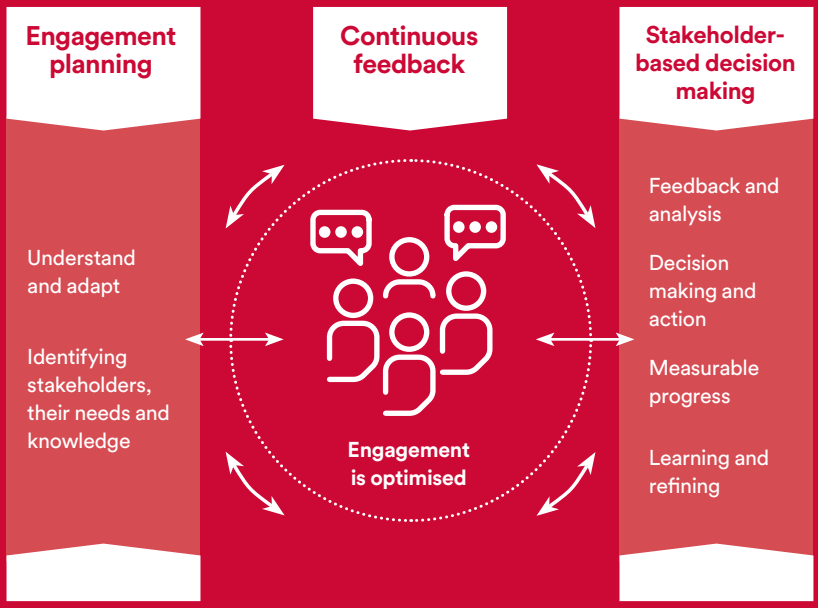
Our engagement strategy sets out how we will engage with more than 20,000 stakeholders every year, utilising our engagement channels, panels, co-creation groups, qualitative and quantitative research and with a published annual engagement schedule. This forms the core of our coordinated annual programme of engagement, with the agility to respond to new, emerging customer priorities or an acceleration in decarbonisation activity during this period.

Our engagement priorities and ambition, underpinned by our enhanced engagement approach, gives consumers a stronger voice.

The outcomes table on page 37 sets out how we will deliver our strategy.

We will continue to build and adapt our engagement on current and emerging best practice, including the areas of focus for implementing our plan. This includes our practical approaches such as the development of our 'no one left behind' framework, introduction of energy champions, future consumer panels, future fairness panel, SME panel and engagement tailored to diverse regional needs and targets.

Figure 1: our engagement approach



Full details of our engagement approach and methodology are available in annex 3.2 Our strategy for engagement (2023-28)

— **Identifying stakeholders, their needs and knowledge**
Our stakeholder database maps over 6,000 stakeholders against our segmentation model with an annual database audit to ensure diversity of representation.

— **Understand and adapt**
We engage with hard-to-reach, vulnerable and time-poor individuals adapting our approach accordingly to meet their needs.

— **Feedback and analysis**
We record and review all feedback in an accurate and timely manner, tracking feedback, satisfaction and actions.

— **Decision making and action**
Our stakeholder engagement leads management group (ELMG) reviews feedback and develops action plans. These are reviewed by the executive, CEG and stakeholder panels.

— **Measurable progress**
Through robust project management, we report and measure progress including stakeholder return on investment (ROI), benefits and satisfaction; and report back outcomes to our stakeholders.

— **Learning and refining**
We operate a cycle of continuous improvement for all engagement and continually refine our processes.

— **Engagement is optimised**
The ongoing feedback and insights gathered are fundamental to our decision-making processes and our success as a business, keeping us accountable for delivery.

Giving consumers a voice in the energy transition

To prepare for a fully decarbonised future, we will deliver a sector-leading programme of ambitious, innovative and effective engagement for our customers and stakeholders right across our region. Working together, we will improve our existing services and innovate, developing new, inclusive markets to meet customer needs better, now and in the future, while ensuring no one is left behind.

We will work collaboratively with our region's stakeholders recognising their differing levels of ambition and understanding of decarbonisation. We will be best in class in providing education, guidance and data to help support their decision making and planning.

We will actively collaborate with other utilities and industry partners to support the development of an efficient and effective whole energy system for our region. This will include a partnership approach to engagement with our stakeholders to ensure future customer needs are met with dynamic cross-sector planning: for example, our joint charter with Northern Gas Networks to support development of LAEPs in our region and our commitment to work on interdependent programmes with other utilities, meeting regularly. We see this as an approach which will extend to support further decarbonisation collaborations.

Throughout our engagement process, customers and stakeholders have told us that we need to be much more ambitious and visible to them in order to effectively fulfil this enhanced support role and provide independent, impartial advice. They want us to raise our profile and general awareness as an anchor organisation in the region.

To respond to these challenges and the accelerated pace of change as our region decarbonises, we will spend an additional £0.5m per annum to increase the ambition, impact and scale of engagement initiatives, marketing outreach campaigns and dynamic external communications materials that will promote, support and advise on what changes are required.

> **The majority of stakeholders we heard from wanted to discuss strategic priorities more regularly. We are therefore proposing to expand our teams to provide the time and expertise sought – this is a key part of our stakeholders' commitments.**

Anda Baumerte
Sustainability manager

Our channels for engagement (core pathways) are tailored and targeted to meet our stakeholders' levels of knowledge:

Figure 2: engagement channels

Level of knowledge	Expert	Interested	Limited
Engagement type	Expert panels	Conferences	Direct customer engagement
	Sector forums	Deliberative engagement	Research
		Capacity-building workshops	Proactive communications campaigns
Reach	500+	2,000+	50,000+

Consumers

70+
customers represented in two panels

Future consumers

64
young people on our panels

SMEs

20
small- to medium-sized business representatives

Rural

30
rural domestic customers contribute to our panel

Community energy

20
Community energy representatives take part from across the region

Future fairness

16
experts give views in a session chaired by Voluntary Organisations Network North East (VONNE)

Social issues

6
leading experts at our independently chaired session

Stakeholders

40+
stakeholders on our representative panel to share their views

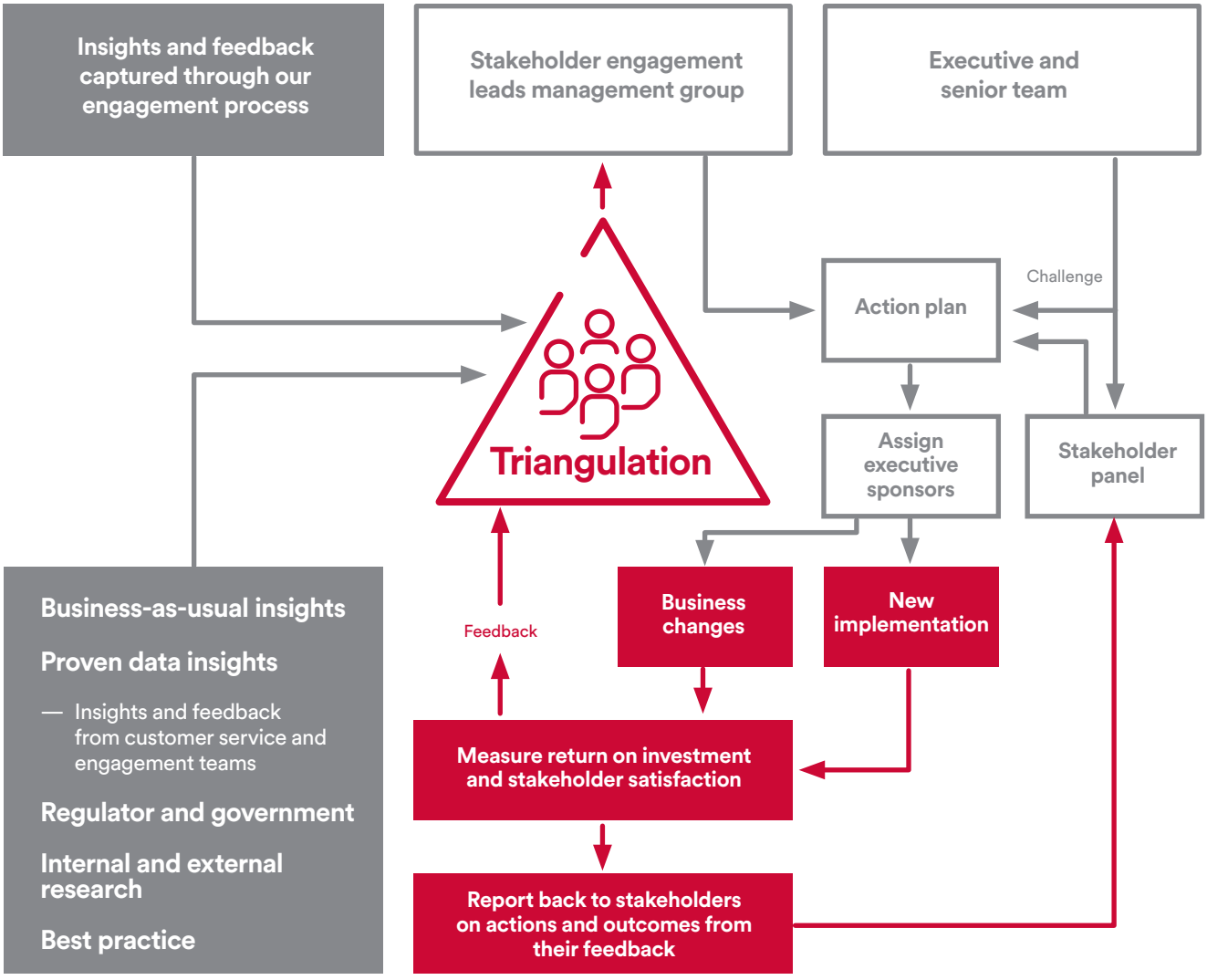
Robust governance, accountability and reporting

Our engagement strategy and approach sets out our robust methodology for effective engagement and ensures that stakeholder voices feed strategic and day-to-day decision making. Our central stakeholder team will continue to oversee this process, with colleagues throughout the business responsible and accountable for leading and delivering engagement and acting on stakeholder feedback in their plans.

We have a comprehensive project management and benefit quantification approach in place to measure our impact and the effectiveness of our programmes in order to deliver value for money for our customers and stakeholders. Our performance targets have been defined based on stakeholder feedback and built on our strong track record. We define different metrics dependent on the engagement activity objectives or intended impact of projects. These will be shaped, challenged and delivered with stakeholders and scrutinised alongside our engagement.

To demonstrate our accountability, in addition to our established governance processes of reporting monthly to our executive team, our engagement commitment delivery will be reported on and published annually. This will be scrutinised regularly by the CEG and our citizens panel, which will receive quarterly updates against commitments, performance targets and the impact of our work from our engagement leadership team. This will hold us to account for delivering our commitments and ensure we continue to reflect a strong customer voice throughout our plan delivery.

Figure 3: stakeholder-led decision-making process



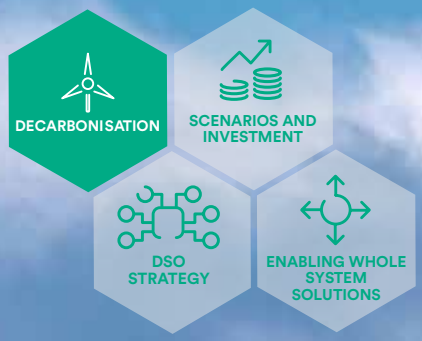
	Customer outcomes	Benefits	Deliverables	Output measure/[1] *indicative input measure*	ED1 to date	ED1 forecast	ED2 target
SE1	**Inclusive: ensure that our engagement reaches and includes a diverse range of individuals, groups, experts and locations that represent the communities we serve**	— Tailored support for community groups — Accelerate decarbonisation efforts — Support early understanding of sector-specific barriers and enablers for decarbonisation — Greater level of understanding of the energy transition journey — Improved resources and reach focusing on emerging, hard-to-reach and seldom-heard customers	**SE1.1)** Attend regional/municipal assemblies, panels, surgeries across our region **SE1.2)** Expand our community energy engagement offering **SE1.3)** Support individual communities with their decarbonisation efforts **SE1.4)** Continue to develop educational resources to raise awareness of the energy transition **SE1.5)** Dedicated resources for local energy groups to develop plans and access expertise across our region	**Independent assessment of inclusion and reach**	-	-	✓
				Regional engagement events p.a.	*6*	*6*	*18*
				Community energy engagement p.a.	*7*	*7*	*12*
SE2	**Accessible: increase the use of new communication channels, remove engagement barriers, and increase cooperation with a wide range of local organisations, so innovative thinkers and future customers access and contribute to our engagement[2]**	— Targeted advice/support for community and customers on low carbon technologies (LCTs) and flexible energy services — Improved collaboration and cooperation in engagement (reducing stakeholder fatigue) — Increased social media interactions, agile engagement and digital reach	**SE2.1)** Facilitate community and customer training programmes and surgeries **SE2.2)** Host three cross-utility forums p.a. **SE2.3)** Expand to host more industrial representative meetings p.a. **SE2.4)** Coordinate with DNOs/GDNs to consolidate events/forums, reducing stakeholder fatigue and improving outputs **SE2.5)** Enhance digital channels to increase presence on social media, text communications and website	*Community and customer capacity programmes*	2	2	**6**
				Cross-utility forums p.a.	1	1	**3**
				Industrial representative meetings p.a.	1	1	**4**
				Cross DNO/GDN forums p.a.	2	2	**4**
SE3	**Relevant: provide additional ways to discuss complex topics and tailor communication approaches so that we deliver engagement that promotes an understanding of priority topics such as decarbonisation and an inclusive energy transition**	— Provide a convening role for local area energy planning (LAEP) — Regional decarbonisation roadmap supporting the energy transition — A regular forum for local authorities to share good practice, problem solve and co-create to support their decarbonisation plans — Building more accurate, detailed scenarios with customer input to deliver an efficient and economic network — Support vulnerable customers, community leaders and customers to better understand decarbonisation and practical steps to take	**SE3.1)** Host four local energy planning forums p.a. **SE3.2)** Meet annually with each local authority, local enterprise partnership (LEP), and combined authority on the energy transition **SE3.3)** Host and coordinate quarterly regional decarbonisation working groups **SE3.4)** Host local authority forums to discuss decarbonisation plans and progress **SE3.5)** Run an annual programme to engage on energy scenario planning **SE3.6)** Deliver tailored communications for hard-to-reach and vulnerable customers explaining the benefits of the energy transition **SE3.7)** Introduce a digital 'ideas board' to improve energy services and transition planning	**Annual Distribution Future Energy Scenarios (DFES) refresh**	✓	✓	✓
				Local energy planning forums p.a.	*2*	*2*	*4*
				Formal local authority consultation p.a.	-	-	*100%*
SE4	**Continuously improving: continue to mature the skills, processes, infrastructure and capacity of communities, customers and our own teams to ensure engagement is two-way, measurable and transparent**	— Longitudinal insight mapping of stakeholder needs, priorities and their satisfaction — Impact-driven analysis delivering increased benefits for stakeholders — Build an innovative, best in class engagement programme based on insight from experts — Communications and engagement materials meeting the needs of all communities — Real-time performance engagement reporting to our customers and stakeholders	**SE4.1)** Undertake economic and social insight analysis to understand changing needs **SE4.2)** Respond to innovative thinkers in engagement, ensuring we aren't satisfied with the traditional ways of doing things **SE4.3)** Annually review our communications assets to increase visual impact and simplify language for all community needs **SE4.4)** Introduce a digital performance scorecard to report progress and impact of our engagement	**Stakeholder satisfaction survey**	**85%**	**85%**	**90%**
				AA100 Stakeholder Standard Accreditation	✓	✓	✓

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 Customer Service (CS1) KPI – Count of digital contact channels.

Innovation | Data and digitalisation | Workforce Resilience

OUTPUTS – DELIVERING AN ENVIRONMENTALLY SUSTAINABLE NETWORK



Decarbonisation

By 2028 the energy system will need to be ready to serve a different world.

Our network is set to play an even more crucial part in the life and wellbeing of our region.

In one of the most ambitious national responses to the threat of climate change, the UK government enshrined the net zero by 2050 target in law in 2019 and accelerated it again to 78 per cent by 2035 in response to the advice of the Climate Change Committee (CCC) in setting the Sixth Carbon Budget. By the end of the 2023-28 period, the country needs to be well on the way to a decarbonised energy system to achieve this – and our network is at the heart of how it will be delivered. To support these targets, the government published its Net Zero Strategy[1] and Heat and Buildings Strategy[2] in October 2021, building on the Ten Point Plan for a green industrial revolution published in November 2020.[3] These strategies include commitments to:

- Subject to security of supply, power the UK entirely by clean electricity by 2035;
- end the sale of new petrol and diesel cars by 2030, and hybrids by 2035;
- end the sale of new gas boilers by 2035; and
- install 600,000 heat pumps (HPs) annually by 2028 across the UK.

How much it will cost

2023-28 expenditure (annual) **£169.9m**
25.7% of totex

£147.8m ex-ante
£22.1m uncertainty mechanisms

versus 2015-23 **+£128.9m**
+314.4%

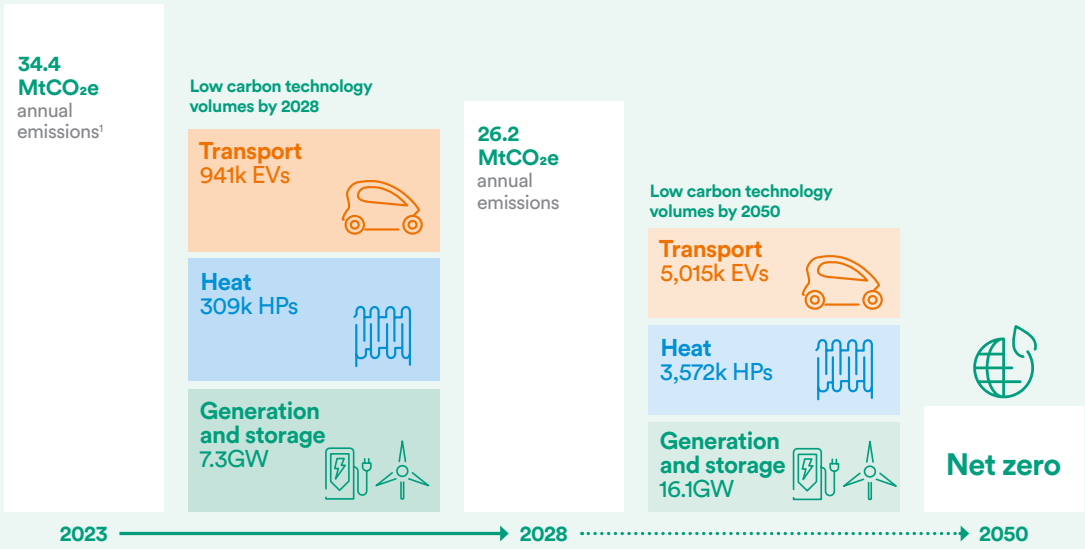
> **Our plan delivers on the call for action from our stakeholders with an ambitious £1bn of investment to support our communities on the way to net zero emissions.**

Jim Cardwell
Head of policy development

1. Net Zero Strategy – assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1028157/net-zero-strategy.pdf
2. Heat and Buildings Strategy – assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1032119/heat-buildings-strategy.pdf
3. See The Ten Point Plan for a Green Industrial Revolution – November 2020.

Setting the scene

Decarbonising the energy system



It is clear that other government policies are set to drive rapid change in the rate of low carbon technology (LCT) uptake during our next price control period.

The precise blend of what technologies will emerge and at what pace is not known, but the outcome is clear: there will a major shift in energy use, and our network will be instrumental in that being possible.

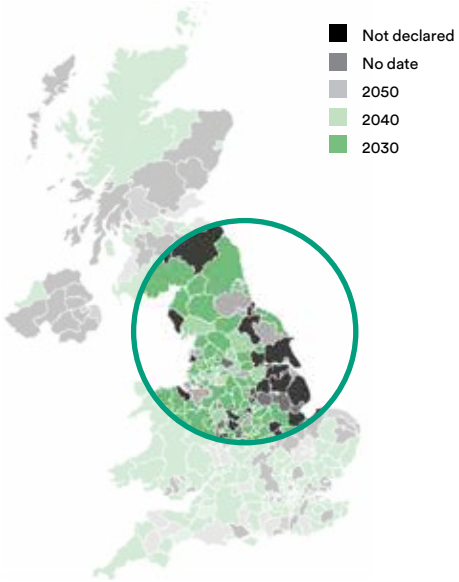
It is also clear that, whatever pathway ultimately emerges, this next decarbonisation phase is focused on the growth in low carbon electricity at the local, lower voltage end of our network – be that HPs, electric vehicles (EVs) or community energy.

Local authorities across the UK, including those in our region, have declared climate emergencies and set their own targets for establishing Clean Air Zones and building efficiency standards. These are in many instances more ambitious than the nationwide target and can increase the pace of decarbonisation by further incentivising the uptake of LCTs.

Climate emergency declarations and dates for net zero ambitions for local authorities

Around three quarters of our region's local authorities and combined authorities have declared climate emergencies – with around 60 per cent having their own net zero targets sooner than 2050, some as early as 2030.

In 2020 Newcastle became one of 88 cities to make the Carbon Disclosure Project's 'A List' of global cities leading on climate adaptation following plans to reduce energy use in homes by 30 per cent, and install solar panels on 30 per cent of homes and 60 per cent of non-domestic properties.[2]



Newcastle City Council is also installing 250 HPs in homes across the city.[3] The industrial cluster of Humberside is pioneering leading green innovation through the Zero Carbon Humber partnership, which plans to create 49,000 green jobs by 2027, and Associated British Ports' completion of the UK's largest rooftop solar array at 6.5MW atop the Port of Hull.[4]

1. Megatonnes (Mt) of carbon dioxide (CO_2) equivalent (e) (MtCO2e).
2. Newcastle CDP's 'A List' cities – https://www.edie.net/news/6/Which-UK-cities-are-leading-on-climate-action---and-how-/
3. Newcastle City Council heat pump scheme – www.newcastle.gov.uk/heatpumps
4. Yorkshire net zero industry hub to create up to 49,000 jobs – www.yorkshirepost.co.uk/business/associated-british-ports-unveils-uks-largest-solar-panel-set-3041001 and ABP Hull completes UK's largest rooftop solar array – www.businessgreen.com/news/4023552/drax-yorkshire-net-zero-industry-hub-create-49-jobs

Four key questions

The answer to these questions will largely be driven by consumer choices and government policy around decarbonisation. Here we are setting out our plans to ensure that we manage and build our network to be ready to deliver decarbonisation and embrace the uncertainty surrounding these choices.

How electrical?

- Electricity today is increasingly generated from low carbon sources. The UK's renewable electricity outpaced its fossil fuel generation for the first time in 2020 with 41 per cent of electricity generated from renewable sources, and a new record of 67 consecutive coal-free days was reached.
- The electrification of some sectors of the economy is a relatively straightforward way to use low carbon energy. We will all rely on electricity more to provide energy, but we don't yet know to what extent.
- This depends on policy decisions that are made by the government about the energy system as a whole, for example whether heat is provided by electric HPs and/or hydrogen boilers. This will be uncertain for some time.

How local?

- In a local, decentralised energy system, engaged users and producers of electricity promote efficient use of every kilowatt hour of green energy generated. Overall, this means that electricity should be more affordable for all.
- We are connecting more locally distributed renewable generation to our network and connecting local buyers and sellers of electricity to each other. In the next price control period, we expect the amount of connected generation and storage to more than double.

How flexible?

- More intermittent energy generation sources such as solar and wind, and more flexible customer demand for power, means that our role is increasingly about controlling and optimising the bidirectional flow of low carbon energy through our network.
- The amount of customer flexibility will drive how much additional capacity we need to add to our network, and how big the whole energy system needs to be (for example, the number and type of power stations), by flattening peaks in demand and generation.
- We have a flexibility-first mindset. This entails prioritising flexibility solutions where we can and only implementing network solutions where flexibility is not viable.

How fast?

- How quickly we reduce carbon emissions will be heavily dependent on the rate at which renewables displace energy generation from fossil fuels, and how quickly customers take up LCTs for transport and heat.
- Different parts of our region will transition at different speeds based on a range of factors, including the location of carbon intensive industries and population demographics which are likely to affect people's willingness and ability to adopt new technologies.
- Total greenhouse gas emissions – the 'area under the curve' – are more important than the point in time when net zero is achieved.

Figure 1: illustrative impact of customer flexibility on gross peak demand (GW)[1]

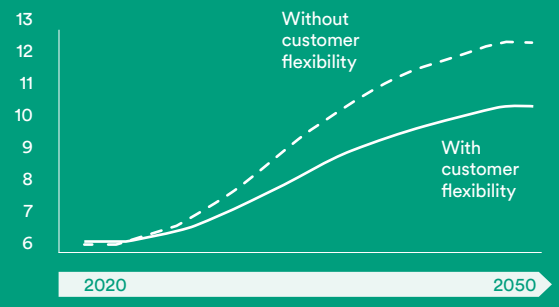
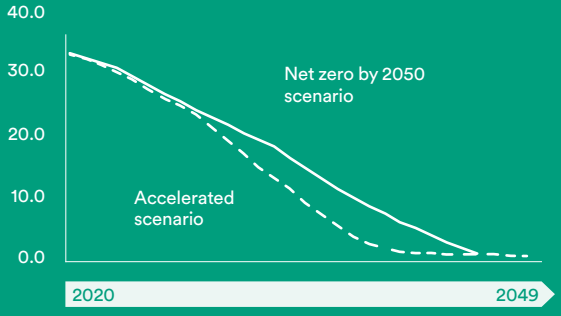


Figure 2: illustration of annual carbon emissions ($MtCO_2e$)



1. Gigawatt (GW).

Optimising our investments

To optimise our investment to 2050, we are taking a flexibility-first approach to our investment strategy for decarbonisation.

The next five-year period marks a key phase of the low carbon transition. Our overall objective is to deliver efficient investment in our network to set us on the right track for achieving the UK government's net zero goals, while remaining able to adapt our plan to changing requirements in the longer term. Our challenge is to make rapid progress but remain able to adapt to an evolving decarbonisation landscape.

As we shared with our stakeholders in our Emerging Thinking consultation published in August 2020, flexibility first means that, wherever it is possible and cost-effective, we will prioritise investment in activities to facilitate and optimise customer and network flexibility ahead of more costly traditional reinforcement. All routes to decarbonisation require significant investment in our network. Taking a flexibility-first approach is a means to ensuring that this investment is targeted where our network needs it most and is delivered efficiently to maximise value for customers.

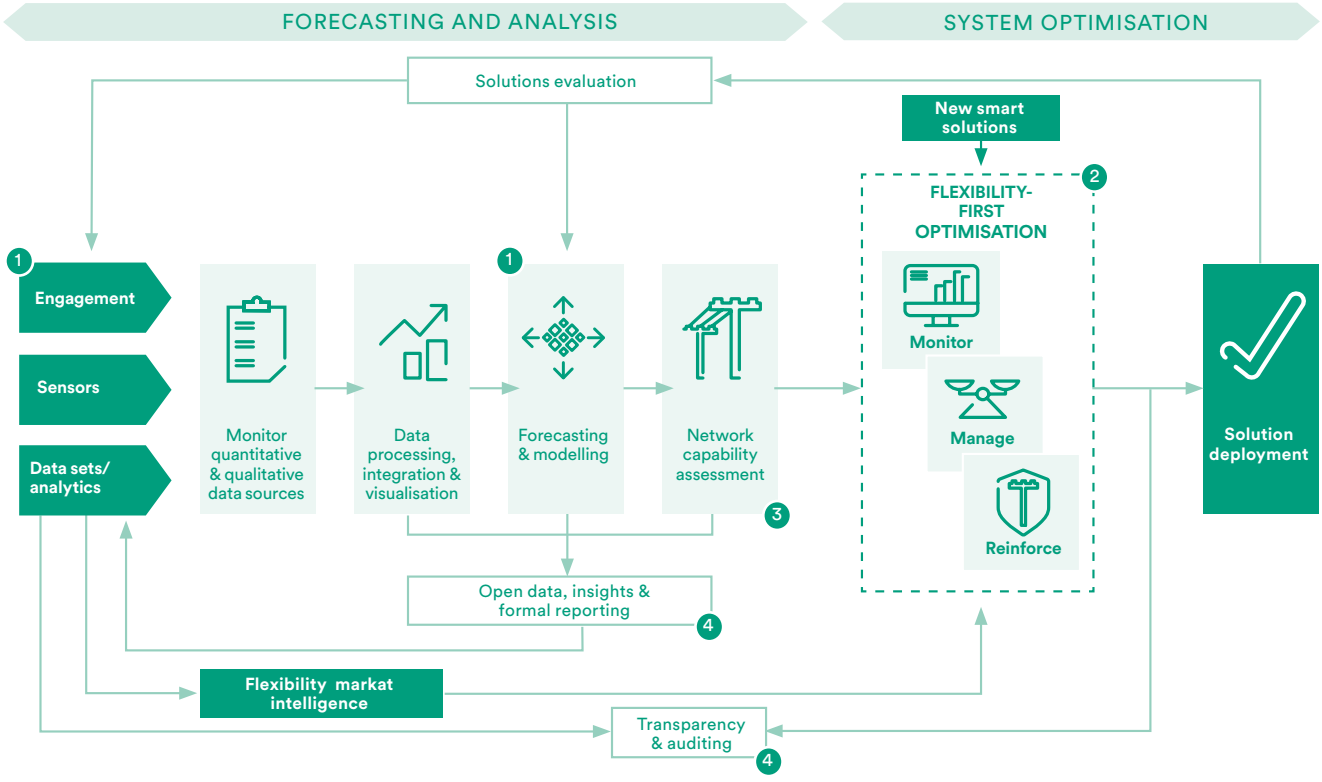
The diagram below shows the generic process that we use for planning and operating the distribution system using a distribution system operation (DSO) approach. We've used this approach to create our business plan and we will continue to iterate the process across the 2023-28 period to respond to the changing external environment, validating the decarbonisation pathway as it unfolds and optimising our response to it. Over the following pages we set out in more detail how our DSO enablers underpin improvements in organisational capabilities across our processes for developing new flexibility markets, investing in innovative smart grid initiatives and network upgrades, developing our people, and implementing leading edge information and operating technology systems. These will deliver efficiency and optimisation benefits to provide open data and operate a smart flexible network. This includes implementing innovative solutions that we and other DNOs have developed while seeking opportunities to embed learning from innovation over the course of the next price control.

Delivering net zero: planning and operating the network

(1) We're developing forecasting methods that represent a shift from a traditional approach to scenario-based forecasting. This has been developed in conjunction with other industry parties to produce Distribution Future Energy Scenarios (DFES), which will continue to evolve over 2023-28. This process will use both qualitative and quantitative data which will link into rich feedback from a new team of regional advisors we plan to establish, to work with local authorities on their regional energy plans

(2) Our flexibility-first approach looks to harness customer flexibility in conjunction with other industry players, leveraging the benefits of time of use tariffs and energy efficiency while developing DNO-contracted flexibility markets.

Our monitor, manage, reinforce approach is described in further detail overleaf



(3) Improvements in network visibility are key to ensuring that we stay ahead of the curve of the decarbonisation pathway, respond in a cost-effective way and are not a barrier to our customers wishing to connect LCTs. An increase in the volume of sensor data from the network and smart meters, and the process of turning of that into informative data sets underpins our open data and network capability assessment. More detail is included in our network visibility strategy annex

(4) Providing transparency in our network needs, we create opportunities for third party commercial developments, sharing our data in an open manner and demonstrating our investment decision making is appropriate and cost-effective

Our flexibility-first approach comprises a blend of solutions to **monitor** what is happening on our network, **manage** capacity where possible, and **reinforce** by building more capacity where necessary.

1 Monitor

Monitoring

- Leverage investment in monitoring to provide visibility of capacity constraints
- Allows us to know exactly what is happening on the network

2 Manage

Network flexibility
(deploying smart grid solutions)

- Operate an active local network, using real-time data to automatically reconfigure or adjust settings and release capacity when it is needed

Customer flexibility

Distribution Network Operator-contracted customer flexibility

- Incentivise customers directly (or indirectly) to either increase or reduce their electricity use or production
- Includes active network management (ANM) flexible connections

Energy price-driven customer flexibility

- Customers respond to information and price signals in their electricity bills from energy suppliers by flexing their consumption patterns

3 Reinforce

Build additional capacity

- Where there is most certainty for future growth, we reinforce our physical assets by replacing or upgrading cables, switchgear and substations to expand the capacity of our network in response to load growth
- This could be after exhausting steps one and two at a given location on the network, or it could be the first and most economic solution
- Reinforcement supports customer flexibility and whole system solutions by providing capacity for low carbon energy to be moved to where it is needed locally, and to enable customers to optimise their usage

Distribution System Operation (DSO) enablers

To ensure we are equipped to continue to keep all options open on the decarbonisation pathway to 2028 and beyond, we are also planning investment to enable our region to go further, faster.

In our decarbonisation plan...

- This means spending to stimulate the flexibility market for future price controls to optimise how much traditional reinforcement we can defer or avoid.
- Investing in the development of a deep and liquid market for flexibility today will ensure efficient investment and option value in managing our network as decarbonisation accelerates into the 2030s.
- This is described in more detail in the Scenarios and Investment and DSO Strategy sections that follow.

In our plans to maintain our assets...

- This means upsizing our equipment to fit larger cables when we are already intervening to make repairs or replace our assets.
- This ensures that our assets are 'net zero ready'. Where possible, we plan to only intervene with our assets once between now and 2050. For further details see our Asset Resilience strategy plan section.

Our investment plans for 2023-28 are geared to facilitate our region's plans to decarbonise.

To respond to the four key questions (how fast, flexible, electrical and local will the energy transition be?), we need to invest in our network, our people and our systems to revolutionise the service that we offer our customers as we transition to a low carbon energy system. In order to do this, we have created a plan with three key elements of decarbonisation investment.

Scenarios and Investment:

£516m

2023-28

Consideration of the possible energy pathways that could unfold in our region

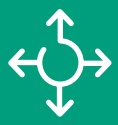
In response to these pathways, we set out what investment we need to make on our network to keep all pathways open to ensure our network is ready for LCTs being connected in the future

DSO Strategy:

£92m

2023-28

Investment in systems and skills to harness data and flexibility of our network and our customers, to facilitate optimised investment in the grid



Enabling Whole System Solutions:

£15m

2023-28

Alongside an investment strategy that favours solutions that optimise the whole energy system where efficient, we set out our plans to collaborate and explore initiatives to deliver whole energy systems benefits to customers into future price controls

We have also made provision for costs to support decarbonisation across our plan, including in Asset Resilience to fit 'net zero ready' equipment when we are already intervening on our network; Connections to support the uptake of low carbon technologies (LCTs) being connected to our network; Customer Service; and indirect support costs. Our decarbonisation plan plus this additional investment is £184.8m more p.a. than we spend today and is essential for adapting our business to facilitate decarbonisation.

Our plans to prepare our network for decarbonisation have been devised through working with a wide range of customers and stakeholders, building on our DSO v1.1 development plan published in October 2019, Emerging Thinking in August 2020, and Distribution Future Energy Scenarios (DFES) in December 2020.

Over the following pages we set out the details of these stakeholder-led plans for Scenarios and Investment, DSO Strategy, and Enabling Whole System Solutions. At £170m p.a., our decarbonisation across 2023-28 represents a 314 per cent increase on what we have spent in the 2015-23 period on decarbonisation enabling activities. See our Costs section for more information.

Figure 3: decarbonisation investment summary per annum, 2023-28

£m annual	Scenarios and Investment	DSO Strategy	Whole System	Total decarb.	Indirect costs associated with decarbonisation	Decarbonisation plan	*Other output areas*[1]	*Total*
Flexibility first: monitor and manage	2.0	18.5	3.1	23.6				
Reinforce	100.4	-	-	100.4				
Go further faster	0.6	-	-	0.6				
Total	**103.1**	**18.5**	**3.1**	**124.7**	**45.2**	**169.9**	***55.9***	***225.8***

1. Incremental investment in ED2

We will deliver a smarter, more flexible energy system.

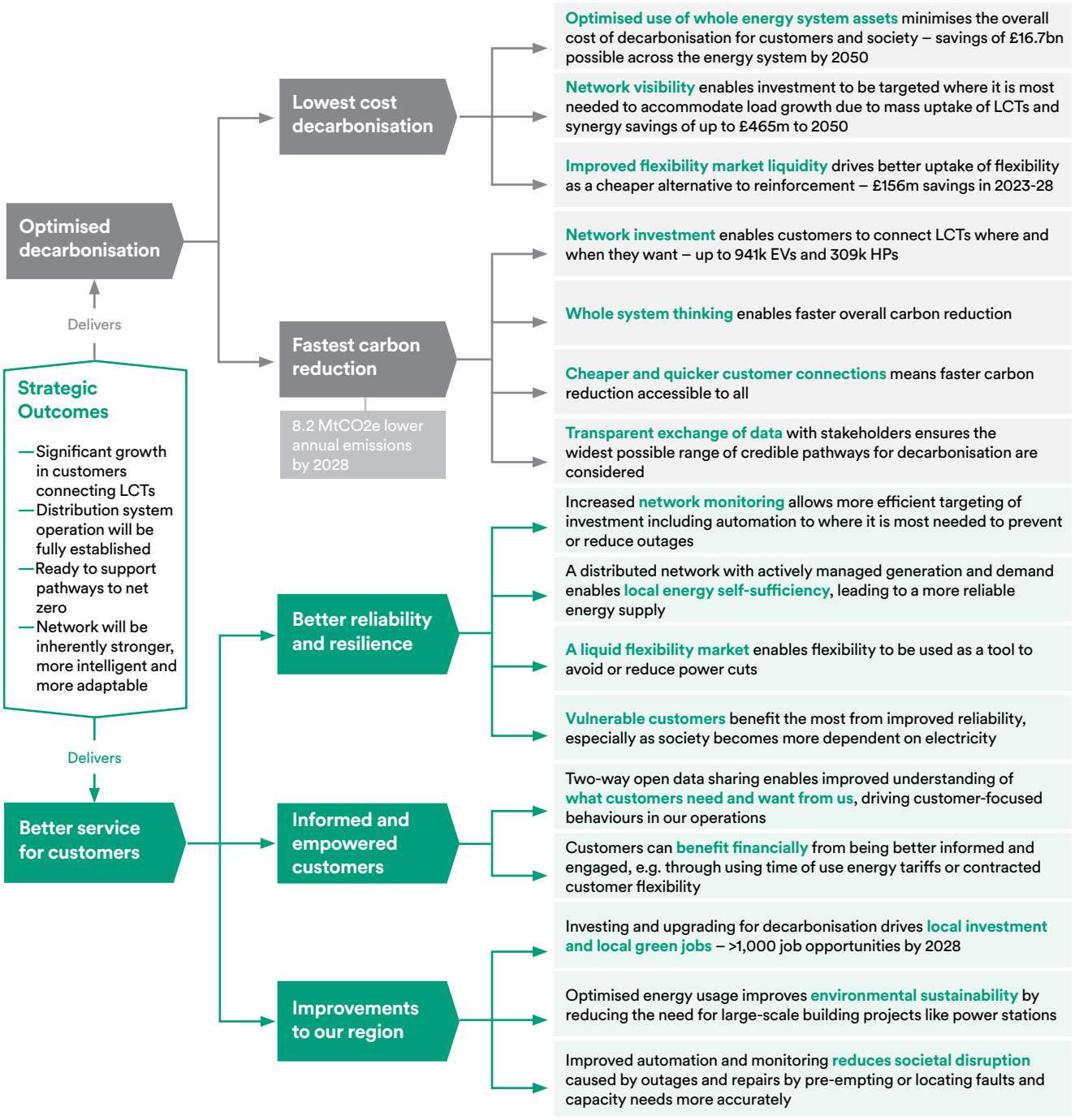
We've set out four strategic outcomes for our 2023-28 business plan, which aim to achieve the overall objective of a smarter, flexible energy system:

- Significant growth in customers connecting LCTs.
- Distribution system operation will be fully established.
- Ready to support pathways to net zero.
- Network will be inherently stronger, more intelligent and adaptable.

Our decarbonisation plans to invest £225.8m p.a. are central to achieving these strategic outcomes. Overall, our 2023-28 plan will benefit our customers by enabling optimised decarbonisation as well as a better service for customers. The diagram below shows the range of benefits that our plans will deliver.

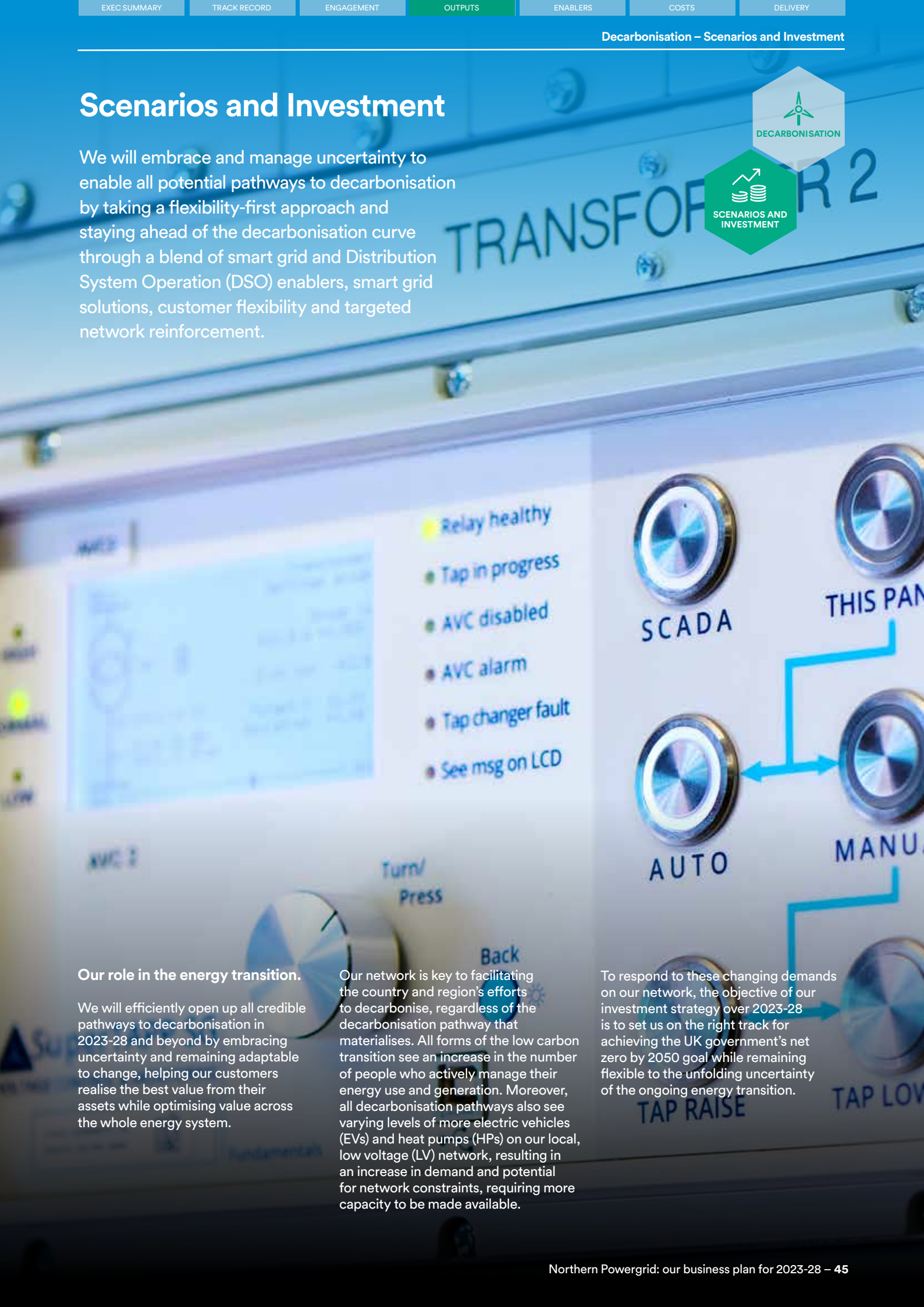
Delivering these benefits is our touchstone for the 2020s and beyond as we approach net zero emissions – some will be achieved in this next period and others will take longer. Our investment and activities described throughout this plan will all contribute to these significant energy system customer benefits.

A net zero ready, smart, flexible energy system



Scenarios and Investment

We will embrace and manage uncertainty to enable all potential pathways to decarbonisation by taking a flexibility-first approach and staying ahead of the decarbonisation curve through a blend of smart grid and Distribution System Operation (DSO) enablers, smart grid solutions, customer flexibility and targeted network reinforcement.



Our role in the energy transition.

We will efficiently open up all credible pathways to decarbonisation in 2023-28 and beyond by embracing uncertainty and remaining adaptable to change, helping our customers realise the best value from their assets while optimising value across the whole energy system.

Our network is key to facilitating the country and region's efforts to decarbonise, regardless of the decarbonisation pathway that materialises. All forms of the low carbon transition see an increase in the number of people who actively manage their energy use and generation. Moreover, all decarbonisation pathways also see varying levels of more electric vehicles (EVs) and heat pumps (HPs) on our local, low voltage (LV) network, resulting in an increase in demand and potential for network constraints, requiring more capacity to be made available.

To respond to these changing demands on our network, the objective of our investment strategy over 2023-28 is to set us on the right track for achieving the UK government's net zero by 2050 goal while remaining flexible to the unfolding uncertainty of the ongoing energy transition.

A comprehensive response to the transition

Our response to the transition has been developed through comprehensive engagement with our customers and other stakeholders.

To deliver a business plan that meets the wide-ranging needs of our stakeholders we have engaged with as broad a range of stakeholders as possible, including not only those in the energy sector (regulator, Electricity System Operator (ESO), other Distribution Network Operators (DNOs)) but also the heat and transport sectors, local authorities, and a range of industrial, commercial and residential customers. We recognise that the transition will be customer-driven and we have, therefore, sought feedback from our customers in particular to ensure that our strategy will empower them to lead the change. In planning our investment, we will continue our effective coordination across stakeholders to ensure efficient investment from a whole system perspective. You can read in more detail about our plans in this area in the DSO Strategy and Enabling Whole System Solutions sections.

Our stakeholder engagement has revealed a high level of ambition for decarbonisation. A significant majority of our customers support that we should pursue an accelerated decarbonisation pathway, reaching net zero by 2050 at the latest. Given the uncertainty of national and local energy developments, as well as diversity in local net zero targets, stakeholders are overwhelmingly in favour of us choosing a scenario in our investment planning that would facilitate any decarbonisation pathway that emerges. They have conveyed an appetite for us to be ambitious in our net zero planning to enable a faster transition to net zero that is socially equitable and does not put vulnerable and fuel-poor customers at a disadvantage.

We have incorporated our stakeholders' feedback when considering possible future scenarios for our region, in determining our assumptions around customer flexibility, and in designing sensitivities to test the robustness of our investment plan.

Putting a flexibility-first mindset into practice.

We've already made it clear that we see the use of flexibility as a fundamental means to efficiently manage well-targeted network utilisation and reinforcement needs. Optimising flexibility enables us to manage peaks in generation and demand on our network, which means we can get the best value out of our existing network and the investments we make, maximising cost efficiency for all customers.

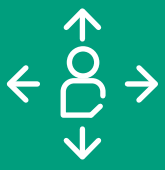
Flexibility will manifest itself in different forms – and we need to be ready to harness them all.

We want all of our customers to be able to financially benefit from offering flexibility to the energy system. From a whole energy system perspective, effective use of network and customer flexibility will also enable customers' energy bills to be kept as low as possible on the low carbon transition by optimising the use of existing infrastructure and driving efficient investment across the whole energy system.

Ongoing stakeholder engagement will help develop our understanding of market needs and help us provide targeted support to stimulate deep and liquid local markets for flexibility. Effectively adapting our business and driving this market development is at the heart of our DSO Strategy.

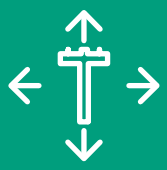
Types of flexibility

DNO-contracted customer flexibility – flexibility services: customers contract with us and we pay them to turn up or down their demand or generation at specific times or under particular circumstances.



Price-driven customer flexibility: customers respond to price signals in their energy tariffs to flex their energy usage patterns. For example, time-of-use tariffs for domestic and commercial customers will incentivise energy usage to off-peak periods when demand is lower, or the use of smart charging for EVs to shift consumption patterns to when there is a surplus of green electricity available.

DNO-contracted customer flexibility – flexible connections: we offer customers a cheaper, faster connection in a constrained area of the network using techniques such as active network management (ANM), which enables us to curtail generation at peak times. We will have four ANM zones in operation by 2023 with an estimated 540MW of flexibility.



Network flexibility: we will continue to invest in smart grid solutions and field-based equipment that will allow us to operate the local network in a more active manner, enabling us to use near real-time data to automatically reconfigure or adjust settings to optimise the power flows on our network and release capacity where needed.

Our progress so far

We have already taken significant steps in preparing for this transition.

A number of our current initiatives are supporting the transition to net zero. In the current price control period we are investing in our flagship smart grid enablers programme, creating the backbone of a smart grid, which is transforming our ability to monitor, control and communicate with our field-based equipment. It allows us to operate the local network in a more active manner and to use near real-time data to automatically reconfigure or adjust settings to release capacity to where it is needed. This has improved our ability to respond to the take-up of low carbon technologies (LCTs) and allowed us to operate our network more flexibly with smarter, more efficient and cost-effective practices and technologies.

Through this increased monitoring we have improved data capture about our network and improved processes for using this data in our decision making, enabling us to target network investment efficiently. We are committed to further modernising our data management practices and sharing information about our network with stakeholders, building on what we share today through our embedded capacity register and our open data platform for our Distribution Future Energy Scenarios (DFES), which are published annually through Open Innovation (formerly ODI Leeds).[1] You can read more about our plans to share and combine our data with external sources (such as smart meters) in the DSO Strategy and Data and Digitalisation strategy.

Since 2015 we have facilitated more than 45,000 LCT connections including HPs, EVs, solar and other distributed generation across our primary and secondary networks, totalling at least 1.5GW, and ensured that our network is ready for this additional demand and generation load.

In May 2021 we published our Green Recovery plans to invest a further £53m[2] to unlock network capacity for green-growth-boosting projects across our region. This is part of a national Green Recovery Scheme, making £300m[2] available for investment in vital electricity networks across the country following the economic impact of the COVID-19 pandemic and will enable the region to accelerate a number of projects, including regeneration and development at the Humber Freeports, large-scale solar and wind generation, and rapid EV charging on our motorway network.

Network utilisation is increasing as consumption and generation patterns evolve.

Net maximum demand has dropped by around 24 per cent since its peak in 2005-06. This trend has been driven by increased energy efficiency and a series of economic events such as the global financial crisis, which affected heavy industrial demand, and increasing amounts of domestic generation such as solar photovoltaics (PV) embedded within our network.

Commercial generation on our network that operates at times of peak demand has also increased each year, which has contributed to the widening difference between net and gross peak demands year-on-year. This has not, however, happened in a uniform fashion across our network. We still have challenges to address, particularly with notable load growth occurring in some of our metropolitan areas and (where embedded generation patterns have changed) an increase in net demand. For this reason, we need to understand and manage the changing nature of demand and generation at a more local level.

Network utilisation, measured at a more granular level than network-wide peak demand, has remained relatively stable throughout the current price control period. We monitor this using large data sets on Load Index (LI) utilisation bands, which assess peak demand versus firm capacity at major substations Our strategy has been to maintain our overall risk position, dealing with highest risk substations (those closest to capacity). Our forecast for the end of 2015-23 has been updated to align with our new planning scenario and the latest network impact assessment done as part of this plan.

Our forecast LI position at our major substations is:

- 88 per cent are less than 80 per cent utilised;
- 10 per cent are 80-99 per cent utilised; and
- two per cent are more than 99 per cent utilised.

You can find further detail in the Scenarios and Investment annex. Looking ahead, the projected increase in EVs and heat pumps discussed below are expected to increase the utilisation quite significantly.

It is important to note that headroom at 132kV/EHV level on the network does not necessarily mean that there is capacity available at a lower voltage levels – in the same way the motorway might be quiet while access roads are busy. We expect that customers connecting greater volumes of LCTs during 2023-28 will drive the greatest need for investment on the local networks operated at LV compared to other voltage levels. See our Scenarios and Investment annex for further detail.

For generation, we provide information to customers setting out the network utilisation for our major substations. We currently have the capacity to connect a typical smaller (5MW) generator to 88 per cent of our primary substations (this would only be possible at 39 per cent without customer flexibility solutions such as ANM). Ninety-five per cent of our largest substations could accommodate a typical generation connection of 25MW when customer flexibility is used (51 per cent without). This means that capacity exists for cost-effective new generation connections on around 90 per cent of our extra high voltage (EHV) and high voltage (HV) network.

1. Open Innovation (formerly ODI Leeds) is a pioneer node of the Open Data Institute. Our DFES are published on its site here: odileeds.github.io/northern-powergrid.
2. 2012-13 prices

Planning the journey towards a low carbon future

1. The potential needs: Scenarios and pathways

A set of credible future pathways to enable us to picture possible energy futures and explore the issues they raise, including:

- Three National Grid Future Energy Scenarios (FES),[1] and our DFES.[2] (Note: one of the FES does not meet net zero by 2050 and, therefore, is discounted.)
- Three pathways described in the Climate Change Committee (CCC)'s Sixth Carbon Budget.[3]

Each scenario is made up of a range of inputs about variables in the energy system including low carbon technology (LCT) uptake, generation, energy efficiency, etc.

Input assumptions are informed by government policy, stakeholder engagement, regional knowledge and market information.

From this range of inputs identified, we create a hypothesis about the set of input assumptions that we believe represent our best view based on a set of principles (described later in this section). This is our Planning Scenario.

We are able to design this hypothesis as a result of the iterative ongoing feedback loop process of DFES and stakeholder engagement over a number of years, refining and updating our range of assumptions regularly.

OUTPUT: a set of input assumptions, LCT projections and gross maximum network demand for a range of scenarios

2. The baseline need: Planning Scenario

We model our Planning Scenario to test our hypothesis against the principles that we have identified for what constitutes our best view.

It is aligned to latest government policy and adopts a balanced approach over the 2023-28 period in line with recommendations from the CCC.

OUTPUT: a set of input assumptions, LCT projections and gross maximum network demand for a Planning Scenario

- **Sensitivity testing** to help us understand the impact of uncertainties around key scenario input assumptions, and how they drive different LCT projections and gross peak demand
- Testing helps refine and iterate our input assumptions as we test our Planning Scenario hypothesis

3. Solutions: Investment plan

Network impact assessment driven by the assumptions in the Planning Scenario about network load growth in the 2023-28 period and customer-connected LCTs.

Optioneering around solving network constraints by a mix of price-driven and DNO-contracted customer flexibility, network flexibility and conventional network reinforcement, to determine network investment required in 2023-28.

Testing of investment across range of potential scenarios and capturing synergies with other investment drivers.

OUTPUT: a set of network intervention costs required to address network needs presented by the Planning Scenario in the 2023-28 period

- **Sensitivity testing** to determine the cost impact of changing scenario input assumptions
- Analysis to cost up the reference scenarios
- Deliverability assessment

1. See: nationalgrideso.com/future-energy/future-energy-scenarios. Our scenarios analysis is based on National Grid's FES 2020. As part of the annual FES/DFES cycle, we are working on our DFES 2021 which reflects National Grid's FES 2021, which includes its latest assumptions about future energy pathways. Our DFES 2021 will be published separately in due course, which will provide a view on the impact of the updated assumptions in FES 2021.
2. See: northernpowergrid.com/asset/0/document/5836.pdf.
3. See: theccc.org.uk/wp-content/uploads/2020/12/The-Sixth-Carbon-Budget-The-UKs-path-to-Net-Zero.pdf.

Step 1
Scenarios and pathways

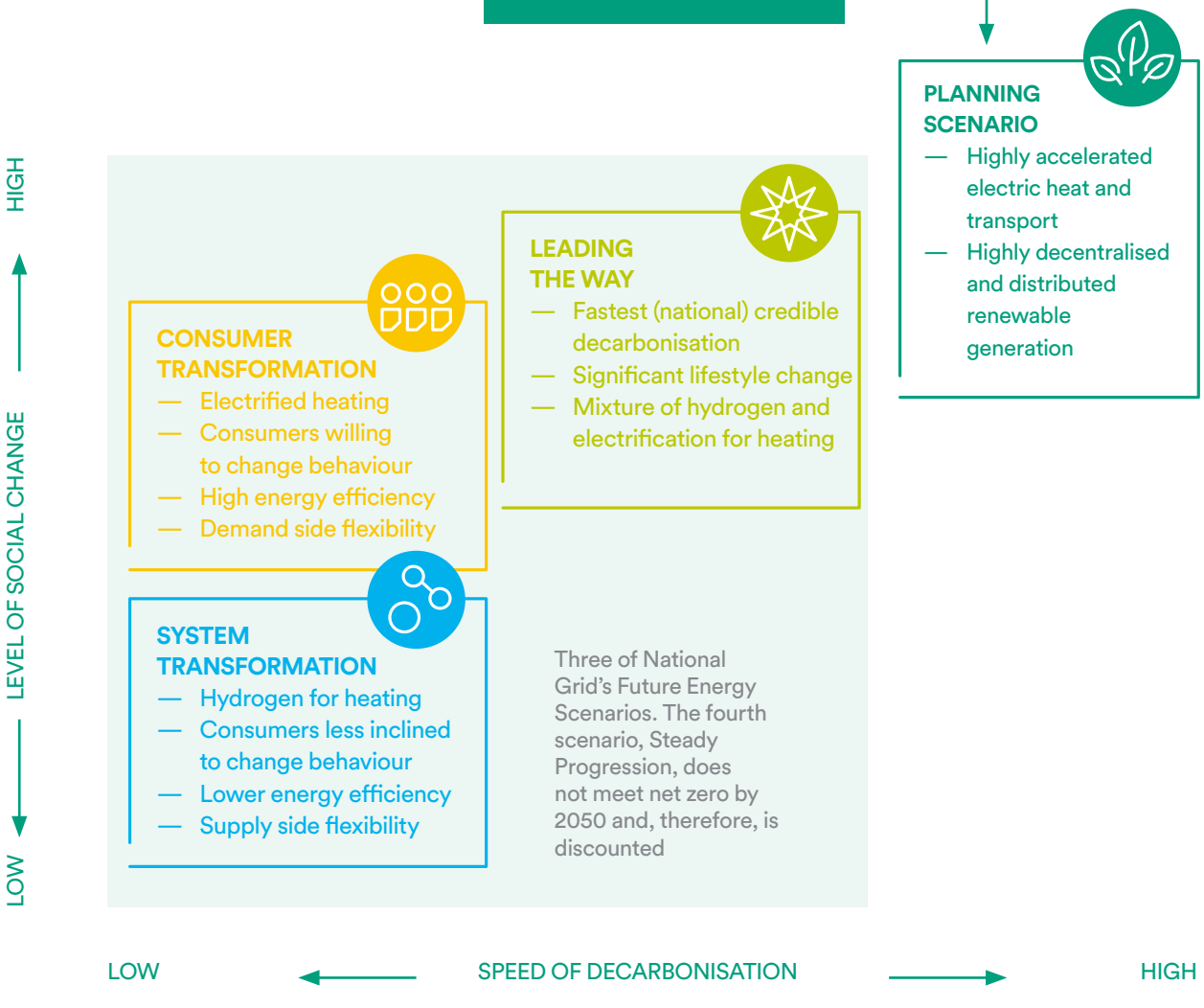
We have developed a range of scenarios to forecast possible decarbonisation pathways to net zero. These scenarios range from high electrification in the heat and transport sectors to other possible states of the world where alternatives to natural gas such as hydrogen are expected to play a greater role.

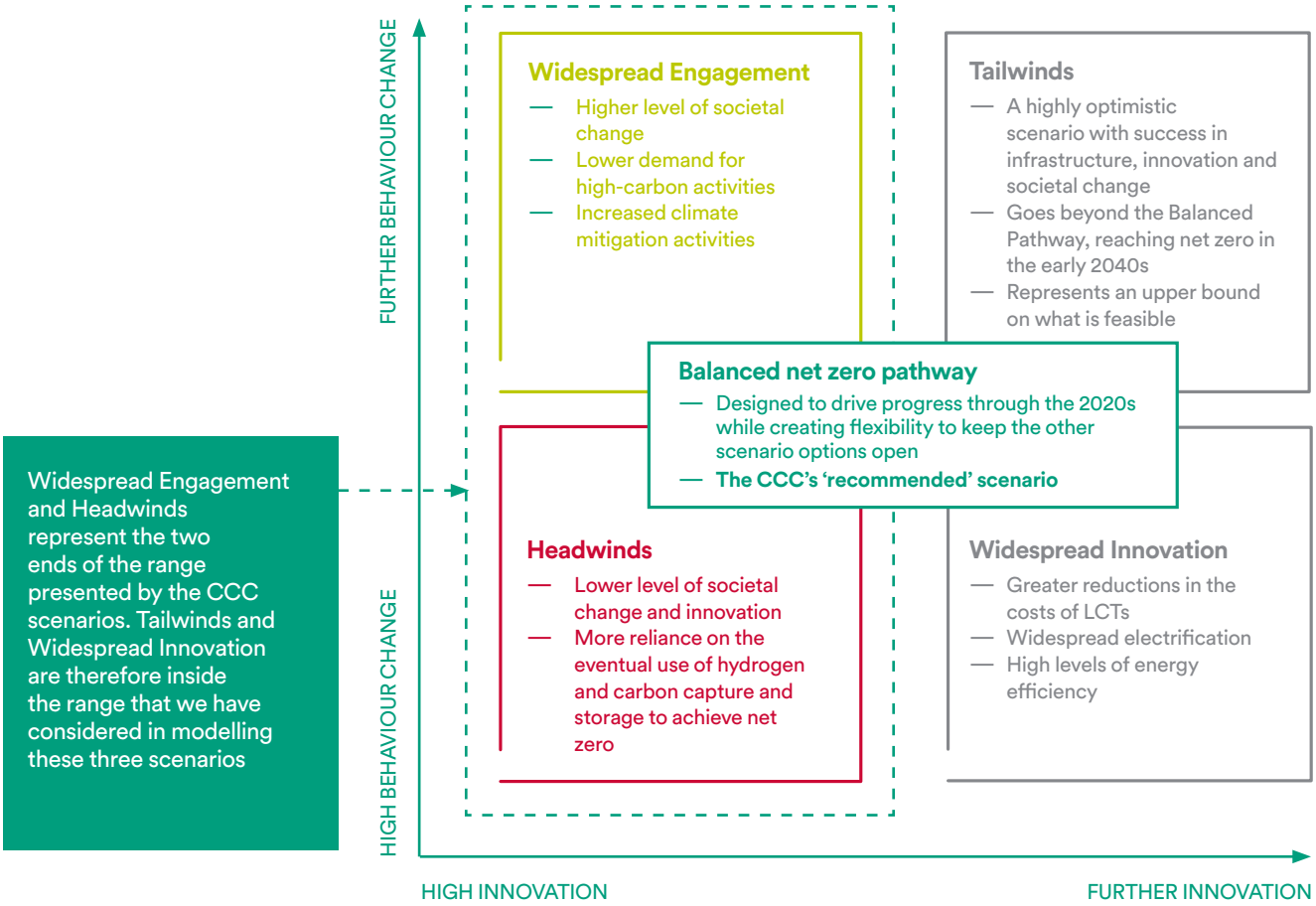
Our range of scenarios includes:

- Four DFES scenarios, covering three regional scenarios based on the National Grid FES developed at the national GB level, and one scenario developed by us.
- Three additional scenarios based on pathways identified in the CCC's Sixth Carbon Budget (Balanced Net Zero, Widespread Engagement and Headwinds). Three of the CCC scenarios are very similar so we have modelled the ends of the CCC range, therefore covering all five scenarios.

Speed of decarbonisation against level of societal change

The Planning Scenario was a scenario devised by us for DFES 2020 in response to our stakeholders' desire for rapid decarbonisation





These seven scenarios have helped inform our Planning Scenario and together comprise the set of future energy pathways that we have considered as part of our business planning process.

Our scenarios are built by considering assumptions about a range of building blocks, including EVs, HPs and energy efficiency and applying them to our electricity network between now and 2050, to create a scenario-based load growth model.

The DFES scenarios use inputs from National Grid's FES in conjunction with regional knowledge and bottom-up assumptions to build a regionalised view of the scenarios. The range of CCC scenarios has been translated from national pathways to our region. As part of this process, we scaled down the CCC's nationwide EV and HP uptake scenarios to our licence areas to create scenarios applicable for our region.

You can read in more detail about the approach we took to modelling the scenarios, the assumptions used and outputs of the range in the Scenarios and Investment annex (4.1).

Our scenario development has been influenced by regional knowledge, stakeholder input and other published data.

We have worked with industry partners and undertaken extensive customer engagement and industry consultation to ensure that the scenarios meet local aspirations. To ensure national coordination in the delivery of the decarbonisation agenda, we engage regularly with the ESO, in particular through the annual FES and DFES feedback loop, which ensures national and regional projections are iterated and aligned regularly. Additionally, feedback from regional stakeholders, including local authorities and industrial customers on our assumptions, informs our scenario modelling.

Refining our view through stakeholder engagement

Stakeholder engagement

Energy scenarios: industry representation in the ENA's Open Networks and FES

Making it local: analysis informed by wide range of local sources (as below)

Engage on scenarios: engagement and feedback on Emerging Thinking net zero scenarios

Launch and inviting feedback: show outputs and seek feedback

Stakeholder validation: virtual workshops to explore scenarios

Defining the scenarios

Capture regional growth in each scenario

- Evidence base and stakeholder engagement
- Customers
- Local authorities
- Local enterprise partnerships
- Local housing planning
- Local energy strategy
- Local economic and industrial strategy

Production of forecasts

Stage 1:
- Baseline (historical data, base year)

Stage 2:
- Pipeline (planned developments, connections, network planning information)

Stage 3:
- Long-term growth (zero carbon targets, local area energy plans)

Forecast outputs

- Demand, generation, storage
- Seasonal outputs
- Daily/half-hourly profile

Publication

- DFES report
- Open data – ODI website
- Heat map visualisations
- Regional data availability

Establishing our scenarios and pathways

The results of our modelling present a range for the expected load growth on our network from now to 2050. The uptake of EVs and HPs are the primary drivers across the range of scenarios.

Figure 1: gross peak demand without customer flexibility

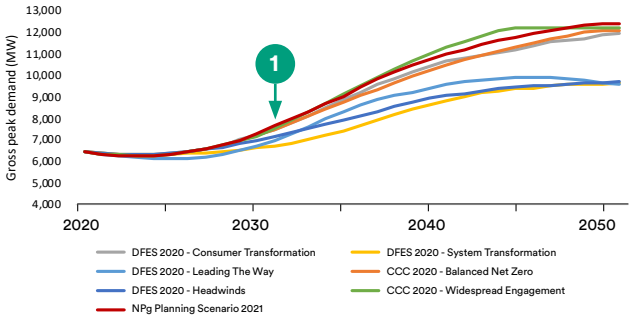


Figure 2: EVs trajectory to 2050

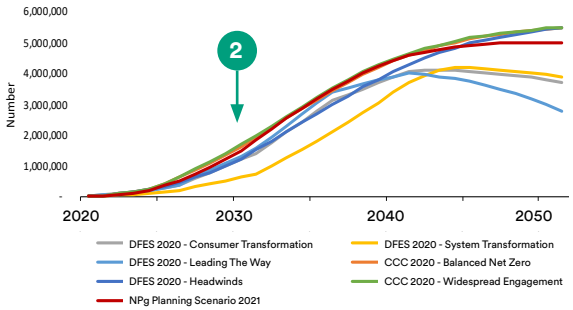
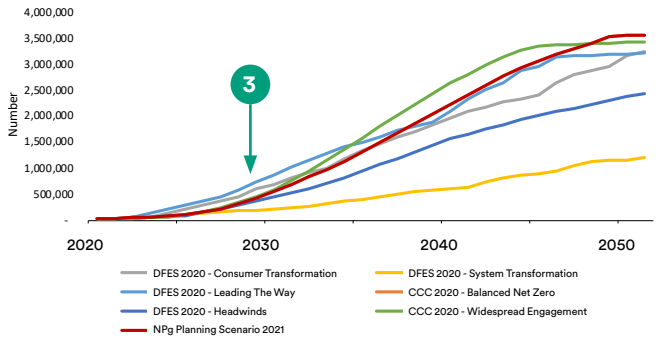


Figure 3: heat pumps trajectory to 2050



1. The Planning Scenario is at the higher end of the range during the 2023-28 period, ensuring we are prepared for an accelerated pathway and minimising deliverability risks in the 2030s

2. Internal combustion engine (ICE) ban: the Planning Scenario takes into account the government's 10-point plan policy decision to ban the sale of new ICE vehicles from 2030, with a ban on hybrids from 2035.

   None of the National Grid FES account for this policy as the scenarios were published prior to this announcement

3. The Planning Scenario follows the CCC's Balanced Pathway for heat pump assumptions, the CCC's recommended path to achieve net zero

Step 2
Planning Scenario

Based on the range of possible future pathways and the assumptions used to build them, we have developed a single Planning Scenario that aligns with our stakeholder feedback and helps achieve their aspirations and plans for decarbonisation across our region. This chosen scenario enables a predominantly electrification-driven decarbonisation strategy, and is based on targets set by the government's 10-point plan to reach net zero by 2050. We have ensured that this Planning Scenario meets the following criteria:

- it keeps all future credible pathways open, ensuring that we are not an obstacle to any decarbonisation pathways;
- it is within the range of Ofgem's reference scenarios, the three net zero compliant FES scenarios by National Grid and the CCC's Sixth Carbon Budget scenarios;
- it is aligned with the latest government policy; and
- it reflects what we have heard from local stakeholders about the desire to facilitate an accelerated decarbonisation pathway.

Our Planning Scenario is at the higher end of the range of pathways since it accounts for government targets that were set after the 2020 FES were published. It assumes that we will connect about a further 831,000 EVs and 251,000 HPs to our network over the course of the next price control period. It is also in line with our stakeholder vision of an accelerated electrification-heavy pathway to decarbonisation.

The Planning Scenario has been informed by sensitivity analysis and stress testing to see how changes in assumptions impact demand levels and corresponding investment requirements. While this results in the Planning Scenario coming close to providing a 'best view' envisioned in Ofgem's business plan guidance, it is important to emphasise that it is not the most likely scenario, rather the one best optimised for the inherent uncertainty in planning for all decarbonisation pathways. It ensures that our network will be in a position to effectively keep pace with any pathway that emerges by 2028 and, therefore, represents the most efficient way of keeping all pathways open.

If we were to plan for a slower transition in 2023-28 we would risk not being able to keep up with the pathway that emerges and, therefore, becoming an obstacle to our stakeholders achieving their decarbonisation ambitions. Additionally, we would risk not being able to deliver on new policy developments from the government in the coming years.

The 2023-28 period provides an opportunity to focus on making a high proportion of low-regrets investments, i.e. investments that are needed in any of the scenarios over the next two regulatory periods (i.e. to 2033). The grouping of pathways is tighter in the early years which reduces the level of uncertainty around the investment we are planning today for the 2023-28 period. Developed in this manner, our Planning Scenario ensures that we are an enabler of effective decarbonisation in the 2023-28 period, keeping all options open to achieve net zero.

As revealed by sensitivity testing, it is sensibly robust against a wide range of assumptions and possible decarbonisation pathways.

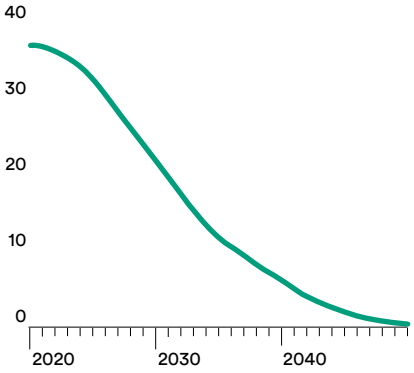
We can enable our region to save 8.2 MtCO2e p.a. by 2028 by investing to facilitate the LCT uptake assumed in our Planning Scenario. Planning for a pathway that meets the requirements of the CCC's Sixth Carbon Budget means we are making our essential contribution to tackling global climate change.

Key building blocks	Our Planning Scenario
Electric vehicles	— In line with the government's 10-point plan, it assumes a ban on ICEs by 2030
Heat pumps	— In line with the CCC's Balance Pathway scenario, it meets the government's 10-point plan targets of 600,000 heat pumps being installed annually by 2028 — It assumes a ban on the sale of new gas boilers from 2025

Category	End of ED2 period (2028)	2050
Total electricity demand (TWh)[1]	37.9	64.2
Total demand from HPs (TWh)	1.4	19.1
Total demand from EVs (TWh)	2.4	7.8
Peak demand (GW)	6.8	12.4
Number of HPs (thousands)	309	3,572
Number of EVs (thousands)	941	5,015
Renewable generation (MW)	4,342.0	10,965.0

Figure 4: overview of our planning scenario

Figure 5: carbon emissions enabled by our Planning Scenario ($MtCO_2e$)



1. Terrawatt hour (TWh).

Step 3
Investment plan

We have developed an investment strategy and plan that presents our assessment of costs, driven by assumptions on the uptake of LCTs and network load growth in our Planning Scenario. Our investment plan takes a flexibility-first approach, first investing in and optimising the use of network monitoring to identify where constraints may arise; then managing potential constraints through network and customer flexibility; and deploying traditional reinforcement where economic and efficient, aiming to maximise the rate at which we can facilitate decarbonisation. It also prepares for us to go further, faster, stimulating flexibility markets for future price control periods, and factoring in synergies with other investment drivers in our Asset Resilience section. Overall this ensures our investment plan is well targeted and efficiently delivered.

To manage the data from the increase in sensors we will invest in new ingestion, storage and analysis tools that provide enhanced insight and decision-making capability. This monitoring – in conjunction with operational technology platforms – then forms the infrastructure necessary to implement customer and network flexibility. Monitoring also provides the ability to assess whether customer price-driven flexibility is having the impact we predicted and provides the basis for better informed investment decisions. This all has the effect of improving our management of network risk.

We see a clear maturity progression in how we will increase digitalisation on our network. Our 2015-23 activity is delivering the building blocks of a digital network with more sensors, advanced control devices in substations, and centralised data stores combined with data analytics for both planning and operational decision making. This progression will take us through increasingly sophisticated stages of data management and digitalisation through 2023-28 and on into the 2030s. The pace of change will be determined by the need and the availability and cost of the technology. The investments we are making now are extensible in functionality, scalable in volume and capable of integration with the investment to follow on later as we manage increased levels of low carbon electrification in local energy systems.

Notwithstanding the £92.4m investment in flexibility enablers described in the DSO Strategy, significant investment is required across four key areas of network reinforcement, namely:

- **load-related reinforcement at EHV level;**
- **load-related reinforcement at HV/LV level;**
- **fault level-related reinforcement; and**
- **looped services.**

Our approach:

Load-related reinforcement EHV: at EHV, we assess the impact on our network from the load growth in our Planning Scenario and across the range of potential decarbonisation pathways. Our load growth model provides future demand profiles that we use in conjunction with equipment ratings to determine the nature and magnitude of network constraints. We then undertake detailed options analysis to establish the optimal solution for the network area.

Load-related reinforcement HV/LV: at HV/LV, we use our LCT planning tool (developed by engineering consultancy WSP) to model, using a techno-economic approach, the network impacts and optimal solutions for resolving constraints across the network. This has been used to inform our investment plan assumptions on solutions and costs for developing this part of the network.

We see more constraints appearing on our LV circuits and to a lesser extent on our distribution HV to LV transformers over the next price control period. This outcome is a consistent theme across a range of the potential pathways. Although there is a range of possible future scenarios, we can say with a high degree of confidence that demand at the lower voltage end of the network is set to increase significantly as the national programme of transition towards electrification of heat and transport proceeds.

This is an extremely important – and valuable – feature of the outlook. It means that digitalising and strengthening the network infrastructure at this local level is a low-regret investment because it has a high probability of requiring additional capacity regardless of the pathway. Delivering these improvements for our customers allows them to maximise their use of LCTs and provide them with the ability to provides flexibility services to the wider energy system. Investments in monitoring the low voltage networks will provide us greater visibility of evolving network conditions and allow us to modify our investment strategy accordingly.

Fault level-driven reinforcement: we conduct a network analysis of the fault-level duty and capability across all our substations sites to identify constraints. Traditionally we have applied operational routines or alternative network running arrangements to manage these constraints. Our plan going forward is to target the removal of operational restrictions on the network to increase fault-level headroom and network flexibility, thereby removing barriers for the connection of low carbon generation.

Looped services: we assess the impact of LCT take-up specifically on the low voltage services to properties that are shared between customers. These are known as looped services and they can be a barrier to the connection of LCTs due to the limited capacity on these shared cables. The optimal solution for these situations is to de-loop the services with new cables. This activity can be disruptive for our customers and our experience is that this is best done when a customer wishes to connect an LCT.

Our flexibility-first approach drives our investment plan, which comprises a blend of smart solutions, price-driven and DNO-contracted flexibility, and conventional network reinforcement.

Our flexibility-first approach

Intervention category	Activity	
Monitor	**DSO Strategy – people and systems**	— We plan to invest £92m (of which £21m relates to LV monitoring, below) in skills and systems to enable us to optimally harness data and flexibility on the network, ensuring reinforcement investment is efficient and well-targeted (See DSO Strategy, annex 4.2)
	LV monitoring	— By using LV monitoring on our ground-mounted secondary distribution substations, we will have much greater data to analyse demand and demand-growth, thus enabling investment decisions on confirmed data, as well as the ability to re-rate assets based on the nature of the load observed — We plan to install LV monitoring on a further 10,000 ground-mounted distribution substations by 2028 (see DSO Strategy, annex 4.2 and Network Visibility Strategy, annex 4.3)
Manage	**Price-driven customer flexibility[1]**	— Based on findings from our Customer Led Distribution System (CLDS) innovation project and other market intelligence, we assume that customer price-driven flexibility will reduce demand by about six per cent and five per cent at EHV and HV/LV respectively during peak hours on the network from 2025 at no cost to our customers — Price-driven customer flexibility is dependent on time of use tariffs being offered by suppliers, expected to be driven by half-hourly settlement — We assume that customer price-driven flexibility will reduce the required investment by up to £108m at all voltages over 2023-28
	DNO-contracted flexibility	— We assume that we will spend £2m to procure customer flexibility at 23 per cent of our EHV substations that are expected to be constrained in 2023-28, driving net savings of £12m in conventional reinforcement — We also plan to invest £3m in flex procurement to stimulate the flexibility market, seeking to prepare sites expected to be constrained in the 2028-33 period for flexibility deployment in the future — Our use of ANM as a form of flexible connection is described in the Connections section of this plan
	Smart grid solutions	— Our smart solutions involve us deploying innovative solutions to use more of the inherent capacity in our network. By investing £8m in our smart solutions, we expect to deliver net benefits of £15m (compared to conventional reinforcement)
Reinforce	**132kV and EHV load-related reinforcement**	— Once all customer flexibility and smart grid solutions have been considered, we turn to asset-based interventions to install new assets of higher capacity. Our projections show that we will need to invest £61m at EHV
	HV/LV load-related reinforcement	— We will install additional circuits to provide capacity and network flexibility and prioritise the replacement and upgrade of assets in areas where we also have a need for condition-related investment — A significant proportion of this investment is expected to be low regrets given the greater likelihood for reinforcement needs at the lower voltage levels to provide for the increasing penetration of LCTs — We expect to invest £348m at HV/LV in 2023-28
	Fault-level reinforcement	— We are targeting the removal of operational restrictions on the network to increase fault level headroom and network flexibility, removing barriers for the connection of low carbon generation — We expect that our investment in this area will be £59m
	Looped service unbundling	— Driven by LCT volumes assumed in our Planning Scenario, we plan to invest £34m to target the replacement of 21,600 looped services to customer properties — This assumes that two per cent of the properties where LCT connections are deployed will require the service to be de-looped to minimise customer disruption
Go further, faster	**DNO-contracted flexibility**	— We also plan to invest £3m in flexibility procurement to stimulate the flexibility market, seeking to prepare sites expected to be constrained in the 2028-33 period for flexibility deployment in the future
	Asset upsizing and synergies	— We have revised our investment strategy to deliver capacity for future periods, installing assets sized to take into account load growth through to 2050, therefore ensuring we touch assets once where possible between now and 2050 — We will invest £12m EHV and 132kV of load-related and £21m of fault level-related expenditure, which will provide synergistic benefits, where the investment for decarbonisation also addresses other issues such as equipment condition — We assume that £24m of EHV and HV/LV load related expenditure was brought forward into 2015-23 as part of our Green Recovery scheme to accelerate net zero driven stakeholder needs, and is therefore deducted from the 2023-28 investment total — We assume that £35m of HV/LV asset replacement expenditure driven by asset health will also address network constraints arising over 2023-28 under our Planning Scenario. Therefore we reduced our load related investment accordingly

1. Ofgem and energy suppliers are in the process of implementing market-wide half-hourly settlement. Enabled by smart meters, it will provide the means for more cost-reflective pricing to encourage and reward customers for using power when it is cheap and plentiful from low carbon sources such as the wind and the sun.

Significant investment, significant benefits

Investment of £92.4m in flexibility-enabling actions drives potential net benefits of £155.5m in conventional reinforcement over the course of 2023-28. These net benefits are described in figure 9.

Our investment to enable decarbonisation, as well as innovation spend, yields synergies across a number of areas of our plan. These are detailed further in the Costs section and our Scenarios and Investment annex (annex 4.1).

Our planned investment will provide extra capacity on our network to meet the needs of the additional demand. Figure 8 shows that our network utilisation would be significantly higher by 2028 without our planned interventions at both our major and distribution substations. Further, we will mitigate the need for further reinforcement with 29 projects to create fault-level headroom at our major substation sites for generation and to combat fault level constraints on the network. Our DSO Strategy and Major Connections Strategy detail our intent to increase our capability to accommodate more flexible customer connections of generation or demand via solutions such as ANM.

The constraints we expect to arise in 2023-28 are predominantly on the local networks as customers connect LCTs. As we do not expect that contracted flexibility will be widely available at LV level during the 2023-28 period, the constraints that we expect to be able to resolve through DNO contracted flexibility are limited to the 132kV/EHV network. As a result, the volume of constraints resolved through DNO-contracted flexibility is expected to be low during the period. The savings that we expect to be available from price-driven flexibility (discussed above) are therefore significantly higher than those from contracted flexibility. We will trial DNO contracted flexibility for LV constraints during 2023-28 ahead of it becoming a business as usual solution.

Figure 6: the impact of customer flexibility on gross peak demand in our Planning Scenario

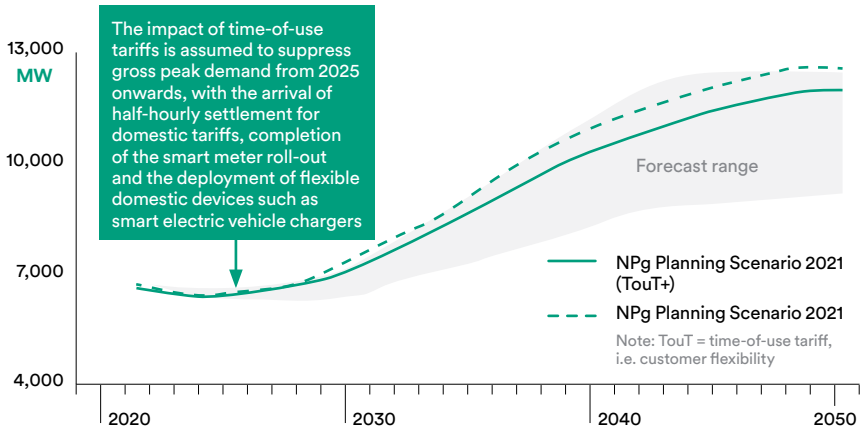


Figure 7: network intervention costs and volumes

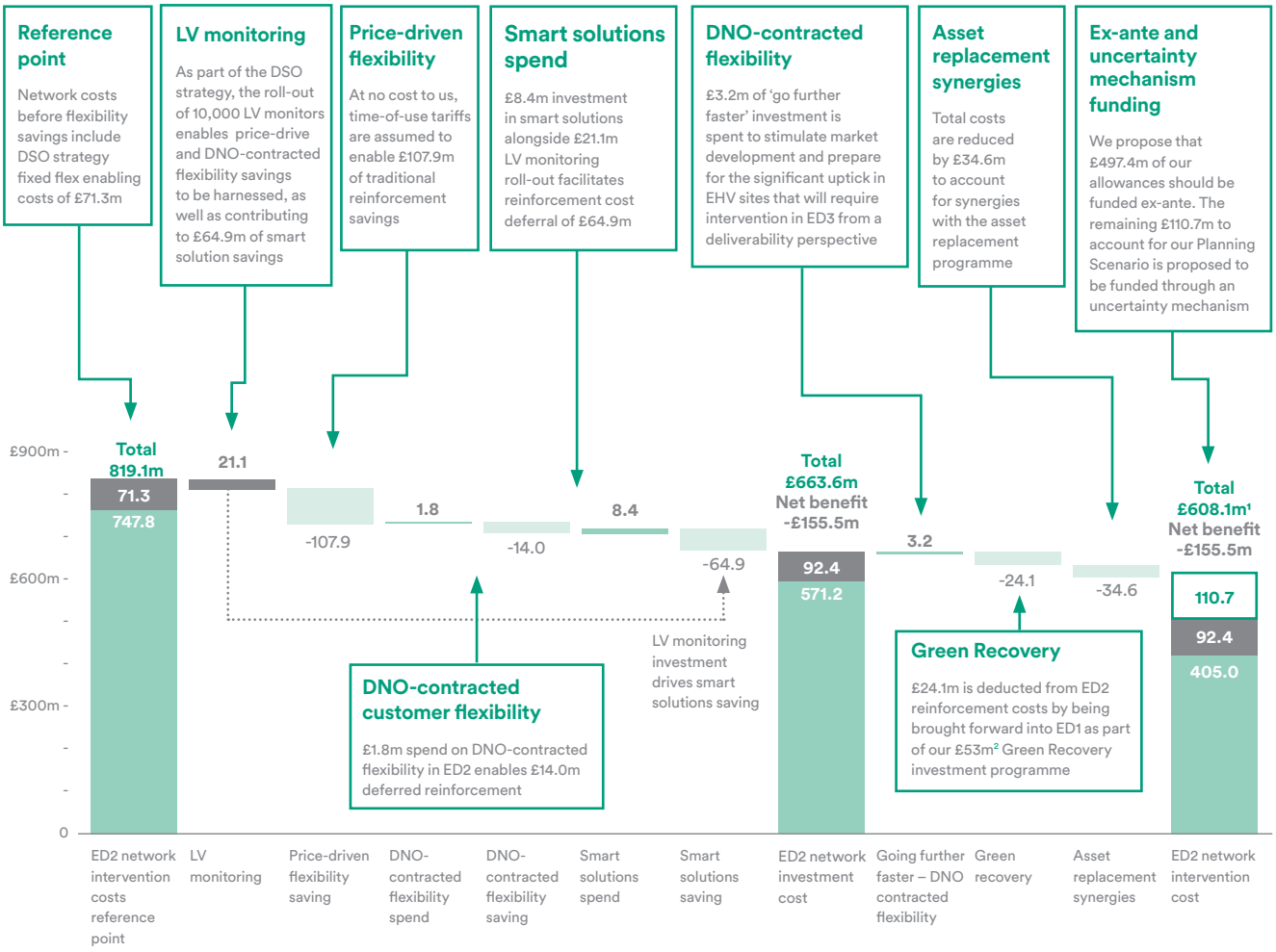
	132/EHV	HV/LV	Fault level	Looped services	Total
Network intervention costs (£m)					
DNO-contracted flexibility	1.8	-	-	-	**1.8**
Smart solutions	3.8	0.7	3.9	-	**8.4**
Traditional reinforcement	60.9	348.1	58.9	34.2	**502.3**
Total	**66.6**	**348.8**	**62.8**	**34.2**	**512.5**
Flexibility enablers – DSO Strategy costs and go further faster flexibility investment					*95.6*
Total					***608.1***
Network intervention volumes (#)					
DNO-contracted flexibility	5	-	-	-	**5**
Smart solutions	5	168	3	-	**176**
Traditional reinforcement	12	12,000	26	21,638	**33,676**
Total	**22**	**12,168**	**29**	**21,638**	**33,857**

Figure 8: network utilisation – forecast 2023-28

% substations	2023	2028				
		Without investment	with ex ante investment only[1]	Difference vs. without investment	With total planning scenario investment	Difference vs. without investment
132kV and EHV substations						
<80% utilised	87.9%	82.7%	85.0%	2.3	85.0%	2.3
80-99% utilised	9.6%	14.4%	14.3%	0.1	14.3%	0.1
>99% utilised	2.5%	2.9%	0.7%	-2.3	0.7%	-2.3
HV/LV substations						
<80% utilised	94.1%	82.4%	85.8%	3.4	86.0%	3.6
80-100% utilised	2.9%	8.4%	9.0%	0.6	9.0%	0.6
>100% utilised	3.0%	9.2%	5.2%	-4.0	5.0%	-4.2

1 For further detail about the split of ex ante and uncertainty mechanism funding, refer to the embracing uncertainty section of scenarios and investment and the uncertainty and risk section and associated annex.

Figure 9: the impact of flexibility-based solutions on reinforcement costs[1]



1. Note 1: total for network investment costs and DSO Strategy only; does not include Whole System.
2. 2012-13 prices.

We have considered the total investment that would be required for each of the reference scenarios we have modelled both with and without flexibility solutions. Our Planning Scenario is relatively central to the full range of possible costs of all scenarios, taking into account the impact of all flexibility solutions on the range of pathways. Several of the electrification scenarios are closely clustered together during 2022-28, and our Planning Scenario is at the lower end of that group. The lowest cost scenario for our network is the System Transformation scenario, which assumes high level of decarbonisation from hydrogen and lower uptake of EVs being connected, giving rise to a lower impact on the electricity network. It is also important to recognise that some of these DFES scenarios created from the ESO FES 2020 do not align with the 10-point plan and are therefore less ambitious.

Figure 10: sensitivity testing – total network costs 2023-2028 by scenario

£m	Without flexibility solutions	With flexibility solutions
DFES System Transformation	273.2	217.3
CCC Headwinds	546.6	
NPg Planning Scenario	747.9	571.2
DFES Leading The Way	768.4	
DFES Consumer Transformation	757.2	
CCC Balanced Net Zero	762.5	
CCC Widespread Engagement	806.0	691.8

Note: to ensure that scenarios are comparable, the costs for all scenarios shown in figure 10 are before adjustments for go further faster flexibility investment, asset replacement and Green Recovery as shown in figure 9.

Embracing uncertainty

We recognise the need to manage uncertainty.

It is clear that our network is at the heart of the UK's net zero journey, but the extent of the impact on the network will remain unclear for some time. There are many considerable uncertainties in the pathway towards decarbonisation:

- The extent of electrification of heat and transport versus other alternatives such as hydrogen – *how electrical?*
- The amount of locally distributed renewable generation connected to our network – *how local?*
- The speed at which renewables and LCTs will be adopted – *how fast?*
- The extent to which customer flexibility will be taken up – *how flexible?*

The answers to these questions will affect how we manage the network. For instance, we are aware of the possibility that there might be significantly less electrification of the heat sector than is currently assumed in our Planning Scenario in a world where hydrogen and existing gas networks play a greater role in decarbonising space heating.

It is, therefore, essential that we continue to monitor the policy landscape and modify our planning assumptions at least annually to reflect the most recent developments. Although the scenarios we have considered are tightly bunched in the 2023-28 period, greater divergence is likely in the 2030s as uncertainty around policy and the uptake of LCTs increases. The commercial viability of LCTs, technological progress and challenges, regional characteristics such as building stock, and customer behaviour will continue to drive uncertainties in the adoption of LCTs. As more LCTs are taken up and more data is gathered, this uncertainty will reduce.

We embrace this uncertainty by building an investment plan that is designed to be flexible to an evolving landscape.

- By adopting a flexibility-first approach to planning network intervention we defer the need for reinforcement and give option value for the decarbonisation pathway that emerges.
- At EHV level where interventions and upgrades are the most costly, we will assess the need for intervention across multiple future energy pathways to minimise the risk of stranded assets.
- At the HV/LV levels, the infrastructure has a high probability of need regardless of the pathway, providing customers with the infrastructure necessary to maximise use of low carbon energy and provide flexibility for management of the whole energy system. The foundation of this approach is an investment in 10,000 additional LV monitoring units (as part of the DSO Strategy, annex 4.2). This will enable us to monitor the emergence of flexibility response among our customers and see when and where the need arises for investment on our network.
- Installing extra capacity on our network has the added benefit of improving energy efficiency by reducing electrical losses, which delivers economic benefits for customers from the perspective of the total cost of their energy, by reducing the need to install additional generation assets.
- In addition to harnessing synergies with asset replacement, our decarbonisation investment plan is underpinned by our principle to take the opportunity to upsize assets when we are investing in them. This adds additional capacity at low marginal cost, ensuring that wherever possible we are installing 'net zero ready' assets in order to minimise the likelihood of the need to intervene at the same location again before 2050.
- If the pathway that unfolds during 2023-28 is not as steep as we anticipate, we still have the option to invest to prepare for the faster pathway, enabling us to efficiently reduce delivery risks in the early 2030s.

Should price-driven flexibility not materialise at the levels forecast, or load growth be greater than forecast, we will need to increase our investment in DNO-contracted flexibility, smart network solutions and conventional reinforcement, in that order.

The costs in this plan – under our Planning Scenario – are based on the level of investment that we forecast will be necessary under the government's 10-point plan, and on the number of heat pumps being used in homes and electric vehicles on our roads that this plan would involve.

As noted in figure 9, in this plan we have also distinguished:

- those costs that we think are necessary under any scenario for the low carbon transition, and that should be funded through up-front cost allowances; from
- those costs that could be funded through an uncertainty mechanism that counts the pace of uptake, and uplifts allowances if uptake is sufficiently high.

We give more details of our assessment to determine the baseline level of cost allowances and how the uncertainty mechanism arrangements could work in the uncertainty and risk section and associated annex.

Our assessment of the cost impact on the scenarios of the socialisation of net zero costs is discussed in the Connections section.

Support for our plan

"Collaboration between business, industry and local government is crucial for York to meet its zero carbon ambitions. As a traditionally carbon intensive sector, energy has a huge role to play in enabling a more sustainable future that we as a city are actively working towards. Northern Powergrid's ambitious plans would not only support our local decarbonisation work, but would also tackle such urgent issues as fuel poverty, prioritising a socially inclusive transition to a carbon zero future."

Cllr Paula Widdowson
Executive member for environment and climate change, City of York Council

We are mindful of the impact of changes in the energy system on customers. We will create opportunities for customers to be active participants and will ensure a just transition towards net zero.

As a key facilitator in the net zero transition, we will enable our customers to become active participants in the energy system, allowing them to maximise the financial value of their energy resources. Our plans for building our own capabilities to harness flexibility and stimulate flexibility markets are set out in our DSO Strategy (annex 4.2).

It is also important that we develop a clear view of what is needed to ensure that the transition not only happens but that it happens in a fair way for customers. We will ensure a just transition by:

- ensuring we keep our investment as efficient as possible to minimise increases in customer energy bills;
- embracing digitalisation and open data to enable transparency in our decision making, giving customers the information they need to support their own decarbonisation agendas and benefit from the opportunities that the low carbon energy transition brings;
- actively finding ways to ensure that the less wealthy and less well-engaged are able to access benefits from the energy transition as well as being particularly mindful of the impact on Vulnerable Customers; and
- harnessing talent by creating green jobs and developing skills in our region. (See Workforce Resilience.)

We will ensure a continuous dialogue with stakeholders as part of our annual planning process.

We expect our plan to keep evolving as part of our annual planning process as society continues on the low carbon energy transition. We will use this annual process to capture broad developments in the policy environment, insights from system monitoring and data capture, and discussions with a broad range of stakeholders. This will enable us to ensure that our plan reflects the latest developments and stays relevant in the context of the national decarbonisation agenda. In particular, we will continue to engage with local and combined authorities in our region on their local area energy plan (LAEP) development (for further detail see our DSO Strategy).

As part of this, we will also continue participating in the National Grid FES process, engage with local authorities and other stakeholders, and reflect their feedback in the development of our DFES and investment Planning Scenario. We will also undertake activities highlighted in our DSO Strategy and Enabling Whole System Solutions plans to ensure that our forecasts are continually updated based on stakeholder input.

This continuous feedback loop reflects the planning and operating the network process flow shown on page 41.

Customer outcomes		Benefits	Deliverables	Output measure/[1] *indicative input measure*	ED1 to date	ED1 forecast	ED2 target
SI1	**Efficiently put the network in a position to support LCT uptake and ensure all credible decarbonisation scenarios in our region remain open for delivering net zero by 2050 or sooner[2,3]**	— All pathways to decarbonisation will be kept open — Increased capacity for customers to connect LCTs	SI1.1) Publish our DFES annually and use it to continue the dialogue with our regional stakeholders to keep refining and updating our views about possible decarbonisation pathways in our region	**Ensure capacity is available**	✓	✓	✓
				Investment in creating capacity p.a.	*£17.5m*	*£19.5m*	*£103.1m*
				Network utilisation – % major substations > LI3	1.1%	2.5%	0.7%
				EVs accommodated (cumulative)	*31,000*	*110,000*	*941,000*
				HPs accommodated (cumulative)	*34,000*	*58,000*	*309,000*
SI2	**Deploy a flexibility-first approach, always choosing network and customer flexibility solutions where cost-effective and viable ahead of network reinforcement[4,5,6,7]**	— Increased capacity — Efficient decarbonisation — Quicker decarbonisation — Increased customer and network flexibility — Customers and stakeholders more actively engaged with the energy system	SI2.1) Run flexibility tender exercises where we will seek to use flexibility to defer reinforcement at our major substations and continue to seek to harness flexibility to defer reinforcement across all voltage levels SI2.2) Invest in market development to stimulate the use of flexibility so that we can defer future reinforcement costs across various network areas that will require intervention in the 2028-33 period SI2.3) Invest in smart grid solutions including LV monitoring SI2.4) Deploy DNO-contracted flexibility to shift peaks in demand on our network to enable deferment of traditional reinforcement	*Our suite of flexibility metrics are set out in our DSO Strategy*			

1. Measures are shown to track delivery of our customer outcomes. While 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 Asset Resilience AR1) Enable an efficient long-term transition to net zero through maximisation of synergies between load-related and asset renewal expenditure.
3. Cross-reference Whole System WS2) Ensure our customers' future needs are met through cross-sector and cross-vector planning.
4. Cross-reference DSO Strategy DSO4) Enhance processes and systems for network operations to enable a step change in our capability to optimise a system with increasing customer and network flexibility.
5. Cross-reference DSO Strategy DS05) Enable significant uptake of customer flexibility and facilitate development of new markets for customers providing services to networks.
6. Cross-reference DSO Strategy DS03) Unlock new capabilities and benefits for customers through provision of open energy system data and engaging in joint planning with our stakeholders.
7. Cross-reference Whole System WS2) Ensure our customers' future needs are met through cross-sector and cross-vector planning.

Innovation
Data and Digitalisation
Workforce Resilience

How engagement with you has shaped our plan

SCENARIOS AND INVESTMENT

Scenarios and Investment

How we engaged with you:

- In wave one, we engaged 1,300 stakeholders at 54 events on decarbonisation using panels, roundtables, surveys and published reports.
- We tested our Emerging Thinking in wave two to gauge levels of customer ambitions – 10,765 partners, customers, SMEs, national and regional governments and young people participated across 75 events.
- In wave three, 33 events covered decarbonisation, engaging 2,154 stakeholders, and we tested and refined our plans. Understanding decarbonisation pathways was a stakeholder key priority.
- We finalised our plan in wave four, responding to queries, addressing gaps and testing overall acceptability. We engaged 10,805 customers and stakeholders overall and with detailed sessions on decarbonisation and outstanding scenario investment topics across 67 events.

ALL DECARBONISATION ENGAGEMENT

227 dedicated events

25,024 stakeholders engaged

What we have heard from you	How this has impacted our plan	Customer outcome ref	Annex detail
Deliver a fair transition to net zero In our Emerging Thinking consultation, stakeholders supported us pursuing an accelerated decarbonisation pathway, but wanted us to balance the rate of investment with costs for customers.	**We will keep all pathways open** We have set a plan that ensures we keep all credible decarbonisation pathways open to 2050, while ensuring investment is efficient and targeted to keep bills as low as possible for customers.	SI1	Link
Ensure capacity is available for connecting LCTs Customers told us they want to be able to connect LCTs where and when they want, so that they can play their part in the low carbon transition.	**Our plan is set to ensure we are ready to respond to high rates of EV and HP uptake** Our planning scenario is towards the upper end of the range, forecasting 941,000 EVs and 309,000 heat pumps by 2028.	SI1	Link
We will be flexible in our energy use Most stakeholders were willing to be flexible with their energy use and expect to respond to time-of-use tariffs.	**We have built in significant benefits from customer flexibility** Our plan assumes £108m of benefits from price-driven flexibility.	SI2	Link
Maximise flexibility benefits Stakeholders want us to engage in flexibility contracts to release network capacity at peak times.	**We will take a flexibility-first approach** We will contract with customers to deliver flexibility services with estimated savings of £12m in the period.	SI2	Link

DSO Strategy

We will deliver an even smarter and more flexible energy system for our customers to decarbonise efficiently.

DECARBONISATION

DSO STRATEGY

We are expanding our capabilities and taking on the functions of Distribution System Operation (DSO) to actively manage the increasingly complex power flows on our network that result from decarbonisation, reduce the need for conventional reinforcement, and ensure the transition to net zero is efficient and affordable.

We face the challenge of facilitating an overall increase in demand for electricity as well as managing greater volumes of intermittent generation connecting directly to our network. To decarbonise efficiently and make the transition affordable, we have to enable a smart, flexible energy system where Distribution Network Operators (DNOs) actively manage the more complex power flows on the distribution grids to optimise the value of the system by taking on the functions of DSO.

We are now looking towards the future and have developed our DSO Strategy for 2023-28 by engaging with our customers and stakeholders, and ensuring alignment with regulatory requirements.

Our DSO Strategy has been informed by the needs of our customers and stakeholders. Since publishing our 2023-28 Emerging Thinking document in August 2020, we have been engaging on our further developed DSO transition plans through stakeholder panels, industry forums, and bilateral discussions with industry and experts. Our stakeholders have told us that two-way sharing of network data through self-service tools is crucial to helping them with their own decarbonisation plans, understanding our network and managing flexibility. Stakeholders have also emphasised the need for transparency and standardisation of flexibility products to stimulate participation in new energy markets.

These priorities have informed our DSO Strategy which has a twin focus on data and the use of flexibility.

We recognise that we need to develop our DSO functions and capabilities in a manner that is coherent with other stakeholders in the energy system, and have hence sought to align our DSO Strategy with recommendations coming out of the Energy Networks Association (ENA)'s Open Networks project, particularly the work streams focused on flexibility services and the DSO transition. For example, the metrics we will use to measure our progress are being developed in collaboration with other DNOs and Ofgem.

Finally, Ofgem has set a clear direction for the transition to DSO with a view to reducing uncertainty and ensuring consistency in approach across the sector. Our strategy has been developed to ensure we meet regulatory requirements.

> **Our action on data and flexibility equips us to manage with the existing network before building new network.**

Paul Glendinning
Director of policy and markets

> **Our plan is set to get the best out of our existing assets through improved visibility of low voltage network by deploying more monitoring.**

Aisha Ahmad
Smartgrid development engineer

The DSO transition

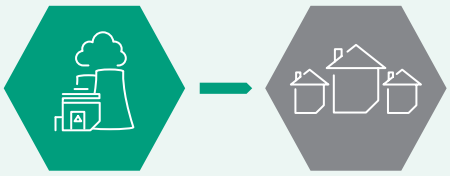
The transition to DSO requires us to operate our network for the evolving needs of our customers on the low carbon transition, ensuring we are a trusted and neutral platform through open, transparent and technology-neutral decision making. To deliver a reliable electricity supply to our customers, we must manage increasingly complex power flows on our network through whole system engagement and optimisation, and proactively share data and insights about our network to facilitate effective decision making across the energy supply chain.

We must incentivise customers to be flexible in their energy generation and consumption, and enable them to play a more active role in supporting the network, including by facilitating their participation in existing and new market-based solutions, such as flexibility markets and local energy markets. In performing the role of DSO we will strive to ensure that customers are empowered to participate in a smarter and more flexible energy system, and adverse impacts on vulnerable customer groups are mitigated to make sure that no one is left behind in the ongoing energy transition.

Figure 1: our energy system is changing

Traditional energy system

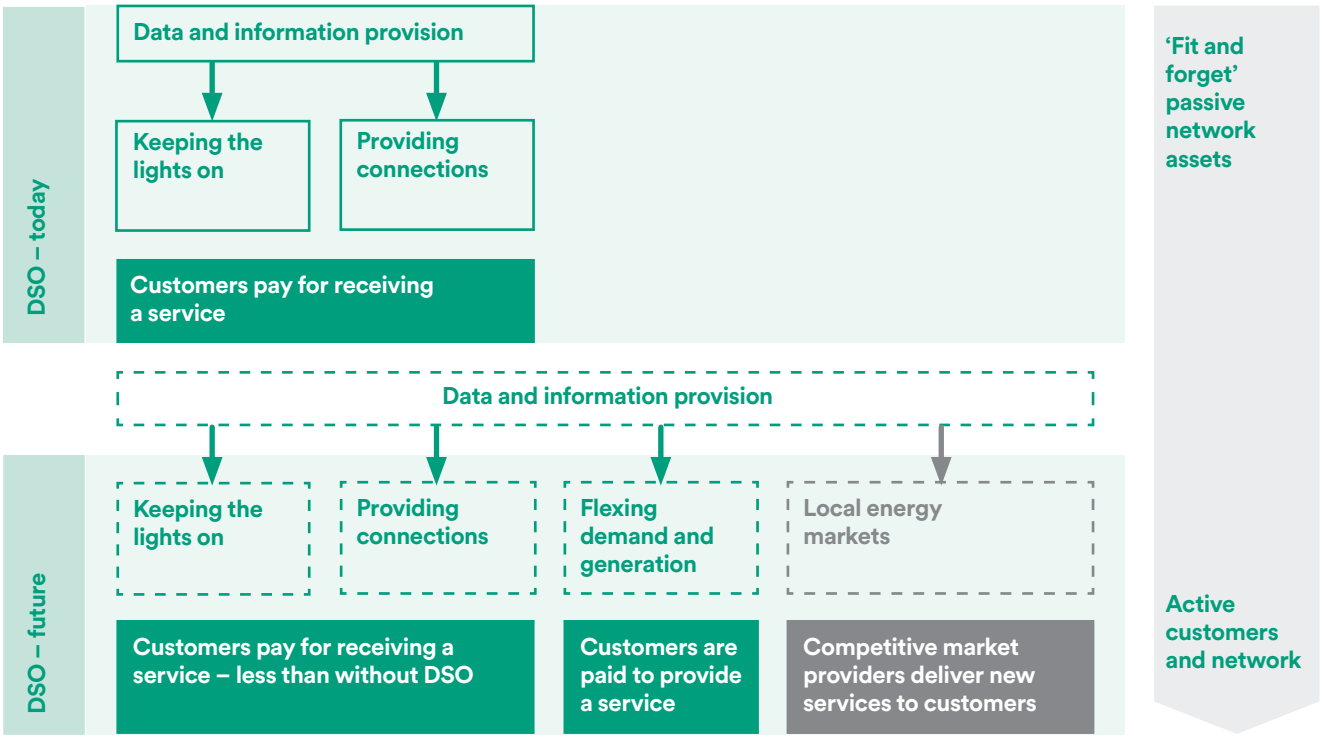
A centralised system where the network is designed around single-direction power flowing from large (often fossil fuel) generators into homes and businesses. Here generation has to meet peak demand.



The energy system of the future

A decentralised system where small-scale energy generation units deliver energy to local customers. Customers utilise renewable energy when the wind is blowing and the sun is shining. Electric vehicles (EVs) and community energy storage are charged up at favourable rates, based on real-time supply and demand data. Users flex their demand and the network facilitates this.

Figure 2: what DSO means for our customers



We have already embarked on the transition to DSO and have made progress over 2015-23, working with our customers and stakeholders to develop our thinking, and investing in our capabilities.

While we have laid solid foundations for the transition to DSO in recent years, it is crucial that we build on this to meet the challenges and needs of the changing energy system. To do this we are setting out our plan here to invest £92m across 2023-28 in developing the functions and capabilities required for DSO. This will unlock benefits for customers and the community by allowing us to decarbonise our network at lower cost. By taking a flexibility-first approach to our network investment strategy we will reduce the need for conventional network reinforcement and ensure that every kilowatt hour (KWh) of renewable energy is utilised. As described in the scenarios and investment section, net benefits of up to £156m could be delivered by avoiding conventional reinforcement costs over the course of 2023-28. The DSO transition will also enable system benefits that go beyond our network and will continue to enable us to optimise the value of the system to deliver savings into the period 2028-33 and beyond.

Since 2017, we have been explicitly exploring the DSO transition with a broad set of stakeholders in the context of addressing decarbonisation. Following an extensive programme of stakeholder engagement we published our first DSO v1.0 thinking in 2018, with 84 per cent of our stakeholders supporting that plan. We then updated this with our development plan (DSO v1.1) in October 2019, and again with our 2023-28 Emerging Thinking (ET) document in August 2020.

We have made significant investments in our DSO capabilities in the current period to date (see figure 3), which have laid the foundations to enable the transition to DSO over the next price control period (2023-28).

Figure 3: investments in our DSO capabilities in 2015-23

Modernising and digitalising our network and operations	Our smart grid enablers project is the UK's most comprehensive network upgrade programme. It is transforming our ability to monitor, control and communicate with more than 860 substations, giving us the ability to respond to real-time information about power flows on our network.
	We have advanced our internal readiness for the smart meter roll-out programme, which has continued to face delays at the national level. We have been preparing our internal systems to integrate smart meter data with our customer, network and operational data so that we can proactively respond to outage alerts and enhance demand forecasting on our low voltage (LV) network.
Focusing our innovation on preparing our network for the future	Our £1.8m customer-led distribution system innovation programme is exploring how to accommodate large volumes of new technologies, such as local generation and electric vehicles (EVs), at least cost, while enabling customers to earn income by selling energy or services to balance the network.
	We are developing our commercial and technical skills to operate a more flexible system. We have been working to build our data analytics skillset in house by developing the right processes and tools.
Exploring and preparing for flexibility	Our active network management (ANM) solution is providing scalable capability to connect more generation at least cost, as an alternative to conventional reinforcement by offering customers a flexible connection. We expect to have deployed ANM across four areas by the period to 2023, with an estimated 540MW of contracted flexibility from generation curtailment within these zones. We intend to roll out further ANM zones where there is high customer interest in connecting to the network, limited capacity and high reinforcement/ flexibility costs.
	We have conducted market testing for customer flexibility services and have run three expressions of interest for reinforcement deferral as well as an e-auction for emergency support. This has allowed us to develop our processes and work with the market to gauge interest and identify potential providers.
	In 2020, we commenced implementation of the flexible power operational system to manage the purchase and operation of flexibility services. This collaboration now includes the majority of DNOs and offers flexibility providers an easier, lower cost, standardised route to market.
Working with our peers, other industry parties and stakeholders	We are participating in the ENA's Open Networks project, including work streams pertaining to flexibility services and DSO transition, to collaborate with other DNOs, as well as the energy system operator (ESO), the market and policy makers, to standardise customer experiences and align processes.
	Our DFES assumptions and results are shared through an open data platform,[1] which includes a view for local authorities, and are accessible to a broad range of stakeholders to use and comment on our assumptions.
	We share a large amount of network data publicly and with the ESO and wholesale and retail markets to facilitate its use towards a whole electricity system optimisation.

1. See: https://odileeds.github.io/northern-powergrid/.

A smarter and more flexible network

Our region will need to be well on the way to a fully decarbonised energy system by 2028. We, therefore, need to make significant investment in the DSO transition over 2023-28 to ensure that we are able to facilitate potential decarbonisation pathways at the most efficient cost to customers.

As outlined in the Scenarios and Investment section, we are aiming to open up all credible pathways to decarbonisation in the next five-year period and beyond, and implementing more DSO functions is fundamental to achieving this.

Our strategy links our vision for the future with the tangible DSO actions we will undertake to get there and sets out the investment required to deliver these actions, and the benefits that will flow from this. It is geared around our flexibility-first approach, ensuring we are able to identify and deploy flexible solutions instead of conventional reinforcement when it is efficient to do so.

To do this, we will need to invest in updating our systems and skills as well as enhancing our data capture, use and sharing to enable optimal use of our assets and facilitate the most cost-effective route to decarbonisation.

We have five strategic objectives – guiding principles that have shaped the development of our DSO Strategy and will continue to guide our decision making as we transition to DSO.

Our strategy will deliver on five strategic objectives (see figure 4) that have been informed by the needs of our customers and stakeholders and by regulatory requirements. These were tested, reviewed and refined through numerous engagements we had with customer and stakeholder groups, particularly over the past six months.

These strategic objectives are linked to and supported by other parts of our 2023-28 business plan. They have shaped the development of our DSO Strategy outcomes and the tangible activities we are committing to undertaking in 2023-28.

Figure 4: our five strategic objectives

Flexibility first

Develop and deploy agnostic flexible solutions as an alternative to network reinforcement where it is economic and efficient to do so, ranging from energy efficiency solutions to dispatchable generation and demand turn-down. Promote and establish markets for deep and liquid flexibility with investment in systems and processes that enable growth in our use of flexibility as the markets mature.

This strategic objective links to and supports the Decarbonisation Scenarios and Investment section of our business plan.

Whole system collaboration

Enable whole energy system solutions by engaging with the wider market on our network investment, system management, and flexibility requirements and capabilities.

This strategic objective links to and is supported by the Enabling Whole System Solutions section of our business plan.

Data and digitalisation

Facilitate fast, efficient and optimised decarbonisation through open data, insight capability and digital tools, without losing sight of data safety and security. Invest in software and hardware that allows us to closely monitor the network, capture more relevant data and execute solutions to constraints as they materialise.

This strategic objective links to and is supported by the Data and Digitalisation section of our business plan.

Openness and transparency

Earn trust through open and transparent decision making by publishing our investment decisions, flexibility needs and procurement results, having our processes independently audited, and collaborating in joint planning with our local stakeholders.

This strategic objective links to and is supported by the Openness and Transparency section of our business plan.

Workplace and workforce fit for the future

Build regional and national skills and value through developing knowledge, transferable skills and an innovative culture.

This strategic objective links to and is supported by the Workforce Resilience section of our business plan.

The five objectives lead to five groups of outcomes that will deliver benefits to customers in 2023-28 and beyond.

Our DSO Strategy (annex 4.2) will deliver outcomes in five areas (see figure 5), focused on how we gather and use data, and how we prepare for and deploy flexibility. These build on our significant progress to date in embedding data and flexibility at the heart of how we operate today. We will invest in each of these outcomes over 2023-28. Each outcome enables us to deliver across a number of the strategic objectives, as indicated by the symbols (shown below).

- ● indicates that an outcome is directly applicable to the strategic objective, while
- ○ indicates that the outcome is an enabler of the objective.

Figure 5: DSO strategy outcomes

		Flexibility first	Whole system collaboration	Data and digitalisation	Openness and transparency	Workplace and workforce fit for the future
DSO 1 **DATA CAPTURE**	We will significantly expand **network and market data capture** to establish a vital building block for a smarter and more active energy system. This will improve the volume, availability and accuracy of the information that we track and share about our network, which underpins the transition to DSO.	●	●	●	○	○
DSO 2 **ANALYSIS CAPABILITIES**	We will **transform our analytical capabilities** to enable more data-driven decision making in planning and operational timescales. Better data and analytics will drive more accurate forecasting and better informed investment decision making, leading to more efficient investment to enable a range of decarbonisation pathways as explored in the Decarbonisation Scenarios and Investment section.	●	●	●	○	○
DSO 3 **OPEN DATA AND JOINT PLANNING**	We will **enable open energy system data sharing and engage in joint planning** with our stakeholders. Joined-up working with regional stakeholders and two-way data sharing will enable more dynamic systems and robust regional planning, facilitating whole system decarbonisation as set out in our Enabling Whole System Solutions section.	○	●	●	●	○
DSO 4 **SYSTEM OPERATION & OPTIMISATION**	We will enhance processes and systems for network operations to enable a step change in our capability to **operate and optimise a system with increasing customer and network flexibility**. Preparing our business operations, network and people will enable us to maximise our ability to identify and deploy customer and network flexibility over the 2023-28 period and beyond.	●	●	●	○	●
DSO 5 **CUSTOMER FLEXIBILITY**	We will **facilitate the development of new markets for customers** providing services to networks in order to enable significant uptake of customer flexibility. Stimulating the flexibility market and procuring flexibility will optimise the use of the existing network and support cost-effective decarbonisation.	●	○	○	○	●

To successfully deliver the DSO transition, we will need to invest £92m in 2023-28, which will unlock benefits for our customers and our region.

Transitioning to DSO will ensure that we are equipped to facilitate potential decarbonisation pathways at the most efficient cost. We plan to invest £92m in DSO activities across our five outcome areas over the next five-year period, as shown in figure 6.

We will enable total energy costs to be kept as low as possible as our region decarbonises by unlocking cost savings for customers as we build a smart system that is more efficient, reliable and cost-effective. It is estimated that up to £187m of conventional reinforcement costs would be avoided over the course of 2023-28, delivering net benefits of £156m, as we embed a flexibility-first approach to network investment. In addition, where we do have to invest to repair and upgrade our network, better data and analytics will drive more efficiency as we are better able to identify and predict areas in need of investment, ensuring we spend customers' money efficiently.

We will maximise the value of existing infrastructure and enable every low carbon kilowatt hour of electricity that is generated to be used. Our approach will allow our customers to earn revenue through participating in flexibility markets facilitated by our DSO activities.

The DSO transition will also enable system benefits that go beyond our network, as data and analytics made available for other participants in the energy and related sectors unlock further whole system value in the future by optimising regional planning. In addition, by enabling the efficient decarbonisation of our network, our DSO Strategy will help to achieve emissions reductions across our network.

Figure 6: investment in DSO Strategy outcomes – 2023-28 (£m)

Ref.	Area	Outcome	Data and digitalisation	Network costs	Workforce	Total
DSO1	Data	Network and market data capture	7.3	21.1	1.6	**30.1**
DSO2		Transform analysis capabilities	19.0	-	3.7	**22.7**
DSO3		Enable open energy system data sharing and joint planning	8.1	-	3.8	**11.8**
DSO4	Flexibility	Operate and optimise a system with increasing customer and network flexibility	12.9	-	6.1	**19.0**
DSO5		Enable significant uptake of customer flexibility	2.6	-	6.1	**8.7**
		Total	**49.9**	**21.1**	**21.3**	**92.4**

Our total planned investment of £92.4m in DSO activities is described below and described in full in our DSO Strategy annex (annex 4.2). Our DSO outcomes are underpinned by significant investment in the cross-cutting enablers of our business plan:

- **Digitalisation –** we plan to invest £49.9m over five years to upgrade and install new information technology and operational technology systems, as outlined in the Data and Digitalisation section, which is key to delivering our data and flexibility outcomes (see figure 7). Our DSO Strategy defines how we will use the systems that will be delivered by the data and digitalisation strategy to deliver our DSO outcomes.
- **Workforce –** we plan to spend £21.3m over five years for training, upskilling and recruitment in order to arm our workforce with data science and commercial skills, alongside enhanced engineering expertise, as outlined in the Workforce Resilience section.
- **Innovation –** we will build on successful innovation activities in the current price control period to continue to find new approaches to how we and other energy sector parties operate. For example, we are planning to build on our Boston Spa Energy Efficiency Trial (BEET) project to rollout voltage optimisation technology on a larger scale, as outlined in the Enabling Whole System Solutions section and our Customer Value Propositions (CVP) section. We will also use innovation funding allowances to explore flexibility product development and procurement and to harness flexibility at low voltage to resolve constraints on our LV network.

Figure 7: interaction of data and digitalisation (D&D) strategy with DSO

Investment driver

Business function specifies user requirements and customer outcomes

Distribution System Operator

£49.9m

47% of total D&D investment supports DSO Strategy delivery

Other plan sections

£57.0m

53% of total D&D investment supports other areas of the business, including broader activities to support delivery of decarbonisation

Stakeholder engagement

Business function level tests stakeholder appetite for use cases

D&D team designs and delivers technical solutions

Data and digitalisation strategy

£106.9m[1]

D&D team tests data use cases and technical appropriateness to drive the right solutions

Our investment will enable our DSO deliverables and initiatives.

We will undertake a suite of key initiatives over the next five-year period. These are tangible actions that will help us to achieve the five outcomes of our DSO Strategy and unlock benefits for customers and our region.

While deliverables are measurable activities, initiatives cannot be measured but are integral to delivering our strategy and meeting Ofgem's regulatory requirements.

In figure 8 we outline eight of our most significant deliverables that demonstrate the scope and scale of our ambition. Pages 69 and 70 set out a summary of our DSO outcomes, benefits, deliverables and measures. In our DSO Strategy annex we detail a complete account of all 29 deliverables and initiatives we are planning to undertake in 2023-28, including cost and benefits, and how they will allow us to meet Ofgem's requirement for us to fulfil the three roles of a DSO:

- **Role one:** planning and network development.
- **Role two:** network operations.
- **Role three:** market development.

1. Capex only.

Figure 8: examples of key deliverables

DSO 1 DATA CAPTURE

DSO1.3 Install targeted LV monitoring

We will invest £21.1m over 2023-28 to install 10,000 LV monitors across our network, prioritised based on sites anticipated to require intervention first, allowing us to monitor power flows and network performance. This will enable us to use our existing network assets more efficiently and target investment in asset condition and reducing network losses, as well as provide network data to facilitate the development of flexibility services and markets.

DSO 2 ANALYSIS CAPABILITIES

DSO2.1 Build low voltage datasets using analytics and machine learning

We will invest £4.9m to upgrade our data analytics capabilities, by investing in software and data scientists, so we can make forecasts and undertake scenario analysis on our low voltage network. We will develop statistical analyses for different types of data (e.g. smart meters and data captured through DSO1.3 LV monitoring roll-out), which will help us plan for reinforcement needs and identify and size flexible connections and flexibility service requirements.

DSO2.4 Create a 'digital twin' of our network for strategic planning

We will invest £7.3m to create LV and HV planning models of the network which integrate historical and real time data. These 'digital twins' will enable extensive analytics on network data, allowing us to test connection of anticipated volumes of LCTs and DERs, providing insights to identify where and when we should target investment in flexibility or reinforcement so that it is timely and efficient.

DSO 3 OPEN DATA & JOINT PLANNING

DSO3.1 Open insights data portal

We will invest £6.7m to develop a free online portal, which will allow customers and stakeholders to access network data, analytical tools and our 'digital twin' strategic planning tool DSO2.4. It will be aimed at customers and stakeholders who do not have electrical engineering expertise, supporting them to make investment decisions about demand and generation and connections see CVP section.

DSO3.2 Recruit local area energy plan (LAEP) advisors

We will invest £2.4m to recruit six LAEP advisors who will work in collaboration with local authorities and the wider energy sector – using knowledge of the network, customers and the wider environment – to provide useful input and feedback to local authorities on their plans. These advisors will also support our network planning by generating better and more comprehensive local insights.

DSO 4 SYSTEM OPERATION & OPTIMISATION

DSO4.1 Flexibility services, processes and dispatch system

We will invest £3.9m to develop a customer flexibility system that enables automatic dispatch of flexibility services by integrating existing systems with our flexibility platform. This will include the automatic billing and payment for services, allowing for a fully automated procurement, dispatch and settlement of flexibility services, generation and connections.

DSO4.2 Enhanced enterprise active network management (ANM)

We plan to invest £5.2m to enhance our use of ANM to become a core function integrated with our network management and customer flexibility dispatch systems. This will allow real-time data exchange and enable a more secure and resilient system.

DSO 5 CUSTOMER FLEXIBILITY

DSO5.3 Develop a flexibility information provision and engagement platform

We aim to spend £2.2m to develop an external-facing platform that gives third parties such as flexibility providers and aggregators single-point access to flexibility services related information. Users will also be able to express interest in providing flexibility services and register assets or meterable units. This will support the procurement of flexibility services and flexibility market development.

We are making changes to instil confidence and earn the trust of our stakeholders.

We set out in figure 9 why stakeholders can be confident there is no potential for actual conflicts of interest to arise in relation to our emerging role as a system operator.

The most important thing to ensure is in place is a set of properly designed incentives that provide strong encouragement to find and adopt the most efficient solution – whether traditional network reinforcement, flexibility or some other solution – when we need to address any specific system requirement. This incentives framework applies to our entire electricity distribution business, both the established elements of DNO and the new DSO functions. Our incentives are aligned with our customers' interests and we have every reason to foster and nurture flexibility markets. A well-designed regulatory incentive combined with our DSO strategy creates a strong foundation for us to deliver a highly efficient and optimised set of outcomes.

However, we recognise that despite this, there remains the risk of a perceived conflict of interest, particularly in relation to the role we expect to play in the development of flexibility markets and in making investment planning decisions across network and non-network (including customer flexibility) solutions. It is also vital that we operate in a way that builds confidence in the potential participants in these new market arrangements – and transparency is key to that.

Our approach to mitigating those concerns is to combine operational effectiveness with openness and transparency. The deliverables and initiatives set out in our business plan and DSO strategy are designed to ensure we have the systems and processes in place to support efficient and technology-neutral decision making across planning, operation and market facilitation functions, and that this is clearly and transparently communicated to our stakeholders and customers.

Figure 9: our business plan and the regulatory framework act to mitigate perceived conflicts of interest

Our DSO Business Unit will drive **operational efficiencies** by embedding flexibility first and whole system approaches, and ensuring appropriate separation of duties and accountabilities across the organisation	**Flexibility first –** we are embedding a 'flexibility first' approach to investment, actively engaging with flexibility providers and improving the development and procurement of flexibility services (DSO Outcomes 4 and 5)
	Whole system approach – we are embedding a whole system approach by undertaking cross-sector and cross-vector planning and removing barriers to whole energy system initiatives (Whole System Outcomes 1 and 2)
	Organisational accountability – we are strengthening accountability for the DSO transition with a new business unit which clusters core DSO functions underneath an accountable director
Openness and transparency is a strategic objective of our DSO strategy. We will build customer and stakeholder confidence that our decision making is neutral and unbiased	**Information sharing –** we are investing in open energy system data sharing which will give customers and stakeholders greater insight into, and scrutiny over, our network and decision making (DSO Deliverable 3.1)
	Assurance – we will provide visibility of both our transition programme and our investment planning, including undertaking an annual independent audit of our decision-making processes and publishing the results (DSO Initiative 3.3)
Provisions in the **regulatory framework** prevent conflicts of interest from arising and help to instil confidence in the sector	**Totex mechanism and benchmarking –** the RIIO model provides strong incentives for DNOs to find the lowest cost solution across capex and opex
	Ring-fencing measures and ownership constraints – licence conditions preserve the independence of DNOs from affiliated businesses and prevent DNOs from carrying out generation or storage activities, except in exceptional circumstances
	Competition and ex post enforcement – DNOs face competition in connections and distribution from ICPs and IDNOs, and face the threat of ex-post enforcement if a breach of competition law occurs

We are making organisational changes that are designed to allow these new processes to become normal, and to mature and become increasingly influential. Firstly, we believe that clear leadership is essential to any organisational change, so we will ensure that there is clear executive accountability. There will be a member of our executive leadership team with a clear and unambiguous accountability to lead the development and deployment of the DSO strategy.

- Executive-level accountability for the DSO transition will sit with the executive director responsible for a new DSO Business Unit.
- The dedicated DSO Business Unit is being established with primary responsibility for the DSO transition. Key DSO functions will be clustered within this unit.
- A DSO Assurance function, sitting within the DSO Business Unit, will have responsibility for auditing compliance across the organisation, monitoring progress and external reporting, including facilitating an independent audit of investment decision making processes and publishing the results. In common with other assurance functions that we operate, the work of that group will be supplemented by internal and external audit, and it will be subject to oversight and scrutiny by the CEO, the Board and our parent company.

The changes we are proposing have been developed alongside our ongoing engagement with Ofgem and other DNOs, as well as industry wide initiatives such as the Open Networks Project. We have also ensured they reflect the expectations of our customers and other key stakeholders; for instance, we have recently engaged in bilateral discussions with flexibility providers that has played an important role in shaping our approach to flexibility procurement and other aspects of our DSO strategy. As well as strengthening operational effectiveness, these changes will help to build stakeholder and customer confidence.

We do not consider that further structural changes, such as legal separation between DSO and DNO functions, are justified. Indeed, they would be damaging for customers interests. As a combined entity we are uniquely placed to leverage synergies between the system operation and network operation components of our business. Further separation would undermine these synergies and weaken the incentives in the regulatory framework we currently face to optimise costs across our system and network operations. It would also undermine the significant benefits that can be unlocked from optimising investment across the range of feasible capex and opex solutions. Our approach greatly values and preserves this important regulatory incentive, while ensuring that DSO functions are appropriately located, with clear executive accountability and oversight, so that cost savings and system-wide benefits can be fully realised.

1. Notably one aspect of Workstream 3: DSO Transition is focused on ensuring progress to mitigate risks of Unintended Consequences and Conflicts of Interest.

Throughout 2023-28 we will monitor potential conflicts of interest in relation to our DSO role, and take additional actions as needed.

We will need to measure and evaluate our performance against our DSO outcomes and deliverables in order to continuously improve.

A clear set of metrics will allow us to transparently measure progress against the deliverables and outcomes of our DSO Strategy. We will use these deliverables and metrics, alongside stakeholder engagement, to evaluate our progress against the outcomes and foster continuous improvement. They will also be used by Ofgem on behalf of customers to financially incentivise the delivery of our plan – see DSO Strategy (annex 4.2) for more details.

Customer outcomes		Benefits	Deliverables	Output measure/[1] *indicative input measure*	ED1 to date	ED1 forecast	ED2 target
DSO1	**Significantly expand our capture of network and market data to establish a vital building block for a smarter and more active energy system**	— Increased data availability — Improved data quality — Improved data accuracy — Stakeholder-led decision making	**DSO1.1)** Build on existing information management capabilities to expand network data and integrate datasets delivering capabilities by the end of 2025-26. Capture more detailed data more regularly, purchase data to enhance network visibility, and cleanse, structure and store data more effectively **DSO1.2)** Work with stakeholders to improve information exchange and understand flexibility service requirements **DSO1.3)** Deliver targeted installation of LV load monitoring equipment to significantly enhance network visibility	**LV ground-mounted substation networks directly monitored (ODI-F)**	4%	10%	50%
				LV load monitors installed (cumulative)	1,250	2,700	12,700
DSO2	**Transform our analysis capabilities to enable data-driven decision making in planning and operational timescales to drive value for customers while working in collaboration with others in the industry to improve the format and consistency of energy system data[2]**	— Consolidation of network data to make it single-point accessible — Increased network knowledge — Techniques developed to mitigate incomplete datasets — Improved losses monitoring through smart meter and LV data — Improved forecasting	**DSO2.1)** Use analytics and machine learning to emulate high quality and granular time-series data sets for LV networks **DSO2.2)** Utilise analytics engines and machine learning to enhance and verify time-series data sets for HV and EHV networks **DSO2.3)** Refine power flow models, and supplement forecasting and scenario modelling (such as DFES), using analytics engines to predict future power flows under different scenarios and therefore improving network planning and gaining operational insights **DSO2.4)** Create a static strategic planning model of the network which integrates historical and real-time data from various OT/IT systems delivering a complete set of capabilities by the end of 2025-26 **DSO2.5)** Improve the format and consistency of our forecasting information, in collaboration with other DNOs, and publish this via our network development plans, and expanded LTDS we share with stakeholders	**Historical operational and outage planning data shared – ESO/DSO**	-	-	*2023*
				Accurate forecasting of network needs (reconciliation of outturn vs. forecast)	*DFES*	*DFES*	*DFES and annual report*
				Standardised DFES inputs	-	-	>90%
DSO3	**Unlock new capabilities and benefits for customers through provision of open energy system data and engaging in joint planning with our stakeholders, including providing support for local authorities on the development of LAEPs**	— Increased open data — More dynamic and robust regional plans through two-way sharing of relevant and rich data	**DSO3.1)** Build enhanced functionality on top of our open data platform to unlock additional customer benefits. This will include a set of free analytical tools to help processing data and enhance self-service delivering capabilities by the end of 2026-27 CVP **DSO3.2)** Provide assistance and expertise to support the design of LAEPs in collaboration with local authorities and the wider energy sector, utilising knowledge of the network, loading projections, customer activity and the wider environment to provide feedback, feeding insights into our own plans	**Availability of energy system data products (ODI-F)**	-	-	+70%
				Network asset data stakeholder feedback survey and report		-	*Annual survey and report*
				New network asset data self-service (ODI-F)		-	2026-27

1. Measures are shown to track delivery of our customer outcomes. While 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 Openness and Transparency – OT1.1) Publish and report on our internal processes for investment appraisal of flexibility solutions and network reinforcement in such a way that demonstrates our flexibility-first approach and ensures the best outcome for the long-term planning of the network.

Customer outcomes		Benefits	Deliverables	Output measure/[1] *indicative input measure*	ED1 to date	ED1 forecast	ED2 target
DSO4	**Enhance processes and systems for network operations to enable a step change in our capability to optimise a system with increasing customer and network flexibility[3]**	— Increased network flexibility — Effective dispatch of flexibility services — Improved flexibility services processes	**DSO4.1)** Create a customer flexibility system with network operation processes that enables us to automatically dispatch flexibility services by integrating systems (such as Power on Fusion) with our flexibility platform (Flexible Power Platform). Planned to deliver capabilities by the end of 2025-26 **DSO4.2)** Enhance our ANM coordination and control to manage thermal, voltage and fault level constraints using a central and/or local management system to control flexible customer assets. Planned to deliver capabilities by the end of 2025-26 **DSO4.3)** Establish network flexibility solutions enabled by control systems to manage thermal, voltage and fault level constraints **DSO4.4)** Collaborate with the wider energy industry (via the ENA) to establish flexibility processes, communication and architecture to avoid conflicting operations **DSO4.5)** Upskill and recruit engineers to use whole energy system thinking to provide increasingly complex solutions to address decarbonisation **DSO4.6)** Offer flexibility services to the ESO to support system-wide decarbonisation	**Error corrections issued for dispatch (ODI-F)**	-	-	<10%
				Late issuance of dispatch data (ODI-F)	-	-	<10%
				Constrained data exchange ESO-DSO (ODI-F)	-	-	>90%
				Operational data exchange ESO-DSO (ODI-F)	-	-	>90%
				Common flexibility dispatch principles	-	-	*2025*
DSO5	**Enable a significant uptake of customer flexibility and facilitate development of new markets for customers providing services to networks**	— £156m benefits from flexibility and smart grid investment — Increased customer and network flexibility — Increased engagement with flexibility market participants — Increased capacity — Increased reliability	**DSO5.1)** Collaborate with the wider energy industry (via the ENA) to facilitate non-DSO services and network access rights **DSO5.2)** Develop, cost and procure flexibility products that are fit for purpose, taking a 'flexibility-first' approach **DSO5.3)** Develop a flexibility services communication, engagement and trading platform that allows third parties such as flexibility providers and aggregators to keep track of flexibility services related information such as service requirements, procurement methods, contracts and outage visibility **DSO5.4)** Create a system to automatically validate flexibility service provision, calculate remuneration and issue relevant invoices or compensation **DSO5.5)** Create a team of knowledgeable Flexibility Relationship Managers to actively engage with customers (such as service providers, aggregators etc.) to facilitate and support flexibility market development	**No. EHV substation areas in flexibility market evaluation (ODI-F)**	23	25	80
				Flexibility provider registration acceptance time <30 days (ODI-F)	-	-	>95%
				Procurement events response time <3 months (ODI-F)	-	-	>95%
				Common registration processes	-	-	*2024*
				Local flexibility stakeholder engagements (ODI-F)	-	-	*120*

Innovation | Data and Digitalisation | Workforce Resilience

1. Measures are shown to track delivery of our customer outcomes. While 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 WS2) Ensure customers' future needs are met through cross-sector and cross-vector planning.
3. Cross reference WS3) Develop the blueprint for the next generation network

How engagement with you has shaped our plan

DSO STRATEGY

DSO Strategy

How we engaged with you:

- We engaged >15,000 stakeholders on the subject of decarbonisation.
- In wave one we ran panels, roundtables, surveys and reports engaging >1,300 stakeholders.
- Net zero targets, collaboration and more network capacity, together with a socially inclusive transition, were core topics.
- In wave two we ran >75 events engaging >10,000 stakeholders, sharing plan options with customers, local interest groups, regional and central government, young people and our workforce.
- In wave three, we tested and refined plans across 31 events with about 3,000 stakeholders to understand in more detail areas where feedback was inconclusive, there were differences of opinion or new areas to consider.
- We finalised our plan in wave four, responding to queries, addressing gaps and testing overall acceptability. We engaged 10,805 customers and stakeholders overall and with detailed sessions on decarbonisation and outstanding DSO topics across 67 events.

ALL DECARBONISATION ENGAGEMENT

227 dedicated events

25,024 stakeholders engaged

What we have heard from you	How this has impacted our plan	Customer outcome ref	Annex detail
Define DSO benefits Stakeholders wanted clarity around the benefits of DSO and what a smarter, more flexible energy system means for them.	**We updated our plans to more clearly set out DSO benefits** We set out benefits customers will receive from investments in DSO enablers, including £156m of savings in 2023-28 through our flexibility-first approach.	DSO1-3	Link
Share more energy data and information Stakeholders wanted accessible data and expect us to take a leadership role in providing energy data to assist decision making.	**Our plan commits to increasing open data by 70%** We set data-sharing targets so that, by the end of 2028, we will share significantly more data than we do today.	DSO1-3	Link
Support local plans Stakeholders asked us to participate in developing local net zero plans.	**We will establish a new team of Local Area Energy Plan advisors** We will recruit advisors to work alongside planning engineers to ensure that specific local needs are met, including for vulnerable customers.	DSO3	Link
Invest in technology and automation to facilitate flexibility Customers wanted the chance to use our network more flexibly if it would benefit them and reduce emissions.	**Our plan invests £31m in flexibility enablers** We set out how we will invest to optimise the use of flexibility on the network, bolstered by £3m in flexibility market stimulation activity.	DSO4-5	Link
Develop flexibility markets Expert stakeholders suggested removing geographical restrictions, improving visibility of future opportunities and standardising flexibility products.	**We will deliver a range of new flexibility tools** Our plan sets out how we will collaborate with the industry to deliver flexibility products and tools. We will also recruit a team of Flexibility Relationship Managers.	DSO5	Link
Manage perceived conflicts of interests Stakeholders wanted further clarity around how we intend to address perceived conflicts of interest about DSO governance.	**We have clearly set out transparency measures in our plan** We will optimise synergies across DNO and DSO functions through transparent decision making and appropriate organisational design.	DSO5	Link

Enabling Whole System Solutions

We will advance optimisation of the costs, functionality and performance of energy services for customers through widespread collaboration to improve the whole energy system.

Electricity networks are at the heart of the ongoing transformation of the energy system.

All credible decarbonisation pathways that deliver net zero by 2050 see electricity playing a central role in decarbonising society's energy needs across transport, heating and industry. But the optimal pathway to decarbonisation is unlikely to involve just electricity. Hybrid, cross-vector technologies such as hydrogen could be vital in enabling decarbonisation across all sectors.

We need to ensure that the electricity system is ready to play its part in this whole system decarbonisation. This is a challenging undertaking, underpinned by the transition to DSO and significant investment in the network. As described in the Scenarios and Investment section, we are exploring the range of decarbonisation pathways that could materialise and have developed our Planning Scenario in relation to a broad range of plausible outcomes.

Underpinned by our network investment plans and DSO transition, our whole system plan focuses on how we are integrating whole system thinking into our business, as well as the specific actions we will take to facilitate whole system solutions.

By embedding whole system approaches, and investing £15m on specific initiatives, we will help deliver a greener, lower-carbon electricity system at a lower cost for customers as we make more efficient use of existing assets. We will also help drive improved service and cost in other sectors such as transport and heat to help achieve a net zero carbon economy. Given the challenge associated with quantifying these system-wide benefits, a subset of the direct benefits that we are able to quantify, indicates that our plan will deliver in excess of £263m of value to customers in 2023-28 and beyond.[1] This value is consistent across the various decarbonisation pathways described in the scenarios and investments section. Studies conducted by National Grid ESO and the Carbon Trust with Imperial College show that the scale of wider benefits is significantly greater. More detail on the benefits delivered by our whole system plan can be found in the Enabling Whole System Solutions (annex 4.3).

1. Whole life NPV using Ofgem CBA (discounted) – voltage optimisation and microgrids initiatives.

Defining the whole system and our role in it

Defining the whole system and our role within it.

Historically, our industry has focused on the whole system at the level of the electricity networks. But the whole system captures many other sectors and industries that are seeking to decarbonise.

Our work with customers, other energy system parties (e.g. the ESO, gas networks and energy suppliers) and stakeholders outside the energy sector (e.g. in transport and industry) has demonstrated that there are whole system opportunities to deliver even greater efficiency, emissions reductions, and better value for customers.

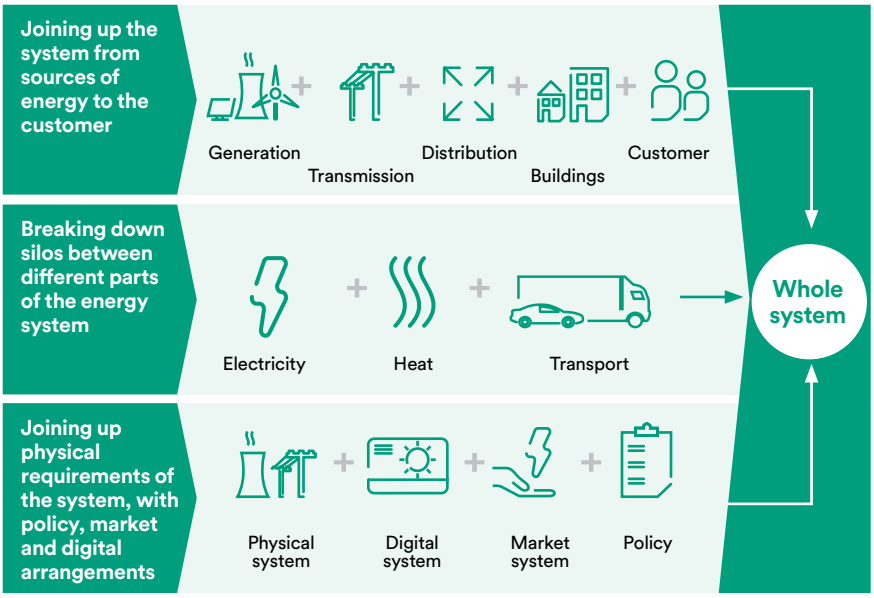
We will improve the whole energy system through widespread collaboration, lowering costs and improving quality of the energy services our customers receive.

To achieve this, we are working to ensure that whole system thinking is integral to all of our operations in two ways.

First, in understanding and playing our role within the whole system transition. This involves proactively managing the uncertainty around the decarbonisation pathway, understanding the potential roles of other vectors within the system, and investing in our network in a way that ensures we keep open all possible decarbonisation pathways.

Second, on a more day-to-day level, we are fostering a whole system way of thinking within our organisation and reflecting that in everything we do. In practice, this means identifying issues affecting the wider energy system, and proactively exploring our part in addressing those issues. In some cases, our role will be to lead on innovative solutions, coordinating across sectors. In others it might be to collaborate under the guidance of another sector, and elsewhere it will simply be to maintain a watching brief.

Achieving our vision is important for wider sustainability as well as for customers. By enabling more efficient use of assets and helping unlock sources of both generation and demand-side flexibility, we can minimise the need to build new infrastructure on our own network and in the wider system. This also supports our strategy to optimise whole system losses while facilitating net zero (see annex 4.5 Losses Strategy for more information).



Progress made in 2015-23 has given us a strong foundation to take forward wider, more innovative whole system solutions.

In the 2015-23 period we made significant progress in a number of areas, improving coordination and whole system thinking across electricity networks. Work is still ongoing in these areas, but some key examples of the progress made so far include:

- **Planning:** our investment planning processes now consider ESO's Future Energy Scenarios (FES) and Climate Change Committee's (CCC's) forecasts for GB as a whole (see scenarios section). Our involvement in the ENA's Open Networks engagements has also improved our Network Development Process (Capacity Signposting Report). In March 2021 we also published our Local Area Energy Plan (LAEP) Charter with Northern Gas Networks, setting out four principles to which we will commit to support local authorities in developing LAEPs.[1]
- **Operations:** we have improved coordination with the ESO through the summer 2020 COVID-19 pandemic lockdown system-balancing arrangements. We have also been working with other DNOs through the ENA's Open Networks project on network capacity, procurement, use of flexible resources, and maintaining system operational limits. (See DSO Strategy).
- **Data and Digitalisation**: we are taking a more coordinated approach to gathering and sharing data with other networks (including Independent Distribution Network Operators (IDNOs)) and local authorities, including through the Distribution Future Energy Secnarios (DFES) consultation process and open data access.[2]
- **Innovation:** we have established the Integrated Transport Electricity and Gas Research Laboratory (InTEGReL), a whole system test site built in collaboration with Northern Gas Networks and Newcastle University. InTEGReL is the UK's first test site that enables large-scale testing of whole system ideas bringing together the transport, electricity and gas sectors.
- **Optimising the value of the system for customers and customer assets:** we have progressed the roll-out of active network management (ANM), voltage reduction at bulk supply points (BSPs), and static voltage optimisation at HV/LV.

We can now build on our experience with further whole system innovations and broaden our view of the whole system beyond electricity networks and into other sectors.

1. See: northernpowergrid.com/asset/0/document/6056.pdf.
2. See: odileeds.github.io/northern-powergrid/2020-DFES/.

Building whole system plans

Our stakeholder engagement has shaped our vision.

We have engaged with a broad set of stakeholders within the energy sector and across other sectors (heat, transport, water and industry), including regulatory bodies, consumer groups, and industry representatives, including energy equipment manufacturers. See annex 3.3, our detailed stakeholder engagement annex.

The key messages we heard from our engagement include:

The need for sharing data and technical understanding (e.g. with local authorities to help develop LAEPs).

- The desire for a collective approach to explore solutions to regulatory and commercial barriers.
- That stakeholders have a wide range of energy-related interests, many of which are about energy use rather than energy systems. Therefore initiatives that improve demand and generation, customers' lives or finances are of more interest than initiatives that improve the network.

We have put a plan together to respond to these stakeholder needs.

Driven by what we have heard from our stakeholders, there are four strategic objectives guiding our whole system planning.

These strategic objectives have shaped our whole system plan for the next price control period. Guided by these objectives, in the next two sections we set out:

- the whole system approaches we are taking across our business, to ensure that our strategic objectives are reflected in our day-to-day decisions; and
- the whole system outcomes we will deliver through specific initiatives.

Whole system thinking drives planning and decision making across our business.

Our strategic objectives will ensure that a whole system approach features in our operational decisions day-to-day and that whole system thinking is central to all areas of our business. Below we describe some of the key approaches that we are implementing across our business to achieve this.

- **A flexibility-first approach to asset strategy.** In investing in our network to enable decarbonisation, we will take a flexibility-first approach. This will help us optimise the value of our own and our customers' assets. As explained in the Scenarios and Investment section, we will invest £92m on DSO flexibility-enabling actions in 2023-28, to deliver £156m of benefits for customers in the period (see DSO and Scenarios and Investment).
- **Understanding and managing cross-sector interdependencies.** We will collaborate with other regional infrastructure operators (e.g. gas network operators, water companies), together with the Environment Agency and regional bodies such as local resilience forums, to build a better understanding of cross-sector interdependencies. We will work together to formulate regional plans to mitigate the highest risks (both from and to our network such as flooding causing the failure of bridge structures carrying multiple utilities), understand the changing needs of other sectors and our impact on them, and improve resilience on our network (see annex 4.1 Climate resilience strategy). We will invest around £2m, including contributions to collaborative projects.

Our whole system strategy objectives

Drive whole system decarbonisation	**As increased use of our network facilitates decarbonisation, we will use whole system solutions to optimise carbon reduction and improve performance at an affordable price.**
Unlock value for customers	**Customers will be able to realise value from their assets by actively engaging, providing services to the energy system and to each other, releasing whole energy system cost savings.**
Create a network for the next-generation energy system	**We will set out the blueprint for a next-generation local energy network that links up energy sources and vectors, balancing in real time, to ensure a reliable and dependable energy service for customers.**
Collaborate through proactive whole system planning	**Customers' future needs will be met through cross-sector planning, both across the energy system and with suppliers and developers of technology, allowing customers to take advantage of new opportunities.**

- **Using data and partnerships to enhance support to vulnerable customers.** Targeted support through data sharing will make priority services and support tools available among trusted partners. Information on our enhanced service offering, access to affordability services and social indicator mapping tools will be made available and shared to support the most vulnerable within society, also allowing for collaboration referrals and targeted support for hard-to-reach and seldom-heard customers. See our Vulnerability strategy (4.11).
- **Continuous data exchange with the ESO.** We will build on established data- and information-sharing processes to continue identifying and using opportunities for more efficient operation of the whole system. We will implement near-real-time two-way data exchange with the ESO to enable efficient short-term market operation. By providing two-way visibility of our actions to trigger flexibility, we can ensure that our actions are complementary (see DSO Strategy).
- We will also continue to explore alignment in the way that the DNOs and ESO implement new flexibility services. We will aim to ensure that the specification and design of these services enables participants to provide their flexibility into transmission and distribution markets that efficiently coexist.

We will undertake more specific whole system deliverables to achieve four customer outcomes, generating value and enabling decarbonisation in collaboration with other sectors.

We have identified four specific customer outcomes that we will aim to deliver in order to achieve our strategic objectives. Each of these outcomes will be delivered through a number of deliverables, such as targeted innovation projects.

We plan to invest £15m to deliver these initiatives, resulting in £169m of net benefits for customers over the next 10 years (around £16m by 2028).[2]

Here we set out each of the four outcomes and provide examples of some of our deliverables. A full list of our deliverables can be found in the Whole System outcomes table overleaf, and further details can be found in the Whole System strategy.[1]

Our business plan enablers are essential to delivering these four outcomes and achieving our whole system objectives:

- **Innovation:** as well as building on recent successful innovation projects, we will explore, test and challenge new ideas to enable whole system decarbonisation through both incremental and large-scale innovation projects.
- **Data and Digitalisation:** we will invest in our systems, as well as sharing data and information to facilitate cross-industry and cross-sector collaboration.
- **Workforce:** we will train and recruit colleagues to embed a whole system mindset in our business culture.

There is inherent uncertainty in how decarbonisation will unfold, with new technologies and policy decisions emerging frequently. The optimal whole system solutions are, therefore, changing – both as new challenges emerge, and as technological developments present opportunities for new solutions.

Collaboration is key to unlocking whole system benefits

Ongoing collaboration with other industry parties is, therefore, key to ensuring that we are unlocking whole system benefits as new challenges and opportunities arise. For example, engaging regularly with energy suppliers will mean that we are aware of developments around time-of-use tariffs and can plan our network accordingly. Throughout the next five years we will continue to engage with stakeholders and refine our whole system approach.

We will continue to track factors that could impact our assumptions about the possible energy pathways and the implications for whole system decarbonisation. We will take this forward mainly through our interactions with stakeholders on improving DFES. Please refer to the Scenarios and Investment section for further discussion of how we will manage this uncertainty.

We plan to use smart meter data to optimise voltage improving the energy efficiency of customers' equipment, with a view to saving each customer up to £20 p.a. on their electricity bill.

Mark Callum
Smartgrid development engineer

Our plan recognises that the power distribution is only one part of our region's energy systems, albeit a critical one to optimising customer value.

Mark Nicholson
Head of smart grid implementation

1. See: Annex 4.3 Whole Systems strategy.
2. Per Ofgem CBA template – discounted NPV.

A progressive set of outcomes

Figure 1: Whole System customer outcomes

		Drive whole system decarbonisation	Unlock value for customers	Create a network for the next generation energy system	Collaborate with proactive whole system planning
WS1	**Remove barriers for customers to use their equipment to support the whole energy system.** To deliver this outcome we will identify barriers, such as informational gaps and coordination challenges, that limit the ability of customers to connect, invest, use their assets efficiently, or use the energy system efficiently. We will work with these customers to understand their needs and then develop and implement solutions accordingly. This will enable customers to benefit more from the efficient use of their own assets and the existing system, facilitating cost savings as well as quicker and cheaper decarbonisation. For example, a solar farm looking to connect to our network might require a costly connection based on its generation capacity in the summer, despite much lower generation in the winter. At the same time, a battery operator might be seeking a connection in the same area. If the two could coordinate and connect jointly, there could be significant synergies in the form of reduced utilisation of the network and lower connection costs. One of our whole system initiatives is designed to overcome this coordination challenge. We will invest £0.4m to collaborate with other network operators in our region to create an open register and a process that allows interested parties with complementary energy needs to find each other – 'energy matchmaking'.	●	●	●	●
WS2	**Ensure our customers' future needs are met through cross-sector and cross-vector planning.** We will work closely with energy industry parties and other stakeholders to ensure that network planning, as well as planning of wider investments such as storage and generation, is carried out as efficiently as possible from a whole system perspective. For example, we will undertake annual workshops to ensure the widest range of stakeholder input (including heat networks, hydrogen and transport sector) is factored into forward plans, and collaborate to develop cross-vector energy storage technologies to allow energy optimisation between vectors. We will also continue to participate in processes already in place with the ESO and other DNOs to promote coordinated network planning, e.g. around further developing FES, DFES and network development plans.	●	●	●	●
WS3	**Develop the blueprint for the next-generation network by rolling out proven innovation.** As society becomes more dependent on electricity, we will seek ways to maintain and improve reliability, availability, and efficiency throughout the seasons. Many of these innovative solutions will require coordination with other energy sector stakeholders, and/or may be more expensive than traditional solutions but can deliver net benefits when costs and benefits are assessed on a whole system basis. For example, building on our ED1 Boston Spa Energy Efficiency Trial (BEET) project[1] we will invest £7.9m to roll out voltage optimisation technology that uses smart meter data to safely reduce the supply voltage that consumers receive, and reduce their energy usage as a result. If successful, we will start deploying this technology more widely across our network. From a whole system perspective this will deliver £167m[2] of net benefits over the next 10 years (at which time the roll-out will be complete) and could help customers save £20 p.a. on the average domestic energy bill (see Customer Value Propositions (CVP) section). Beyond this, these initiatives could deliver an estimated net benefit of £81m[2] p.a. We will also invest £6.7m to roll out microgrid technology to 30 of our most vulnerable low voltage networks on a fixed basis (see CVP section), and six mobile microgrid vans.[3] This will deliver £3m whole system net benefits for our customers and wider society over the next 10 years, initially through the societal value attributed to the improved system resilience as experienced by customers, and increasingly through the support the microgrids provide to wider system security as the network loading increases as we approach net zero – see our Vulnerability strategy. Beyond this (out to 2050), this initiative is forecast to deliver an estimated net benefit of £12m[2].	●	●	●	
WS4	**Exchange knowledge with those specifying future low carbon technology (LCT) and low carbon use cases.** We will work with partners beyond the energy system to foster whole system thinking in product and service design. If future products can be designed in a way that optimises their performance, reflects whole system needs, and minimises their impact on the electricity system, this will help contribute to low-cost decarbonisation. For example, we will work with industrial and transport manufacturers and their trade bodies and standards bodies to contribute to the design and specification of future equipment.	●			●

1. In 2015-23 we will also have deployed this technology in three primary substations to manage energy efficiency.
2. Per Ofgem CBA template – discounted NPV.
3. In 2015-23 we will also have rolled out two microgrids on low voltage networks.

Customer outcomes		Benefits	Deliverables	Output measure/[1] *indicative input measure*[2]	ED1 to date	ED1 forecast	ED2 target
WS1	**Remove barriers for customers to use their equipment to support the whole energy system, launching an open register and energy matchmaking process that enables parties to work together to reduce costs and deliver whole system benefits**	— Customers will be able to maximise value from their assets by providing services to the energy system or to each other — Lower whole system costs — Cheaper connections costs — Quicker connections	**WS1.1)** Undertake an NIA-funded innovation project informed by inter-seasonal energy requirements (ref WS2.3) to determine the system impact of commercial options for inter-seasonal storage. This will provide commercial and technical energy policy insights to drive this future market **WS1.2)** Collaborate with other network operators in our region to create an open register and a process that allows interested parties with complementary energy needs to find each other – 'energy matchmaking'. We will facilitate the initial engagement between parties, who can then work together to produce whole system benefits, such as reduced utilisation of the network, reduced probability of constraints and greater value that is possible through enhanced coordination	*Date of NIA project learnings publication*	-	-	*End of period*
				Energy matchmaking scheme go-live	-	-	*2025/26*
WS2	**Ensure our customers' future needs are met through cross-sector and cross-vector planning, including annual workshops with a wide range of stakeholders such as the heat, hydrogen and transport sectors to develop our regional DFES[2]**	— Quicker, cheaper decarbonisation — Increased service performance — Reduction in costs	**WS2.1)** Undertake annual workshops to ensure the widest range of stakeholder input (including heat networks, hydrogen and transport sector) is factored into forward plans, and that our DFES becomes the focal point for regional 'energy' scenarios **WS2.2)** Develop new network planning tools to improve our modelling of the impact of flexibility and mobile loads, and therefore improve our network planning process. Work with other DNOs and build on previous learning **WS2.3)** Undertake an NIA-funded innovation project to develop techniques to understand the differing summer and winter loads as electric heat develops and generation becomes dominated by renewables, and the requirement for summer-harvested energy to be stored for winter use[3] **WS2.4)** Building on Northern Gas Network's (NGN) Winlaton hydrogen project and our joint InTEGReL projects, we will collaborate with Northern Gas Network and other partners to develop cross-vector energy storage technologies to allow energy optimisation between vectors and provide additional value to our customers offering these services	**Annual workshops for heat networks, hydrogen and transport sectors**	-	-	✓
				Date of NIA project learnings publication	-	-	*End of period*
				No. cross-vector innovation projects across the period	*0*	*0*	*≥2*
WS3	**Develop the blueprint for the next-generation network by rolling out proven microgrid technology and deploying network voltage optimisation to deliver energy efficiency savings for customers**	— £167m of net benefits from voltage optimisation over 10 years: £20 bill savings p.a.[4] — 424,000 tCO_2e savings over 10 years — £2m of net benefits from microgrids over 10 years[4] — More resilient supplies — Dependable energy as the no. alternative energy sources reduces (even during storms)	**WS3.1)** Undertake the first-stage deployment of the blueprint for the next-generation energy system to enhance system resilience, particularly for remote customers, by rolling out innovative microgrid technology in some of the most remote parts of our network (CVP) **WS3.2)** Optimise network voltage to improve energy efficiency, delivering a reduction in customer energy bills and carbon emissions by dynamically managing voltage on our LV network (CVP)	**No. fixed microgrids rolled out on low voltage (LV) networks**	0	2	30
				Percentage of LV customers benefiting from voltage optimisation	0	0%	30%
WS4	**Facilitate knowledge exchanges with organisations specifying future LCTs and low carbon use cases**	— Lower overall costs and optimised performance due to future energy use concepts and designs being developed with whole energy systems in mind	**WS4.1)** Collaborate with organisations supplying equipment and solutions to industrial and commercial (I&C) customers and their trade bodies. This will ensure that standards for future I&C customer equipment and network infrastructure are specified for optimised performance and costs **WS4.2)** Collaborate with organisations supplying equipment and solutions to domestic customers for use 'behind the meter' and their associated trade bodies. This will ensure that standards for network optimisation and home optimisation complement each other, and that system planning keeps pace with changing customer demands	*No. low carbon equipment supplier consultations in period*	*1*	*5*	*≥50*

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 DSO Strategy annex 4.2: local area energy planning.
3. Cross-reference enabling inter-seasonal storage WS1.1.
4. NPV based on Ofgem's CBA.

Innovation | Data and Digitalisation | Workforce Resilience

How engagement with you has shaped our plan

Enabling Whole System Solutions

How we engaged with you:

- 25,000 people heard and shaped our decarbonisation plans, with collaborative, whole energy systems proving to be of significant interest.
- We ran panels, roundtables, surveys and published reports with stakeholders, including customers, partners, local interest groups, regional and central government, young people and team members.
- Wave one activities saw 1,300 stakeholders engaged across 54 events. In wave two, 75 detailed events were held including dedicated focus groups. Meetings, surveys and workshops engaged 2,154 individuals over 33 events in wave three.
- We finalised our plan in wave four, responding to queries, addressing gaps and testing overall acceptability. We engaged 10,805 customers and stakeholders overall and with detailed sessions on decarbonisation and outstanding whole system topics across 65 events.

ALL DECARBONISATION ENGAGEMENT

227
dedicated events

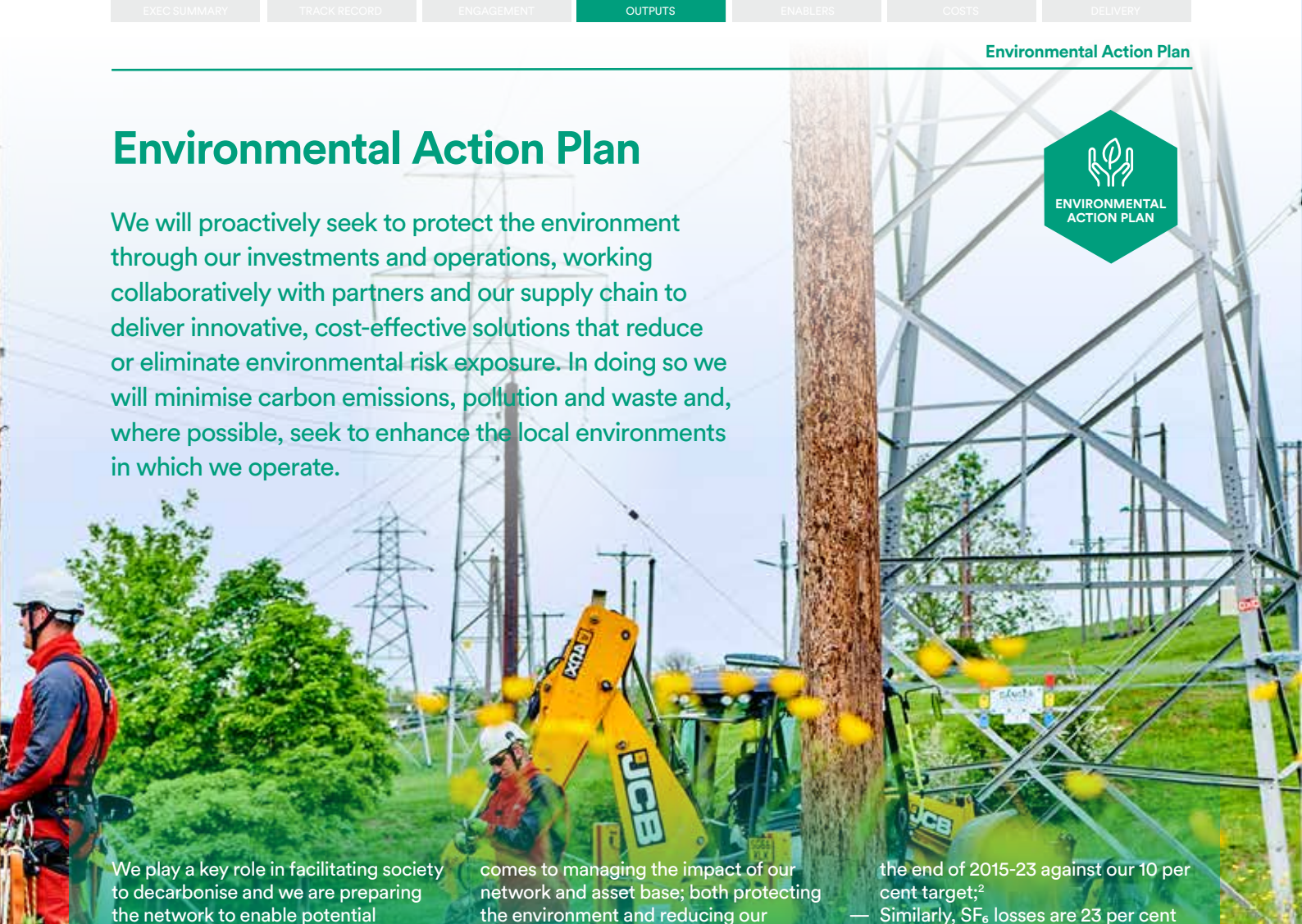
25,024
stakeholders engaged

What we have heard from you	How this has impacted our plan	Customer outcome ref	Annex detail
Enable customers to use their assets to support the energy system Customers expressed their interest in taking part in peer-to-peer energy trading, using their assets to offer solutions for the local energy system and its users.	**We introduced an 'energy matchmaking' service to our plan** We will invest £0.4m to support collaboration with other network operators, developing an open register of parties with complementary needs.	WS1	Link
Collaborate and coordinate activities with others in the energy system Stakeholders expected cross-sector and -vector coordination to understand and minimise the cost impacts from the different investments needed for decarbonisation.	**Collaboration is embedded in our plan** We will deliver annual stakeholder workshops to ensure a wide range of inputs into long-term planning, develop new network planning tools, progress innovation projects and advance cross-vector energy storage technologies.	WS2	Link
Reduce whole electricity bills Stakeholders wanted innovative solutions that benefit the whole energy system and the net zero transition to be accessible and beneficial to fuel-poor customers.	**Our plan targets customer bill savings** Our roll-out of dynamic voltage optimisation to 1.2m customers by 2028 could save households an estimated £20 p.a. on average on their energy bills and generate carbon savings of 27kg p.a. Our roll-out will be phased to maximise benefits for vulnerable customers.	WS3	Link
Innovate to shape the future energy network There was broad support for the rolling out of smart, community-level energy solutions that create a resilient network for the low carbon energy transition.	**We will demonstrate the blueprint for the next-generation energy system** Our roll-out of 30 fixed microgrids will create a blueprint that can be used across the country while improving security of supply as dependence on electricity increases.	WS4	Link
Work with experts and early adopters Stakeholders wanted us to work across sector boundaries and demonstrate an approach that tackles decarbonisation challenges in a joined-up way.	**Our whole system plan reaches beyond the energy system** We have included specific initiatives to collaborate with organisations that supply equipment and solutions to customers and their trade bodies.	WS4	Link

Environmental Action Plan

ENVIRONMENTAL ACTION PLAN

We will proactively seek to protect the environment through our investments and operations, working collaboratively with partners and our supply chain to deliver innovative, cost-effective solutions that reduce or eliminate environmental risk exposure. In doing so we will minimise carbon emissions, pollution and waste and, where possible, seek to enhance the local environments in which we operate.



We play a key role in facilitating society to decarbonise and we are preparing the network to enable potential pathways on the transition to net zero. Whilst supporting our region on this journey we will take action to reduce the environmental impact of our own network operations.

Environmental protection is important to our stakeholders.

The nature of our business means we have a responsibility to protect the environment and minimise our impact where we can. This presents opportunities to utilise innovation to drive change and overcome challenges. Societal shifts will deliver an improvement in carbon emissions driven by the overall carbon intensity factor falling, for example reducing building and substation energy emissions and losses. In support of this, legislation is forcing progressive societal changes towards the net zero target including the ban on sale of new petrol and diesel vehicles by 2030. We have an obligation to protect the environment, support society's path to net zero and minimise long-term costs to consumers.

Our stakeholders have told us that they expect high levels of ambition when it comes to managing the impact of our network and asset base; both protecting the environment and reducing our business carbon footprint (BCF). Environmental protection was in the top quartile of stakeholder priorities; specifically, we have heard:

- we should lead by example in reducing our own emissions;
- reducing SF_6 emissions and oil leaks is important;[1]
- we should reduce our BCF but via the most cost-effective means;
- biodiversity initiatives should be increased in terms of scope and scale; and
- visual amenity is valuable but not essential.

Our plans build on strong performance in the 2015-23 period.

During the current price control period we have performed strongly on environmental measures compared to our own targets and we benchmark well compared to other networks.

- Our BCF has so far, in this period, reduced by 48 per cent against our original ten per cent target, meaning we have achieved our stretch target to deliver a 47 per cent reduction by the end of 2015-23 against our 10 per cent target;[2]
- Similarly, SF_6 losses are 23 per cent lower since the start of the current price control period;
- We have reduced oil and fluid lost to the ground by 47 per cent to date through investment in our network and deployment of innovative solutions, surpassing our 2015-23 target of 15 per cent;[3] and
- By the end of 2023 we will have removed 114km of overhead lines in Areas of Outstanding Natural Beauty (AONB) and national parks.

How much it will cost

2023-28 expenditure (annual)	**£27.0m** 4.1% of totex
versus 2015-23	**-£0.8m** -2.9%

One of our eight plan areas, taken together, delivering more for less.

1. Sulfur hexafluoride, a greenhouse gas.
2. Including contractors and excluding losses, relative to our current business plan baseline (59,700 tCO_2e).
3. Relative to our current business plan baseline (53,245 litres).

An ambitious set of outputs

Our Environmental Action Plan (EAP) delivers an ambitious set of outputs at a lower cost to customers through the use of innovative technologies and solutions.

The total cost of our plan is £27.0m p.a., which is £0.8m (2.9 per cent) lower than we currently spend each year. For this expenditure we will achieve significant output improvements while also accommodating £8.6m p.a. of unavoidable costs relating to the removal of polychlorinated biphenyls (PCBs) – 32 per cent of the expenditure in our EAP. We achieve these outcomes efficiently by harnessing innovative solutions, most notably perfluorocarbon tracer (PFT)[1] and self-healing cable technology, allowing us to generate a saving of £8.1m p.a. in cable replacement while achieving comparable fluid loss outcomes.

Reducing our internal BCF is a key priority and our plan will set us on a path to be carbon net neutral by 2040.

While we play a vital role in supporting society to decarbonise, we must also work to decarbonise our own operations and reduce our greenhouse gas emissions. We have set ambitious targets to reduce our internal BCF and intensity of emissions from our supply chain while delivering value for money for stakeholders.

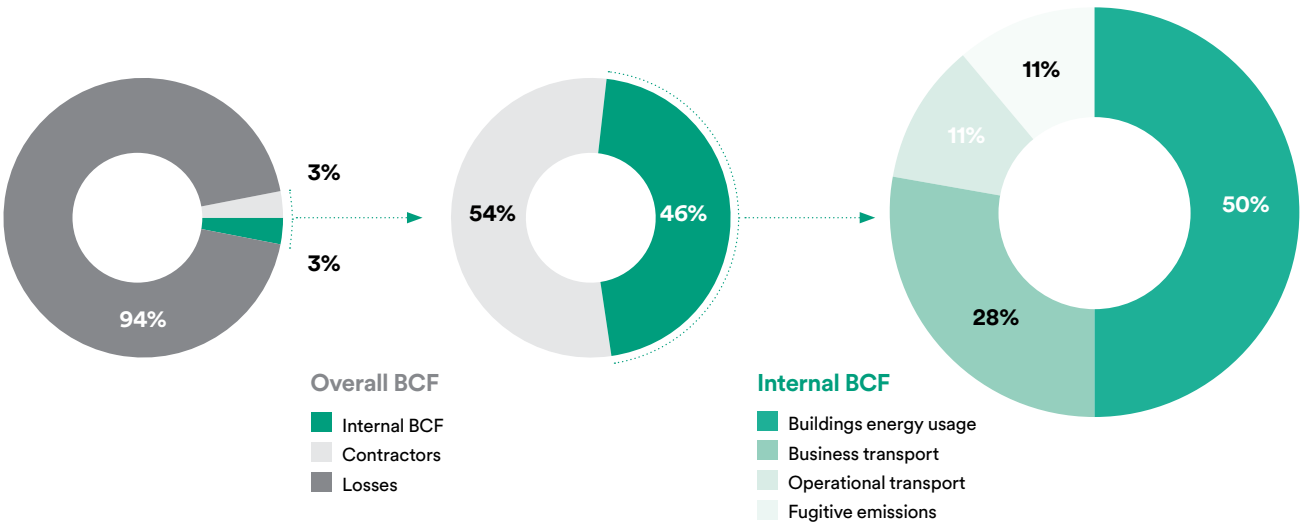
Our plan is carefully calibrated to ensure that we make strong progress while ensuring efficient costs for customers that will come from future developments in technology.

Our stakeholders showed strong support for an ambitious plan that achieved internal carbon net neutral operations by 2040. This puts us ahead of the government's commitment to be net zero by 2050 and represents a trajectory that aligns with the government's interim commitment to reduce emissions by 78 per cent from 1990 levels by 2035. Our plan balances ambition with long-term costs, taking measured but progressive steps between 2023 and 2028, while allowing low carbon technologies (LCTs) such as ultra-low emission vehicle (ULEV) and zero emission vehicle (ZEV) technology, charging infrastructure and renewable generation to develop and reduce in cost, ensuring long-term value for money for customers.

By 2028 we will target a 20 per cent reduction in controllable internal BCF by:

- reducing building and substation emissions by 15 per cent; we will begin to introduce renewable generation onto our property estate, optimising the most cost-efficient solutions, and we will introduce BREEAM initiatives to make our sites more sustainable;[2]
- increasing the number of ULEVs and ZEVs on our fleet to 40 per cent and developing the required charging infrastructure across our property portfolio;
- leveraging adjustments to our operations made during the pandemic to support reduced business mileage; and
- reducing SF_6 losses by 15 per cent through targeted asset replacement.

Figure 1: components of our business carbon footprint (BCF)



1. Perfluorocarbon tracers: an additive put into fluid-filled cables that 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.
2. Building Research Establishment Environmental Assessment Method (BREEAM) is a sustainability assessment method that is used to masterplan projects, infrastructure and buildings.

Reducing our business carbon footprint

Building and energy substation use accounts for nearly 50 per cent of our total controllable internal BCF.[1] During 2023-28 we will introduce LCTs, including renewable generation across our properties, with a view to matching generation with our own consumption.

We have already begun introducing ULEVs/ZEVs onto our fleet and we plan to scale this up with the addition of a further 265 vehicles to 40 per cent ULEV/ZEVs by the end of 2028. This will support us in reducing the impact of our operational transport emissions. We considered options for various levels of penetrations of ULEVs and ZEVs to our fleet. Our 40 per cent target aligns with our fleet replacement cycle (five to seven years), balances costs of charging infrastructure and provides time for the availability of public charge points to increase to ensure reliable operation of our fleet (see our CBA-46, ULEVs/ZEVs on Fleet). We will look for opportunities to go further in the next price control period where technological developments, infrastructure and funding allows, to make this a beneficial proposition for our customers.

To address business transport emissions, which are made up of employees travelling to site or for business meetings, we will retain benefits from the adjustments made to our business during the COVID-19 pandemic, leverage technology and promote more flexible working, as set out in our Workforce Resilience strategy to target a 15 per cent reduction.

SF_6 is 22,800 times more potent than CO_2,[2] and is a key component of grid infrastructure with limited commercially viable alternatives currently available. Our SF_6 strategy targets a 15 per cent reduction in losses through targeted asset replacement and continued use of thermal imaging Forward Looking InfraRed (FLIR) camera technology to pinpoint and target leaks on the network. We have begun trialling the use of non-SF_6 alternatives on our network as we innovate to tackle fugitive emissions with a view to adopting alternatives when practical and cost-efficient to do so. For more details, see our SF_6 strategy in our Environmental Action Plan (annex 4.4).

We do not plan to offset our carbon emissions at this stage in our path to net zero operations. Our stakeholders have told us that they would rather we focused on reducing our own physical carbon emissions before offsetting. An extra pound of investment in our network to enable decarbonisation offers much better value to customers than incremental spend on carbon offsetting for our own emissions.

We will optimise whole system losses while facilitating net zero.

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 unavoidable in distributing electricity. The main type of losses are technical losses resulting in electricity converted into heat on the network.

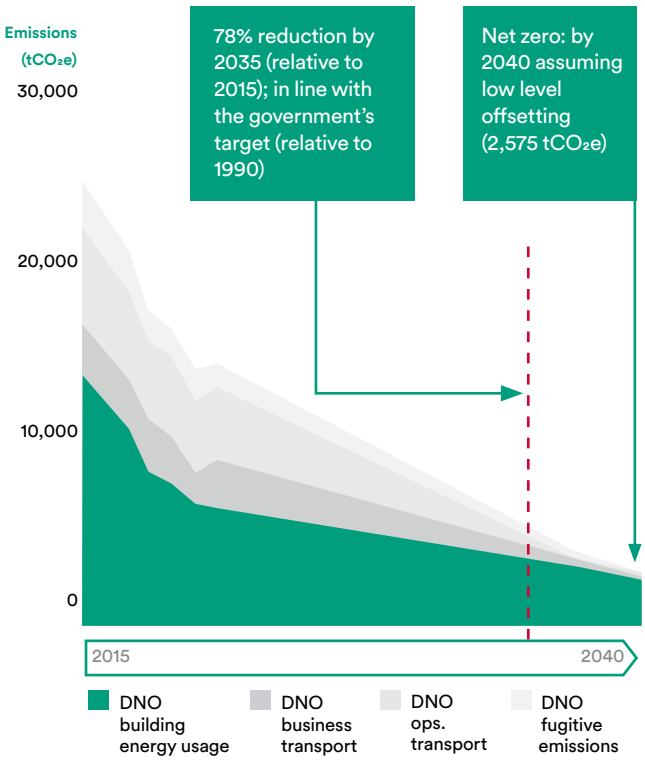
For Northern Powergrid, the magnitude of losses equates to roughly 2TWh per year (94 per cent of our total carbon footprint). When expressed as a percentage of the total energy entering the network, losses are approximately six per cent. This energy that is 'lost' needs to be generated and therefore has a financial and carbon impact. We work to ensure losses are as low as reasonably practicable.

Losses are mainly determined by the energy requirements of our customers where the higher the loading, the higher the losses. Decarbonisation will result in a significant increase in network loading, so, when taking into account that the majority of our existing network will continue to operate well into the future,[3] losses will generally increase.[4]

Figure 2: make-up of our operational fleet

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%

Figure 3: our path to internal carbon net neutral operations



1. In 2020-21.
2. DEFRA figure used as this is what we report via the Regulatory Reporting Pack (RRP) process, noting that the strictly standardised mean difference (SSMD) states SF_6 is 23,500 times more potent than CO_2.
3. Consisting of roughly 63,000 substations and over 60,000 miles of circuit.
4. ENA working group project: Impact of Low Carbon Transition – Technical Losses.

We will, therefore, only be in a position to directly influence a small percentage of the losses on our network, primarily when we make changes to our network and install new equipment.

Nonetheless, 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 customer outcomes CO3.1 and CO3.2.

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 to do so in the future; such as the use of lower resistance cables at low voltage (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 the 2023-28 as part of our Whole System Solutions plan.

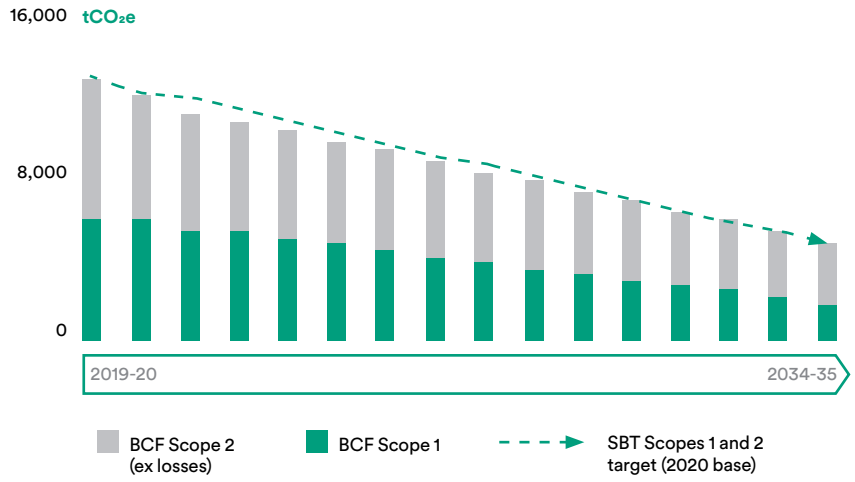
Our losses approach is to optimise whole system losses while facilitating net zero:

1. **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.

2. **Whole system** A whole system approach is imperative, where increasing distribution network losses to obtain a reduction in transmission losses and wider carbon reduction is a positive outcome.

3. **Facilitate net zero** Through our transition to Distribution System Operation (DSO), we are committed to a flexibility-first approach. The use of customer flexibility and smart solutions will often lead to an increase in network losses. From a whole system 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.

Figure 4: Scope 1 and 2 (excluding losses) emissions against SBTs



Our plan to manage losses is detailed in our Losses Strategy in annex 4.4. These actions range from the deployment of low-loss technologies to enhanced use of data for improved planning and operation of the system. As part of the significant decarbonisation investment in transformers, and our environmental investment to remove PCB-contaminated transformers, we will be adopting amorphous core technology where it can provide a net benefit to our customers, which is roughly 80 per cent of all units.[1]

We will report on our progress in delivering our losses strategy annually.

We are adopting science-based targets so our emissions are aligned to limiting global temperatures to 1.5°C.

Science-based targets (SBT) provide a clearly-defined pathway for companies to reduce tCO_2e emissions, helping to prevent the impacts of climate change and future-proof business growth. Targets are considered 'science-based' if they are in line with the goals of the Paris Agreement. A carbon budget is calculated that identifies levels of emissions consistent with limiting global warming to 1.5°C.

Scope 1 and 2 emissions.

To meet the carbon budget, our emissions need to reduce annually by 4.2 per cent relative to our baseline of 2019-20. Our SBT (covering Scopes 1 and 2) is to reduce our emissions by 63 per cent by 2035, at which point we would emit 208,470 tCO_2e p.a.

Our plan is set to achieve our SBTs. They have been developed with the support of an external consultant and we are in the process of being verified by the science-based target initiative (SBTi).[2]

Projected emissions within Scope 2 are dominated by losses. As losses emissions are not directly within our control and are heavily dependent on the rate at which the grid decarbonises, there is significant variability in the future projections. Figures 4 and 5 show our forecast emissions reductions against our SBTs excluding and including losses.[3]

We will report on our BCF reduction and progress towards our SBT based on a common methodology.

Scope 3 emissions: supporting our supply chain

Scope 3 emissions cover a broad range of emissions in the value chain, some of which we capture data for today and some that we currently do not.[4]

1. Subject to final review of learnings from our amorphous transformer (AMT) trial.
2. We are in the process of submitting our science-based targets to the SBTi to be verified.
3. Scope 2 emissions for distribution losses.
4. Scope 3 emissions are all indirect upstream and downstream emissions that occur in the value chain of the reporting company, excluding indirect emissions associated with power generation (Scope 2).

We track contractor emissions and these account for about half of our overall carbon footprint (excluding losses).

Engagement with our supply chain has highlighted that our suppliers are at very different stages in their transitions to low carbon operations. Around 50 per cent of our suppliers have set decarbonisation targets in line with our own to reach net zero by 2040 or sooner, however some do not yet have well-developed plans.

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, in particular through our willingness to pay testing. 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.

For 2023-28 we will launch a package of measures that will support environmental performance in our supply chain. We will implement a Responsible Procurement Charter (RPC) which will have a key focus on supporting our suppliers to reduce their emissions (see Openness and Transparency). Our charter will set out consistent standards and our framework for a collaborative approach. We will target 90 per cent of our suppliers (based on contract value) to be compliant with our RPC which will require annual reporting on actual and forecast emissions against their own targets.

We also plan to make changes to our procurement process to explicitly factor environmental standards into our choice of supply chain partners. Once we have selected our partners, we will invest £1.2m over the 2023-28 period, funded through cost efficiencies in our plan, to support suppliers in enhancing environmental competences including achieving ISO 14001 accreditation so that all of our suppliers have consistent baseline standards.

In our planning scenario, network investment levels could increase by over 75 per cent 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. 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. This way we can demonstrate the impact of our initiatives in achieving continuous improvement in emissions rates. Our target will be set to reduce by 4.2 per cent p.a. in line with SBT principles.

For the remaining Scope 3 emissions, we will implement tracking over the 2023–28 period to build our data sets in order to establish baselines from which to take further meaningful and actionable steps to reduce emissions. We will report on our progress annually.

Figure 5: Scope 1 and 2 emissions science based targets (SBTs) (including losses) showing range of future pathways for losses

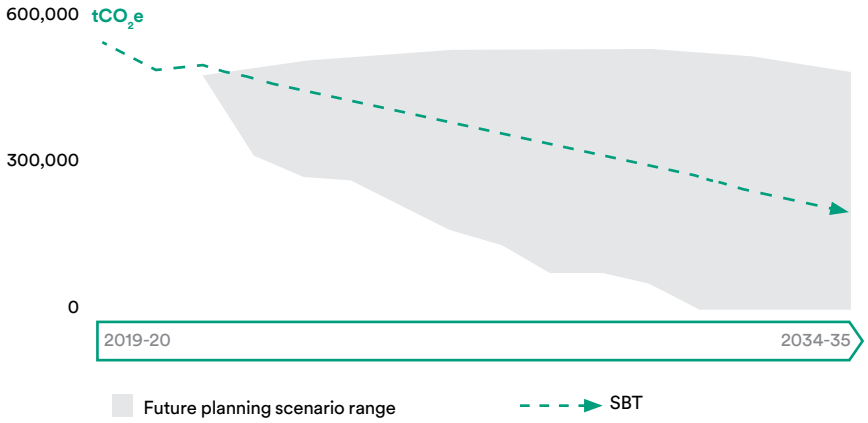
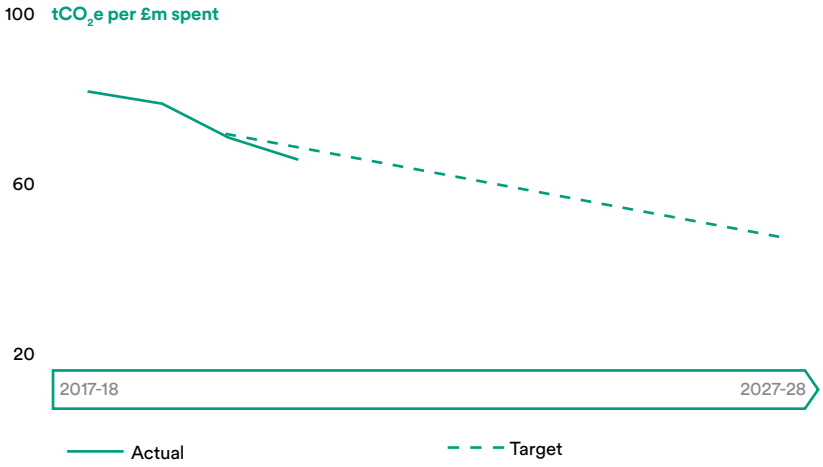


Figure 6: supplier emissions per £m of contractor capital investment



We will assess and report on embodied carbon in new projects.

We are collaborating with other DNOs to develop a model that will allow us to calculate a baseline for embodied carbon and then measure the impact of new projects. The method has been developed based on industry best practice sources and methodologies. This gives an opportunity to give greater accountability in our operations and to collaborate with suppliers to deliver downstream benefits and transparency. We will use the data to support our investment decisions based on the whole life carbon cost associated with work on our network.

Reducing the environmental impact of network activity

Oil and fluid loss from our network poses an environmental threat that we must continue to reduce.

Reducing fluid lost to ground is a priority for our stakeholders and an area where we will continue to have a strong focus. By maintaining and managing our fluid-filled cable (FFC) network we reduce fluid leaks to ground preventing environmental damage and minimising risks of cable failures.

We have significantly outperformed our current plan in this area. By 2023 we will have replaced over 220km of cable compared to our original plan of 134km. This puts us in a strong position, despite having one of the largest FFC networks in the country.

Our investment options to minimise fluid loss during 2023-28 include:

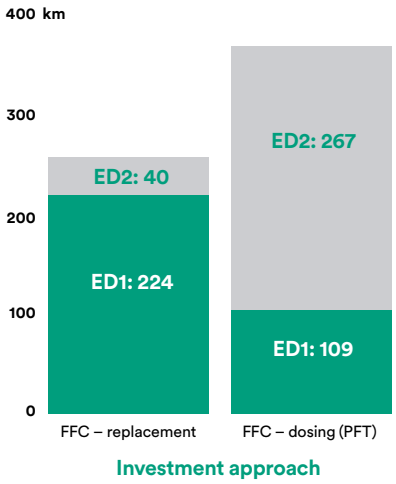
- replacement of the FFC with new solid cables containing no fluid;
- refurbishment of the FFC;
- injection of PFT directly into the FFC; and[1]
- injection of self-healing cable fluid.[2]

Replacement of the fluid-filled cables has traditionally been the main method of reducing fluid loss. While this provides a long-term solution to the risk posed by FFC it is costly. Refurbishment often does not provide good value for money to our customers as the costs associated with refurbishing a FFC circuit can be almost as much as cable replacement. PFT dosing and tracing is now widely available and has become a proven technology, which is significantly less expensive than cable replacement and allows us to detect leaks faster. Self-healing cable fluid is currently undergoing live trials on our network and the technology, although promising, is very much still in its infancy.

Our target to reduce our fluid loss by 15 per cent leverages the significant asset replacement programme completed in the current price control period, to maintain focus on fluid loss reduction but with much lower investment levels than we've seen to date. Our plan will reduce cable replacement annually by 70 per cent and increase PFT injection rates by 400 per cent. We will introduce self-healing cable fluid additive to our network subject to successful trials and adjust PFT investment accordingly.

This blended approach delivers output performance for 2023-28 equivalent to that targeted for 2015-23 while delivering an annual net cost saving of £8.1m.

Figure 7: investment options for fluid-filled cables



> **Through consultation with our stakeholders we have set ambitious targets to drive our environmental performance.**

Gordon Walker
Environmental manager

Recent legislation requires decontamination or disposal of equipment containing PCBs from our network by 2025.

Polychlorinated biphenyls (PCBs)[3] could potentially exist in all ground- and pole-mounted transformer oil if the transformers were manufactured prior to 1987. New legislation requires removal of all PCB-contaminated oil from our network by the end of 2025 due to its high levels of toxicity.

By testing our ground-mounted transformer population we have identified 461 transformers confirmed to contain PCB oil, which will be addressed by either replacing the oil or the unit. Pole-mounted transformers, however, are sealed units making testing for PCBs impossible currently. To overcome this, we have been working with the Energy Networks Association (ENA), our industry trade body, to develop a statistical model based on historical data to support network operators in estimating the number of pole-mounted transformers that might contain PCB oil.

We currently have a total of 16,742 pole-mounted transformers that were manufactured prior to 1987 that could potentially contain PCBs. Through the statistical model we estimate that the number of pole-mounted transformers we need to address is over 8,401 – a significant challenge. We will be taking the opportunity to reduce PCB risk in a way that maximises synergies and supports decarbonisation including by installing amorphous core transformers to reduce our energy losses while sizing our assets for future forecast load growth in our investment scenarios.

Given the large volumes involved, PCBs are the largest cost driver within our environmental plans with an unavoidable annual cost of £8.6m p.a. However this will be almost entirely offset by the savings we have planned through our blended FFC strategy.

1. The length of circuits dosed with perfluorocarbon tracers. Perfluorocarbon (PFT) tracers are an additive put into fluid-filled cables that 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.
2. Self-healing cable fluid solidifies upon contact with air and can stop very small leaks from becoming larger.
3. PCBs are synthetic organic chemicals that were manufactured for use in various industrial and commercial applications – including oil in electrical transformers, plasticisers in paints, plastics and rubber products – because of their non-flammability, chemical stability, high boiling point and electrical insulation properties.

Managing our wider environmental impact

We will manage our wider environmental impact and maximise opportunities to bring about positive benefits.

Waste management is imperative when considering the protection of our wider environment. Our plan will set us on a path to achieve zero waste to landfill by 2035. We will aim to divert 90 per cent of waste from all of our operations by 2028, managing the greater quantity of waste generated from the additional network activity required to deliver our overall investment plans and decarbonisation objectives. Additionally, we will target a recycling or reuse rate of 85 per cent of total materials by 2028.

We have an opportunity to enrich local habitats through our activities. Our plan is set to deliver biodiversity initiatives to promote natural habitats and increase the variety and variability of species and ecosystems at 200 of our major sites. This relatively low-cost initiative (£0.1m p.a.) carried support from our stakeholders and includes working with partners such as Natural England and engaging our local communities. We will also monitor our impact from new connection and network projects to assess our impact on ecosystems.

Noise and other effects from our activities such as dust, smoke, odour and disruption caused by digging up roads can be a nuisance to the communities we serve. 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. Our deployment of SilentPower battery vehicles will assist in this area.

Within our region we have four National Parks and five AONBs. By 2023 we will have put 114km of overhead lines underground in these areas. Our stakeholder engagement highlighted an appetite for us to continue this programme and we pride ourselves on being industry leaders in this area. We will continue this programme – at the same run-rate, with up to 10 per cent outside of designated areas – to improve the visual amenity in our region.

Our EAP supports our long-term ambition to minimise our environmental impact while ensuring value for money for our customers.

Our EAP carefully balances ambitious output targets with affordability for our customers. By the end of the 2023-28 period we will be well positioned for net zero operations by 2040; we will have significantly expanded our environmental management standards within our supply chain, achieved double-digit reductions in pollution in our local environments and delivered on legislative obligations for PCBs, all while reducing total costs to customers.

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

Our ISO 14001 certified environmental management system (EMS) provides a robust framework against which we continually assess our environmental impact, performance against our environmental plans and associated risks and opportunities. A summary of these risks, challenges and opportunities is set out in our Environmental Action Plan (annex 4.4).

Customer outcomes		Benefits	Deliverables	Output measure/[1] *indicative input measure*		ED1 to date	ED1 forecast	ED2 target
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 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 5kg 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	**Science-based target Scope 2 emissions (losses only)** (tCO2e)		526,909	480,710	365,210
			EP2.2) Install super low-loss amorphous core transformers	*Low loss transformers (units)[3]*		4	5	12,000
			EP2.3) Install low-loss (i.e. oversized) LV and HV cables	*Low loss cables (km)[3]*		*1,582*	*2,240*	*3,400*
			EP2.4) Improve the energy efficiency of our substations	*Number of substations assessed*		*N/a*	*N/a*	*100%*
EP3	**Promote environmental management and decarbonisation of our supply chain, achieving 90% compliance with our responsible procurement charter[4]**	— Reduction in energy and fuel use — Reduction in waste to landfill	**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 through the period	**% of suppliers compliant**		N/a	N/a	90%
				Normalised contractor emissions rate (tCO2e 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 FFC 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*
				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/ remediated*	*Ground-mounted transformers*	*0*	*34*	*427[6]*
					Pole-mounted transformers	*0*	*413[6]*	*8,401[6]*
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%[7]	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

1. Measures are shown to track delivery of our customer outcomes. While 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.
4. Cross-reference Openness and Transparency OT2) Governance and sustainability frameworks.
5. Includes 15 units delivered synergistically via asset replacement.
6. Includes 500 units delivered synergistically via reinforcement.
7. We are forecasting to invest £3.5m above our allowances from efficiency savings – an additional 16km of overhead lines removed from AONB.

Innovation | Data and Digitalisation | Workforce Resilience

How engagement with you has shaped our plan

ENVIRONMENTAL ACTION PLAN

Environmental Action Plan

How we engaged with you:

- In wave one, we engaged 721 stakeholders on their environmental priorities through a range of panels, roundtables, surveys and reports.
- We tested options generated from the first wave in wave two, discussing our EAP in detail at 18 events, engaging 14,861 individuals.
- We tested and refined our EAP at eight events in wave three, such as online panels, forums, surveys, discussions and conferences, engaging 2,628 individuals.
- In wave four we finalised our plan, responding to queries, addressing gaps and testing overall acceptability. We engaged 10,091 customers and stakeholders overall and with detailed sessions on outstanding EAP topics across eight events.

48
dedicated events

28,301
stakeholders engaged

What we have heard from you	How this has impacted our plan	Customer outcome ref	Annex detail
Balance ambition with affordability In our Emerging Thinking consultation, customers chose high levels of ambition to reduce our environmental impact but at the same time wanted us to be mindful of costs.	**We have maximised innovation to deliver environmental benefits at lower cost** Our plan deploys innovative technologies that deliver ambitious environmental outcomes, while reducing the cost to our customers by £0.8m p.a.	EP1 EP2 EP3 EP4 EP5 EP6	Link
Take ambitious steps to net zero Stakeholders supported the introduction of low- or zero-emission vehicles to our fleet, on-site renewable energy, and the proactive reduction of SF_6 emissions.	**We set a target to be carbon neutral by 2040** Our plan will deliver a 20% reduction in our internal business carbon footprint by 2028 through a range of measures. We carefully calibrated our plans for 40% ultra-low emission vehicles in our fleet mindful of making the transition at most efficient cost.	EP1	Link
Minimise network losses Most consumers supported an ambitious approach to minimising network losses to reduce costs to consumers, and wanted to be kept up-to-date with progress.	**Our losses strategy will go further to support greater energy efficiency** We introduced more low-loss equipment into our network investment plan, and improvements to energy efficiency at our major sites. The progress of our losses strategy will be reported annually.	EP2	Link
Support the supply chain to decarbonise but at no extra cost Stakeholders wanted us to work collaboratively with our contractors to lower emissions and improve sustainability; but they did not support paying more to bring suppliers in line with our own targets at this stage.	**We introduced a new contractor emissions reduction target** Our plan includes a suite of new measures to support decarbonisation and improve environmental standards in our supply chain including our Responsible Procurement Charter and a £1.2m programme of support funded by efficiencies in our plan.	EP3	Link
Prioritise reducing fluid loss Stakeholders told us fluid loss was one of the most important areas for our plan.	**We set a target to reduce oil loss by 15%** We are introducing a range of innovative initiatives to further reduce oil loss at lower cost including dosing >250km of FFC with PFT.	EP4	Link
Prioritise flora and fauna Stakeholders were concerned by pollinator decline and wanted us to extend our environmental proposals to non-designated landscapes.	**We introduced a collaborative, regional biodiversity programme** We will optimise synergies across DNO and DSO functions through transparent decision making and appropriate organisational design.	EP6	Link
Continue to improve visual amenity Customers supported undergrounding overhead lines in National Parks and Areas of Outstanding Natural Beauty (AONB) but wanted us to manage potential disruption.	**We will continue our undergrounding programme at current run-rates** We will deliver 73km of undergrounding while working collaboratively with our customers to mitigate impact and disruption.	EP6	Link

OUTPUTS – MAINTAINING A SAFE AND RESILIENT NETWORK

Safety

We will be energy industry leaders in safety, keeping our colleagues and members of the public safe so that they can return home safely at the end of the day. We will be proactive in assessing and mitigating emerging safety risks, collaborate with others and explore potential innovation and technologies that offer opportunities to make our network and operations safer.

How much it will cost

2023-28 expenditure (annual)	**£3.0m** 0.5% of totex
versus 2015-23	**£0.0m** 0.0%

One of our eight plan areas, taken together, delivering more for less.

The safety of our customers and colleagues is paramount. We have delivered an industry-leading safety performance over the current plan period, and will continue to improve during 2023-28 by focusing on the leading causes of injuries and reducing exposure to high-risk activities.

We are committed to delivering a safe network and environment for our colleagues and for those we serve across the region.

We intend to continue our improvement during the next business plan period, so that we can further reduce our accident rates, lessen the severity of incidents, and reduce the impact of occupational ill health on our colleagues and contractors.

We are on track to exceed the commitment we made for 2015-23 to halve our accident rate, which was underpinned recently by a record run of 690 consecutive days without a recordable lost-time accident. Our benchmarking positions us as an industry leader on safety performance and we have used this position and our learnings since 2015 as the foundations for our business plan.

Our 2023-28 plan has been built around the following objectives:

- We will deliver an annual safety performance that represents our best-ever performance from 2015-23. Sustaining this performance throughout the five-year period will enable us to halve our accident rate again by 2028.
- Our intention is to remain as a leading safety performer by maintaining our International Organization for Standardization (ISO)-accredited safety management system and investing in training programmes to equip our managers and first-line supervisors with the skills to identify and resolve at-risk behaviours.
- We will also invest in wearable technology solutions for front-line colleagues to provide improved information to reduce risk and manage fatigue.
- We will continue to engage with our customers and communities about managing risk around our network equipment and infrastructure, to ensure the public remains safe.
- Our contractors' safety performance is a major priority. We will enhance the effectiveness of our collaboration with contractors to deliver a significant improvement in their safety performance.

Continuously improving our safety performance

We will deliver an enhanced package of outputs investing £3.0m each year, or £15.0m over the five-year period.

Culture and accreditation will underpin our efforts.

A key factor in maintaining a leading position in colleague safety performance will be the ongoing delivery of an improved safety culture that focuses on the leading causes of injuries, and reduces exposure to high risk activities. We have held an externally verified accreditation for our safety management system since 2004, upgrading that accreditation to the ISO 45001 standard during 2015-23. We will maintain that accreditation throughout 2023-28 ensuring that our safety management system underpins the improvement in performance.

Investing in the training we provide our colleagues will continue to be a priority. We will invest in safety training programmes for our first-line managers and supervisors that will equip them with the necessary skills to identify and resolve at-risk behaviours and actions. We will continue to invest in driver training to further reduce the number of preventable vehicle accidents by 2028. As part of this commitment we will be sponsoring 250 colleagues to undertake the IAM RoadSmart advanced driver accreditation.

Our stakeholders highlighted that they would like to see our fleet vehicles equipped with the latest safety technology to improve our driving safety performance and reduce vehicle accidents. As a result we will be equipping our fleet vehicles with collision avoidance and lane-departure warning technology as standard. Also, we will invest in a new vehicle telematics system that will enable us to benefit from significant improvements and developments in the technology since 2015 when our current telematics system was installed.

We will continue to prioritise the health and wellbeing of our colleagues and invest in a technology-supported approach that enables us to better monitor and ensure positive impact in this area.

To support our ambitions to further improve our colleagues' mental and physical health and wellbeing we will invest in an independently verified, ISO-accredited health and wellbeing programme (ISO 45003). The health and wellbeing programme will take our stakeholders' feedback into account – with particular focus on using technology to monitor and prevent health risks, and reducing the impact of fatigue in our workforce. We will continue to effectively manage working hours, limiting the maximum consecutive hours worked to 16 hours, including on-call periods.

We recognise that supporting colleagues' health and wellbeing will become ever more important as the impact of the COVID-19 pandemic changes working circumstances. Our health and wellbeing programme will include initiatives to further support the mental health of our colleagues.

We have a well-established programme for training our colleagues in the skills they need to undertake work safely on the electrical distribution network. This already caters for safe working methods with the power sources we have at customers' premises now. However, as the network changes with increased power sources at our customer's homes we will update our training programmes to ensure that our colleagues continue to be able to undertake their roles safely. Our community energy advisors will also provide important public safety messages associated with low carbon technologies for our customers.

Our contractors' safety performance is not at the same level as ours and we want to support them to improve their performance.

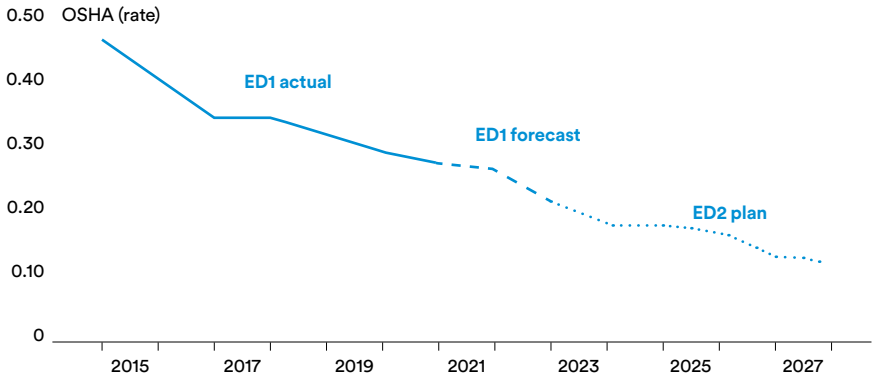
Throughout the extensive engagement we have undertaken, stakeholders have told us that when it comes to safety they expect our contractors to perform to the same level as us. Our contractors play a key role in delivering our work programmes, but their accident rate is nearly three times that of ours. While our safety performance has improved, the safety performance of our contractors has remained relatively flat.

We intend to enable our contractors to achieve this ambition and while we recognise this will take time to fully deliver we will set ourselves on the right trajectory by aiming to halve their current accident rate by 2028. To achieve this we will enhance collaboration with our contractors so that we will focus on reducing exposure to high-risk activities and learning from incidents. We will also align our respective safety management systems and focus on the delivery of safety improvement plans.

Ambitious safety awareness programmes for children and minimising inadvertent contact with overhead lines in at-risk sectors will help keep the people we serve safe.

Public safety is important to stakeholders, with safety awareness training for school-age children being highlighted as one of our highest safety priorities. Stakeholders asked that we set an ambitious target to reach more than 55,000 school-aged children each year through our education programmes, which we will aim to achieve through a combination of online training packages, face-to-face training and collaboration with other infrastructure providers in our region.

Figure 1: our Occupational Safety and Health Act (OSHA) recordable accident rate, rolling five-year average



Rural stakeholders wanted to see a significant investment in safety awareness for high-risk sectors such as agriculture and road haulage that are at risk of inadvertent contact with overhead lines. We are investing in an innovation project that could produce a solution that enables the GPS location of overhead lines to be loaded in the navigation systems of agricultural vehicles to alert drivers to the presence of overhead lines. We will continue to engage with these groups about the hazards of overhead lines and how to avoid inadvertent contact with them.

Stakeholders were also in favour of installing defibrillators in fleet vehicles, which could be used to support our communities. We plan to equip some of our fleet vehicles with portable defibrillators and explore how we can link this into the community first-responder programmes run by the local ambulance services in our region.

Customer outcomes		Benefits	Deliverables	Output measure/[1] *indicative input measure*	ED1 to date	ED1 forecast	ED2 target
S1	**Maintain our position as an industry-leading safety performer delivering continued improvement by focusing on leading causes of injuries, and continuing to reduce exposure to high-risk activities**	— Reduced number of injuries to our workforce — Reduced number of vehicle accidents and injuries	S1.1) Deliver a comprehensive safety training programme for first-line managers and supervisors that will equip them with the necessary skills to identify and resolve at risk behaviours and actions S1.2) Deliver a behavioural safety programme that addresses the root causes of minor accidents that relate to complacency, distraction and lack of concentration S1.3) Complete an independent study into arc flash workwear technology developments and renew our workwear contract to ensure colleagues benefit from the latest technology S1.4) Deploy digital solutions to transform the process of safety data acquisition, processing and analytics to better inform improvement and intervention areas, including virtual reality training S1.5) Deliver a comprehensive driver training programme that meets drivers' individual needs based on risk assessments and driving behaviours S1.6) Ensure our fleet vehicles are equipped with the latest telematics technology to enable data-based interventions to support driver behaviour changes S1.7) Operational skills training updated to incorporate new requirements from changes resulting from transition to DSO or changes in generation at customers' premises.	**OSHA rate**[2]	0.27	0.22	**0.12**
				RIDDOR rate[2]	0.12	0.07	**0.02**
				No. colleagues with behavioural safety training	-	-	*1,800*
				Health and Safety Executive (HSE) compliance	✓	✓	✓
				No. colleague drivers trained[3]	*112*	*120*	*200*
S2	**Expand safety management standards within our supply chain, achieving a 50% reduction in contractor accident rates**	— Reduced number of injuries to our contractors	S2.1) Implement methodology on contractor safety performance improvement target-setting and monitoring S2.2) Integrate hazard and near-miss reporting systems through application programming interface (API) solutions S2.3) Update safety performance expectations for contractors with 2023-28 targets S2.4) Deliver increased proportion of enhanced audits on contractors based on risk assessments	**Contractor OSHA rate**	0.73	0.55	**0.37**[2]
				Date of reporting system go-live	-	-	*2024 /25*
				No. enhanced audits[3]	*1,047*	*1,340*	*1,610*
S3	**Improve the standards of health and mental wellbeing among our workforce**[5]	— Improved health and wellbeing of staff — Improved attendance rate	S3.1) Implement a health and wellbeing management system that is accredited and externally verified under the ISO 45003 framework S3.2) Deliver a health and wellbeing programme that supports ongoing improvement in the physical and mental health of colleagues S3.3) Reduce the risk of fatigue in the workforce through the effective management of working hours	*ISO 45003 accreditation*	-	✓	✓
				In addition, we will track: Colleague access to healthcare services	-	-	-
S4	**Deliver targeted intervention and education programmes in our communities**[6]	— Increased awareness of hazards to school-aged children — Lower number of contacts with overhead lines — Safer agricultural working practices — Reduction in repair costs from damaged lines	S4.1) Deliver awareness education programmes that utilise technology solutions to reach more school-aged children and workers from high-risk sectors S4.2) Support the Ambulance Service(s) through their community first-responder programmes, equipping fleet vehicles with a defibrillator S4.3) Enable the agricultural sector to reduce the number of contacts with overhead lines by developing an innovative technology solution to alert workers to the location of overhead lines	*No. children engaged p.a.*[3]	*43,473*[4]	*43,400*	*55,000*
				No. overhead line contacts p.a.[3]	43	41	**31**

1. Measures are shown to track delivery of our customer outcomes. While 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. Rolling five-year average; Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR); Occupational Safety and Health Administration (OSHA).
3. Rolling five-year average.
4. COVID-19 pandemic impact: As a result of social distancing, our face-to-face school engagement ceased in 2020-21 and is being restarted in stages for the remainder of the current plan period.
5. Cross-reference Workforce deliverable 3: increase workforce engagement
6. Cross-reference Physical and Cyber Resilience deliverable PC3.1 Rapid incident response.

Innovation | Data and Digitalisation | Workforce Resilience

How engagement with you has shaped our plan

SAFETY

Safety

How we engaged with you:

- In wave one, we discussed safety at three events with >100 stakeholders, including phone interviews with rural customers, online panels and one-to-ones with the Health and Safety Executive (HSE).
- We tested our Emerging Thinking in wave two, engaging with over 4,500 domestic consumers, partners, commercial consumers, stakeholders, SMEs and future energy consumers.
- In wave three, we tested and refined our safety plans and priorities by engaging 2,473 stakeholders across six events.
- We finalised our plan in wave four, responding to queries, addressing gaps and testing overall acceptability. We engaged 10,021 customers and stakeholders overall and with detailed sessions on outstanding safety topics across five events.

28 dedicated events

17,376 stakeholders engaged

What we have heard from you	How this has impacted our plan	Customer outcome ref	Annex detail
Build on your strong health and safety performance Stakeholders asked us to build on our safety performance and continue to deliver cost-effective improvements.	**Health and safety will continue to be our No.1 priority** Our plan builds on our ISO-accredited safety management system and invests in training to identify and resolve at-risk behaviours.	S1 S2 S3 S4	Link
Set stretching safety targets Stakeholders want us to continue to improve our safety performance, recognising this is an area of incremental improvement.	**We will maintain industry-leading safety standards** We will target another 50 per cent reduction in our accident rate.	S1	Link
Prioritise PPE and workwear Colleagues ranked safety-wear, PPE and safety equipment improvements for front-line teams ahead of other safety initiatives.	**Our plan delivers workwear upgrades** We will renew our workwear contracts, incorporating the latest safety technology.	S1	Link
Contractor safety performance should be a priority Stakeholders challenged us to enhance contractor safety standards and performance.	**We set ambitious targets for contractors** Our safety targets aim to reduce contractor accident rates by half by reducing exposure to high-risk activities and aligning our safety management systems.	S2	Link
Prioritise colleague health and wellbeing Stakeholders wanted us to learn lessons from the pandemic and introduce a structured workforce health and wellbeing programme.	**We will accredit our wellbeing systems** Our health and wellbeing programme for colleagues will be accredited by external experts, ensuring that it considers the changing needs of our workforce.	S3	Link
Support community health Customers supported us carrying defibrillators in company vehicles and felt staff should also be first-aid trained where possible.	**Our plan pilots defibrillators in our vehicles** We will introduce defibrillators into 100 fleet vehicles.	S4	Link
Focus on high-risk safety areas Stakeholders asked us to focus our safety awareness education on high-risk sectors such as agriculture and haulage.	**We will use innovation to reach more high-risk groups** We will support a joint technology project for drivers of agricultural vehicles to improve their safety around overhead lines.	S4	
Expand our education reach Stakeholders pressed us to be ambitious and extend school safety talks to reach more young people across our region.	**We extended the reach of our educational programme by 35 per cent** We will increase the reach of our safety education programmes to 55,000 school-aged children.	S4	

Reliability and Availability

We will drive excellence in our front-line operations and have a network that is safe, resilient and reliable but also smart and flexible. Progressive use of network technology will allow us to manage an increasingly dynamic and complex low carbon energy landscape for our customers in real time.

By the end of 2023-28 we will have improved the reliability and availability of our network with increased technology and efficient operational response, underpinning our customers' transition to decarbonisation.

Our reliability and availability performance has improved significantly over a long period of time – our supplies are available 99.99 per cent of the time and the majority of you experience no power cuts in a given year.

System-wide reliability performance is measured by the number of customer interruptions (CI), which is the number of power cuts in a year per 100 connected customers, and the number of customer minutes lost (CML), which is the average power cut duration in terms of the number of minutes lost per connected customer.

We're proud to be on track to significantly outperform our reliability and availability commitments in the 2015-23 period. We have reduced the number of power cuts (CI) by 27 per cent and their length (CML) by 37 per cent relative to our baseline,[1] exceeding our CI and CML commitments (of eight per cent and 20 per cent respectively) for the 2015-23 period.

We have also reduced the number of customers experiencing extended power cuts (i.e. those lasting longer than 12 hours) by a third. And we have reduced the average length of planned power cuts by 20 per cent, to just over three hours.

These performance improvements have been driven by investing £34m in doubling the number of remote-control operation points on our high voltage (HV) network over the period;[2] continued deployment of automated power restoration system (APRS) technology to automatically restore customers following faults and supporting our operational response with smart fuse technology at low voltage (LV).

You've told us that maintaining a high level of reliability on our network is essential and will remain that way, especially as the reliance on electricity increases.

Though most customers were not dissatisfied with their current level of service, our stakeholder engagement indicates that there is support for a further step change in performance. And, while the exact transition pathway to net zero by 2050 remains unclear, we do know there is likely to be increased reliance on electricity for heating and transport. This will make it even more important that our network is reliable and available for our customers. Indeed, our stakeholders have told us that reliability is one of their top priorities.[3]

Our stakeholders have told us that they want to see a stronger focus on reducing the length of power cuts (CML). In addition, our stakeholders have been very supportive of the use of new technology to reduce the number and duration of power cuts.

During our engagement, most stakeholders believed we should prioritise investment in the worst-performing parts of the network and use of new technology on our HV and LV network, which will allow us to shorten restoration times and proactively manage potential failures where possible.[4]

How much it will cost

2023-28 expenditure (annual)	**£153.8m** 23.3% of totex
versus 2015-23	**+£13.5m** +9.6%

1. The 2015-23 baseline was defined against network performance in 2012-13.
2. Total forecast spend for ED1 on HV automation.
3. NPG, Willingness to Pay. Customer Priorities, Quantitative Prioritisation, August 2020.
4. Emerging Thinking – Supporting Material.

Building on our strong 2015-23 performance, we can deliver a step change in service in the next regulatory period by installing higher volumes of remote switching and automation on our HV networks.

While we have always met or exceeded our reliability targets set by Ofgem, we recognise there is an opportunity in the 2023-28 period to deliver a better service for our customers. On average on our network, 49 customers out of 100 experience interruptions in a year and customers experience 37 minutes lost per annum. But Ofgem's current working assumptions for our 2023-28 targets require a step change in our CI and CML performance relative to today.

Our plan aims to rise to the challenge. Based on our review of the options available and our consultation with stakeholders, we are proposing an investment programme involving accelerated roll-out of automation on our HV network, which is key to improving our network reliability at the lowest cost. We have invested efficiently in HV automation in the past, which has helped us to exceed our reliability targets in the current period. Our plan aims to build on this position by increasing the number of remote switching and network automation points at the HV level.

Our analysis has shown that this is the lowest-cost way to raise performance levels to meet our new targets, when deployed in conjunction with effective operational response to fix faults on the network. There are alternatives to automation, in the form of increased asset replacement or increasing our workforce to deliver improved operational response. However, this is less cost-efficient than automation, which also allows us to optimise the use of our current workforce in response to faults.

We also need to make improvements on our low voltage network to realise performance improvements.

Improvements in our network capability at HV alone will not enable the performance improvement required to meet stakeholder expectations or to meet our regulatory targets. We will also need to improve fault restoration times on our LV network to reduce the impact of interruptions on customers.

Our assessment has shown that our LV network requires continued targeted investment and rapid deployment of new technology to further improve our performance.[1] This is because our LV network has relatively high levels of challenging legacy cable types, which have yet to reach the end of their useful life.[2]

Our programme of investment in network upgrades is efficient.

We have assessed a number of options as well as the stakeholder feedback. Our plan includes expenditure of £153.8m p.a. to deliver our reliability targets. This is £13.5m p.a. (+9.6 per cent) more than our expenditure in the 2015-23 period, driven by our investment in network capability upgrades.

We have tested our proposals to ensure that our proposed costs are efficient while delivering customer priorities.

- An optimised programme across HV and LV: our plan contains £64.8m of investment in HV automation technology to double the rate of installation on our network from 2023-28. We will also invest £38.5m in a range of LV technologies across the network over the period, including smart fuses and proactive fault management technology. Over half of this investment will enable further preventative fault detection on our wider suite of LV devices, such as our LV monitors, further enhancing support of efficient net zero investment decisions. These investments in upgraded capability account for the increase in cost compared to 2015-23.
- Keeping ongoing operational costs flat: our business-as-usual fault restoration costs are in line with the industry median. We will continue to identify efficiencies to fund front-line performance improvements, which will allow us to provide improved service for our customers at no additional cost.
- Ensuring customers only pay for the upgrades we deliver: the funding to deliver this programme is included in our plan as baseline allowances. To give Ofgem and customers comfort that we will only be funded for what we deliver of our HV Automation programme, we propose to include this investment as a bespoke price control deliverable (PCD).

The remainder of this section of our Reliability and Availability plan is structured to provide more detail around our stakeholders' priorities.

- Our plan is focused on improving system-wide performance on unplanned outages, in order to impact the largest number of customers.
- We also have specific proposals to improve services for customers who experience below-average performance, i.e. our worst-served customers.
- Our plans to improve our planned power cuts service.
- Finally, we set out how we will leverage data, innovate, and upskill our workforce to deliver our commitments and prepare for the future needs of customers.

Figure 1: reliability plan costs	2023-28 total £m	2023-28 annual average £m	2015-23 annual average £m	Variance	
				£m	%
Non-load capex – HV Automation	64.8	13.0	4.8	8.2	170.2%
Non-load capex – LV Automation	21.9	4.4	2.9	1.5	51.0%
Non-load capex – worst-served customers	4.3	0.9	0.0	0.9	-
Non-op capex	16.6	3.3	0.0	3.3	-
Network operating costs	435.5	87.1	90.0	-2.9	-3.2%
Closely associated indirects	141.1	28.2	26.4	1.9	7.0%
Business support costs	84.8	17.0	16.2	0.7	4.5%
Total proposed cost	**769.0**	**153.8**	**140.3**	**13.5**	**9.6%**

1. See: EJP-10.2 LV Network Automation.
2. See: Emerging Thinking – Supporting Material.

Improving system-wide reliability and availability

Our plan is set to continue our strong performance trajectory from the current period into the 2023-28 period, delivering a step change improvement through the use of technology as reliance on the electricity network increases.

Ofgem's targets for 2023-28 will require a step change in our reliability performance. We will strive to achieve the three per cent and 15 per cent reduction in CI and CML in Yorkshire and seven per cent and 15 per cent reduction in CI and CML in Northeast in 2023-24 that these targets demand.

Given the scale of the challenge, those improvements may not be deliverable by March 2023. However, our plan will enable us to continue on a steeper trajectory of improvement, so that by the end of the period we will aim to have reduced the number of power cuts (CI) that our customers experience by 12 per cent relative to our current performance. In addition, we will have sought to have reduced the impact of power cuts on our customers, delivering 25 per cent shorter power cuts (CML) relative to our current performance.[1]

Figure 2: Northeast – customer interruptions[2]

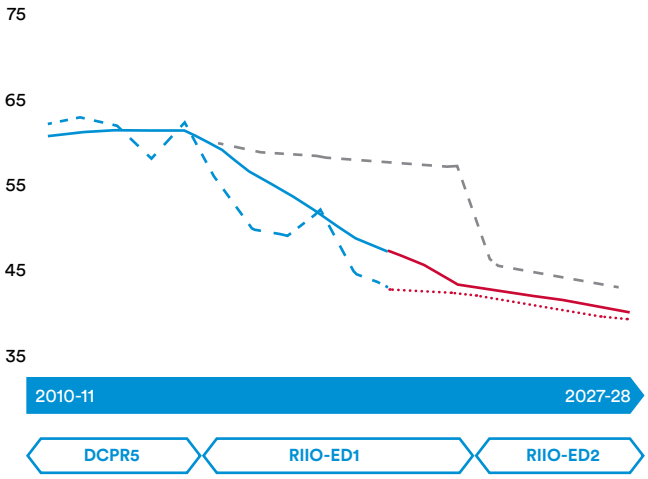


Figure: 3: Yorkshire – customer interruptions[2]

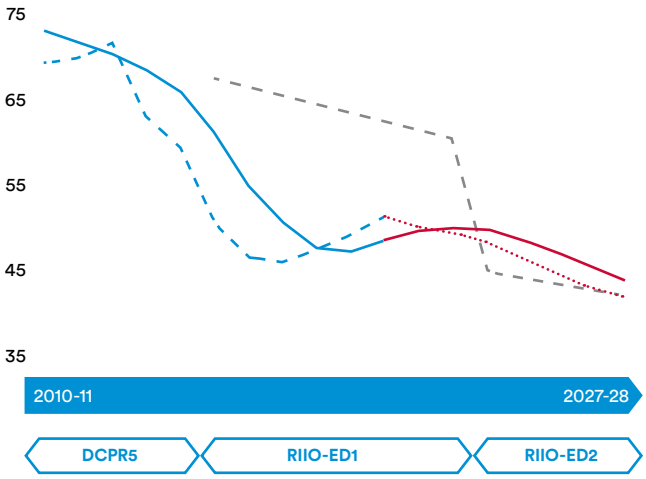


Figure 4: Northeast – customer minutes lost[2]

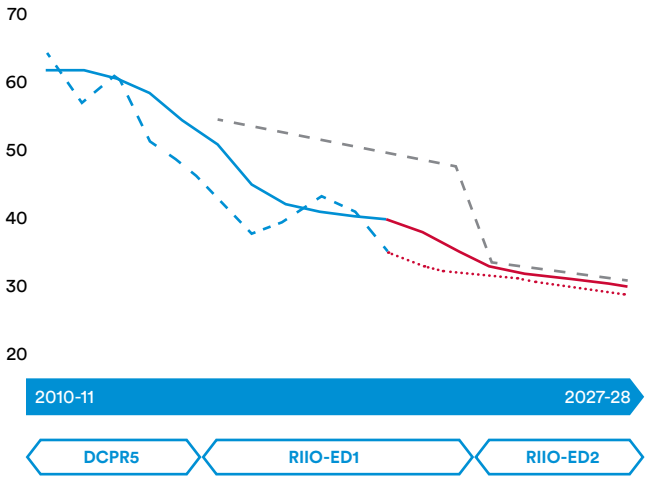
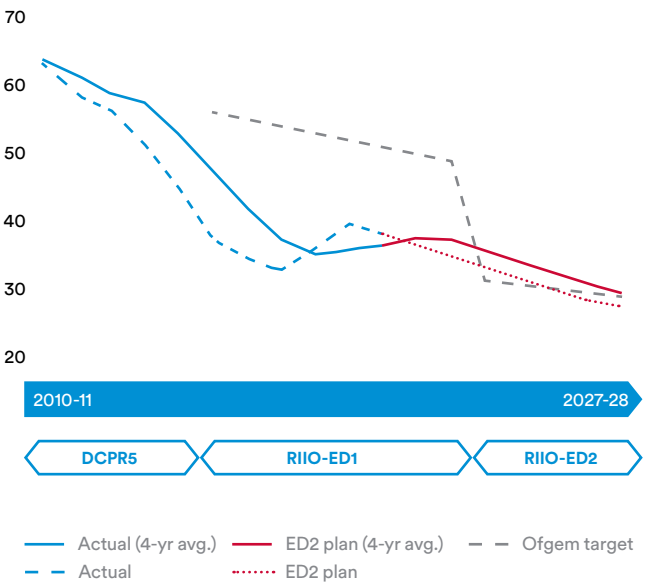


Figure 5: Yorkshire – customer minutes lost[2]



1. Current performance is the four-year average at 2020-21.
2. Ofgem targets are indicative based on 2019-20 data and will be updated prior to final determinations.

Investing to further improve performance

This will require a programme of enabling investment.

Seventeen per cent of the HV switches on our network are remote-controlled. Automation technology enables us to restore a proportion of customers impacted by HV faults in three minutes and is already providing customers with an improved level of service. Since 2015 so far, over half a million customers have been restored within three minutes by our automated power restoration system, with further restoration within 15 minutes from our control centre using remote control.

In our Emerging Thinking stakeholder engagement consultation,[1] the majority of our stakeholders told us they would like to see at least a 'major upgrade' in our network capability. So we are proposing to:

- double the installation rate of automation devices onto our network by investing £64.8m on the HV network by 2028, such that 30 per cent of our HV network will be covered by automation technology, see EJP-10.1 HV Network Automation;
- expand the types of devices that we can remotely control. This enables automation capability to extend further across the overhead line network to benefit our rural communities, who generally experience more reliability and availability issues; and
- invest a further £38.5m to roll out over 8,100 automated restoration devices on our LV network and enable proactive fault management across 9,000 network locations, building on LV monitoring capability for decarbonisation. See DSO Strategy and EJP-10.2 LV Network Automation.

Our comprehensive plan will put us on a new improvement trajectory. However, we have not only considered the new targets, customer priorities and stakeholder willingness to pay in formulating our plan. We have also considered a long-term view of the best way to modernise our network while ensuring affordability for our customers. Our reliability investment plan is proposed as part of a 10-year programme to deliver a modernised, reliable network for our customers, the first leg of which will be delivered in 2023-28.

Only upgrading our network will not be sufficient, however. We will complement our investment programme with the following operational improvements:

- **Enhancing the skills of our operational teams:** we plan to provide training to our in-house response teams with the goal of deploying multiskilled response units who will be able to react more effectively to a larger variety of faults. In addition, by upskilling our in-house team, we aim to reduce our reliance on contractors.[2]
- **Utilising network diagnostics and industry data more effectively:** our existing LV network technology reports extensive information about faults. We aim to develop an industry-leading protocol of using LV diagnostic data to improve our reactive and proactive response to faults.
- **Concentrating our efforts on difficult faults:** we will aim to deploy additional excavation teams to improve our response to underground faults.

Overall our plan assumes we achieve above industry average restoration times of 45 minutes at HV and 155 minutes at LV (compared to 54 and 180 respectively today).

As we develop customer flexibility in the transition to the role of Distribution System Operation (DSO)[3] it will increasingly provide opportunities to improve network reliability. We plan to use restore and dynamic flexibility products to manage risk and help mitigate loss of supplies. We will also investigate how we can use flexibility to improve partial restoration at the LV level.

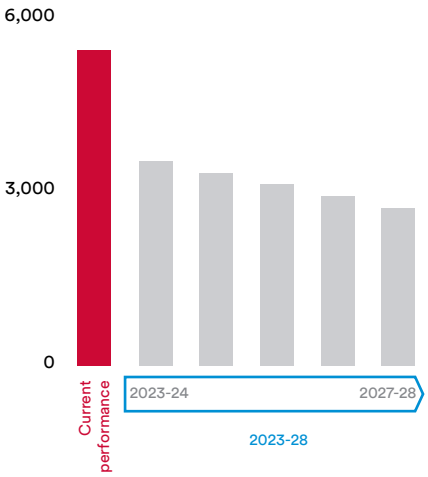
Improving service levels for customers who experience below-average network performance.

Our stakeholders want to see us continue to strengthen our focus on improving performance for customers who experience long duration interruptions.

Below-average reliability can mean two things for customers: customers who experience long-duration interruptions and customers who experience multiple interruptions during a year.

We have made good progress in terms of long-duration interruptions, reducing the number of 12-hour interruptions by a third since 2015. However our stakeholder engagement has indicated that we should target a further significant reduction in the number of 12-hour interruptions.

Figure 6: customers experiencing 12-hour power cuts[4]



Therefore, we will aim to achieve a 50 per cent reduction in the number of customers experiencing 12-hour power cuts through operational improvements, in particular the following initiatives:

1. Emerging Thinking.
2. See Workforce resilience (People Strategy).
3. See DSO Strategy section.
4. Current performance is the four-year average at 2020-21.

- **Reducing the impact of interruptions via the use of mobile generation:**
  - we will further increase the deployment of mobile generation to restore supplies following an interruption, introducing low carbon fuels to mitigate environmental impact. See Environmental Action Plan; and
  - we will increase our fleet of SilentPower electric mobile generation vehicles to six to provide more low carbon restoration solutions. See Vulnerability Customers plan section.

- **Innovating to improve reliability for customers on challenging segments of our network:** we will deploy 30 innovative microgrids for customers in rural areas, where challenges to overhead line asset resilience can lead to longer interruptions. See Whole Systems plan section.

Responding to stakeholder feedback.

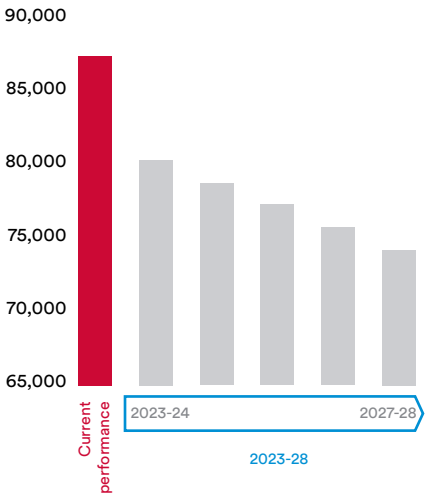
We will also target reductions in the number of six-hour interruptions our customers experience.

Our stakeholders have reinforced that the 12-hour power cuts standard is a backstop, and that we should increasingly focus on trying to limit power cuts to six hours. We have heard that this is important for customers for several reasons, for example:

- Significant disruption can occur when a power cut extends beyond six hours, because it covers two meal times, and is long enough for frozen food to defrost.
- Six hours can also cover most of a working day, which is particularly important as we expect to see more of our customers working from home, as demonstrated during the COVID-19 pandemic.
- A more than six-hour power cut also presents additional challenges to our customers who require electric vehicle charging. This is expected to be increasingly problematic as we transition to net zero.

Overall, we expect that this trend of increasing sensitivity toward six-hour power cuts is likely to continue as the pace of decarbonisation increases, and we recognise that improvements in this area will be required to meet evolving customer expectations.

Figure 7: customers experiencing 6-hour power cuts



Therefore we will target a reduction in the number of six-hour faults on our networks by 15 per cent, supported by the following additional measures:

- **Enhancing our dispatch facilities** to enable faster and more effective response to LV faults using the richer data that new technology will provide.
- **Reviewing our inventory of plant and equipment** in order to ensure our staff have what they need to better respond to both the most frequently occurring faults, as well as the most complex faults.

Reducing multiple interruptions.

Our customers' changing use of electricity came through strongly in our engagement. For example, in the case of telecommunications over broadband, our stakeholders suggested multiple power cuts can be in some cases more disruptive than a single longer one.

As such, we will aim to reduce the number of customers that experience five or more power cuts annually by almost 25 per cent, so that 99 per cent of our customers will not experience five or more power cuts in a year.

In parallel, we also plan to develop offerings for the partial restoration of our customers, recognising from their feedback that this would benefit them as the pace of decarbonisation increases.

Our stakeholders are keen to see us take steps to address the level of service experienced by our worst-served customers (WSC).[1]

Customers that experience both long-duration and multiple power cuts can be said to be WSC.

Our stakeholders have consistently told us that raising standards for this group of customers is crucial. Therefore, we plan to invest £4.3m in improving services for 2,835 WSC by upgrading the assets supplying our rural communities and installing automation to help restore their supplies faster. This will significantly improve the level of service they receive by reducing the duration of power cuts they experience by at least 25 per cent.

In parallel, our £64.8m investment in HV network automation will be targeted at the worst-performing circuits on our network, delivering significant improvements to customers that experience worse-than-average service on our network.

Our WSC investment is a common PCD.

1. Ofgem's definition of worst-served customers is those that experience 12 HV interruptions over a three-year period, with a minimum of two per year.

Improving services for planned power cuts.

Communication and delivering on our promises remains critical to mitigating the impact of planned power cuts.

To maintain and renew assets it is sometimes unavoidable that we interrupt the supply to our customers on a planned basis.

Customer satisfaction with our planned power cuts service has improved by more than 5.8 percentage points since 2015 to over 91.6 per cent,[1] ranking second in the industry.

Through discussion with our stakeholders, we have identified a number of measures that will continue to minimise the disruption that customers experience. We will aim to:

- increase the amount of live line working and deployment of mobile generation to allow us to maintain our assets without power cuts;
- extend our seasonal planned power cut policy to ensure that in winter outages are only taken during daylight hours, and will be cancelled if temperatures drop below freezing; and
- give customers 10 days' advance notification of all planned power cuts to allow sufficient time to make alternative arrangements.

> **We plan to further improve reliability by using technology on our networks, facilitating shortened restoration times and proactively managing potential failures ahead of time.**

Paul Black
System engineering manager

Data and digitalisation will provide us with new capabilities.

Going forward we will have access to a far greater quantity of data from HV and LV monitoring, as well as smart meters. This will provide us with valuable insights to address the challenges of improving the reliability and availability of our network as electrification gathers pace.

- At HV, our smart grid enabling investment during the current period provides us with a more robust and modern Internet Protocal (IP) Supervisory Control and Data Acquisition (SCADA) communications network, which is a foundation of our 10-year network automation plan starting in 2023. We will maximise the value of this investment by increasing automation and investing in upgrading our control systems to help restore power more quickly.
- On the LV network, our proposed LV technology investment will allow us to increase the amount of operational information we collect about our network. This provides us with the opportunity to develop best practices regarding the use of LV-monitoring data to enhance reactive and proactive fault response. We will combine the roll-out of monitoring with information from smart meters and pre-fault technology to drive a more proactive approach to network management. To maximise the value of these new initiatives and allow rapid decision making, we will modernise our operational hub to allow more efficient allocation of resources to faults.

We will also look to invest in additional data analytics to allow us to make better short-term decisions about our operational response, and to support better long-term decisions about optimising investments.

Finally, to support our overarching objective to provide our customers with access to a modernised network, we will continue to enhance our provision of information on the reliability and availability of our network.

- We will release more open source reliability and availability data on network performance using our data platforms.
- We will continue to keep our customers informed about faults through the latest digital channels, e.g. using our website, social media, and text messages to ensure customers are prepared.

Innovation is driving benefits in our plans.

Our fault prediction technology innovation (Foresight) is a key enabler for improving the reliability of our LV network during 2023-28. By the end of 2023-28 we will target fault predictive technology covering 9,000 network locations – over 30 per cent of the accessible ground-mounted network. This, combined with our LV monitoring programme, will help us proactively intervene and prevent faults from occurring on our network.

Critically, we will target the deployment of this technology on the worst-performing parts of the network to ensure improvements are prioritised towards our WSC.

Enabled by improvements in technology, customer flexibility will provide further reliability and availability opportunities. We will also explore how we can use flexibility at LV as well as using suitcase generation to affect partial restoration.

We will need to upskill our teams to deliver enhanced reliability on an increasingly smarter powergrid.

Innovations such as Foresight allow us to move beyond the traditional paradigm of 'fix on fail'. To maximise the benefits, we will need to broaden the skills of our people, while developing greater technical specialist skills in certain areas. Our plans to support the necessary skill development in our workforce are set out in annex 5.2 Workforce resilience strategy.

1. 2020-21 regulatory year.

Customer outcomes		Benefits	Deliverables	Output measure/[1] *indicative input measure*	ED1 to date	ED1 forecast	ED2 target
RA1	Deliver a ≥12% reduction in the number of power cuts[2]	*System average improvements* — A more reliable network for our customers — Additional automation will continue to drive reliability and availability improvements for the duration of the assets' functionality — Creation of a smarter and more flexible network facilitating decarbonisation — Increased network monitoring and automation allows more efficient targeting of future expenditure through a greater understanding of our network	RA.D1) Deploy 8,600 HV remote switches (Bespoke PCD) RA.D2) Deploy 8,100 LV fault-management devices RA.D3) Establish LV network management capability to allow the increased data from Foresight, LV monitoring and smart meters to be used to improve services RA.D4) Innovate in flexibility to support unplanned interruptions and the use of microgrids/microresilience for worst-served customers (HV and LV) RA.D5) Enhance our first response through improving our ability to track and deploy staff to faults more swiftly, by skillset and by location (24/7/365)	Customer interruptions (unplanned)	48.6	47.4	42.0
RA2	Deliver a ≥25% reduction in the duration of power cuts[2]			Customer minutes lost (unplanned)	37.2	34.0	28.3
RA3	Reduce by 50% the annual number of customers that experience a 12-hour power cut[2]	*Reduction in long-duration power cuts* — Reduced disruption to customers now and in future periods as they become more reliant on electricity supplies		Power cuts >12hrs (pre-clock stop)	3,943	3,600	2,700
RA4	Reduce by 15% the annual number of customers that experience a 6-hour power cut[2]			Power cuts >6hrs (pre-clock stop)[4]	87,001	82,500	74,000
RA5	Ensure 99% of our customers do not experience 5 or more interruptions in a year[5]	*Improvements for worst-served customers* — Improved services for customers who experience a worse than average level of service — Long-term investment will allow us to move customers out of this category benefiting them in the long-term	RA.D6) Target significant improvements in network operability through use of technology to manage planned outage risk and proactively identify and deliver solutions to emerging 'problem networks' RA.D7) Roll out HV Foresight using primary disturbance recorders RA.D8) Deliver investment to enable the isolation of substations without incurring network outages	Customers who experience 5 or more interruptions annually[4]	30,174	26,000	23,000
RA6	Deliver £4.3m of targeted investment to improve network performance in rural areas for 2,835 worst-served customers predominantly in rural areas			Worst-served customers addressed[3] (Common PCD)	0	0	2,835
RA7	Provide customers with 10 days' notice of planned interruptions, operate only in daylight hours during winter months and cancel if temperatures are <0°C	*Better services for planned outages* — Improved planned outage customer satisfaction	RA.D9) Expand SilentPower mobile battery fleet to support during planned and unplanned interruptions	% of time customers provided with 10 days' notice	63.5%	70%	80%

Innovation | Data and Digitalisation | Workforce Resilience

1. Measures are shown to track delivery of our customer outcomes. While 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. Relative to a four-year average baseline.
3. In line with Ofgem's definition.
4. Four-year average figures.
5. Cross-reference Enabling Whole System Solutions deliverable WS3. Roll-out of microgrid technology.

How engagement with you has shaped our plan

RELIABILITY & AVAILABILITY

Reliability and Availability

How we engaged with you:

- More than 18,000 people had the chance to shape our plan including insights from consumer panels, rural panels, and future customer panels.
- Four events in wave one reached 491 people. Key themes were reliability as a priority, frequency and duration of power cuts, and costs.
- Our wave two engagement tested options with >20 events engaging 15,189 individuals.
- Engagement in wave three across nine events helped refine proposals and gain endorsement with 3,031 consumers, young people, politicians and local authorities.
- In wave four we finalised our plan, responding to queries, addressing gaps and testing overall acceptability. We engaged 10,043 customers and stakeholders overall and with detailed sessions on outstanding reliability and availability topics across eight events.

43 dedicated events

28,754 stakeholders engaged

What we have heard from you	How this has impacted our plan	Customer outcome ref	Annex detail
Target a step-change in reliability Stakeholders confirmed they were not dissatisfied with the level of service they receive today, but the majority of stakeholders, over 65 per cent, wanted to see at least a 'major upgrade' to our network reliability (at least option C).	**We set stretching targets to reduce power cuts by 12% and customer minutes lost by 25%** To deliver this step-change, our plan invests 10 per cent more p.a. than in 2015-23.	RA1 RA2	Link
Continue to innovate in network reliability Stakeholders supported investment now to deliver future improvements through technology.	**Our plan transitions innovation into business-as-usual** We will increase network monitoring to 9,000 locations, unlocking savings through proactive fault management and improving long-term asset planning and reliability for our customers.	RA1 RA2	Link
Invest in a network for the future Customers valued a more capable, future-focused network with increased automation, wanting us to reduce faults that last 1.5-3 hours to three minutes or less.	**We will deliver a ring-fenced £64.8m network automation programme to support the delivery of our stretching targets** More automation will deliver faster, cost-effective power restoration alongside real-time network monitoring.	RA2 RA3 RA4	Link
Both duration and number of power cuts can impact worst-served customers Stakeholders wanted to see improvements for those who experience worse than average service. They told us 12 hours is too long; six hours is where a power cut becomes an inconvenience.	**We introduced a range of new commitments to support worst-served customers** Commitments to reduce six-hour power cuts by 15% and 12-hour power cuts by 50%. A new standard for multiple interruptions (<5 p.a.).	RA3 RA4 RA5 RA6	Link
Improve performance worst-served customers in rural areas Stakeholders supported investment in areas that would not necessarily meet the economic efficiency test, such as rural Northumberland.	**Our plan includes £4.3m of investment to improve services for 2,835 worst-served customers** Our network automation programme will also focus on worst-performing areas. In addition, we will increase the use of mobile generation and green SilentPower vehicles and pilot innovative microgrids to improve reliability.	RA5 RA6	Link
Keep customers up to date to prepare for longer power cuts Customers told us they can work around longer power cuts, provided we keep in close contact.	**We set a standard for communication** We will provide 10 days' notice before planned power cuts.	RA7	Link
Focus on vulnerable customers Avoiding long-duration power cuts for vulnerable customers was a key issue. Customers wanted to see more generator deployment.	**We will deploy more suitcase generators** We will roll out 25 more suitcase generators, delivering partial restoration options for 380 more vulnerable households per year.	VN2	Link

Our business-wide approach to resilience

Collaboration is at the heart of our approach.

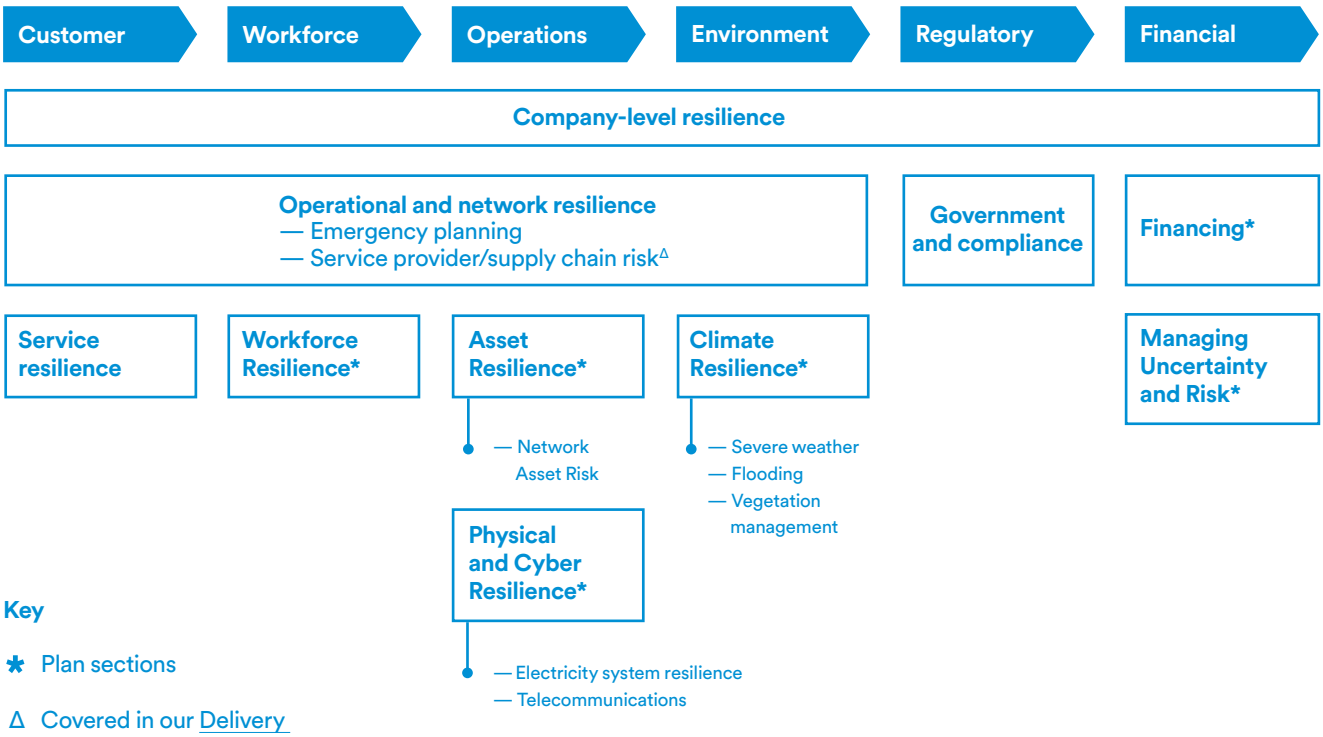
We work with central government, the Department for Business, Energy & Industrial Strategy (BEIS), and the seven local resilience forums (LRFs) in our region on a multi-agency basis to ensure we have a firm grip on threats, risks and issues. This structured and enduring stakeholder engagement allows us to plan effectively for the long term and execute coordinated responses to emergency events that bring about or involve disruption to power supplies.

Through this industry-wide collaboration we learn about situational exposure to risk, insecurities or vulnerabilities that need mitigation, and build actions into our business planning.

We have built a portfolio of more than 30 operational response plans that we periodically review, drill, test or exercise to ensure we remain prepared and ready. Our operational response plans contain triggers that drive the extent of incident response required. We proactively move through controlled escalation stages of awareness, preparation, readiness and mobilisation as each trigger point is met. In this way, we have become accustomed to switching between business-as-usual operations and emergency response modes. For certain types of disruptive events, it is also necessary to have a specific recovery phase to allow a smooth transition back to normal routines.

The threat landscape will continue to evolve.

The external threat landscape is constantly evolving, whether that be changing weather patterns or the ever-present risk of malicious physical or cyber-attacks. We undertake regular threat assessments, analysis and modelling to assess risks and we carry out proactive asset hardening to resist and absorb any impacts. Long-term resilience is embedded in our investment plans to ensure the assets we install today are fit for the environment in which they will be operating in the future. We extend our planning to our supply chain, which will become increasingly important as we scale our activity levels for decarbonisation. Our approach to resilience in our plan is set out below:



Key

✱ Plan sections

△ Covered in our Delivery Strategy Annex

The next three sections of our plan cover three key areas of our approach in line with Ofgem's resilience framework – Asset Resilience, Climate Resilience, and Physical and Cyber Resilience. Our Workforce Resilience plans can be found here – Workforce Resilience plans. We set out more detail in annex 4.9 Our approach to resilience.

Asset Resilience

Our network will fit the evolving needs of our region. The long-term condition and performance of our asset base will be efficiently managed so it is safe, reliable, environmentally friendly and resilient, maintaining a long-term view on capacity needs for decarbonisation pathways.

Our approach to asset resilience will not only maintain the health of our network but also support the transition to net zero.

Maintaining and renewing our asset base is our single largest expense and the decisions we take to invest (or not) can have a material impact on the service we provide to both our current and future customers.

The average age of our assets is increasing and sustained investment is required to maintain the long-term health of the network. In deciding which investments to make, we optimise between refurbishment and replacement, targeting those assets that are high risk or in poor condition. It is also particularly important that we adopt an approach that manages the condition and performance of the asset base in a way that maximises future capacity for decarbonisation and realises other synergistic benefits. This way we can minimise long-term costs for our customers.

To do this we plan to spend £226.7m p.a. in the 2023-28 period, which is 12 per cent (£23.7m) more than we've spent each year in 2015-23. This increase in investment includes £24.8m of expenditure p.a. (£124.2m over the five-year period) that delivers two-for-one outcomes related to decarbonisation – adding capacity for future pathways as part of our core asset renewal programmes that generates an estimated net saving of £465m in future avoided costs between 2028 and 2050.

How much it will cost

2023-28 expenditure (annual)	**£226.7m** 34.3% of totex
versus 2015-23	**+£23.7m** +11.7%

A resilient asset base is our foundation

The resilience of our network is important for stakeholders and will become even more so, especially given the increased reliance on electricity as we decarbonise.

Our stakeholders have indicated that they want us to:

- maintain network health, continuing with programmes to replace and refurbish assets that drive greater reliability;
- optimise asset lives through the use of condition monitoring;
- deploy innovative technologies to monitor assets and understand where investments should be made;
- recognise the need for a balanced approach to managing risk over the longer term while supporting wider plan objectives; and
- maximise synergies with other elements of our plan, such as ensuring that we adopt a net zero ready approach to asset refurbishment and asset replacement.

We assess our asset health through the use of industry standard methodologies.

- A **health index** framework for collecting information relating to asset condition and probability of failure. Health is assessed utilising a variety of condition monitoring and inspection data to measure asset condition and performance (which tends to deteriorate as assets age).
- A **criticality index** to collect information relating to the consequences of failure of an asset (which tends to remain static through its life).

We ascribe a monetary value to the consequence of failure for each asset to represent the impact of failure (criticality). This is then combined with a value for the asset's probability of failure (health) to allow risk for an individual asset to be calculated as monetised risk (in £s). This can be brought together within and across asset categories to calculate total network risk (monetised) at a given point in time.

Risk can be reduced through replacement and refurbishment activities, which can improve both asset health and criticality. Using this approach, we have made an assessment of the changes in health and criticality that will occur – both without any investment and with our proposed 2023-28 investment plans – and assessed that against our view of network risk.

We do not mechanistically use asset health, criticality and risk indices to drive our investment plans. Instead we use these indices as one of a number of inputs into an asset management approach that combines analytical and operational experience to produce an investment plan that delivers efficient and effective levels of service.

We are ahead of our plan for reducing the levels of network risk.

Our total network risk is ahead of our straight-line profile for the eight-year period 2015-23, at 79 per cent (compared to a 75 per cent target),[1] and so are well positioned to deliver our targets.

In the Northeast, we have so far delivered 87.6 per cent of our risk-reduction target. We expect to achieve our overall agreed risk-reduction targets by 2023, with total levels of network risk currently 11 per cent lower than they were in 2015.

In Yorkshire we have delivered 69.6 per cent of our risk-reduction to date. However, our plan is phased to deliver more outputs in the latter years of the 2015-23 period. We expect to achieve our target by 2023. Our forecast includes significant lengths of 132kV fluid-filled cable replacement works that are in progress. These schemes are several years into multi-year programmes and have not yet delivered outputs. Total levels of network risk are currently 5 per cent lower than they were in 2015.

Age related deterioration represents a major challenge in the management of long-term risk.

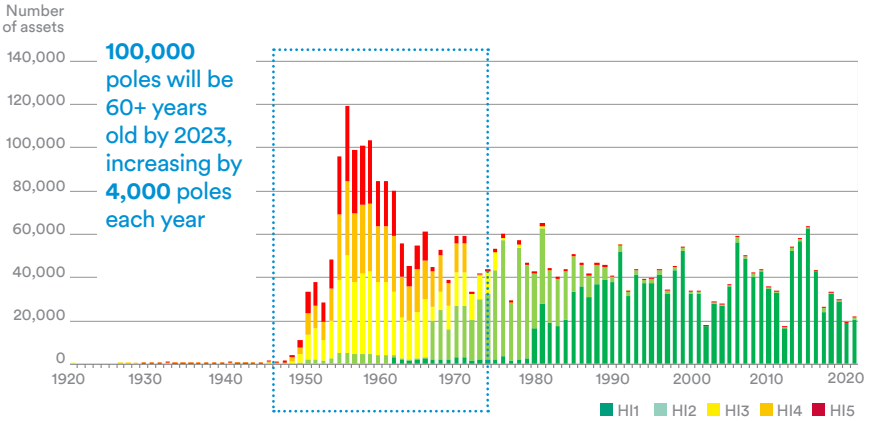
Many of our assets were installed between 1950 and 1970. This age profile of historical investment represents a major challenge in the management of long-term risk. A high proportion of those assets are now moving into the mid- to highest-risk bands, which is driving an overall expected increase in asset risk between 2023 and 2028. A key example of this is our wood overhead line poles.

This increase in the average age of our assets across most asset categories has resulted in approximately 20 per cent of the network exceeding what has traditionally been accepted as their normal expected life (see figure 1).

The process of managing these installation peaks began in earlier periods, prioritising replacement of critical assets at 132kV and extra high voltage (EHV). In our 2015-23 plan we recognised that the management of this profile would be a key ongoing issue for 2023-28 period and beyond.

Our current approach supports this efficient transition, targeting life extension through refurbishment wherever practicable, with a programme of enhanced asset monitoring to offset projected risk increases and to maintain our low and stable fault rates over the long term. We will continue this approach.

Figure 1: example Health Index profile for low voltage (LV) and high voltage (HV) wood poles



1. 2020-21 regulatory year.

Maintaining the long-term health of the network

Our investment strategy will enable us to better understand, maintain and manage the condition of our network in a safe and cost-effective manner.

Our network investment strategy is set out at annex 6.1 Network investment strategy.

Our plan for each asset class has been developed holistically to deliver the following key strategic objectives:

- maintain legal and regulatory compliance;
- deliver long-term stable network asset risk;
- deliver value for money, minimising whole life cycle costs via the optimisation of synergies;
- manage uncertainty around decarbonisation;
- recognise the likelihood that reliance on electricity will increase through the period and beyond, particularly 2030 to 2050; and
- deploy proven innovative technology and continue to explore new solutions to:
  - enhance the maturity of our asset management process;
  - enhance inspection and maintenance techniques;
  - extend asset life through targeted refurbishment;
  - improve intervention targeting; and
  - improve efficiency.

We will target a 24.5 per cent risk benefit from our asset interventions.

Figure 2 shows the forecasted change in monetised risk due to asset degradation over the five years from 2023 to 2028 and how our interventions will mitigate that.

The specific asset resilience investments set out in our plan reduce whole life risk by 24.5 per cent (relative to there having been no intervention). The result is a modest and manageable overall increase in risk of 2.8 per cent on average across Northeast and Yorkshire over the 2023-28 period. This is reduced further by 1.8 percentage points when we consider the benefit that may come from investment for decarbonisation in our planning scenario. This modest increase in risk is acceptable as it:

- is part of a strategy to mitigate peaks in investment while maintaining the underlying health of the network over the long term;
- is a natural part of the ageing of a multi-generational asset; and
- can be managed by asset management by targeted control measures in the period.

We have modelled our investment strategy over the long term to understand how risk will change. Due to our asset age profile we will be on an increasing risk trajectory throughout 2023-28, which will peak in the early 2030s (see figure 3), before reducing again. These projections give us confidence that we are properly balancing the timing of investment in our long-lived assets to keep downward pressure on costs and maintaining the health of the network, thereby sustainably managing the peaks in historical investment.

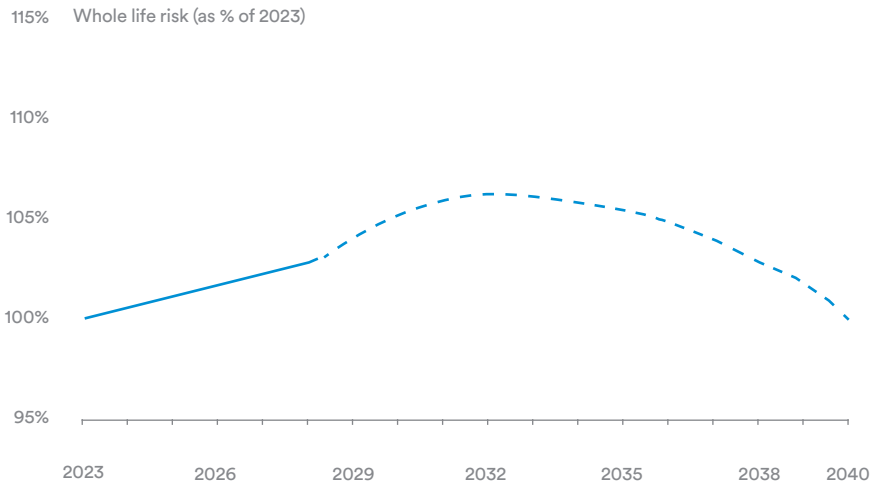
> **A resilient asset base is the foundation of our plan; we will maintain the underlying condition of our equipment efficiently and maximise wider future benefits.**

Peter Collinson
Investment planning and delivery manager

Figure 2: asset resilience investment – whole life risk

	Whole life risk (as % of 2023)		
	Northeast	Yorkshire	Northern Powergrid
2023	100.0	100.0	100.0
2028 with no intervention	126.3	128.4	127.4
Impact of interventions	-24.1	-24.9	-24.5
2028 with proposed intervention	**102.2**	**103.5**	**102.8**
Modelled benefit from decarbonisation investment	-1.3	-2.3	-1.8
2028 with modelled benefits from potential decarbonisation investment	100.9	101.2	101.0

Figure 3: future projected risk profile of the asset base



Deploying innovative techniques to manage risk.

Our plan targets priority areas by deploying condition-monitoring solutions alongside moderate programmes of asset replacement and refurbishment to target worst-performing assets and manage predicted fault rates, see annex 5.3 Digitalisation Strategy and Action Plan. Where power cuts do arise as a result of asset failure our investments in specific reliability initiatives are designed to minimise the impact for our customers (see Reliability and Availability section).

We are able to manage moderate increases in our overall risk profiles within our proposals by:

- prioritising investment in our highest-risk assets, for example low voltage (LV) poles in residential areas, or fluid-filled cables near water courses and manually operated plant;
- prioritising investment in our worst-condition assets by targeting assets with the highest probability of failure as a consequence of observed or measured condition data, or performance data;
- targeting asset refurbishment to ensure we can address a wider range of assets allowing the deferral of more costly asset replacement until more certainty over future loading and utilisation is achieved; and
- establishing other enhanced control measures such as including more frequent or comprehensive asset inspections, additional monitoring and innovation to improve inspection data quality and intervention targeting. Overall, we estimate savings of £78m in the 2023-28 period from our use of these innovative techniques. For further detail see Explaining Our Costs.

Decarbonisation investment will provide additional asset health benefits.

In addition to the risk reduction derived from our asset resilience investments, the replacement of assets as part of our decarbonisation investment (see scenarios and investment section) will deliver asset health benefits. Assuming levels of LCT uptake in our 'best view' Planning Scenario, we estimate that this would reduce network risk by a further 1.8 percentage points to leave total whole life risk 1.0 per cent higher than at the start of next price control period. Due to the uncertainties inherent within our forecast for decarbonisation investment the exact value of this additional health benefit will vary and may deliver more or less benefit than estimated here. However, it is clear that a manageable 2.8 per cent increase in risk represents the worst case scenario.

Our asset health and criticality priorities for 2023-28 target investment in our highest-risk and worst-performing assets.

The change in whole life risk is not uniform across our asset categories. Our investment plan targets investment toward the areas where risk is forecast to increase the most.

Figure 4: asset category movements in whole life risk from 2015-23 to 2023-28

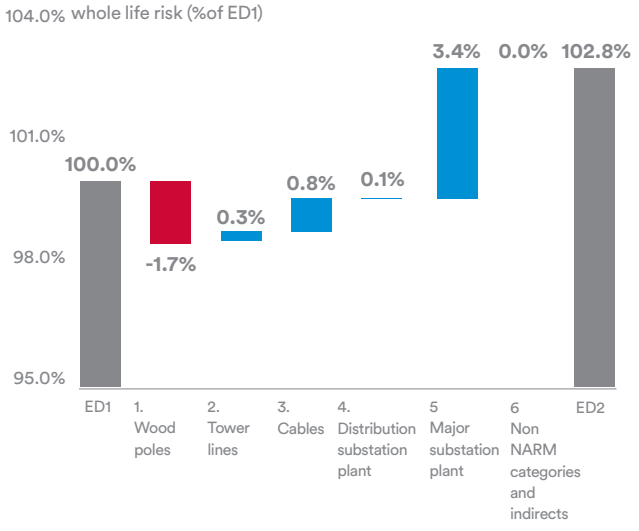
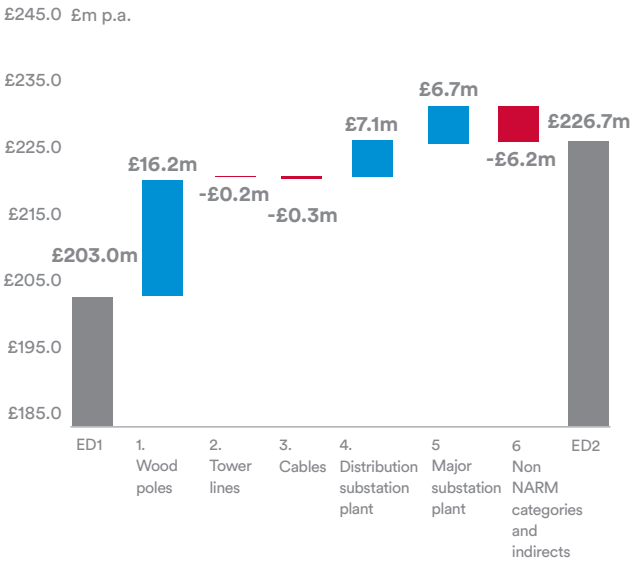


Figure 5: asset category movements in expenditure from 2015-23 to 2023-28



An overview of our approach

	Approach	Engineering Justification Papers
1 Wood poles	Our plan contains a significant uplift in investment to address the large number of poles installed during the peak investment period of the 1950s-1970s, which are expected to degrade to the point that intervention is required. We have identified opportunities to optimise our replacement intervals through the use of innovative enhanced monitoring techniques (such as the use of Thor hammers) in order to extend asset lives where safe to do so. We will seek to align our interventions with changes required to the network to support future decarbonisation demand, such as where a requirement is triggered to replace overhead line conductors as part of full line rebuilds, particularly at LV.	— EJP-4.1a LV Overhead Lines — EJP-4.1b HV Overhead Lines — EJP-4.2 EHV and 132kV Wood Pole and Mast Overhead Lines
2 Tower lines	We anticipate a moderate increase in risk, which will be managed, by exception, through tower refurbishment and conductor replacement.	— EJP-4.3 EHV and 132kV Tower Lines
3 Extra high voltage (EHV) and 132kV cables	We forecast a small increase in risk as a result of a large reduction in investment in the replacement of fluid-filled cable. Our plan significantly increases our use of tracer perfluorocarbon (PFT) tagging to better manage oil and fluid loss (and reduce leak rate by 15 per cent) allowing an overall cost reduction in this area.	— Environmental Action Plan — EJP-1.3a EHV & 132kV Cables (oil) — EJP-1.3b EHV & 132kV Cables (gas) — EJP-1.3c EHV & 132kV Cables (solid)
4 Distribution substation plant	A high proportion of our distribution substation plant asset base will degrade into the highest risk bands (see figure 6). While the increase in asset risk could be managed to existing levels by targeting individual assets for replacement, the projected uptake in the connection of low carbon technologies (LCTs) will also require increased network capacity. To achieve asset health and capacity synergies we will increase full substation replacements where network utilisation is forecast to be the greatest, while accepting a moderate increase in risk.	— EJP-2.1 Distribution Substations – Plant
5 Major substation plant	We will see a small increase in risk in this area as we deploy targeted midlife refurbishment to manage an increase in the population of assets that exceed their normal asset lives. We will prioritise investment in assets where the utilisation on the network is highest and the need for reinforcement more certain.	— EJP-3.1a Major Substations – Plant (Transformers) — EJP-3.1b Major Substations – Plant (Switchgear)
6 Non-network asset risk metric (NARM) categories and indirect costs	Our non-NARM investments include increased costs to address overhead line clearances (+£3.7 p.a.) and costs for additional inspection, maintenance and repairs activities in line with our strategy to manage the ageing asset base (+£5.2m p.a.). These costs are offset by the completion of a number of programmes in the current price control period (such as Black Start resilience).	— For more detail on these cost movements see explaining our costs

Figure 6 shows the forecast proportion of assets in each health index category in 2023, the proportion of assets in each health index category by 2028 without intervention (due to asset degradation) and the proportion of assets in each health index category by 2028 after the effects of degradation and our planned investments.[1]

- **Wood poles:** the number of high-risk poles (HI4 and HI5) increases substantially during the next price control period from about 26 per cent to 39 per cent of the population. We are able to manage this increase down to about 28 per cent of the population by the end of the period by targeting the replacement of our highest-risk poles, particularly those with the highest criticality (e.g. LV poles in residential areas) as well as increasing our inspection frequencies for those that we do not plan on replacing in the period.
- **Tower lines:** we will continue to manage our tower population through mid-life refurbishments to ensure that these assets do not degrade beyond the point that refurbishments become uneconomic. Half of the tower line conductor population will move beyond the normal expected asset life for the asset base as shown by the movement into the HI3-HI5 health index bands.
- **EHV and 132kV cables:** we project a modest increase in assets in the highest risk bands (HI4 and HI5) as older cable assets degrade. We will manage a potential increase in associated fluid loss incidents by increasing our use of PFT technology.
- **Distribution substation plant:** we will accept a moderate risk increase in this area to ensure we are able to prioritise the replacement of substations that also require additional network capacity where there are also strong condition drivers and where there are synergies with other business objectives such as improved safety and reliability.
- **Major substation plant:** We will see a small increase in risk in this area as the population of high risk assets (HI4 and HI5) increases from about 19 per cent to 28 per cent of the population as many of our oldest assets (currently HI3) degrade beyond their normal expected asset lives. Investment will continue to be targeted at the highest risk (HI5) assets supplemented by an extensive programme of mid-life refurbishments of our HI3-HI4 assets where economic to do so.

Figure 6: movement in Health Index bands from 2023-28

Asset group	Total assets		Health Index band				
			HI1	HI2	HI3	HI4	HI5
Wood poles	**393,883 poles**	2023	36%	18%	21%	12%	14%
		2028 without ED2 intervention	30%	17%	14%	18%	21%
		2028 with ED2 intervention	**41%**	**17%**	**13%**	**13%**	**15%**
Tower lines	**4,601 towers**	2023	27%	39%	34%	0%	0%
		2028 without ED2 intervention	18%	31%	51%	0%	0%
		2028 with ED2 intervention	**19%**	**46%**	**34%**	**0%**	**0%**
	2,167km	2023	21%	63%	7%	8%	1%
		2028 without ED2 intervention	15%	17%	53%	9%	6%
		2028 with ED2 intervention	**18%**	**17%**	**53%**	**8%**	**4%**
Distribution substation plant	**128,778 items of plant**	2023	58%	25%	10%	5%	2%
		2028 without ED2 intervention	53%	25%	6%	10%	7%
		2028 with ED2 intervention	**58%**	**24%**	**5%**	**8%**	**3%**
Major substation plant	**10,843 items of plant**	2023	40%	25%	17%	9%	10%
		2028 without ED2 intervention	37%	20%	8%	15%	20%
		2028 with ED2 intervention	**43%**	**21%**	**8%**	**13%**	**15%**
EHV/132kV cable	**3,179km**	2023	79%	9%	9%	0%	3%
		2028 without ED2 intervention	74%	14%	1%	9%	3%
		2028 with ED2 intervention	**76%**	**14%**	**1%**	**8%**	**2%**

We will maximise the substantial value for customers that can be delivered by driving synergies between decarbonisation and asset renewal investment.

We have developed an optimised asset renewal plan, which will create significant additional capacity in the areas that most need it and limit the increase in total cost by minimising asset renewal expenditure on those areas where the future requirements for additional capacity are less certain.

Specifically, we will:

- Use the latest data from network monitoring and analytics to ensure effective identification of priorities, whichever pathway to net zero is followed, and deploy capacity-increasing solutions such as full substation replacements, overhead line rebuilds and circuit overlays, where the network constraints are the most onerous and occur soonest under any credible pathways.
- Defer asset replacement where there is less certainty over future network capacity requirements, and where we judge we can accept and manage the risk of ageing assets through enhanced inspections or monitoring combined with asset life extension techniques.
- Continue to proactively increase the capacity within our network through incremental investment, where efficient, as part of routine asset replacement works through design and specification choices or our policies.

1. Excluding modelled health benefits from decarbonisation investment.

Significant benefits

£465m

estimated savings between 2028 and 2050

+ additional capacity

significant additional capacity to enable accelerated pathways to net zero

Our investment proposals are underpinned by robust cost benefit analysis (CBA).

We have undertaken extensive analysis of the least total cost options for our plan, considering the total suite of plan objectives and drivers for investment.

We have used the following CBA tools within our optioneering where appropriate: Ofgem CBA template; NARM long-term risk; and the Energy Networks Association's (ENA) Open Networks common evaluation methodology.

For further information on our proposed investments, justifications and links to our engineering justification papers (EJPs) and CBAs see annex 6.2 Our Costs In Detail.

Our plan has been reviewed and challenged by our independent Technical Panel. See Annex 2.2 Technical Panel letter.

Customer outcomes		Benefits	Deliverables	Output measure/[1] *indicative input measure*	ED1 to date	ED1 forecast	ED2 target
AR1	**Enable an efficient long-term transition to net zero through maximisation of synergies between load-related and asset renewal expenditure[2]**	— £465m of synergy savings between 2028 and 2050 — Increased capacity for accelerated pathways — Reduced disruption for customers — Increased efficiency	**AR1.1)** Prioritise replacement towards assets that also deliver capacity increases required by our net zero pathways and upsize our assets where required to deliver long-term synergy savings, annually reporting on benefits created **AR1.2)** Enhance our business processes and analysis tools to better enable the identification of load growth and asset condition synergies	*Annual reporting on decarbonisation synergy benefits created*	-	-	✓
AR2	**Deliver our investment plan to improve network health through efficient decision-making, deploying innovation and optimisation of interventions**	— Maintain long-term asset risk and reliability — Reduced cost — Improved delivery efficiency — Improved data quality — Long-term strategic investment — Maintain safety, legal and Electricity Safety, Quality and Continuity Regulations (ESQCR) regulatory compliance — Reduced likelihood of unnecessary investments and/or premature replacement of equipment in the journey to net zero by 2050	**AR2.1)** Replacement of 'high risk' outdoor substations with indoor substations **AR2.2)** Utilise our new innovative Thor hammer assessment device, alongside foot patrols, to better target the ageing wood poles in worst condition through our inspection and replacement programmes **AR2.3)** Implement online dissolved gas analysis (DGA) technology on power transformers to identify current and future issues **AR2.4)** Carry out 'fingerprint' analysis on switchgear to identify current and future issues **AR2.5)** Undertake partial discharge mapping for HV and EHV circuits on underground cables to identify current and future issues **AR2.6)** Utilise smart meter data to identify customers with high load and, therefore, increased risk of overloaded cut-outs **AR2.7)** Utilise drone technology to capture imagery for routine asset condition inspections, as opposed to helicopters **AR2.8)** Investigate using AI and machine learning to automatically triage captured drone imagery (ref. AR2.7) and highlight where works are required **AR2.9)** Undertake a market assessment to investigate alternative technology and/or materials for substation building and civils to ensure we are aligned to modern best practice for non-electrical assets **AR2.10)** Report on the condition and health of our asset base annually	**Delivery of NARMS target**	79.1%	100%[3]	**100%**
				Impact of interventions on whole life risk (%)	-	-	*24.5%*
				High risk substations replaced[4]	168	178	**70**
				Annual reporting on health of asset base	✓	✓	✓

1. Measures are shown to track delivery of our customer outcomes. While 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 DSO1.3) Installation of low voltage (LV) load monitoring, SI1) Ensure network capacity is available.
3. Network Output Measures (NOMs) forecast/target in 2015-23 period.
4. Cumulative, in price control.

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How engagement with you has shaped our plan

ASSET RESILIENCE

Asset Resilience

How we engaged with you:

- Asset resilience is a complex topic that is closely related to other priority business plan areas such as Reliability and Availability and, as a result, it was discussed by stakeholders at the majority of our events, in addition to the specific engagement with >12,000 stakeholders set out below.
- In wave one we ran two dedicated panels, engaging with 64 customers and future energy consumers.
- We engaged with 234 individuals in wave two, including domestic customers, SMEs, and stakeholders across five events, testing options, and gauging levels of ambition.
- In wave three we engaged with 2,402 customers at six events to refine our plans and discuss in more detail the more complex issues, bill impacts and trade-offs associated with long-term asset investment.
- We finalised our plan in wave four, responding to queries, addressing gaps and testing overall acceptability. We engaged 10,042 customers and stakeholders overall, with detailed sessions on outstanding asset resilience topics across seven events.

20 dedicated events

12,742 stakeholders engaged

What we have heard from you	How this has impacted our plan	Customer outcome ref	Annex detail
Invest to deliver long-term benefits Higher levels of investment to deliver longer-term network performance improvements (option C) was the most popular choice for customers in our Emerging Thinking consultation. Customers recognised that a balance must be struck between the need to invest in long-term network improvements while managing costs in the near-term.	**We have taken a long-term strategic view of investment** We seek to maintain the long-term health of the network. In developing our plan, we have looked out to 2050 to ensure our decisions to replace and refurbish assets are the most efficient solution over the long-term, taking into account future energy scenarios.	AR1 AR2	Link
Wherever possible use investments to support net zero Stakeholders supported the marginal cost increase of upsizing equipment that will deliver net zero capacity benefits where possible, adopting a 'net zero ready' mentality in our plans.	**Our plan sets up £465m in potential long-term savings to 2050** Our plans will deliver long-term value by investing in asset replacement that creates simultaneous decarbonisation benefits. We will prioritise assets for replacement based on both condition and net zero requirements.	AR1	Link
Maximise innovation to keep costs low Stakeholders indicated support for targeting improvements in areas with lower reliability but wanted us to reduce costs through innovation.	**We have built significant efficiencies into our plan** Our plan is underpinned by £78m of cost-saving innovations to ensure we keep costs low for customers.	AR1 AR2	Link
Adopt progressive asset management approaches Our plans have been challenged by an independent technical panel throughout the process to provide assurance that they are robust and efficient. The panel challenged us to improve the justification of our investment through robust analysis and demonstrate benefits from technology and innovation. The panel's final report on our plan can be found here.	**We adapted our plans to address challenges from our experts** We adapted our plans and justification papers to take account of the expert feedback received. For example, in response we modified plans around the use of data and digitalisation to enhance our programmes for the management of the LV network, enabling improvements in reliability and LCT uptake.	AR1 AR2	Link
Report on the health of the network Customers wanted us to continue to educate them about asset resilience and report on overall asset health.	**We will report annually on asset health** Our annual reports will provide updates on the condition and health of our asset base (in plain English) to improve customer understanding of asset resilience.	AR2	Link

Climate Resilience

We will adapt our network and operations to build resilience against the effects of climate change, including working collaboratively and using innovation to develop new solutions to address the range of climate change pathways and consider wider system interdependencies.

Climate change represents a significant ongoing risk to our network and our customers.

We have heard the following key messages from our stakeholders:

- Plan for the worst – consider a 4°C global temperature rise as a worst-case scenario.
- Collaborate with other infrastructure and regional organisations to share knowledge and data.
- Address interdependencies with other infrastructure providers.

We have built strong foundations in the current period. We accelerated our programme of flood mitigation works to ensure that our major sites are compliant with national standards. We are on track to deliver 211 flood defence upgrades by 2023, allowing us to reduce our costs in the 2023-28 period.

Our plan, set out in detail in our Climate Resilience Strategy contains investment of £16.2m p.a. throughout the 2023-28 period on climate resilience, an overall reduction of £6.2m (28 per cent) p.a. compared to 2015-23. The major elements of this work are:

- flood mitigation where our plan contains annual expenditure of £1.2m, a reduction of £5.0m or 80.6 per cent.
- vegetation management where our plan contains expenditure of £11.2m p.a., an increase of £1.8m or 19.1 per cent.

How much it will cost

2023-28 expenditure (annual)	**£16.2m** 2.4% of totex
versus 2015-23	**-£6.2m** -27.7%

One of our eight plan areas, taken together, delivering more for less.

Analysing the potential impacts

We have risk-assessed the impact of climate change and severe weather on our network to inform our plans.

Using the Met Office's UK Climate Projections 2018 (UKCP18), we have considered a range of scenarios (or climate change pathways) predicting the effect of climate change on our local weather to the end of the century. We have focused on two representative concentration pathway (RCP) scenarios:[1]

- RCP2.6 (close alignment with the 2°C global warming considered in the Paris Agreement); and
- RCP8.5 (a worst-case scenario of 4°C global warming).

The main signals for the UK are warmer, wetter winters; hotter, drier summers; and an increased risk of extremes. We have also considered regional variations and are working with other organisations to consider how their adaptations will affect our network.

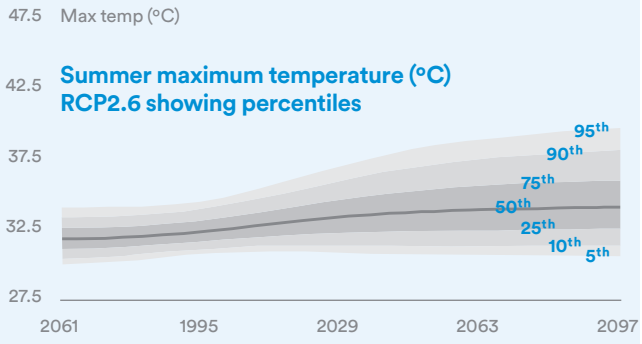
In addition, we have carried out benchmarking comparisons against best practice alongside consideration of emerging national guidance from organisations such as the Climate Change Committee, the Department for Environment, Food & Rural Affairs (Defra) and the National Infrastructure Commission. This shows that we are in a strong position as a result of our work to date.

A full risk assessment has been carried out across three timescales (current, 2050s and 2080s) for both RCP2.6 and RCP8.5 to inform our plan. The analysis shows that no significant divergences are seen until beyond 2050 (see figure 1).

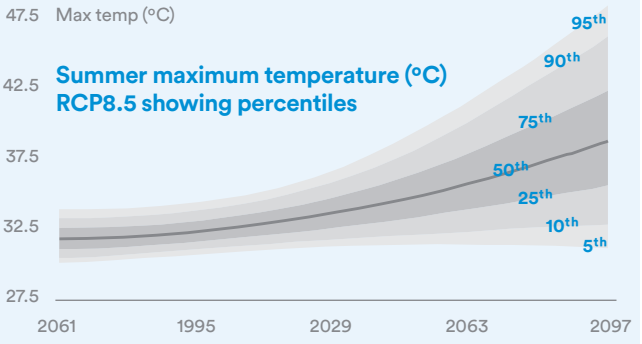
> **Our long-term success depends on how well we prepare for the challenges of the future by accounting for and adapting to the effects of climate change on our network.**
>
> **Clare Thomas**
> Asset management engineer

Figure 1: UKCP18 climate change profiles

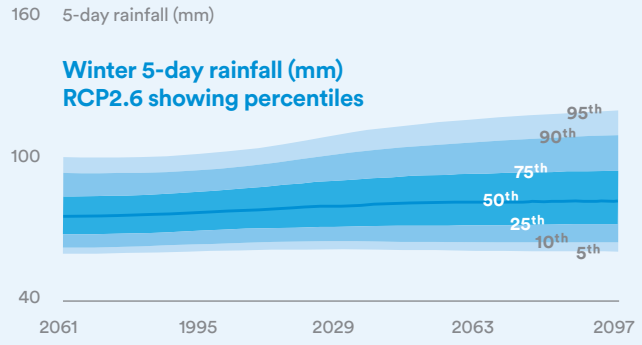
If the global average temperature is kept within 2°C, the Met Office predicts that, by the end of the current century, maximum summer temperature for our region will fall within the range of 30.5°C and 39.5°C.



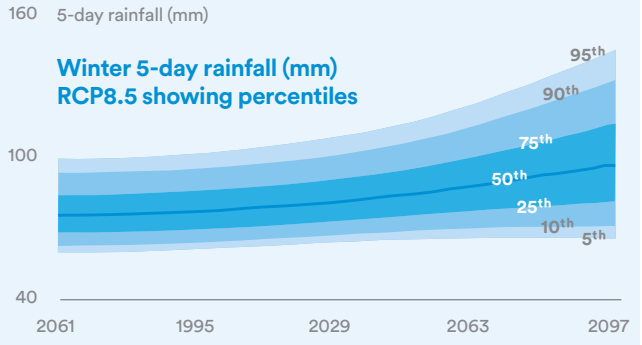
Should the global average temperate rise reach 4°C the uncertainty in the modelling creates a much wider range of possible outcomes.



Rainfall predictions are equally as uncertain as temperature projections out to the end of the century. Should global temperature stay within 2°C winter rainfall is likely to remain relatively stable.



However, should global temperature rise reach 4°C there is much greater risk that winter rainfall significantly increases for our region. This increases the risk of flooding and possible loss of supplies.



1. Our plan approach aligns with the supplementary Green Book Guidance on 'Accounting for the Effects of Climate Change', published by Defra in November 2020. This document sets out specific guidance for projects, policies and programmes that have a lifespan beyond 2035. The guidance states for these projects we should follow a climate resilient approach using at least two climate scenarios to:
   – consider options that include all adaptation measures that would mitigate the known impacts of the 2°C scenario; and
   – make decisions based on our own risk appetite about whether we also want to consider adaptation measures aligned with 4°C.

Developing our response

Flooding (fluvial and pluvial)

long periods of above average precipitation or intense rainfall events resulting in flooding and erosion.

- We will continue to maintain compliance with industry requirements for flood mitigation.
- Our plan has £1.2m of flood defence investment (80.6 per cent less than 2015-23) to:
  - carry out minor upgrade works at 13 major substations to ensure continued compliance with Engineering Technical Report (ETR) 138 standards; and
  - carry out flood mitigation works at 35 high-criticality distribution substations in the period to continue to enhance our resilience, for example sites that feed other infrastructure providers.
- We considered options for enhancements to existing flood defences to raise our level of resilience above that considered to be industry best practice, for example by increasing defences at all at-risk major substations up to a 1:1,000 year level.[1] While this carried some support from some stakeholders it did not represent value for money.

Gradual increase in temperature and rainfall

warmer and wetter conditions extending vegetation growing seasons.

- Our established programme of works for vegetation management will continue in the 2023-28 period to ensure clearances to overhead lines. We will target 24,100 spans of the network p.a.
- Overall vegetation management costs in our plan are £11.2m p.a., an increase of £1.8m (19.1 per cent). This is driven by the emerging risk of ash tree dieback (forecast to affect 290 spans of overhead line p.a.), as well as clearances to tower bases and substations. The introduction of two light detection and ranging (LiDAR) surveys in the period will better enable us to drive efficiencies through targeting our programmes.

Extreme heat

high temperatures reducing the performance and efficiency of assets.

- We will work to embed climate resilience into all our specifications and standards to deliver synergistic resilience through our core asset replacement programmes.
- We will protect sensitive substation equipment from gradual ambient temperature rise and prolonged extreme heat with modifications to our substation design approach.

Storms

storm conditions leading to operational failure of above ground assets, increased faults and loss of supply to customers.

- We will enhance our storm resilience through strengthening of our overhead line networks through our core asset replacement programmes.

In parallel, we will enhance our ability to recover from major events through learning lessons from major events to inform improvements in our processes and practices, allowing us to promptly calibrate our operational response plans, trigger criteria and controlled escalation stages, see annex 4.11 Our approach to resilience.

Our stakeholders have reinforced the need to manage interdependencies to ensure whole system resilience.

We will continue to work with other infrastructure sectors and regional organisations to identify interdependencies and enhance resilience. This includes collaborations with:

- the national Energy Networks Association (ENA) climate resilience working group, consisting of UK electricity and gas distribution and transmission operators;
- other local infrastructure organisations, such as Northern Gas Networks, Yorkshire Water and Northumbrian Water, to enhance regional climate change strategies;
- other regional bodies on catchment-based flood mitigation projects – £2m is included in our plan to fund these works; and
- local resilience forums, BEIS, and other infrastructure providers on joint scenario planning and testing of recovery processes.

Our plan sets out metrics to track our progress in enhancing the resilience of our network to climate change.

We are working with other network companies as part of the ENA climate resilience working group to develop a comprehensive set of industry-wide, common resilience metrics. We will report on our progress annually.

We will also continue to submit progress reports to DEFRA and the National Adaptation Plan in line with the five-yearly reporting cycle laid out under the Adaptation Reporting Powers.

1. '1:1,000 year' means that, statistically, a flood of that magnitude (or greater) has a 1 in 1,000 chance of occurring in any given year. In terms of probability, the 1,000-year flood has a 0.1 per cent chance of happening in any given year.

Customer outcomes		Benefits	Deliverables	Output measure/[1] *indicative input measure*	ED1 to date	ED1 forecast	ED2 target
CR1	**Maintain flood defence resilience at all major substations**	— Improved long-term resilience of the network — Increased protection against flooding events	**CR1.1)** Improve and maintain flood resilience through targeted adaptations in civil defences and installing additional substation defences across the region **CR1.2)** Improve flood resilience at distribution substations, either by moving them out of the line of flooding risk or by implementing mitigation measures **CR1.3)** Share data with infrastructure providers on local-level resilience and identify local dependencies	*High-risk sites protected to ETR138*	93%	99%[2]	100%
				Flood defence upgrades[3]	199	211	*48*
				Major substation flood defences installed[3]	73	84	*13*[2]
				High criticality distribution substations with increased resilience[3]	-	-	*35*
CR2	**Reduce the impact of storms on our network through a comprehensive programme of vegetation management**	— Maintain resilience of the network — Improved efficiency and, therefore, lower cost due to the use of technology	**CR2.1)** Undertake enhanced resilience cuts in line with ENA's Engineering Technical Report 132 (ETR132) on our overhead network to comply with enhanced resilience requirements **CR2.2)** Establish and maintain clearance corridors **CR2.3)** Assess and tackle the issues anticipated from ash tree dieback **CR2.4)** Undertake a vegetation clearance programme for substations and tower bases **CR2.5)** Utilise LiDAR technology to ensure efficient targeting of our vegetation management	**High voltage (HV) network resilient to high winds (ETR132)**	42%	60%	75%
				ETR132 network clearance (km)	*889*	*1,295*	*844*
				Vegetation management clearance spans p.a. (ENATS 43-8)[4]	*24,800*	*25,700*	*24,100*
				No. of full LiDAR network surveys in the period[5]	-	-	*2*
CR3	**Improve resilience through collaborative work on interdependencies to reduce the risk of cascade failures across systems**	— Improved resilience of the network, our region, and beyond — Increased efficiency of delivery — Increased collaboration	**CR3.1)** Collaborate with other regional infrastructure operators to identify and mitigate interdependencies **CR3.2)** Collaborate with the Environment Agency and local authorities on the implementation of their regional flood risk management plans and establish support where appropriate	**Implement consistent Climate Resilience metrics in collaboration with the industry**	-	-	✓
				Collaboration events p.a.	*8*	*8*	*28*
CR4	**Maintain operational resilience and embed long-term resilience across our asset programmes, working with others to better understand future risks**	— Improved resilience efficiency through long-term adaptation — Improved operational response to post-storm restoration — Increased embedded resilience across all our asset programmes — Improved resilience at lower cost	**CR4.1)** Utilise drones for storm damage assessments **CR4.2)** Undertake collaborative exercises to test our operational response. These simulations test our response to the loss of critical national infrastructure and are often carried out in collaboration with government or in coordination with National Grid or our parent company, Berkshire Hathaway Energy **CR4.3)** Embed resilience across our asset programme designs and specifications to deliver long-term synergistic resilience, for example moving substations out of the line of fire when replacing them for condition drivers and ensuring we have the appropriate ambient future temperature included when we design and establish the rating for overhead lines **CR4.4)** Trial the installation of current flow monitors in areas at risk of wildfire **CC4.5)** Undertake collaborative research projects to develop predictive analytics for the effects of weather on our underground networks	*Company resilience exercises in the period*	*1*	*1*	*2*
				Update our design policies to consider ambient future temperatures	-	-	✓

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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. One major scheme and two shared National Grid sites to be completed in 2023-28.
3. Cumulative, in price control.
4. Annual average, in price control.
5. We have completed a trail LiDAR survey in the ED1 period on a partial section of the network. ED2 surveys will be full network surveys.

How engagement with you has shaped our plan

CLIMATE RESILIENCE

Climate Resilience

How we engaged with you:

- During wave one we spoke with 150 future energy users, utilities and local authorities across five events.
- In wave two, panels, surveys and workshops offered the chance to express a view. Climate resilience matters were raised at 11 of our 135 engagement events with >5,000 customers and stakeholders.
- In wave three, up to the draft plan launch in July 2021, seven events covered climate resilience with >2,300 customers.
- We finalised our plan in wave four, responding to queries, addressing gaps and testing overall acceptability. We engaged 10,029 customers and stakeholders overall and with detailed sessions on outstanding climate resilience topics across six events.

29 dedicated events

17,505 stakeholders engaged

What we have heard from you	How this has impacted our plan	Customer outcome ref	Annex detail
Take a balanced approach to climate resilience Stakeholders supported an ambitious approach to climate resilience but asked us to balance with keeping costs low.	**Our plan improves climate resilience without increasing customer bills** We considered a range of future climate scenarios to inform our proposed solutions.	CR1 CR2 CR3 CR4	Link
Plan for worst-case scenarios Stakeholders asked us to plan for worst-case climate scenarios. They also asked us to consider a range of risks including flooding, but also droughts, extreme high temperatures, wildfires and heavy and prolonged rainfall.	**We embedded continuous monitoring and adaptation into our plans** We explicitly considered a worst-case scenario in our planning. We addressed the full range of climate risks in our risk assessments. Our plan embeds resilience across our asset programme designs and specifications to deliver long-term resilience and wider decarbonisation benefits.	CR1	Link
Consider a wide range of measures to manage storm impacts Our climate panels supported our flood resilience plans but asked us to consider climate mitigation and adaptation in the widest sense, including natural solutions such as land management.	**We expanded the scope of our flood resilience plans** Our plan builds on our significant investments in the 2015-23 period. It improves flood resilience through targeted adaptations, installation of additional substation defences, moving substations and implementing wider mitigation measures.	CR1	Link
Protect high-risk areas Stakeholders felt climate resilience measures should be targeted in areas most at risk from severe weather.	**Flood mitigation will be targeted at high-criticality and high-risk sites** Flood mitigation will be targeted at high-criticality and high-risk sites. Our plan invests £1.2m p.a. in targeted flood investment. We will invest at major substations identified as at risk of flooding and strategic distribution substations identified through our climate risk assessments.	CR1	Link
Use technology to reduce costs Stakeholders wanted us to use technology and natural solutions to improve climate resilience and reduce costs.	**Our plan deploys a range of innovative solutions** For example, we will use LiDAR technology to efficiently assess issues caused by ash tree dieback and target our work programmes.	CR1 CR2 CR4	Link
Work with partners to ensure a joined-up approach Stakeholders wanted us to collaborate to mitigate flood risks, asking us to work with partners including the Environment Agency, local authorities, DEFRA, Rivers Trust, farming associations and other networks.	**We added explicit collaboration commitments to our plan** We will share local-level resilience data to identify interdependencies. We will also plan collaborative exercises to test our response readiness to severe weather.	CR2 CR3 CR4	Link

Physical and Cyber Resilience

We will build on the extensive investments we have already made to protect your information and electricity supply, and to continually reduce the risks of existing and evolving threats.

We understand changing customer needs and net zero ambitions mean a move to an increasingly decarbonised, decentralised and digitalised energy system is required. At the same time, we are seeing increasing IT/OT network risk – particularly in the field of cyber security. However, we are set to start the five-year period from 2023 in a strong position because of the £66m investment we have made in physical and cyber resilience in the period 2015-23, meaning that we can continue to secure your existing and future services while reducing costs.

We know that security of your electricity supply and information is important to you. We plan to invest £62.5m on driving down risk that will, in turn, create a stronger network that is resilient to cyber and physical attacks, and a further £9m on ensuring we have resilient communications systems that will ensure our engineers can safely control and maintain your electricity supply.

We will start in 2023 from a position of strength.

As a business, we already take the threat to your services and information very seriously and our activities since 2015 have gone above those identified in our 2015-23 business plan. This is particularly the case in cyber security, where the need arose to invest more than £19m in meeting the emerging threat.[1]

We also invested significantly in improving the physical security systems at our substations, including establishing a dedicated, round-the-clock, alarm-receiving centre to monitor the security systems at our substations and critical sites.

How much it will cost

2023-28 expenditure (annual)	**£14.3m** 2.2% of totex
versus 2015-23	**-£1.3m** -8.3%

One of our eight plan areas, taken together, delivering more for less.

In the 2015-23 period we have invested to:

Establish a dedicated cyber-security team and a 24×7×365 security operations centre.

Certify our systems and processes to the international standard for management of information security, ISO 27001.

Implement the Center for Internet Security's (CIS) Controls across our systems.

Meet the requirements set out under the EU Security of Networks & Information Systems (NIS) Directive.

Establish processes and deploy a wide range of cyber detective and defensive technologies.

1. £15.8m in 2012-13 prices.

The investments made since 2015 mean that our focus from 2023 is on maintaining the systems and processes we have established, coupled with targeted incremental improvements to further reduce risk. Our business plan will deliver enhanced outputs without increasing the level of spending compared to 2015-23.

You have supported our proposal to invest to reduce risk and improve the resilience of our systems.

Coupling investment in new technology, such as artificial intelligence (AI), with investment in our people is the cornerstone of our business plan.

— We recognise that, in the cyber-security arena, the increasing level of threat means that even just to stand still requires investment. This is driven by the ever-growing level of sophistication and determination of adversaries, be that criminal organisations seeking profit, nation states gaining access to critical infrastructure to cause disruption, or groups looking to cause social harm through attacks. These can be directly targeted at specific organisations, or distributed attacks that look for any opportunity to exploit weaknesses in an organisation's IT systems.

Recent high-profile examples illustrate this growing threat:

— May 2021: Colonial Pipeline, which carries just over 50 per cent of the fuel supplies across the East Coast of the US, was forced to cease operation following a ransomware attack.
— February 2021: Oldsmar, Florida, where a hacker took control of chemical dosing of a water treatment works in an attempt to poison 15,000 residents.
— December 2015 and 2016: nation-state attack on the Ukraine power system that resulted in disruption to power supplies across the country on two separate occasions.

Our customer outcomes focus on reducing the risk of a successful physical or cyber-attack and maintaining resilient communications across our network. Based on our essential service, and feedback on what is important to you, our approach is to deliver on two clear responsibilities: **protecting your information and protecting your power supply.**

We take these responsibilities seriously. As such they shape our approach to cyber security.

As a responsible network operator, we are obliged to ensure our systems are resilient to attack. Your feedback reinforced that stance. You told us you are concerned about the potential impact from the increasing frequency of cyber-attacks and you supported the need for an action plan for communicating any cyber-security risks and proportionate mitigations associated with digitalisation including security of transferring smart meter data.

Under the EU Security of Networks & Information Systems (NIS) Directive, we are duty-bound to take appropriate and proportionate measures in securing the network and information systems on which the essential service we deliver to you relies. Equally, under the General Data Protection Regulation (GDPR), we are required to protect our customers' personal information.

Your feedback continues to echo that it is our responsibility as a network operator and guardian of that information to ensure it is safe, and that we use it appropriately.

You asked us to engage with specialists in this area to ensure we can work to available best practices. Our approach focuses on the continual reduction of risk that is proportionate to an ever-changing cyber-threat landscape. This means we need skilled cyber professionals and training programmes that will see these skills evolve to match the maturity of cyber criminals over time; additionally, we have partnered with a National Cyber Security Centre (NCSC)-approved supplier to ensure we have specialist input in assessing and selecting improvements to help us work toward meeting the NCSC Cyber Assurance Framework.

From 2023, we plan to increase our team by 20 per cent by recruiting more cyber specialists, then investing in their training and ongoing development. More broadly we will invest in our workforce to provide the skills needed to help them do their job in a cyber secure way, building on our solid approach that has already provided our people with the cyber essentials to perform their work in a safe and secure way. For example, instances of colleagues clicking on test phishing emails has reduced, from 33 per cent at the start of 2016 to just under 0.5 per cent at the end of 2020.

Protecting your information

One of the first lines of defence against cyber threats is our people. Therefore we are investing in training, development and security tools to help us identify weaknesses, as well as detecting and responding to cyber-attacks on our systems to protect your information and any other information we own or process.

Protecting your power supply

In addition to making sure that our systems are secure to protect your data, we must also make sure that our systems and network are cyber secure to protect your electricity supplies. Disruption to our network remains the most significant way that we impact the lives of our customers. We have seen this come through strongly in your feedback to us, which encourages continued investment in the security and resilience initiatives required to ensure that we minimise that disruption.

> **We plan continued investment in our cyber and property defences to meet the growing threats to our network, customers and systems.**

Phil Green
IS security and compliance manager

We will invest in security tools to protect our networks from unauthorised access or attack.

Part of this will include extending our operational technology network surveillance capability to detect unauthorised or abnormal activity. As part of this, we will enhance our systems to detect network-based attacks to all our major substations.

We will invest in tools that employ AI to help us quickly detect and respond to cyber-attacks on our control systems utilising machine-first decision making, ultimately verified by a human. Our approach, however, is not solely reactive: we will improve the systems that we use to hunt for active threats and weaknesses in our IT and power network control systems by investing in security tools that can continuously inspect our systems, and alert us to weaknesses as they are found, as well as investing in risk-management applications that will help us manage and improve our cyber risk management and governance processes. These initiatives are all aimed at improving our capability to detect cyber-attacks by monitoring more of our data at more points on our systems. This will help our security operations centre see and correlate more events that may be an indicator of a threat or compromise.

We plan to establish third party security connectivity models and expand our cloud security prevention, detection and response capabilities by ensuring that cloud security tools are installed as a standard part of our system build. This continued expansion of our cyber-security capabilities includes mitigating the risks presented by open data and the increased digitalisation of our operations.

Any new or changing systems and processes will be incorporated into our ISO 27001-certified information security management system, which is in place to ensure they remain under continuous risk review and improvements. Finally, we recognise it is important to be prepared for the worst case. For this reason we are investing to improve our cyber breach response and recovery capabilities.

Our approach to physical security will continue to underpin protecting power supplies.

The new threats of cyber security do not overshadow the well-established physical security threats the network faces.

The significant work we have done since 2015, including meeting the standards set for sites designated as Critical National Infrastructure (CNI), means that we are able to reduce our costs while incrementally maintaining, and improving, our levels of resilience.

From 2023 we will continue to focus on security incident 'hot spot' areas, responding with improved physical security measures based on best practice that are designed to protect our network from theft and vandalism activity that not only increases costs but also puts your electricity supply at risk. The plan proposes improvements in perimeter defences that will enable us to better deter and detect third-party access to our most critical assets.

We plan to target investments at our highest-risk sites. We will enhance the physical security at 25 per cent of our highest-risk substations including all our sites designated as CNI. These security enhancements will blend traditional security defences, ensuring the integrity of existing security measures designed to delay intrusion, with the use of new technology that enable us to better detect trespass. These enhancements will renew and build upon the security systems already installed, enabling more value to be extracted from our previous investment and helping us to deploy the appropriate response and minimise false alarms.

Underpinning our network resilience is a reliable communications network that allows us to safely coordinate our workforce as well as remotely control the electricity network.

During the period it is vital that we invest to mitigate the impact of the retiring of the power resilient public telecom network technologies that we use today for communication with our field engineers.

The Emergency Services Network (Airwave) will be closing down and BT systems (PSTN) that deliver telephone lines to our substations are changing to a more advanced but less power resilient model. These are the power resilient systems that our engineers currently use to communicate when mobile telephones cannot be relied on.

With our own fixed telecommunications network providing a high degree of resilience, we will invest in mobile communication to ensure our field engineers have continued access to power resilient mobile communication that will ensure that they can safely work to restore power in extreme events.

This investment is essential in order to ensure we are able to meet our obligation to provide 72 hours of power resilience to the systems that we use to remotely control the electricity network and that will be needed to restore power in the event of a major national failure. We plan to maintain the current power resilience for our substation communications in line with the current national resilience guidance.

Cyber security is important to us all, but one of the strongest forms of defence is obfuscation so we cannot share all we will do. An overview of our plans for investment is shown in this section of our plan but our detailed Cyber Resilience plans have been securely provided to Ofgem's Cyber Security team to scrutinise.

Customer outcomes		Benefits	Deliverables	Output measure/[1] *indicative input measure*	ED1 to date	ED1 forecast	ED2 target
PC1	**Protect our customers' information**	— Customers' information will be kept safe	**PC1.1)** Invest in technology, such as cloud access security broker (CASB) and AI analytics, that helps to identify weaknesses in our IT systems and quickly detect attacks **PC1.2)** Develop and implement a cyber-specialist training programme for our workforce **PC1.3)** Invest in automated event response technology to help us quickly respond to cyber-attacks **PC1.4)** Achieve recertification for ISO 27001 and ISO 27019	**Loss of information *(material cyber breach)***	0	0	**0**
PC2	**Protect our customers' power supply from cyber-attacks**	— Customers' power supplies will not be impacted by cyber-attacks	**PC2.1)** Design and implement core OT system and major substations network sensors **PC2.2)** Develop and implement an OT cyber-specialist training programme **PC2.3)**) Implement enhanced monitoring detection and response technology on our core systems	**Loss of supply *(material cyber breach)***	0	0	**0**
				Operational Technology Network Monitoring upgrades	-	-	*700*
PC3	**Protect our customers' power supply from physical attacks at our major substations**	— Customers' power supplies will not be impacted by physical attacks	**PC3.1)** Deploy a rapid incident response security solution to quickly protect network substations **PC3.2)** Deploy intelligent perimeter security upgrades	**Loss of supply (material physical breach)**	0	0	**0**
				Intelligent perimeter security upgrades	-	-	*155*
PC4	**Ensure our communications systems are power resilient to help our engineers safely and quickly restore power**	— Restoration of customers' power supplies will not be impacted by major communications failures — Power supply will remain resilient	**PC4.1)** Deploy a resilient mobile communication system for our critical field colleagues **PC4.2)** Establish vehicle deployable emergency communication hubs (deployable resilience)	Date of system upgrade	-	-	*2025/26*
				No. mobile resilience vehicles	-	-	*4*

Innovation | Data and Digitalisation | Workforce Resilience

1. Measures are shown to track delivery of our customer outcomes. While 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.

How engagement with you has shaped our plan

PHYSICAL & CYBER RESILIENCE

Physical and Cyber Resilience

How we engaged with you:

- In wave one we spoke to 227 customers, stakeholders, cyber experts, and central government representatives across five events.
- We began gauging customers' priorities and levels of ambition in wave two at six events covering physical and cyber resilience, engaging 4,940 customers.
- We refined our plan in wave three, running 91 events and engaging 32,500 stakeholders – physical and cyber resilience was a specific sub-topic at three events, covering 2,277 individuals, including customers and internal stakeholders.
- In wave four we finalised our plan, responding to queries, addressing gaps and testing overall acceptability. We engaged 10,021 customers and stakeholders overall with detailed sessions on outstanding physical and cyber resilience topics across five events.

19 dedicated events

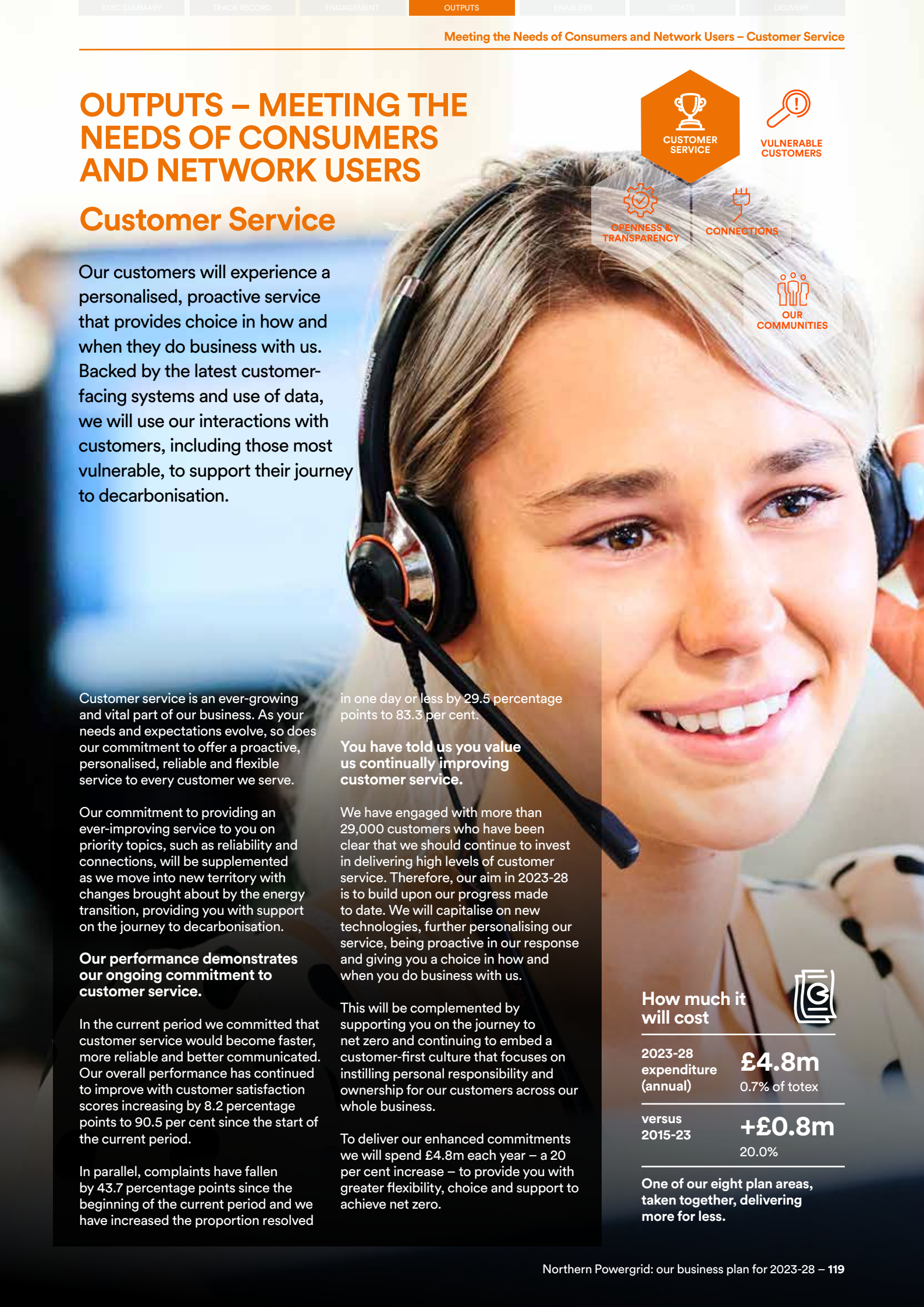
17,465 stakeholders engaged

What we have heard from you	How this has impacted our plan	Customer outcome ref	Annex detail
Deliver high standards of cyber and physical security In our Emerging Thinking consultation, most stakeholders asked us to adopt the most ambitious proposals for physical and cyber security.	**We developed a plan that leverages our investments to date and enhances our levels of resilience** We will work with experts to target investment in automated response technologies that can detect threats and support our response to attacks.	PC1 PC2	Link
Work with specialists Stakeholders asked us to engage with cyber-security specialists to understand and apply governance and best practice.	**We embedded continuous monitoring and adaptation into our plans** Our plans have been developed with independent cyber experts to ensure they meet best practice. They have also been reviewed by Ofgem's cyber advisory team.	PC1 PC2	Link
Protect personal information Customers trust us to handle personal information and wanted us to ensure our platforms remain secure and that threats are detected and responded to immediately.	**We introduced our commitment to safeguard customer information** We will keep customer information safe by investing in technologies and skills that give us a strong information security system.	PC1	Link
Invest to protect power supplies from cyber-attacks Stakeholders recognised the threat of cyber-attacks on power supplies and the levels of complexity involved in making sure we are prepared.	**The delivery of our plan will be supported by National Cyber Security Centre-approved suppliers** Our plan implements upgrades to core operational technology systems, major substations network sensors, and introduces a cyber-specialist training programme.	PC2	Link
Improve physical security Customers were concerned that damage to our sites could give rise to increased costs or disruption to customers.	**We have included a range of measures to secure our sites and protect power supplies** We will protect power supplies by deploying rapid security responses to physical breaches and utilising intelligent perimeter security systems.	PC3	Link
Maintain resilience in major events Most customers supported investment in more resilient communications.	**We will invest to upgrade our secure communications capabilities** We will deploy a resilient mobile communication system to enable faster restoration of power in major power-cut events.	PC4	Link

OUTPUTS – MEETING THE NEEDS OF CONSUMERS AND NETWORK USERS

Customer Service

Our customers will experience a personalised, proactive service that provides choice in how and when they do business with us. Backed by the latest customer-facing systems and use of data, we will use our interactions with customers, including those most vulnerable, to support their journey to decarbonisation.



Customer service is an ever-growing and vital part of our business. As your needs and expectations evolve, so does our commitment to offer a proactive, personalised, reliable and flexible service to every customer we serve.

Our commitment to providing an ever-improving service to you on priority topics, such as reliability and connections, will be supplemented as we move into new territory with changes brought about by the energy transition, providing you with support on the journey to decarbonisation.

Our performance demonstrates our ongoing commitment to customer service.

In the current period we committed that customer service would become faster, more reliable and better communicated. Our overall performance has continued to improve with customer satisfaction scores increasing by 8.2 percentage points to 90.5 per cent since the start of the current period.

In parallel, complaints have fallen by 43.7 percentage points since the beginning of the current period and we have increased the proportion resolved in one day or less by 29.5 percentage points to 83.3 per cent.

You have told us you value us continually improving customer service.

We have engaged with more than 29,000 customers who have been clear that we should continue to invest in delivering high levels of customer service. Therefore, our aim in 2023-28 is to build upon our progress made to date. We will capitalise on new technologies, further personalising our service, being proactive in our response and giving you a choice in how and when you do business with us.

This will be complemented by supporting you on the journey to net zero and continuing to embed a customer-first culture that focuses on instilling personal responsibility and ownership for our customers across our whole business.

To deliver our enhanced commitments we will spend £4.8m each year – a 20 per cent increase – to provide you with greater flexibility, choice and support to achieve net zero.

How much it will cost

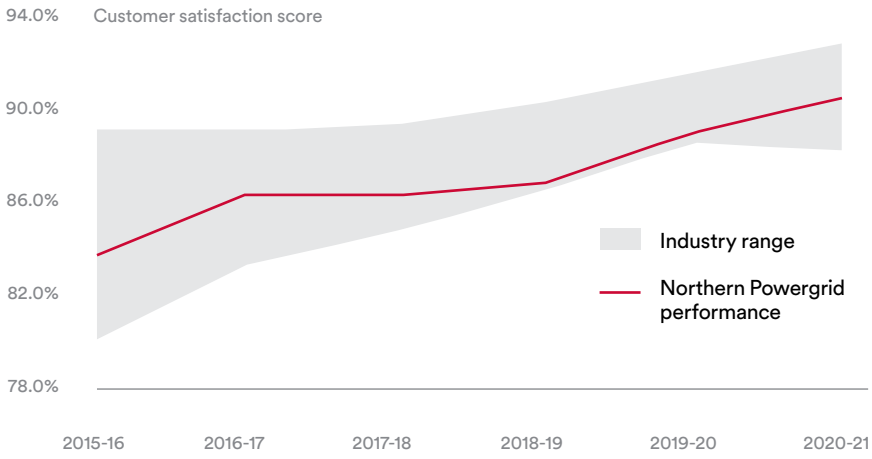
2023-28 expenditure (annual)	**£4.8m** 0.7% of totex
versus 2015-23	**+£0.8m** 20.0%

One of our eight plan areas, taken together, delivering more for less.

Striving to be the best

We have listened to your feedback and our customer service commitments break down into the four key themes that matter most to you.

Figure 1: overall customer satisfaction



Proactive and flexible service: you have told us that immediate, proactive and personalised communications are a priority, combined with flexibility in when you do business with us. We will utilise the latest technology to engage with you on new platforms and expand our service offering.

- Building on the £4m invested in digital customer service during 2015-23 and the introduction of our self-service platform, we will aim to further integrate our systems with our customer relationship management (CRM) platform to provide a streamlined, easily accessible service if you choose to engage with us digitally.
- We will introduce at least three new channels to support communication, which have been been identified through customer feedback – reply text messaging, direct messaging (e.g. WhatsApp) and video chat, supported by what3words.
- We will enable ease of navigation between channels, while retaining our traditional contact channels so you have the choice to speak to a person, if you wish.
- We will provide greater flexibility by enhancing our appointment offerings, extending our service to provide appointments up to 8pm and over weekends for planned services. Additionally, we will offer same-day/next-day appointments with a cost-reflective charge paid by customers using this service.
- Proactive communications with you before, during and following a power cut remain critical and you have fed back to say that you want greater levels of support once a power cut exceeds six hours, that support for vulnerable customers is a priority, and that you would benefit from practical advice, support and information within your local communities.
- Where you experience a long-running power cut, we will aim to provide proactive, practical, on-site support through deployment of our customer service vehicles and customer service professionals.
- We will deliver enhanced proactive communication to you on planned power cuts and identify where you may benefit from additional on-site support.

Proactively responding to dissatisfaction: you have told us that when something does not go to plan you want to see us managing your expectations, keeping you informed and being proactive in our approach to resolve your dissatisfaction quickly and effectively.

- We will be proactive in our approach, embedding ownership and devolving complaint resolution to our upskilled regional teams where it is better for you and more effective to do so, while offering on-site customer service support to engage in person and quickly respond to your concerns.

Customer care: you have told us that delivering personalised and dedicated customer care to vulnerable customers is important, in particular supporting a fair transition to net zero through our services.

- We recognise the importance of providing greater support to our most vulnerable customers and you have said you want us to be ambitious in our commitments, to which we have listened and acted upon – see our Vulnerable Customers section.

Supporting decarbonisation: you have told us to evolve our customer service offerings to provide more support on your journey to net zero. We will use our expertise in this area to provide information, support and advice as you transition to using low carbon technologies (LCTs) and provide additional help and guidance.

- We will be proactive in our approach, providing information on energy efficiency and decarbonisation, supporting you via our range of communication channels.
- Our intergenerational research and engagement with early adopters of LCTs shows that customer service to support net zero needs to focus on education and must be generationally targeted with a range of platforms for different needs. We will use our range of channels to target and support understanding of net zero and decarbonisation, to bring to life what it means for our customers.
- Our research shows that the task of decarbonisation can be overwhelming for many customers, with clear guidance, support and education considered essential for real change to occur. We recognise the complexity of this topic and want to use our expertise to help inform you during your interactions with us.
- As our services expand for our large customers, electricity suppliers and Independent Distribution Network Operators (IDNOs), our customer service teams will work in hand in hand with our experts to provide you with tailored support on flexibility products and services.
- We will make the best use of our CRM system to identify your requirements, answer any frequently asked questions on matters such as electric vehicle charging or adopting new forms of high-efficiency electrical heating, and signpost you to externally accredited service

providers. Where you need extra support our team will be on hand to provide a personalised service through further understanding your requirements.

- Using insight and information available to us across our region, we will develop and deliver targeted outreach campaigns to further inform you on decarbonisation and how you can support the journey to net zero.
- Backed up by our suite of analytical tools, we will support you by providing access to system data, along with simple intuitive guidance. This will support you in making informed decisions when you wish to connect to our network.
- As part of our commitment to the communities we serve, we will recruit a team of community-based energy advisors (CEAs) across our region. They will deliver direct advice and support to communities, partners and local authorities. Through our regional CEAs, we will support local authorities in line with decarbonisation targets. We will collaborate across our teams to ensure that you receive consistent guidance and continuously learn from our communities to enhance our customer guidance in this area. Our CEAs will work seamlessly with our regional and customer service teams to further enhance and tailor the service we provide to you.

Above all we want to ensure we offer you best-in-class customer service.

Our service will be underpinned by further investment in our people and contractors through an annual programme of customer service training, which will evolve as we mature our customer service offering, aligned with high standards of quality.

We will seek independent assurance of our approach via external accreditation of our customer service standards to provide a roadmap of continuous improvement with you, our customers, at the heart of our delivery.

Customer outcomes		Benefits	Deliverables	Output measure/[1] *indicative input me*	ED1 to date	ED1 forecast	ED2 target
CS1	**Improve customer satisfaction by introducing new contact channels, greater on-site support and choice in booking slots for planned services, providing increased choice and flexibility in how and when customers do business with us[2]**	— Improved customer satisfaction — Choice and flexibility – enhanced digital offering, including self-service, supporting our customers and future customers where this is important, but offering choice of human contact where required if this is a preference of our customers who are unable to access digital channels — Enhanced convenience of when and how our customers can do business with us including on-site support where required	CS1.1) Give customers more choice in how to contact us through the introduction of three new communication channels, supporting accessibility while ensuring full access to traditional contact channels CS1.2) Offer greater convenience to customers by extending appointment booking slots for planned services into evening/weekend and same day/next day CS1.3) Provide proactive communications to customers for both planned and unplanned power cuts, where available, using smart meter data[3] CS1.4) Provide on-site support where customers experience long-running power cuts[4] CS1.5) Provide an enhanced digital self-service offering, preserving the option of 100% human contact where preferred	**Broad measure of customer service score (ODI-F)**	90.5%	92.0%	93.5%
				No. digital contact channels	*5*	*5*	*8*
				Convenience (days of week/ time slots)	*5 (working days), business hours*	*7 days am/ pm/ weekend*	*7 days next day/same day*
CS2	**Improve the speed of complaint resolution, resolving 90% of complaints within one day**	— Faster turnaround for complaints resolution	CS2.1) Resolve complaints through our regional teams where it is quicker and more effective to do so CS2.2) Use data analytics to aid quicker analysis of common themes and group complaints by type to support quicker resolution and root cause analysis	**Complaints resolved within day+1**	83.3%	88.0%	≥90%
				Complaints resolved within day+31	96.4%	98.0%	≥98.5%
				Complaints metric (ODI-F)	2.8	1.8	1.4
CS3	**Expand our customer service offering to provide support for flexibility providers and data users[5]**	— Customers more active, informed and engaged on the decarbonisation transition — Customers able to maximise use of data and services offered	CS3.1) Expand our services for our large customers, electricity suppliers and Independent Distribution Network Operators, working collaboratively with our customer account management team to provide tailored support on flexibility products and services, making best use of our customer relationship management system to identify requirements, answer FAQs and signpost to approved service providers[6] CS3.2) Provide simple, intuitive guidance for data to our customers making it easier to access, find and use[7]	**Introduction of customer satisfaction survey for data services customers**	-	-	2023-24

1. Measures are shown to track delivery of our customer outcomes. While 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 CO3.1) Providing information through communications aound the path to decarbonisation.
3. Cross-reference VC2.2) Deliver proactive communication during supply interruptions utilising digital channels.
4. Cross-reference VC2.4) Establish a new support team to provide additional on-site support in the event that power cuts last longer than six hours.
5. Cross-reference DSO3.1) Build enhanced functionality on top of our open data platform to unlock additional customer benefits; DD1) The journey to open data; and DD9) Advanced analytics.
6. Cross-reference DS01.2) Work with stakeholders to improve information exchange and understand flexibility requirements; and DSO5.5) Create a team of knowledgeable Flexibility Relationship Managers to actively engage with customers.
7. Cross-reference DD8) Enabling customers to self-serve.

Innovation | Data and Digitalisation | Workforce Resilience

How engagement with you has shaped our plan

CUSTOMER SERVICE

Customer Service

How we engaged with you:

- In wave one we covered customer service at 13 stakeholder events, engaging with over 1,100 customers. Themes covered personalised service, flexible options and digital tools.
- In wave two we tested the opinions of engagement gathered in wave one. We gauged customers' priorities and levels of ambition at 16 sessions, covering 14,544 people.
- We refined our proposals in wave three to gain endorsement for our final plan. We covered customer service at 11 events, engaging with 3,411 customers
- We finalised our plan in wave four, responding to queries, addressing gaps and testing overall acceptability. We engaged 10,082 customers and stakeholders overall, with detailed sessions on outstanding customer service topics across nine events.

49 dedicated events

29,213 stakeholders engaged

What we have heard from you	How this has impacted our plan	Customer outcome ref	Annex detail
Deliver best-in-class service In our Emerging Thinking, 50 per cent of stakeholders wanted higher levels of ambition (options C to E). Most customers were happy with current customer service levels but also supported improvements.	**We set our plan around four key stakeholder priorities** Our plan responds to your top four priorities: providing a flexible and proactive service, responding quickly to dissatisfaction, prioritising vulnerable customers, and supporting decarbonisation.	CS1 CS2	Link
Communicate clearly Stakeholders outlined the importance of keeping customers updated during power cuts by providing simple and essential information.	**We upgraded our plans for communication** We will focus on providing effective communication before and during power cuts using smart meter data. We will deliver an enhanced self-serve communication option and on-site support.	CS1	Link
Act quickly and proactively Customers wanted us to be more proactive and to quickly solve any problems.	**Our plan is set to deliver proactive, regional support solutions** Our front-line regional teams will provide proactive support, acting quickly and attending site swiftly to resolve customer problems.	CS1 CS2	Link
Build trust in all customer conversations Customers told us that building trust should be at the heart of all conversations – from planned power cuts to decarbonisation.	**We will develop enhanced training programmes** We will invest in our people and contractors through an annual programme of customer service training. We will independently assure our services via external accreditation.	CS1 CS2	Link
Educate on net zero Most customers didn't understand DSO, or how it would impact their bills. They wanted us to focus on helping them understand decarbonisation.	**Our plan leverages collaborations to provide tailored support** We will deliver impartial and helpful advice on decarbonisation, emissions and flexibility for all customers including large customers and IDNOs, to help everyone prepare for net zero.	CS3 CO3	Link
Be flexible Providing flexible appointment options was important for customers: 79 per cent of customers were in favour of us offering evening and weekend appointment slots.	**We expanded our appointment options** Our plan extends appointments for planned services into evenings and weekends.	CS1	Link
Provide options Customers wanted to see more options offered for communication, receiving information, booking appointments, and paying.	**We will add more communication channels** We will give customers more choice by introducing three new channels and providing enhanced digital self-service.	CS1 CS3	Link
Ensure someone is always available Stakeholders asked us to maintain free and high-quality phone services and felt that this was most important during emergency situations.	**100 per cent human contact service will be available for customers** In addition to expanded communication channels, we will maintain our free accessible phone lines for all customers.	CS1 CS2	Link

Vulnerable Customers

Vulnerable customers will be at the centre of our thinking. We will use data and strong partnerships to provide tailored services to vulnerable customers. We will support customers in fuel poverty and support a socially inclusive transition to net zero by minimising barriers to enter the energy market so that no one is left behind.

We will provide enhanced services to vulnerable customers.

We recognise that all customers can be at an increased level of vulnerability when experiencing a power cut, and that our role in providing additional support for vulnerable customers who require it is an essential service.

We have high prevalence of vulnerability in our region, with approximately 4.5m of our customers (56 per cent) meeting Ofgem's definition of vulnerability.[1]

We conducted extensive engagement and research to significantly increase our knowledge and understanding of vulnerable customers and their requirements, with the aim of developing tailored services to meet their needs. Where we had a mandate, we addressed relevant wider social issues with an increased emphasis on fuel poverty and affordability services. The development of our social programme and consumer vulnerability matrix has widened the range of tailored support services we are able to provide. Investment in data gathering and social indicator mapping has (in conjunction with partners) enabled us to target and recruit in excess of 900,000 customers to our Priority Services Membership (PSM)[2] throughout the period. We have established a robust partnership network that improves access to hard-to-reach customers, expanding our understanding of vulnerability and the issues and challenges that customers are faced with in our region. Finally, we have developed affordability outreach programmes, supporting 5,000 customers a year to alleviate the impact of fuel poverty in our region.

How much it will cost

2023-28 expenditure (annual)	**£3.9m** 0.6% of totex
versus 2015-23	**+£3.1m** +387.5%

One of our eight plan areas, taken together, delivering more for less.

1. Ofgem's definition of vulnerability: "We define vulnerability as when a consumer's personal circumstances and characteristics combine with aspects of the market to create situations where he or she is: significantly less able than a typical domestic consumer to protect or represent his or her interests; and/or significantly more likely than a typical domestic consumer to suffer detriment or that detriment is likely to be more substantial."
2. In light of stakeholder feedback, we are now referring to the Priority Services Register as the Priority Services Membership.

Supporting vulnerable customers is a priority for us

Building on these foundations, our plan will formalise and enhance the services we provide to customers in vulnerable situations. Support will include:

- more targeted recruitment to the PSM;
- a new accessible communication channel;
- enhanced support for vulnerable customers;
- smarter use of data;
- ambitious plans to scale up our fuel poverty programmes; and
- the development of new programmes to ensure no one is left behind in the low carbon energy transition.

Above all, we will ensure that customer vulnerability is central to our activities throughout our work, an approach that our stakeholders widely favour.

Support for vulnerable customers during power cuts was one of our stakeholders' top priorities. Customers want to see increased outreach and communication campaigns – targeted at the vulnerable – to enhance awareness of the PSM and the support available during power cuts. The support needs to be proactive and accessible, with human contact preferred where possible. Stakeholders also approve of increased collaboration with partners (both those in other sectors and experts in their fields) in order to provide the best service possible. As part of the wider strategy, we will do more to address fuel poverty, and address the barriers to vulnerable customers, including promoting energy efficiency in their homes.

This a stretching plan that commits to a level of ambition over and above Ofgem's minimum requirements in several key areas. These significant improvements will cost around £3.9m in total p.a. between 2023 and 2028, which represents an increase of £3.1m p.a. compared to our current spend. But this step up in activity and investment will bring forward significant benefits for our most vulnerable customers and is offset by efficiencies in other areas of our plan.

We will deliver more targeted recruitment of vulnerable customers to our PSM to proactively communicate with and manage the needs of vulnerable customers on an ongoing basis.

In order to most effectively help customers in the most vulnerable situations, it is vital to be able to identify and recruit them to our PSM. Ofgem expects us to undertake proactive and targeted advertising of the PSM and the services offered to vulnerable customer groups, and our stakeholder research supports this. Feedback suggests that an 'all in one solution' application would be valuable; to enable customers with different communication needs to easily engage with priority services and affordability programmes.

There are in the region of 900,000 households on our PSM. We will build on our existing progress and hold ourselves accountable with stretching targets. We have set a target of recruiting 70 per cent of our eligible high-risk customers and at least 50 per cent of all eligible customers to the PSM before the end of the price control period.[1] To do this, we will use data and partners to develop a regional approach to our recruitment to reflect local differences (including rural and urban differences). Campaigns will be delivered through external PR agencies, media communication and media outlets. To complement this, customer-facing staff will have access to an application that enables them to submit real-time amendments to the PSM and complete new registrations.

Sophisticated digital techniques will be employed to recruit, track, maintain and share information on vulnerable customers. We are actively working with other utilities and regulators to develop a shared essential services PSM, and we will continue to use wider data sources and social indicator mapping and partners to help identify hard-to-reach customers and sign them up to the PSM.

Our communication aims to be proactive, accessible and human-centred, an approach supported by our stakeholders. This is why we will continue to communicate in a variety of spoken languages (as a minimum, the top 10 languages in our region), plus non-spoken languages such as British Sign Language, and produce accessible web pages using services such as Recite Me. We will also undertake a review to ensure we are continuing to meet the web content accessibility guidelines (WCAG) Level AA standard, and a wider assessment to check we are using the best techniques and approaches suitable for vulnerable customers.

As part of our plan, we will also develop a new 'all in one' application solution for vulnerable customers; an approach supported by our stakeholders that also goes beyond Ofgem's requirements to deliver for those across our region. See Customer Value Propositions section for more details. The application will be developed with stakeholders and will be robust and responsive to changing needs in the coming years, and aims to:

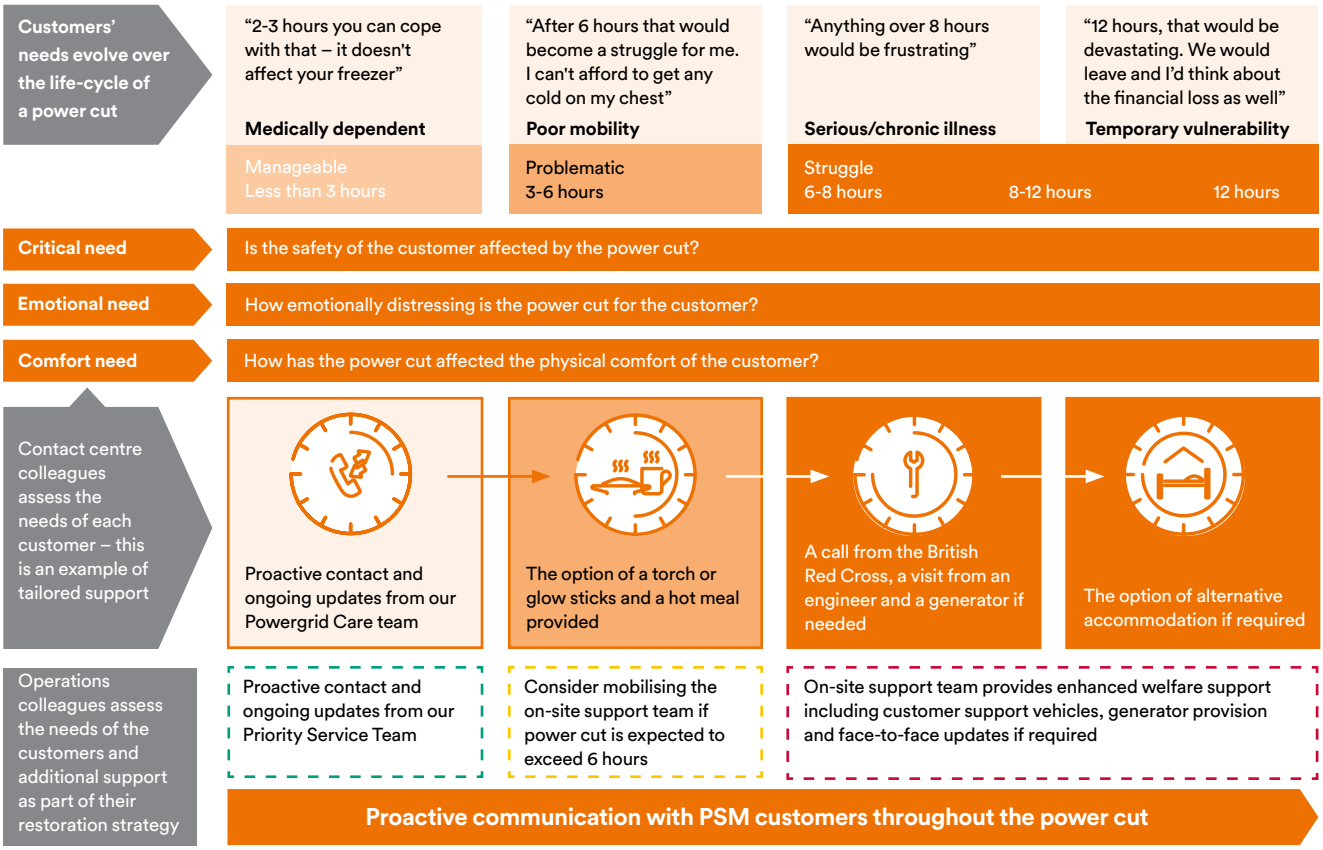
- improve our accessibility for those customers with special communication needs;
- enable us to respond to their requirements through the new digital platform;
- provide an alternative and less resource-intensive method of communication, which means a decrease in customer time spent contacting us through traditional methods;
- release resource to assist those customers who do not utilise digital channels;
- offer wider benefits, such as energy efficiency advice and affordability programmes;
- provide us with a two-way communication tool, increasing information on customers' needs and helping overall customer relationship management; and
- improve awareness of low voltage power outages.

The majority of the cost increases relating to PSM recruitment are from the application development and roll-out. There will be an upfront development cost of £1.1m, with ongoing maintenance costs of around £0.2m p.a., however the benefits are likely to be significant.

Customers can make savings as a result of access to valuable information. On average, the savings from switching energy suppliers is around £250 p.a. per switch, while the savings from energy efficiency advice is around £102 per household. The application is likely to increase the instances of all these scenarios, and combined they could have a total value in the region of £3.3m.

1. High-risk customers are defined as those who are medically dependent on electricity, have a severe physical disability, chronic serious illness or have mental health needs.

Taking our support to the next level



As a vital part of our support during power cuts we are committing to faster and more personalised proactive communication and providing enhanced care for our PSM customers.

When talking to vulnerable customers about power cuts (as part of our 'How to drive behaviour changes in PSM' research), we learned that proactive communication is important, as is the availability of human contact to discuss the needs of that customer. Relevant information channels are, therefore, required to be accessible for a diverse range of vulnerable customers, and our stakeholders have told us that tailored support should be offered during power cuts.

We have devised initiatives across two broad areas where we can offer enhanced support for vulnerable customers. These areas cover proactive communication before and during a power cut, and enhanced onsite welfare support during a power cut that exceeds six hours. These initiatives have been developed in line with the principles set out by Ofgem, particularly principle one, which requires vulnerable customers to be effectively supported and communicated with throughout.

We will endeavour to proactively contact 100 per cent of high-risk PSM customers within the first hour of a power cut and 95 per cent of remaining PSM customers within three hours of a power cut.

To meet this new target, we will increase the size of our PSM communication team. This additional capacity will help increase the speed of response, and the ability to respond across channels according to the needs of customers. For planned power cuts we will endeavour to speak to all impacted PSM customers. We will also aim to provide these customers with a proactive contact at least three days ahead of a planned power cut.

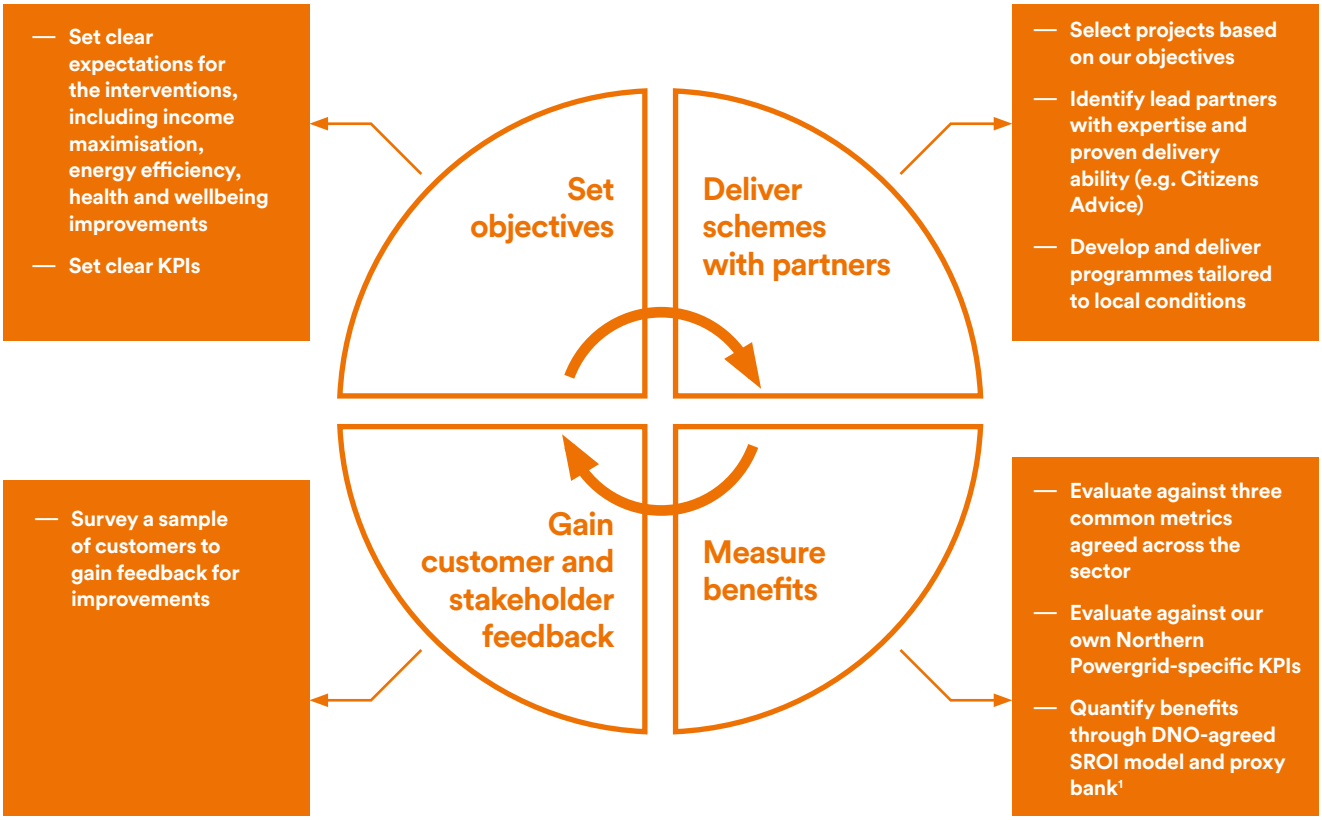
Building on the welfare support offered to vulnerable customers during the current price control period, where we developed our vulnerability matrix to tailor services to the customer's needs, we are planning to establish a new dedicated support team that will provide enhanced, personalised onsite welfare support in the event that a power cut is expected to last longer than six hours, when more than one household is impacted. Our target for 2023-28 is to provide onsite support during the day for 75 per cent of unplanned power cuts that impact more than one household and exceed six hours.

Similarly, we plan to work with businesses that support people in vulnerable situations, such as care homes, to develop resilience strategies.

As part of our enhanced welfare offering we are also aiming to reduce the impact of long-duration power cuts for those customers who are most at risk by increasing our capacity to install remote generation.

There will be additional costs associated with this increased level of service, particularly around proactive customer communication and the enhanced level of support offered on site. In the 2023-28 period, there will be an increase in spending of around £1.5m per year. Almost all of this will fund proactive onsite support for customers.

Delivery partners – delivering success



Making better and smarter use of data will improve social indicator mapping, help us better access hard-to-reach customers and deliver targeted support to vulnerable customers across our region.

We need to keep building partnerships with other organisations, and make smart use of data. This aligns with our stakeholders' wishes for us to improve access to hard-to-reach customers in disadvantaged areas and communities.

In the current price control period, we have used data to access hard-to-reach and seldom-heard customers. Using social-indicator mapping aligned to Ofgem's vulnerability needs codes, we acquired additional data that provides an accurate view of fuel poverty and low energy homes, and also established a Future Fairness consumer panel.

We have been committed to ongoing data improvements, refreshing our social-indicator mapping and acquiring new data that will help us ensure that nobody is left behind during the energy transition.

We will continue to work across these themes by enhancing our access to hard-to-reach customers and collaborating with partnership agencies working across our regions.

Our approach to vulnerability will recognise the changing needs of vulnerable customers, and, through the use of data and working with expert panels and partnerships, we will deliver targeted support to those customers across our region.

We will select partners (including those beyond the energy sector) based on the impact that we can have working together in our region. The partners will use localised information and knowledge to enable intervention. We will continue to deliver programmes through a mix of in-house teams and partners, working proactively on issues such as affordability, and reactively to power cuts.

In practice, we will use data from Experian, our partners, our community fund, and our other programmes (including those for fuel poverty, social impact and education) to better understand social issues. This will enable identification of emerging issues, and target our support in response to the changing needs of customers. These initiatives have been developed in line with the principles set out by Ofgem, particularly principle two, which describes how the smarter use of data can help inform service development and have a greater understanding of social issues.

However, meeting the minimum expectations is not enough. We will identify additional data sources and complete more frequent data refreshes to track new and emerging issues. We will increase our work with partners to ensure representation and support across our region and enhance our access to hard-to-reach customers. This is alongside an annual review of data, partnerships and policy, in conjunction with an annual action plan and ongoing monitoring of our programmes that will be assured by our social issues expert group.

1 SROI: social return on investment.

Focusing on affordability and a just transition

We will offer affordability services that will help customers access debt and financial advice, solutions to reduce energy bills, and critical financial support.

We have made significant progress in addressing fuel poverty issues by completing in-depth research to inform our approach, establishing fuel poverty support programmes, mapping areas of fuel poverty to assess the extent of the issue in our region and developing a fuel poverty strategy (which will be refreshed annually). Most importantly, we have developed successful programmes in partnership with Citizens Advice.

Affordability is a theme that our stakeholders have strongly reinforced for a long time, and our work to date has allowed customers to access solutions to reduce energy bills and benefit from bespoke income maximisation advice as well as in-house visits from energy efficiency advisors. We also deliver targeted communications campaigns run annually to improve reach.

Our focus in the 2023-28 period will be to address the differing levels of support within our region, and we plan to build on the success of these programmes by scaling them up across our region. This will allow us to directly support around 100,000 customers, representing 25 per cent of our customers experiencing extreme fuel poverty.

The affordability measures include working with partner organisations to improve the effectiveness and delivery of our affordability service. This means increasing support from two to six of our operating regions so that all customers can benefit from these services regardless of where they are located. The actual support offered will include debt advice, advice on income maximisation and advice on eligibility for grants (such as the Warm Homes Discount). We will also offer referrals to Green Doctors, a charity-run initiative that delivers in-home efficiency and advice visits and offer critical financial support through a hardship fund for those facing acute fuel poverty or crisis. As noted by our stakeholders, we are seen as being impartial and are therefore well served to offer independent energy efficiency advice.

Enhancing affordability services will increase costs by £0.6m per year, which is primarily direct customer interventions and supporting products and services for vulnerable customers. But we estimate the value of this service to customers could be as much as £40m over the course of the price control period.

As part of the energy transition, we must ensure that none of our customers are left behind on the decarbonisation journey, and that the shift to net zero is made with awareness, affordability and accessibility.

When we established our low-carbon strategy we considered the impact of this strategy on vulnerable customers. We developed a research and engagement programme to understand the challenges and barriers for vulnerable customers faced with the transition, and participated in workshops with the Centre for Sustainable Energy. This work introduced the idea of a vulnerability lens, which we used to prioritise our actions, and informed the development of our 'nobody left behind' framework, which sets out our approach for a socially just and inclusive transition. This approach is supported by our stakeholders, who have highlighted that awareness, affordability and accessibility must be central to the energy transition.

The nobody left behind framework will provide the foundations on which we can tailor our engagement approach to ensure inclusivity and accessibility across the next price control period. In doing so, we will deliver against Ofgem's principle three blockers to participating in a smart, flexible energy system. We will play our part in ensuring future policies and services are fair and reduce barriers to participation by aiming to:

- remove barriers to the services that we deliver directly, making sure that they are inclusive and accessible through a range of communication channels;
- apply our vulnerability framework to all new services and innovations, identify barriers, benefits and opportunities and collaborate with partners to co-create actions and communications aimed at overcoming barriers that emerge from these services;
- work with partners to put initiatives in place that will directly support 5,000 vulnerable customers p.a. through the transition to provide practical advice and support to enable customers to benefit from government funded support schemes for reaching net zero;
- engage customers with simplified communications and a range of tools to educate and support them on their journey to net zero;
- empower our community-based Energy Advisors to act in customers' best interests by creating direct links with support programmes across the region;
- actively monitor the impact of the journey to net zero on vulnerable customers; and
- trial new approaches using Ofgem's network innovation allowance (NIA).

Ensuring no one is left behind will cost £0.6m per year more than we currently spend. We are developing new areas of activity and the costs will cover research, engagement, programme development and partnership working. Our programmes will be delivered by independent and impartial partners and our newly formed team of community energy advisors (see the Our Communities section for more details). The net present value of this service, using a social return on investment model, is over £2m in the 2023-28 period.

Embedding our approach

We want to embed a culture of protecting vulnerable customers in our operation, and be able to maximise opportunities to provide support for these customers.

Supporting vulnerable customers is the responsibility of everyone at Northern Powergrid. A key part of our vision is putting customer vulnerability issues at the centre of our thinking, especially when it comes to our people and our culture.

We have made good progress and we must keep up the momentum. In line with principle four of Ofgem's baseline expectations, we will continue to work with our expert groups (such as those on social issues, and social responsibility management), who provide essential guidance and support for our teams. We will also continue to deliver vulnerability training to all staff which has helped us identify 'vulnerability champions' and created ownership of vulnerable customer issues in the business and across our region. We plan to go further by expanding and enhancing the vulnerability training we offer and give more explicit prioritisation to vulnerable customers in our investment decisions.

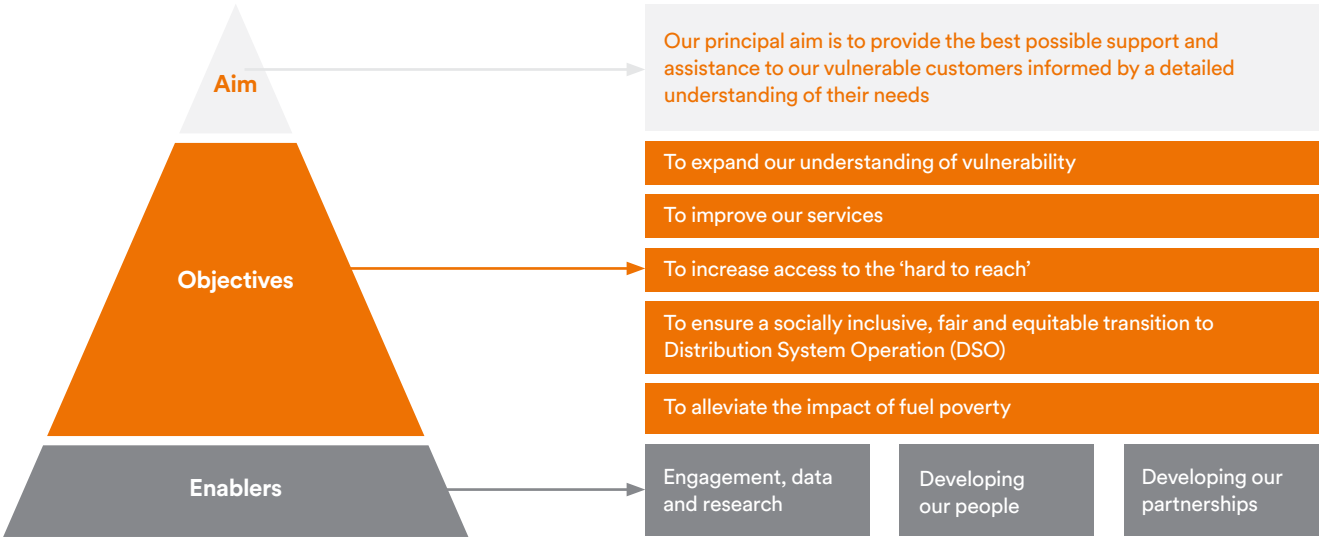
Where vulnerability training is concerned, we are planning to increase our in-house capabilities to train staff on vulnerability issues. We will increase the frequency of customer vulnerability training for all colleagues to every two years, improving on our current aim to do so every three years. Colleagues who have face-to-face interactions with vulnerable customers will also benefit from additional enhanced training that examines regional specific challenges, and we will coordinate with our wider customer-first training to ensure that vulnerability issues are covered (see Customer Service section for more details).

Similarly, we will enhance the roles of our vulnerability champions to empower decision making, raising the profile of these issues throughout the business. Vulnerability issues will also feed into our practical decision making on a routine basis. For example, when considering the priority of network resilience investments, once our standard criteria have been met, we will then use vulnerability criteria to prioritise resilience works where they can deliver benefits for vulnerable customers.

> **Delivering enhanced support, tackling fuel poverty and ensuring no one is left behind in a greener energy future is at the heart of our plans and reflects our stakeholders' feedback.**

Catherine Harris
Consumer vulnerability manager

Our approach to vulnerability



Customer outcomes		Benefits	Deliverables	Output measure/[1] *indicative input measure*	ED1 to date	ED1 forecast	ED2 target
VN1	**Undertake targeted recruitment of vulnerable customers to our PSM, contacting all PSM customers every two years to refresh our records (LO)**	— Greater reach to support vulnerable customers — Greater flexibility for how vulnerable customers access our information and communicate with us	**VN1.1)** Provide customer-facing and front-line staff with access to our PSM so they can submit real-time amendments and complete new registrations **VN1.2)** Using data and collaboration with our partners, develop our recruitment campaigns to reflect regional differences, including urban and rural customers **VN1.3)** Give our vulnerable customers more choice in how they engage with us by creating a fully digitised 'one-stop-solution' by 2024-25 to enable a more accessible, faster and convenient route to contact us and access our services. This will also free up capacity for a more responsive telephone-based service for those who prefer it (CVP)	**% of eligible high-risk customers recruited to PSM (ODI-F)**	37%	42%	70%
				% of all eligible customers recruited to PSM (ODI-F)	35%	37%	50%
				Proactive contact for data cleanse every 24 months for PSM customers (ODI-F)	100%	100%	100%
				Broad measure of customer service: overall – PSM customers (ODI-F)	N/A[2]	N/A[2]	93.5%
				PSM sign ups from colleague referrals	*8%*	*13%*	*25%*
VN2	**Provide enhanced support to vulnerable customers during supply interruptions including temporary restoration and proactive communications (LO)**	— Tailored support during a power cut — Personalised and proactive support — Proactive and more frequent communication utilising a wider range of channels	**VN2.1)** Provide enhanced customer support vehicles during planned and unplanned power cuts. These will include innovative upgrades, for example, suitcase generators and pandemic safety measures **VN2.2)** Deliver proactive communication during supply interruptions utilising digital channels **VN2.3)** Roll out regional use of net zero-ready SilentPower mobile battery vehicles to support temporary restoration during planned and unplanned outages **VN2.4)** Establish a new support team to provide additional on-site support in the event that power cuts last longer than six hours, providing personalised, proactive support for vulnerable customers	**Broad measure of customer service: power cuts – PSM customers (ODI-F)**	91.4%	91.8%	93.1%
				Proactive contact of high-risk (P1) customers within one hour (ODI-F)	-	-	100%
				Proactive contact of all PSM customers within three hours (ODI-F)	-	-	95%
				Customers offered enhanced support on site for >6hr power cuts (ODI-F)	7%	14%	75%
VN3	**Use data and partnerships to enhance our support for vulnerable customers, sharing information with trusted partners to access hard-to-reach customers**	— Targeted support — Greater understanding of our customer base	**VN3.1)** Share and make priority services, enhanced service information and support tools available among trusted partners, allowing collaboration for targeted support for hard-to-reach and seldom-heard customers **VN3.2)** Identify additional data sources and partnerships to allow us to track new and emerging issues and to support customers and, in doing so, improve our understanding of our customer base	*Refresh our regional demographic/ social indicator mapping data every 24 months*	-	-	✓
VN4	**Support customers in fuel poverty with affordability services, targeting 100,000 customers to unlock up to £40m of benefits**	— Up to £40m of benefits — Different forms of vulnerability addressed	**VN4.1)** Extend our partnership reach to deliver a regionally tailored multifaceted affordability service for 100,000 customers in extreme fuel poverty (c. 25% of those in our region) unlocking £40m of benefits **VN4.2)** Work with partners to educate customers on energy efficiency and available grants	**Average no. fuel poverty interventions p.a. (ODI-F)**	4,356	6,320	20,000
VN5	**Work with partners to put in place initiatives that overcome barriers to the smart energy transition and support a socially inclusive transition to net zero, targeting 25,000 interventions[4]**	— Vulnerable customers supported to allow them to benefit from the low carbon energy transition	**VN5.1)** Work with partners to offer customers tailored support on how to benefit from the transition to net zero and ensure that vulnerable customers are not left behind	**Average no. of customers engaged through the no one left behind programmes p.a. (ODI-F)**	-	-	5,000
VN6	**Embed vulnerability across our business operations**	— Enhanced support for vulnerable customers across the range of our services	**VN6.1)** Deliver enhanced, regionally focused training to colleagues every 24 months **VN6.2)** Apply vulnerability criteria (once standard criteria has been met) as part of prioritising network investment works **VN6.3)** Publish an annual vulnerability report for our stakeholders covering the delivery of our 2023-28 vulnerability commitments and metrics	*Front-line staff trained in rolling 24-month programme (ODI-F)*	N/A[3]	N/A[3]	100%

1. Measures are shown to track delivery of our customer outcomes. While 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. Only the power cuts element of BMCS is measured in 2015-23.
3. 2015-23 performance is not comparable as this is currently on a three-year cycle – we currently train 100 per cent of colleagues on this basis.
4. See Our Communities CO3.2) Community energy advisors

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How engagement with you has shaped our plan

VULNERABLE CUSTOMERS

Vulnerable Customers

How we engaged with you:

- We've spoken with Priority Services customers, along with partners representing their needs, including our Future Fairness Panel and Social Issues Experts Group.
- In wave one, vulnerable consumers support was discussed at 10 events with >330 stakeholders. Key topics included how we can support fuel poverty and a socially inclusive transition to a low carbon future.
- We began testing plan options in wave two through 10 more events with 996 people. We then refined our plans and priorities through seven events in wave three, engaging 628 individuals.
- From July 2021 we undertook dedicated face-to-face research with both domestic and vulnerable customers and a targeted acceptance testing exercise.
- We finalised our plan in wave four, responding to queries, addressing gaps and testing overall acceptability. We engaged 10,134 customers and stakeholders overall with detailed sessions on outstanding vulnerable customer topics across 20 events.

47 dedicated events

12,089 stakeholders engaged

What we have heard from you	How this has impacted our plan	Customer outcome ref	Annex detail
Tailor and target PSM recruitment and support Stakeholders highlighted the need for targeted and tailored approaches to address the complexity, scope, and scale of vulnerabilities across our region. They highlighted that those in vulnerable situations often did not know what help was available or how to access it.	**Our plan sets ambitious targets for PSM recruitment and support** We will target recruitment of 70 per cent of high-risk customers using a targeted approach that recognises differences in support needs. To achieve this, we will expand our team to enable us to contact 100 per cent of high-risk customers within the first hour of a power cut. Our enhanced training will also enable staff to make better referrals.	VN1	Link
Provide enhanced communication channels Customers and stakeholders asked for an app to facilitate support and two-way communication between Northern Powergrid and customers.	**We introduced a one-stop support app to our plan** We will give customers more choice in how they engage with us through a new communications app, freeing up capacity for those who prefer 100 per cent human contact. This will provide simple access to our partnership services to support affordability and a just transition.	VN1	Link
Invest in support for power cuts Vulnerable customers welcomed our enhanced welfare support proposals.	**We enhanced our plan to deliver more proactive support** We will create a new team to provide on-site support for customers who experience power cuts that last longer than six hours.	VN2	Link
Collaborate with partners Stakeholders emphasised that partnerships and data sharing are fundamental to understanding vulnerabilities and improving support.	**Our plan uses data to develop better local partnerships** We will share more data with our partners and build new partnerships to improve our reach and support for hard-to-reach vulnerable customers.	VN3	Link
Help fuel-poor households Stakeholders felt we should do everything possible to tackle fuel poverty, prioritising partnerships with social services and charities.	**We scaled up our affordability plans** We will deliver a tailored affordability service for 100,000 customers in extreme fuel poverty, unlocking £40m of benefits.	VN4	Link
Help ensure no one is left behind by the energy transition Stakeholders told us to support a just transition in all of our service developments.	**Our plan targets support for 25,000 vulnerable customers through the energy transition** In addition, we increased the number of community-based energy advisors in our plan from two to six to support in delivering decarbonisation advice to vulnerable customers.	VN5	Link
Prioritise the most vulnerable Stakeholders asked us to prioritise affordability, fairness, and inclusivity in our plans. They also asked us to embed vulnerability services into business-as-usual activities.	**We have ensured vulnerability is embedded throughout our business plan** Vulnerability support cuts across all of our output areas to ensure our customers are fully supported. Front-line staff will receive training on vulnerability every 24 months.	VN6	Link

Our Communities

We will be a force for good in our communities, leveraging our position in our region to make a positive contribution to the communities we serve.

We see our role as being a force for good, which goes beyond running our network. This includes everything from making a positive contribution to our communities, to creating a cleaner, greener energy system that everyone can benefit from. Our performance shows that we benefit most when we engage with trusted partners to deliver programmes that meet our social objectives, and we will continue into the 2023-28 period. We serve not just our customers and region, but the communities we live and work in.

Support for our communities is a principle that we apply to our thinking across all areas of our business plan. We work closely with communities to develop and establish strong programmes and initiatives to improve the lives of the more than eight million people who we serve. In the next price control period we will integrate our approach further by developing social programmes that simultaneously improve both the network and our communities.

We are proud to be an anchor organisation firmly rooted in the region we serve. Through our actions we seek to be a force for good.

Communities across our region are focused on the after-effects of the COVID-19 pandemic. This, coupled with the shift towards a decarbonised society, is creating a changing landscape that, in our role as an anchor organisation, we must help communities to navigate.

Understanding how these changes impact households, communities and local authorities has driven our approach and grounded our plans in customer-led evidence. Our social impact initiatives in the current price control period demonstrated that our communities want us to interact more with them and to strive to meet their social needs alongside their energy and business ones.

Our approach to supporting our communities breaks down across three clear themes. Firstly, we must embed social initiatives in a way that delivers the most impact based on local area needs. Secondly, we should be supporting the most disadvantaged schools and encouraging pupils from a broad and diverse range of backgrounds to engage with STEM subjects, as well as to consider careers in energy specifically. Finally, it's imperative that we help communities to understand, participate in and benefit from the transition to net zero, while overcoming any associated barriers.

How much it will cost

2023-28 expenditure (annual)	**£1.6m** 0.2% of totex
versus 2015-23	**+£1.0m** +166.7%

One of our eight plan areas, taken together, delivering more for less.

Our role as an anchor organisation

We are proud to be an anchor organisation firmly rooted in the region we serve. Through our actions we seek to be a force for good. We are a major employer and investor and we will leverage the positive impact that we create for the benefit of our communities. We will work collaboratively with other regional anchor organisations to have a greater positive impact, creating a sustainable future for our stakeholders.

We set out below what it means to us to be an anchor organisation.

Our approach covers five main areas:

Employer

- As a major employer in our region, we will recruit in ways that provide equality of opportunity, maximise the scope for local people to secure good jobs with us and remain committed to ensuring that our workforce better represents the diversity of our regions including social diversity (see Workforce Resilience). We will deliver targeted programmes to raise aspirations in educational institutions with a particular focus on STEM.
- We support our colleagues in reaching their full potential, providing a supportive and inclusive work environment, guidance and development and a focus on wellbeing.

Investment

- We invest efficiently for the long term to ensure that our network is able to underpin and support regional economic growth and pathways to net zero.
- We engage with our local supply chain (and also other regional anchor organisations) to drive quality and efficiency in our service delivery, with a focus on value for money, sustainability and decarbonisation, capacity building and sharing best practice. We will seek to identify opportunities to maximise the social and environmental impact of our collective investments in our local economy.

Assets and environment

- We will proactively seek to protect the environment through our investments and operations, working collaboratively with our partners, supply chain and other regional anchor organisations. We will deliver cost-effective solutions to minimise environmental impact and enhance the quality and biodiversity of our local environments, including optimising network losses (see Environmental Action Plan).

Service delivery

- As a critical service provider and key enabler of decarbonisation, we have an enduring responsibility to support our customers, communities and those in vulnerable situations. Our services are designed to reach all of our diverse customers and communities, adapting to their needs (see Customer Service and Vulnerable Customers).
- We collaborate with regional anchor partners to ensure joined-up working, supporting them to work with those who may be disadvantaged in the energy transition.

Civic leadership

- We are a convenor, bringing regional stakeholders together to share learning, overcome barriers and work on common goals to drive regional decarbonisation and economic growth (see Decarbonisation section).
- We will continue to build partnerships and, through these, deliver initiatives that benefit our local communities, in particular those in disadvantaged areas.
- We will deliver key public electrical safety messaging.

Our community-based energy advisors

Support:

- Community groups
- Charities
- Households
- Businesses
- Local organisations

Community energy | Energy efficiency | Green job awareness

2023: 2 advisors

2028: 6 advisors

Community-based energy advisors

- Advise
- Support
- Signpost
- Offer technical expertise
- Upskilling

Net zero ambitions | Upskilling and education

- Supporting the region to decarbonise
- Helping the most vulnerable to benefit from net zero plans
- Connecting the dots with local area energy plans
- Helping to bring forward more community energy schemes
- Partnership working with energy suppliers & wider market participants
- Upskilling and educating in decarbonisation

A force for good in our region

Partnerships will be key to delivering our communities strategy. We will continue to use our existing strong partnership model to further enhance our relationships and collaboration, and to deliver our customer outcomes.

Our engagement has taught us that our customers value the work we do in their communities, and that we should maximise the promotion of this, thereby increasing the opportunities for people to participate in, and benefit from, the schemes that we support. We will, therefore, also focus on raising the profile of our community support schemes to enhance awareness and participation.

The cost of our communities propositions will be £1.6m p.a., a £1.0m increase on what we are spending in the current price control period. However, this additional investment is funded through efficiencies elsewhere in our business plan. Therefore we will be able to improve our service in communities without passing this increased cost onto customers.

Our focus when working with our communities is to build on the strong baseline we have established in the current price control period to enhance our social programmes over the period to 2028.

We have worked hard to align our social programmes with our network investment programmes and, over the next regulatory period, we will aim to roll out social initiatives to support 50 per cent of the schemes in our major investment portfolio, a significant increase from the two per cent of investment schemes that we are currently complementing with social programmes. The social return on investment of this initiative is £9.50 for every £1 spent.

Key to achieving this is the support of our network of partners across the region, who will deliver grassroots initiatives such as energy efficiency and decarbonisation advice and support, STEM engagement in local schools, tree planting and woodland creation and assisting community energy groups to meet community needs as well as our social objectives.

Areas of need will be identified through our social mapping tool, which we will continue to use to plot the vulnerability characteristics across our region.

The tool provides a socioeconomic profile of an area and helps us accurately assess which initiatives will have the greatest social impacts for local communities, and deliver them. As part of our digitalisation strategy, we plan to integrate this tool within the asset management team and our operating systems.

Our education programme is a key pillar in our communities engagement strategy and we will increase its reach in the 2023-28 period.

The aim of the programme is to improve social mobility in our region, particularly for those who live in more disadvantaged areas.

In the current price control period, we have maintained a strong focus within secondary education on developing employability skills. We will use this as a foundation to increase that support and our education programme will be grounded in engaging pupils in STEM and increasing their awareness and understanding of decarbonisation and the path the net zero. We will also ensure that this programme delivers the appropriate safety messages to complement our wider safety programme.

With a specific focus on schools in more disadvantaged areas, our team will be empowered to inspire growth in future skills and to showcase energy and low carbon career pathways, in tandem with our apprenticeship and graduate recruitment propositions outlined in our Workforce resilience strategy.

Our workforce is an integral part of our local communities, one that underpins the regional economy and its growth. We live and work in the communities we serve, and our education programme, along with our wider workforce resilience plan, is designed to help us progressively diversify our workforce. It will help us to build a pipeline of talent entering our business and the wider energy industry that reflects the diverse make-up of our communities.

> **Being a force for good has always been important to us and we've heard from stakeholders that they too value this support for local communities.**
>
> 
>
> **Michelle Cummings**
> Social responsibility manager

We recognise the key role we hold in supporting a sustainable low carbon future for our region.

We hold a privileged position – our activities have a direct impact on the communities we serve.

Supporting our more disadvantaged communities to save energy and reduce their energy bills has long been a focus of our community initiatives, but the transition to net zero means that our approach needs to evolve and include all customers to help them decarbonise.

We will support our suppliers to have a positive social, environmental and economic impact in our communities which will support our supply chain decarbonisation objectives.

We plan to recruit six community-based energy advisors (CEAs) who will cover our region to deliver advice and support to communities, partners and local organisations. The CEAs will have a number of responsibilities, including delivering decarbonisation advice and support to households, community groups, local organisations and businesses, as well as signposting to external partners offering energy efficiency advice and support. They will have the technical expertise to support groups looking to develop and deliver community energy schemes and the advisors will also be able to deliver important public safety messaging related to new low carbon technologies. They will be able to refer vulnerable households to external partners for support as part of our vulnerability strategy to ensure that everyone benefits from the transition to a zero carbon society.

There will be a strong link to the energy efficiency advice being given as part of our customer service offering to ensure that we meet the goals set out in our 'no one left behind' proposals. We have a role to play in supporting communities and individuals affected by the transition to low carbon technologies, which is

why our communities approach extends to ensuring a just transition and the wider social mobility agenda. The CEAs will be working to deliver these wider social impact initiatives and closely collaborating with the schools team and external partners to ensure that there is a clear map to explain potential career pathways into low carbon industries – whether this is from education, or transferring of skills from traditionally carbon-intensive industries.

Our CEAs will also complement our team assisting in the development of local area energy plans (LAEPs) to support the decarbonisation agenda with local authorities and the wider energy sector. The team will use network knowledge, load projections, customer activity and the wider environment to provide feedback, and also feed insights into our own plans.

Investment in upskilling external partners will be key. Collaborating with community groups to deliver messaging around decarbonisation and exploring opportunities for secondments into Northern Powergrid will help deliver this programme and, more widely, expand the knowledge of local groups on decarbonisation and the move to net zero. Long-term we will be exploring external contracted partnerships to expand the scheme.

Customer outcomes		Benefits	Deliverables	Output measure/[1] *indicative input measure*	ED1 to date	ED1 forecast	ED2 target
CO1	**Deliver tailored social impact programmes for 50% of our major investment schemes**	— Supporting bespoke communities needs, enabling them to gain from benefits above and beyond our investment programmes	CO1.1) Minimum of 50% of major project investment schemes to have a social impact scheme attached CO1.2) Review potential social schemes using our social mapping tool	**% of major schemes with social impact scheme attached**	15%	17%	50%
				£m investment in social programmes in period[2]	*£0.3m*	*£0.4m*	*£1.4m*
CO2	**Support our communities to promote STEM subjects and careers**	— Increased social mobility — Increased longer-term workforce resilience	CO2.1) Develop relationships with educational establishments across our region with a particular focus on deprived areas CO2.2) Support colleagues who want to take part in skills-based volunteering, to provide education on energy careers as well as opportunities within Northern Powergrid CO2.3) Become active in regional recruitment fairs and school, college and university career events	*STEM pupils supported in deprived areas p.a.*	*245*[2]	*450*	*800*
				Hours volunteered p.a.	*616*	*770*	*1,130*
CO3	**Offer community energy advice to support our communities on the path to decarbonisation**	— Communities educated on energy saving as part of the route to decarbonisation[3] — Enabling efficient decarbonisation — Cheaper route to decarbonisation	CO3.1) Educate our communities through communications, awareness activities and partnerships around the path to decarbonisation CO3.2) Establish community energy advisors in each of our regions to deliver direct advice and support to groups and local authorities	*Average number of customers supported on decarbonisation via support schemes p.a.*	-	-	*20,000*
				No. schemes supported through community energy advisors[3]	-	-	*45*
CO4	**Maintain our position as an anchor institution in our region, working collaboratively with our organisation to have a greater positive impact**	— Positive economic and social impacts in our regions — Continuous improvement through benchmarking against other anchor organisations	CO4.1) Annual review completed against the Joseph Rowntree Progressive Framework (harnessing the power of anchor institutions) to assess and improve performance	*Outcomes of annual anchor institution review published*	-	-	✓

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1. Measures are shown to track delivery of our customer outcomes. While 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. ED1 annual average. This is due to COVID-19 impact on figures.
3. This aligns with the key actions in our losses strategy. See Annex A4.5 Losses Strategy for more information.

How engagement with you has shaped our plan

OUR COMMUNITIES

Our Communities

How we engaged with you:

- In wave one we engaged 149 stakeholders through events such as panels, roundtables and webinars.
- We began defining our outcomes in wave two, gauging consumer ambition across 16 community events such as online surveys, face-to-face conversations, bilaterals and panels.
- Responses covered our school outreach and social impact programmes, and gave feedback on how ambitious we should be.
- We refined our plan in wave three, engaging with rural, domestic, vulnerable and future customers, SMEs, utilities and government representatives.
- In wave four we finalised our plan, responding to queries, addressing gaps and testing overall acceptability. We engaged 10,296 customers and stakeholders overall, with detailed sessions on outstanding communities topics across 19 events.

40
dedicated events

18,251
stakeholders engaged

What we have heard from you	How this has impacted our plan	Customer outcome ref	Annex detail
Drive sustainable development in our communities Most stakeholders asked us to be very ambitious in our plans for community support.	**We have created our most ambitious plan yet** We doubled the scale of support for communities and pupils, and quadrupled investment in social programmes that support people across our region.	CO1 CO2 CO3	Link
Reflect the diversity of our region Stakeholders asked us to work with local organisations that better reflect the diverse communities we serve.	**We will restructure our partnerships approach** We increased our level of investment in communities by £1m p.a., supporting more through our partnerships, with a focus on inclusive representation.	CO1	Link
Help society's most vulnerable Stakeholders asked us to reflect on the COVID-19 pandemic and the growth in vulnerability across our region. They asked us to build a model that delivers support directly to those in most need.	**Our plan expands our social impact programmes by 50%** We will introduce localised social impact programmes for 50% of our major investment schemes to offer more face-to-face support for vulnerable customers.	CO1	Link
Make future energy skills a priority Stakeholders supported increased scale and ambition of our education programmes to engage with children and build STEM and future energy skills.	**Expand our education programmes** We will include a dedicated skills programme in STEM and enrich children's understanding of net zero – putting a focus on schools in disadvantaged areas. We will also become active in regional recruitment fairs and school, college and university career events.	CO2	Link
Promote STEM careers Stakeholders supported our proposals to expand the scale and ambition of our education programmes.	**Our plan expands skills-based volunteering** We will refresh our volunteering programme, promoting green energy careers, with a target of 45% more volunteering over the next decade.	CO2	Link
Clearly communicate the decarbonisation process Stakeholders want us to be very clear about the decarbonisation support we provide in our region, especially for vulnerable customers.	**We will communicate how we will enable the energy transition** Our plans include detail about how we will support local area energy plans, invest in upskilling external partners and collaborate with community groups to deliver a decarbonised future.	CO3	Link
Support communities through the energy transition Stakeholders supported our proposals to introduce regional energy advisors but asked us to increase the number from two to six advisors for greater reach.	**We increased the number of community-based energy advisors** We will recruit six community energy advisors, which will give us more capacity to provide decarbonisation support for our customers.	CO3	Link

Connections

We will deliver a cost-effective, efficient and personalised service for all our connections customers, with smarter, more flexible solutions that enable the connection of low carbon technologies on to our network and support of the transition to net zero.

The energy landscape is evolving, with net zero targets driving a significant increase in new connections for low carbon technologies (LCTs), storage and generation. We are an enabler of this transition – connecting people to the electricity network is one of the most important jobs we do.

Every new connection we deliver contributes to the economic growth of our region by enabling new homes to be built, new businesses to start trading and new sources of renewable generation to come online and start supporting the energy system.

During 2023-28 we will deliver an efficient and cost-effective connections service. We will offer smarter, more flexible solutions that support our region's net zero ambitions. We will give our customers more choice and deliver a range of additional services and benefits, while aiming to keep the price of a connection flat.

The connection costs that are socialised across all our customers – where the investment we make has a wider benefit to our network – will increase by £29.4m p.a. during 2023-28. This increase is entirely driven by the need to ensure our network can support our region's transition to net zero.

Furthermore, to give our customers net zero ready homes, we will provide single service 100 amp connections as standard. The costs of upgrading existing connections to this level will be socialised, ensuring a just transition. Assuming that low carbon technology uptake in our region follows our planning scenario, we estimate this will cost around £23.1m p.a. with £3.1m p.a. included in our base plan.

Our regulator has taken a minded position to change who pays for certain portions of large connections. We do not believe this change will be good for customers and it is not reflected in our plan. However, we have set out more detail, including how much it might cost, in our socialisation of costs annex.

How much it will cost

2023-28 expenditure (annual) **£39.4m**
6.0% of totex

£19.4m ex-ante

£20.0m uncertainty mechanism

versus 2015-23 **+£29.4m**
+294.0%

Increased investment to support net zero homes +£23.1m

Connections prices

Smaller connections: flat
Major connections: flat

Quicker, easier and more efficient connections

Our plan is shaped by customer feedback.

We engaged with a broad and inclusive range of connections stakeholders and customers to inform our plan, using their feedback to develop and refine our customer outcomes.

All our customers agreed that network investment, flexibility services and the availability of network data would be key to facilitating the significant number of new and modified connections that will be required to achieve net zero.

Our customers encouraged us to be ambitious in terms of our data provision and digitalisation plans. They also stressed the importance of a personalised service, so we will be developing our online platforms for customers who want to self-serve and complementing this with enhanced upfront support and technical advice for those who prefer to talk to us before making an application.

Our small works customers prioritised quicker, cheaper connections and we have responded with a target to reduce lead times. We will offer more services aimed at improving their customer journey and deliver more for the same cost for these customers.

Major works customers – consultants and developers in particular – prioritised availability of network data to allow them to perform their own upfront assessments and access to our experts. Local authorities said they need more support to deliver their decarbonisation targets and confidence in our network's ability to support their long-term, strategic plans.

These insights have shaped our plan.

> **We will focus on providing an efficient and cost-effective connections service with smarter, more flexible solutions that support our region's low carbon ambitions.**

Andy MacLennan
Commercial director

Connections are an important part of our plan for net zero.

In order to ensure that we open up all the credible pathways to decarbonisation in our region, we will help more customers to get connected to constrained areas of our network with increased levels of network flexibility, smarter solutions and reinforcement where required.

For customers seeking flexible connections, we will facilitate better, more frequent discussions at all voltage levels and help them to understand when this type of offer could result in a quicker and cheaper connection.

Our major works connections customers can expect to benefit from the deployment of active network management (ANM) schemes with associated flexibility contracts that will enable them to get connected quicker and without the need for significant reinforcement. Those same customers will also get access to an Enterprise ANM system that will allow them to access network information and curtailment operations for the parts of the network to which they are connected, and help them to understand factors affecting the performance of their connection. We have already deployed ANM across four network locations, further supporting customers who may want to connect. Our Decarbonisation section provides more detail on our plans in this area including the flexibility services our customers will be able to access.

The decarbonisation of heat and transport are two of the most important drivers for reaching net zero. To support the transition we will offer 100 amp single phase connections as standard (socialising the costs of upgrading) and develop new automated processes to streamline the notification and application process for electric vehicle (EV) charge points and heat pumps, making it quicker, easier and fairer to connect these LCTs.

In the 2023-28 period we will be increasing the number of connections we deliver and keeping costs low with new services and automated processes.

The next five-year business plan period will see us introduce more services and new automated processes that will allow us to deliver a range of additional benefits for our customers, while keeping the cost of connections low.

We will help all our customers, including those who are vulnerable, to get connected with a range of tailored support and services to guide them through the connections process and improve their overall experience. We are targeting delivering connections up to 20 per cent more quickly for our small works customers, while delivering the highest levels of customer service, including the ability to choose the date and time of a new connection.

To further support our customers throughout the connections process, we will provide a free advice and application checking service for small works customers who are seeking new connections or making changes to existing ones. This will include customers who are seeking connections for EV charge points, solar photovoltaic (PV) and heat pumps.

Recognising the importance our major works customers place on upfront support, we will facilitate better and more frequent pre-application discussions with our engineers. We will also offer an expanded 'ask the expert' service, providing technical advice on topics such as which EV charging solution to select or typical loadings and connections arrangements for small and medium-sized enterprises (SMEs). Our Major Connections Strategy (annex 4.12) sets out our vision and customer outcomes in this area.

A growing number of our customers appreciate self-service opportunities. In response, we are developing our digital platforms to enable customers to self-serve and create a more seamless online experience. However, for those customers that would still prefer to talk to us, we will complement this with enhanced upfront support before making an application.

To unlock further benefits for those customers who prefer to self-serve, we will build enhanced functionality on top of our open data platform, including free analytical tools to help with the processing of data, capabilities to enable self-service connection quotations, retrofitting of existing connections and more dynamic heat maps and tools to understand power flows on our network.

Through the provision of network data that is easy to access and understand, we will empower our customers to make more informed decisions about how and where to connect. Publishing more comprehensive network planning and capacity data in open and accessible formats will be key to this.

By making enhancements to our extra high voltage (EHV) and high voltage (HV) network availability heat maps, we will make them more dynamic and user-friendly, including a combined long-term development statement (LTDS) that will give customers full visibility of our network, from low voltage (LV) to EHV, and support investment decisions by offering transparency at substation and feeder level.

Our award-winning AutoDesign tool will be evolved so it can be used for new generation connections and to retrofit LCTs to existing properties – this is something we were told was a priority by our stakeholders. Users will be able to identify the most viable options to connect to our LV network and get a real-time cost for the work.

We will also look to develop an industry-first LV heat map that utilises LV monitoring and smart meter data. It will give users unprecedented visibility of our LV network's capacity and help them make more informed decisions about how, when and where to connect.

We are improving the customer journey so we can offer high-quality connections services.

To do this we will:

- ensure customers have a clear choice between self-service or our expert-led service with the ability to switch seamlessly between the two;
- support self-service customers with a new web chat tool;
- make the same tools that our own teams use available for our stakeholders and customers;
- maximise the number of small and major works customers self-serving by making more services available online;
- provide more data to customers about our network together with locational signals for capacity availability and forecast load growth to assist deployment strategies; and
- be as efficient as possible with available resources, i.e. people, process and IT, to make it quicker and easier when planning and delivering work for our customers.

We will give our customers more choice and deliver a range of additional services and benefits, while aiming to keep the cost of a connection flat.

Derek Fairbairn
System design manager

In creating our business plan, we have carefully considered that the decisions we make now will affect our region's ability to meet net zero.

We have a network investment plan that enables us to cater for all credible decarbonisation scenarios. Our planning scenario assumes that we will see about 1.84m EVs on our region's roads by 2030, requiring 32,000 new connections for EV charging infrastructure alone. We will be ready to support this and ensure our efficient and cost-effective connections service meets the future needs of our customers.

The increased demand has the potential to increase workload and we have carefully considered this. We plan to resource our team and deliver capabilities accordingly, balancing need, flexibility and cost.

We will promote fair and open competition.

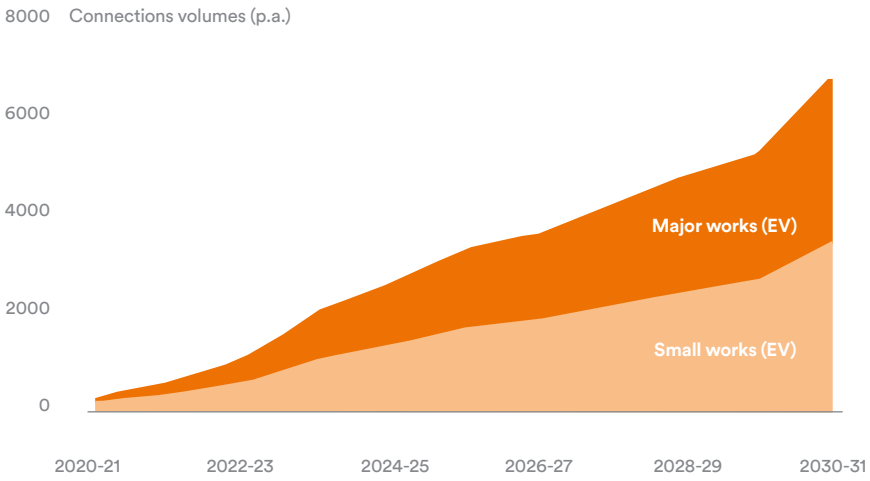
We will continue to promote fair and open competition in connections so that our customers have more choice in who delivers their connection. We will continue to be open and transparent by publishing guide prices and performance metrics, so that customers can compare our prices and service levels with other independent providers and decide who is best for them.

Through our development work on the open data platform, we plan to provide Independent Connection Providers (ICPs) and Independent Distribution Network Operators (IDNOs) with access to the same planning tools as our own design engineers and technicians.

To develop our future connections service, we engaged with a broad and inclusive range of stakeholders and used their feedback to refine and develop a plan which is truly customer focused and designed to address their future priorities and needs.

Emma Wilson
Connections stakeholder advisor

Figure 1: increase in connections to facilitate the EV charging infrastructure based on our Planning Scenario



Our Major Works Connections Strategy sets out the commitments we are making for our diverse range of major works connections customers and stakeholders.

During 2023-28, we will focus on providing a cost-effective and efficient connections service and on supporting customers throughout the end-to-end connections process.

We will empower customers to make more informed decisions about how and where to connect, through the provision of network data that is easy to access and understand. We will complement this with upfront support and advice and more options for customers who prefer to self-serve.

Our Major Connections Strategy sets out our commitments for the 2023-28 period. Customers can expect to benefit from:

- better and more frequent upfront discussions with our engineers;
- a new open data platform that will provide access to free analytical tools and comprehensive network data for those who prefer to self-serve;
- increased levels of ANM to get them connected more quickly, without the need for significant reinforcement, and access to a new Enterprise ANM system that provides detailed network and curtailment data; and
- new automated processes to streamline the notification of and application for EV charge points and heat pumps, making it quicker, cheaper and easier to connect LCTs.

We are aiming to deliver these additional services and benefits while keeping the cost of connections flat for our major works customers.

Socialisation of costs

Net zero service upgrades

We are modernising the standard power supply (i.e. the final few metres of cable serving an individual customer and the fuse – what we call 'services') that we offer to customers to 100 amps so that our customers will have net zero ready homes. This will enable them to charge an electric vehicle at their property and install a heat pump. Where existing services need to be upgraded to their standard, the cost of doing this will now be socialised, ensuring a just transition.

Taking account of the current levels of service upgrades and assuming that low carbon technology uptake in our region follows our planning scenario, we estimate upgrading the existing services will cost around £23.1m p.a.

Given the uncertainty around the speed and scale of the uptake of low carbon technologies (and therefore the volume of required service upgrades), we propose to only include £3.1m p.a. in our ex-ante allowances, which is based on the levels of LCT uptake we are seeing on our network today. However, as we expect uptake to accelerate, we are proposing that Ofgem uses a sector-wide uncertainty mechanism that operates on a 'pay-as-you-go' basis to address the risk of over- or under-funding DNOs for costs that are driven by factors outside their control. This will ensure our customers only pay for the volumes of work required in the period.

Access charging reform

Our regulator has proposed to make changes to the way that we recover the costs of connecting large demand and generation customers to our network. The proposals involve recovering more of the reinforcement costs triggered by a connection through our general network charges (i.e. socialising them across our customer base) rather than recovering them directly from connecting customers. We do not believe the proposals will be good for customers as they remove price signals that help direct connections towards areas of our network where there is already capacity available. Removing these signals will lead to an inefficient system. Ofgem is yet to make its final decision on this matter and it should reconsider.

The proposed changes will impact our costs in two ways. Firstly, they will mechanistically increase the proportion of connection costs that are socialised across our customer base; and second, they will impact customer behaviour as it will now be cheaper for a given customer to connect to our network where reinforcement is triggered. We would expect the behaviour of connecting customers to change in ways that will lead to an increased volume of connections and an increased average size of connection. Fundamentally, we anticipate more connections to congested areas of the network and more requirements for reinforcement.

We have good reason to assume that behaviour will change and that the effects will be material, particularly if some developers hold projects back until the rules change. But there is no good way to accurately predict the extent of these changes. Therefore our analysis can only be considered broadly indicative of potential future costs with a very wide range of possible outcomes. We estimate that our costs could increase from anywhere between £77.5m to £511.5m, with a best view estimate of £226.1m. It could be even more. These highly uncertain costs have been excluded from our plan view of totex.

Given the high degree of uncertainty around the impact of the proposed changes, if our regulator does proceed with them, we support a sector-wide uncertainty mechanism to manage this risk appropriately, in particular to remove the risk that networks receive significant over- or under-remuneration for connections work. This is particularly important because connections are entirely customer-driven, so we cannot manage volume risk.

More information on service upgrades and access charging reform can be found in our socialising costs annex.

An outline of our proposed uncertainty mechanism for connections reinforcement costs can be found in our uncertainty section.

Customer outcomes		Benefits	Deliverables	Output measure/[1] *indicative input measure*	ED1 to date	ED1 forecast	ED2 target
CN1	**Help our small works customers to get connected quickly by providing more self-service options, greater support and more flexibility over delivery**	— Customers have more choice in how they engage and interact with us — Better support through the connections process — Customers able to understand likely costs and timescales before making an application — Independent technical advice — Quicker, more efficient connections	**CN1.1)** Develop our digital platforms for customers who want to self-serve and provide enhanced upfront support for those who prefer to talk to us before making an application **CN1.2)** Provide a free advice and application checking service for small works customers and community energy groups, including for LCTs and generation **CN1.3)** Give small works customers the option to pick the date and time of their connection	**BMCS connections** – *small works* (ODI-F)[2]	88.9%	91.2%	92.5%
				Average connections lead time – *small works* [3]	71.2	36.2	29.0
				Time to quote LVSSA – *small works* (ODI-F)[4]	6.6	3.4	2.7
				Time to quote LVSSB – *small works* (ODI-F)[5]	14.3	5.5	4.4
				Time to deliver LVSSA – *small works* (ODI-F)	48.7	28.3	22.7
				Time to deliver LVSSB – *small works* (ODI-F)	78.5	36.5	29.2
				Connections GS (LO) % compliance – *small works*[2]	98.9%[6]	99.0%	99.5%
CN2	**Facilitate the mass uptake of LCTs, flexible connections and network flexibility to support the drive to net zero**[7] ✓	— Customers able to identify the most viable and cost-effective connections and get a cost for the work in real-time — New automated processes to streamline the connection process for LCTs — Quicker connections — Cheaper connections	**CN2.1)** Develop AutoDesign functionality to enable customers to self-serve and generate quotations for LV demand connections, load increases for existing LV connections and budget estimates for new LV generation connections. Go-live planned for 2025-26 ✓ **CN2.2)** Utilise AutoDesign technology to develop an LV network availability heat map that utilises LV monitoring and smart meter data to enable real-time system planning. Go-live planned for 2024-25 ✓ **CN2.3)** Introduce new automated systems to streamline the notification/application process for LCTs and facilitate mass uptake. Go-live planned for 2023-24 ✓ **CN2.4)** Provide service upgrades that enable net zero ready homes	**Major connections satisfaction (overall)**	84.3%	85.0%	90.0%
				Major connections satisfaction – pre-application services ✓ (ODI-F)	-	-	90.0%
				Major connections satisfaction – quotations ✓ (ODI-F)	-	-	90.0%
				Major connections satisfaction – delivery ✓ (ODI-F)	-	-	90.0%
CN3	**Empower our customers to make more informed decisions about how and where to connect by expanding the scope of network information**[8] ✓	— Increased information about where to connect — Easily accessible and understandable network information — Ability to undertake upfront assessments	**CN3.1)** Make improvements to our HV and EHV network capacity heat maps to include the provision of an integrated LTDS and information that can forecast changes in capacity availability.[4] Go-live planned for 2024-25 ✓	*HV and EHV heat map upgrades – Go-live*	-	-	*2024-25*
CN4	**Continue to facilitate fair and open competition so that our customers have a choice in who delivers their connection** ✓	— Increased choice of connection provider — Quicker connections — Cheaper connections — ICPs/IDNOs will have access to increased levels of network data	**CN4.1)** Work with ICPs and IDNOs to further minimise input services and extend the scope of contestable works ✓ **CN4.2)**) Publish guide prices and monthly performance metrics as well as providing clear cost breakdowns in connections quotations ✓ **CN4.3)** Develop a bespoke AutoDesign platform for ICPs and IDNOs with non-contestable costs. Go-live planned for 2024-25 ✓	**Introduction of customer satisfaction bespoke survey for IDNO and ICP customers**	-	-	2023-24
CN5	**Deliver an efficient connections service for all our customers, providing more technical advice to customers on smarter and more flexible solutions** ✓	— Increased connections in areas of constraint — Quicker connections — Cheaper connections	**CN5.1)** Provide an enhanced 'ask the expert' technical advice service. Go-live planned for 2023-24 ✓ **CN5.2)** Upskill our LV/HV design engineers to facilitate better and more frequent discussions with customers on flexible connections at EHV, HV and LV **CN5.3)** For EHV connections, where a flexible solution could avoid the need for additional network reinforcement, we will have a detailed discussion with the customer and provide them with the information they need to make an informed choice on the options available.	**Connections guaranteed standards % compliance** – *major works*	99.8%[3]	99.8%	99.9%
				% of major connections appointments met	99.3%[3]	99.5%	99.7%

1. Measures are shown to track delivery of our customer outcomes. While 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. BMCS: Broader Measure of Customer Satisfaction.
3. This is an average based on the ratio of LVSSA and LVSSB volumes.
4. LVSSA: single service low voltage connections.
5. LVSSB: small project demand connections.
6. ED1 annual average.
7. Cross-reference Whole Systems WS2.2) Energy matchmaking scheme.
8. Cross-reference DSO4.2) Enhance our active network management (ANM).

Data and Digitalisation | Workforce Resilience | Innovation | ✓ included in Major Connections Strategy

How engagement with you has shaped our plan

CONNECTIONS

Connections

How we engaged with you:

- We listened to more than 1,500 connections customers across 15 events in wave one.
- In wave two, up to the publication of our draft plan in July 2021, we spoke to more than 5,100 customers, presenting our plans for refinement or endorsement.
- Dedicated business plan engagements were supplemented with 12 connections workshops and events that reached a further 1,400 stakeholders early in the process.
- In wave three, we had more than 2,200 interactions with customers at 12 connections-focused events.
- We finalised our plan in wave four, responding to queries, addressing gaps and testing overall acceptability. We engaged 10,422 customers and stakeholders overall and with detailed sessions on outstanding connections topics across 31 events.

73
dedicated events

19,379
stakeholders engaged

What we have heard from you	How this has impacted our plan	Customer outcome ref	Annex detail
Deliver cost effective connections improvements Small works customers wanted us to reduce lead times without increasing costs for doing so.	**We set a target to reduce small works lead times by 20 per cent** We will reduce lead times and allow customers to pick the date and time of their connection.	CN1	Link
Support customers through the end-to-end connections process All customers valued upfront support and advice to help them make better choices about how and where to connect.	**We introduced a range of new support service promises** Our plan includes a free advisory and application checking service for small works customers. We also committed to upgrade our 'ask the expert' technical advice and customer support.	CN1 CN5	Link
Provide more digital self-service Customers wanted us to offer more digital channels including self-service, apps and increased online services.	**We added a range of multi-channel technologies to our plan** Our plan includes upgrades to our award-winning AutoDesign system and network heat maps. We will also enhance upfront support and advice for customers who prefer to talk with us.	CN1 CN5	Link
Facilitate and encourage the uptake in LCTs Stakeholders wanted us to take the lead on decarbonisation, remove blockers for customers and ready our infrastructure for the surge in new LCT connections.	**Our plan streamlines connections for low carbon technologies** New self-serve tools will make LCT connections simpler and faster. We will support net zero ready homes through offering single service 100A connections as standard and upgrading existing connections to this level; socialising the costs.	CN2	Link
Improve access to network data Stakeholders wanted access to increased network data to help them perform their own upfront assessments.	**Our plan significantly expands and improves data availability** We will publish more network data on capacity and performance, improving our EHV and HV heat maps and develop a new LV heat map.	CN3	Link
Promote fair and open competition ICPs and IDNOs wanted us to continue to facilitate fair and open competition, providing them with network information and a bespoke AutoDesign platform.	**Our plan adds a range of improvements to our input services for ICPs and IDNOs** We will publish guide prices, data and monthly performance metrics. We are committed to developing a bespoke AutoDesign platform for ICPs and IDNOs.	CN4	Link

Openness and Transparency

We will remain open and transparent in how we operate, earning the trust of our stakeholders through Distribution System Operation (DSO) in our region. We will report on the delivery of our commitments, open ourselves up to scrutiny and support new and existing markets by providing open data, taking a flexibility-first approach to network investment.

We will evolve our open and honest culture by building trust and being even more collaborative, ensuring that together we can achieve our shared goals.

As a business we understand that being open and transparent is how we establish effective relationships, collaborate with our partners and encourage others to compete with us. We have a strong foundation and actively publish reports, share network data, facilitate fair procurement processes, encourage independent scrutiny and enable healthy competition. However, despite the mechanisms already in place, we recognise that we need to be progressive and continue to act reliably and with integrity as the demands on our business increase.

We need to continue to build trust and reinforce our open culture.

Like you, we believe that by making our data open, we can facilitate the move to a more flexible net zero energy system, stimulate competition, and enable you to interact with us more quickly, cost-effectively and easily. Our Data and Digitalisation section sets out our open data offering, including our plans to publish more network data such as combined long-term development statements, interactive heat maps, and more information on capacity and network performance. We will also explore how we can use smart meter data to provide personalised, proactive energy efficiency information and support. And importantly, we will create tools to improve the accessibility of our data to help and encourage you to maximise its use.

More information is positive, but we must also demonstrate our truly transparent system of operation.

Our regulatory framework incentivises us to optimise efficiencies and minimise costs to achieve long-term, sustainable network performance and deliver value for money. As a result, when we make decisions about our network, we always select the solution to achieve the best outcome, irrespective of whether it is asset or non-asset based. This ensures that, when investment decisions are made, they are fair and maximise customer benefits. Nonetheless, we recognise and want to address that for some, a perceived conflict of interest exists.

How much it will cost

2023-28 expenditure (annual)	**£0.7m** 0.1% of totex
versus 2015-23	**+£0.2m** +40.0%

One of our eight plan areas, taken together, delivering more for less.

Earning the trust of our stakeholders

We have already taken steps to reaffirm that our approach to making investment decisions is transparent and equitable. We have published our investment appraisal processes and supporting metrics and have also appointed an independent body to review the application of our procedures and report its findings to us. In addition, we have identified areas where potential conflicts could materialise and made clear distinctions around roles and responsibilities to ensure that decisions are discrete and independent.

Irrespective of this, we plan to go further, and will use our transition to DSO to evolve our internal arrangements by further separating our systems and ensuring our appraisal and decision-making processes are even more robust, well-defined and independently audited. This will include a dedicated DSO business unit with primary responsibility for the DSO transition, clear executive accountability, and a DSO assurance function.

To encourage more flexibility in the regulated energy sector, there has to be more competition.

We believe in healthy competition and we actively encourage Independent Connection Providers (ICPs) and Independent Distribution Network Operators (IDNOs) to carry out contestable services. By ensuring our procurement processes are fair and transparent we also attract suppliers to compete for our business. But we know that encouraging competition is important to you, and so we want to do more.

In Connections, we plan to enhance our bespoke AutoDesign platform, enabling ICPs and IDNOs to access a range of self-service tools to identify optimum points of connection and obtain instant quotations. This will save time and, for major works connections where AutoDesign is used, it will eliminate charges for connection offer expenses. We will also continue to extend the scope of contestable services that ICPs are able to undertake.

Our enhanced open data will provide real-time network information, tools and analytics to help identify opportunities such as where network reinforcement is needed. In performing the role of DSO we will continue to foster the utilisation of flexibility-first solutions by running a robust and transparent investment appraisal process. And finally, where projects meet the relevant criteria, we will adopt Ofgem's early and late models of competition. Our plans for late competition will comprise a milestone approach that minimises customer detriment. Eligible early competition projects will be evaluated in terms of viability and customers' interests.

Collaboration is essential to help us successfully deliver DSO roles and achieve our environmental commitments.

We already utilise robust and transparent procurement processes to achieve high standards of service that are delivered safely and efficiently. However, we know that by working even more closely with our suppliers we can collectively adopt best practice and achieve our net zero targets. You have confirmed that you support our approach and believe it is important for our suppliers to demonstrate strict ethical, social and environmental standards.

We are taking steps to implement your feedback. Our Environmental Action Plan (EAP) includes a commitment aligning our procurement processes with the international standards set out in ISO 20400. We will adopt a responsible procurement policy and an accompanying charter. The charter will clarify our environmental, health and safety, customer, operational and compliance requirements. This will include that a minimum of 98 per cent of suppliers working on our network will be ISO 14001 accredited. We have set a target of 90 per cent compliance with our charter and will report on this to you and Ofgem. During the 2023-28 period, we will engage an independent third party to review our procurement processes, allowing us to check progress and adapt accordingly.

You have told us that, to be successful, we need to take you with us on our journey to net zero.

We know that only together can we achieve a sustainable decarbonised whole energy system, foster regional economic development, promote flexible energy solutions and become more efficient. These are big challenges, and we have an important role to play. In conjunction with regional energy organisations, we will provide support and guidance through our six new community-based energy advisors (see Our Communities section). We will also upskill external partners and community groups to promote decarbonisation, and support groups involved in the transition to future energy systems.

Supplementing this will be the actions we take to deliver DSO and facilitate our region's decarbonisation. We will use knowledge of our network, customers and the wider environment to provide feedback to local authorities on their future energy plans and seek input on ours. In addition, we will invest in enhanced cross-sector and cross-vector collaboration to improve system planning, and will undertake annual workshops to ensure comprehensive input. It is our intention that our Distribution Future Energy Scenarios (DFES) will become the focal point for regional energy scenarios. As a result, we plan to create six regional system-planning engineering roles to enable our local area energy planning and community energy schemes to support local area energy planning.

To ensure we are fulfilling our promises, we will appraise our performance with enhanced rigour and scrutiny.

We start from a strong position. Our governance is robust and demonstrates we understand and care about our responsibilities. Our sufficiently independent non-executive directors hold the executive directors and senior leadership team to account. We routinely report to our shareholder, the regulator and you, while several expert groups independently audit our activities. But even with these arrangements, we have found that the oversight provided by the Customer Engagement Group (CEG) during the development of this business plan has helped us to challenge our ambition, clarify benefits and evaluate if our planned expenditure is aligned with your priorities and willingness to pay.

Accordingly, we plan to retain the CEG at a cost of £0.7m during 2023 to 2028, not only to critique and report on our future business plans and the achievement of our commitments, but also to oversee our ongoing stakeholder engagement programme. As the value provided by the CEG is contingent on its independence, the chair and members will be regularly refreshed.

We will share timely and clear information about our performance, plans and achievements.

This is particularly important for our rapidly evolving priorities such as our transition to DSO and the facilitation of our region's decarbonisation. But, when we asked you about our reporting, you told us that you wanted clearer visibility of our activity and associated costs, but you did not want us to invest more in this area.

As a result, we plan to publish the reports produced by the CEG and an annual report on our DSO plans. To drive efficiencies, we will better utilise our existing material by making it easier to find on our website and more understandable by using less technical jargon. In support of our open and honest values, we will also limit the information we redact for commercial reasons.

We know we need our workforce behind us to realise our goals and commitments.

We are proud of the relationships we have built with our trade unions and, while our safety and people services teams have regular dialogue with our trade unions, our directors would welcome even greater exposure to the views of our employees. We, therefore, plan to invite our trade union representatives to attend one board meeting per year and let them choose how best to utilise the time.

Customer outcomes		Benefits	Deliverables	Output measure[1] *indicative input measure*	ED1 to date	ED1 forecast	ED2 target
OT1	**Develop our DSO business unit to stimulate flexibility markets, procure flexibility and govern our internal investment appraisal processes, openly publishing and reporting on outcomes**	— Increased transparency — Flexibility market development	**OT1.1)** Publish and report on our internal processes for investment appraisal of flexibility solutions and network reinforcement in such a way that demonstrates our flexibility-first approach and ensures the best outcome for the long-term planning of the network **OT1.2)** Undertake independent audits of DSO decision-making processes	*Routine reporting on our approach to investment decisions (full period)*	-	-	✓
OT2	**Enhance our corporate governance and sustainability frameworks, making them even more transparent**	— Increased transparency — Increased independent scrutiny — Increased access to our performance, key performance indicators and decision making	**OT2.1)** Establish our CEG as a standing body to scrutinise our stakeholder engagement activities and delivery of our business plan outcomes **OT2.2)** Extend our reporting framework to include annual reports on DSO, Major Connections, our Environmental Action Plan, Vulnerable Customers, including upgrading accessibility to material via our website, further utilising plain English, and limiting our use of content redaction **OT2.3)** Establish regular trade union meetings with our board **OT2.4)** Develop a responsible procurement policy and supporting charter (including underlying metrics) to drive initiatives such as sustainability and decarbonisation throughout our supply chain **OT2.5)** Develop and implement a sustainable procurement policy and align it to the guidance set out in ISO 20400	**Suppliers compliant with responsible procurement charter**	-	-	≥90%
				Network suppliers ISO 14001 accredited	97%	97%	≥98%
				Enduring CEG model established	-	-	*2023-24*
				Annual reporting framework implemented	-	-	*2023-24*
OT3	**Enable fair and open competition[2,3]**	— Increased competition — Greater choice for customers — Reduction in cost	**OT3.1)** Continue to proactively engage with ICPs and IDNOs to further minimise the input services they require and to extend the scope of contestable works and the services they can offer their customers (LO) **OT3.2)** Adopt Ofgem's early and late competition models for applicable projects	*Introduction of customer satisfaction survey for IDNO and ICP customers*	-	-	*2023-24*

Innovation | Data and Digitalisation | Workforce Resilience

1. Measures are shown to track delivery of our customer outcomes. While 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 Connections CN4.3) Bespoke AutoDesign platform for ICPs and IDNOs.
3. Cross-reference Connections CN2) Data and heat maps.

How engagement with you has shaped our plan

OPENNESS & TRANSPARENCY

Openness and Transparency

How we engaged with you:

- In wave one we ran 103 events, engaging 4,762 stakeholders. Openness and transparency featured as a specific sub-topic on five occasions.
- We gauged stakeholders' perception of our ambition in wave two. We obtained feedback on openness and transparency from more than 4,948 individuals at five specific events.
- In wave three we refined our proposals and gained endorsement for our plan engaging 2,785 more individuals.
- We finalised our plan in wave four, responding to queries, addressing gaps and testing overall acceptability. We engaged 10,081 customers and stakeholders overall, with detailed sessions on openness and transparency topics across eight events.

23 dedicated events

17,874 stakeholders engaged

What we have heard from you	How this has impacted our plan	Customer outcome ref	Annex detail
Stakeholders wanted high levels of openness and transparency Most customers supported our highest levels of ambition in our Emerging Thinking consultation. Stakeholders helped us to define how we can promote flexibility markets. Further details can be found in our DSO Strategy engagement summary.	**Our plan strengthens our corporate governance approach** We will regularly report on the progress of our plan and open ourselves up to more scrutiny. Our commitments to publish and report on our investment appraisal processes, and undertake regular audits, will reinforce our flexibility-first approach.	OT1 OT2 OT3	Link
Maintain high levels of scrutiny There was overall support for retaining our CEG to promote the best interests of stakeholders and customers on an ongoing basis.	**Our CEG will be retained as a standing body** The CEG will continue to ensure we are reflecting the views of our stakeholders in our plans and scrutinise our delivery in the 2023-28 period.	OT2	Link
Promote sustainability within the supply chain Stakeholders wanted us to collaborate with our supply chain to promote high environmental standards, ethics and sustainability.	**We will introduce a Responsible Procurement Charter** Our plans target ≥90 per cent compliance with our charter to drive sustainability and decarbonisation throughout our supply chain. For more detail see our Environmental Action Plan.	OT2	Link
Keep us informed of progress Stakeholders reinforced that clear and simple ongoing reporting of progress was important.	**We will extend our reporting framework** In addition to reporting annually on the delivery of our whole business plan, we will specifically report on progress in DSO, Major Connections, our Environmental Action Plan and Vulnerable Customers.	OT2	Link

Going the extra mile

We have built an ambitious plan for 2023-28 and in certain areas we have identified opportunities to deliver additional value to unlock significant and meaningful benefits for our customers and communities.

We are proposing four consumer value propositions (CVPs) where we have identified robust benefits for our customers. Our CVPs cover four of the five categories allowed by Ofgem. These propositions go beyond the minimum requirements and functions typically undertaken by an energy network company as 'business as usual'.

Our CVPs form part of our overall plan to ensure we lead the drive to decarbonisation in our regions while making the transition as efficient and affordable as possible.

The benefits of our CVPs have been independently modelled to estimate the consumer value in each case. We have used the industry-wide social return on investment (SROI) tool to do this with our modelling subject to external third party review.

Our Customer Engagement Group (CEG) has reviewed our CVPs and we have amended our proposals in light of their feedback.

The full details of our CVP proposals are set out in annex 1.5 Detail on our CVPs.

CVP proposals

One-stop app solution for vulnerable customers

CVP1

Our fully digitised 'one-stop solution' app for vulnerable customers will make it easier for customers to access a wide range of services and put energy-saving advice at their fingertips. The app will not only enhance the accessibility, speed and convenience for vulnerable customers to interact with us, but will provide direct access to our partner programmes, in particular for fuel poverty and supporting a socially inclusive net zero transition. The app will also free up capacity for a more responsive telephone-based service for those that prefer it or who are digitally excluded.

Open Insights – self-service analytics toolkit

CVP2

Our free online platform Open Insights will unlock value for our customers on top of our open data platform. It will bring together the tools that our customers and stakeholders need to self-serve energy system data, undertake network planning and get low carbon technologies (LCTs) connected.

Dynamic voltage optimisation for domestic energy efficiency

CVP3

We will dynamically manage voltage on our system to achieve behind the meter benefits at 30 per cent of domestic properties in the 2023-28 period, increasing to 80 per cent over the project lifetime. Our solution (currently midway through innovation trials) will improve energy efficiency delivering an estimated annual average reduction of around £20 in customer energy bills and 27kg of carbon emissions per household each year.

Phase one roll-out of next-generation energy system

CVP4

First stage deployment of a blueprint for the next generation energy system, rolling out 30 innovative microgrid solutions in some of the most remote parts of the network to enhance system resilience.

Plan area	Vulnerable Customers	DSO and Major Connections	Enabling Whole System Solutions	Enabling Whole System Solutions
Costs	£1.9m	£6.7m	£7.9m	£6.3m
Net consumer value	£3.3m	£4.7m	£14.5m	£7.6m[1]

1. The net present value (NPV) of the project is shown over a 10-year period as the CVP relates to the first-stage deployment of a future energy system and so the benefits are reflected over a longer time period.

Our Consumer Value Propositions

CVP1: app to support vulnerable customers

Our 'one-stop solution' app for vulnerable customers that will make it easier for customers to access a wide range of services and provide direct access to our partner programmes, in particular for fuel poverty and supporting a socially inclusive net zero transition.

Through our engagement, our stakeholders – including our social issues expert group – have placed emphasis on support for vulnerable customers during power cuts. Digital solutions and increased contact channels were identified as important opportunities to enhance our services.

In response to this (see annex 4.13 – Vulnerability strategy), we will develop an app solution that will give customers greater flexibility and convenience with access to real-time information, consolidated in one place. By extending our digital channels we will make digital services more accessible for those with complex and diverse vulnerabilities. The pandemic has accelerated an uptake of digital technologies; however, we recognise that some vulnerable communities have greater instances of digital exclusion. An additional benefit of introducing our app is that, as we open up a new channel for people who prefer engaging through that medium, we free up more capacity in our contact centre to support the digitally excluded and those customers who prefer to engage in person.

Customers will benefit from a personalised experience with access to live information on the network, proactive communications, be able to manage their own customer records and access information to support them to save money and benefit from the transition to decarbonisation.

Our proposition goes beyond the Ofgem minimum standards for vulnerable customers as it will offer consumers even greater choice in how to interact with us and provide the option to seamlessly self-serve their data and information requirements.

Our app will cost £1.9m during the 2023-28 period and will deliver a net present value of £3.3m, representing a SROI of £2.00 for every £1 spent over 2023-28.

The value assumes uptake of 300,000 customers from our 900,000-strong Priority Services Membership (PSM) households, delivering benefits including reducing stress caused during a power outage, customers feeling more in control and savings realised as a result of information provided to support switching energy suppliers and energy efficiency advice.

We propose that 30 per cent of any CVP reward would be contingent on delivery of the app, with the remaining 70 per cent contingent on uptake (number of vulnerable customer users) proportionate to the forecast used to derive the projected benefits. Non-delivery of the app would result in full clawback of any reward.

CVP2: Open Insights – self-service analytics toolkit

Our free online platform Open Insights will unlock value for our customers on top of our open data platform, providing a range of tools that will enable our customers to self-serve energy system data, undertake network planning and get LCTs connected.

Our stakeholders have told us that they not only want to access but also to better understand and be able to interact with our network data. We have received very strong support for our self-service offerings such as AutoDesign. In response to demand for this type of provision we will develop a comprehensive open data platform Open Insights that we will build on to establish a variety of self-service offerings.

The decarbonisation transition will impact a wide range of stakeholders, all of whom will have different requirements to serve a variety of outcomes. To give functionality to our open data we will provide an analytics toolkit that will allow more self-service and value to be extracted from our data, supporting uptake of LCTs and planning for decarbonisation.

Open Insights will include capabilities to enable self-service connection quotations, budget estimates, the connection of LCTs, dynamic heat maps, and tools to understand power flows on our network.

Our plans go beyond Ofgem's minimum data provision requirements, adding analytics tools and self-service offerings, brought together into one place for ease of access. This will allow customers to extract maximum value from our data. It will also provide a scalable solution as more LCTs connect to our network.

This will cost around £6.7m in the 2023-28 period, delivering a net present value of £4.7m, representing a SROI of £0.81 for every £1 spent.

The benefits we have modelled include the savings from designers' time as customers self-serve their connection requirements and the savings achieved from connection offer expenses.

We have however been unable to reliably estimate the benefits from the open data portal as we cannot reliably quantify who will use the data, what it will be used for and the downstream benefits this will bring. Our approach therefore reflects a very prudent view as we anticipate benefits delivered from the open data portal will be significant.

We propose that any CVP reward is contingent on the delivery of the following functional work packages with rewards clawed back for non-delivery:[1]

- LCT retro-fitting of small connections;
- connection budget estimates at LV level;
- connection budget estimates at HV/EHV level;
- diversion budget estimates;
- dynamic heat maps;
- real-time operational status information; and
- dedicated ICP/IDNO platform.

We plan to build on the success of AutoDesign and our heat maps to produce an intuitive open data portal to allow our customers to get maximum value from our data.

Phil Jagger
Programme manager

Our Open Insights CVP will deliver a range of benefits across our customer base:

- **Domestic (including vulnerable) customers** will be able to assess the viability and costs associated with adoption of LCTs such as electric vehicles and heat pumps, simply by inputting their addresses.
- **LCT installers** will be able to identify costs and timescales for projects in real time.
- **Major connections customers** will be able to self-serve to obtain quotes for potential connections to the network at low voltage.
- **Flexibility aggregators** will have visibility of the network to identify potential network constraints where flexibility opportunities lie and support wider decarbonisation initiatives.
- **Local authorities** will be able to use network data to plan for decarbonisation and identify the most cost-effective routes to deliver their plans, which may include assessment of development opportunities, green belt and brown belt development, locational pricing signals, public transport planning, localised community energy schemes and supporting vulnerable customers.
- **Independent Connection Providers and Independent Distribution Network Operators** will be able to self-serve their requirements for network data and formal points of connection offers as and when they need to, further reducing the requirement for input services and supporting competition. Their connections will be faster and cheaper.

CVP3: dynamic voltage optimisation

We will improve domestic energy efficiency through dynamic voltage optimisation to reduce customers' bills and carbon emissions.

Our stakeholders have told us that decarbonisation and affordability are key priorities.

Our Boston Spa Energy Efficiency Trial (BEET) innovation project is piloting using smart meter data in near real time to dynamically optimise the high voltage (HV) and low voltage (LV) network to improve customer energy efficiency. The project consists of three phases, and we are currently in phase two.

Subject to successful trials in the remainder of the current period, we will rapidly ramp up deployment to target roll-out of the technology and capability to 165 primary substations (30 per cent) serving 1.2m customers over the 2023-28 period. Beyond 2028 we will complete the roll-out to a further 273 substations,[2] which will mean over the project's lifetime it will deliver benefits to 3.1m customers.

Our roll-out strategy is to do it as quickly as possible, to as many customers as possible, however we are looking to maximise the impact of energy efficiency and therefore financial benefits benefits where they will be felt most, targeting fuel-poor customers as a priority, where all other things are equal.

Boston Spa Energy Efficiency Trial (BEET)

Phase one
Now completed, proved that existing methods of voltage control available to us are not suitable for voltage optimisation and therefore a new approach was required.

Phase two
We are integrating smart grid and smart meter systems to develop capability to undertake and implement a new voltage optimisation technique within a trial area in Boston Spa.

Phase three
We will explore whether this new technique can be used to provide other services, such as frequency response.

1. Functional package weightings set out in annex 1.5 Detail on our CVPs.
2. Eighty per cent of our primary substations. The remaining 20 per cent of our network is either technically incompatible with this solution or voltage optimisation is not required.

With our solution deployed we estimate that on average customers will receive a reduction in their energy bills of £20 p.a. as well as 27kg of lower carbon emissions annually per household per year as we deliver optimised voltage levels. Customers will be able to benefit from these savings without having to take any action, with benefits being felt particularly strongly for our vulnerable customers in fuel poverty. Additional benefits will be felt by the wider system including additional capacity to connect and improved network operability due to the identification and mitigation of voltage and thermal issues on the network.

Our proposal delivers above Ofgem's minimum requirements. It delivers whole system benefits by leveraging our assets and data to manage energy efficiency behind the meter, generating wider economic and societal benefits while making the system more efficient.

Our proposal will cost £7.9m over the 2023-28 period, and will deliver a net present value of £14.5m, representing a SROI of £2.11 for every £1 spent.

In the event of non-delivery we propose any reward is clawed back pro rata on the proportion of customers for whom the solution is not delivered compared to the projection used to calculate the reward.

Support for our plan

"The business planning process has been thorough and you have articulated to the many stakeholders what the issues are and also what some of the options are as you endeavour to adapt to fundamental changes in the energy sector."

Keith Jackson, Boston Spa community green group, member of Northern Powergrid stakeholder panel

CVP4: next-generation energy systems

We will undertake first-stage deployment of the blueprint for a next-generation energy system, enhancing system resilience, particularly for remote customers.

Our engagement has reinforced that reliability and resilience are particular concerns for our rural customers who want to participate in decarbonisation.

Through our innovation programme we are currently testing the viability of enhancing resilience through use of storage and smart technology at remote substations to provide a step change in resilience for remote customers, facilitating communities to become mutually supportive of one another in the event of upstream faults.

Subject to successful trials, we plan to begin first stage roll-out in the 2023-28 period, demonstrating this solution on our network by deploying 30 microgrids as a blueprint for the next-generation energy system.

Customers will experience a more resilient energy supply, protecting them from the inconvenience caused by even very short interruptions. This will improve customer service, particularly for customers in rural areas who are susceptible to supply interruptions and support the transition to a future energy system which is becoming increasingly reliant on electricity. Through use of storage and smart technology at remote substations we will support localised dependable energy as the number of energy vectors reduces. Our solution also unlocks the potential for peer-to-peer trading and the development of local demand and generation markets.

Successful deployment will allow for wider roll-out beyond 2028 and, by 2050, potentially up to 20 per cent of our network could be served by microgrids. The benefits however will be wider than just for our customers, as other Distribution Network Operators (DNOs) are able to adopt the solution in other parts of the country.

Our proposal delivers above the baseline standards as it could demonstrate that power microgrids provide a more dependable whole system.

In the event of non-delivery we propose a linear clawback of reward based on the number of microgrids delivered during the period.

Our proposal will cost of £6.3m in the 2023-28 period delivering an NPV of £7.6m, representing a SROI of £1.40 for every £1 spent over a 10-year period.

We used the value of lost load and the costs savings microgrids can achieve through deferred reinforcement that would otherwise be required between 2023-33 to calculate customer benefits.

A 10-year period was deemed more suitable to capture consumer value as we look to prove the concept for future roll-out and capture some of the costs savings from deferred reinforcement, which will be required between 2023 and 2050.

Unleashing the potential of...
Innovation

INNOVATION | DATA & DIGITALISATION | WORKFORCE RESILIENCE

We have developed a sector-leading programme of exciting, cutting-edge innovation that accelerates the creation of next-generation energy systems and balances the targeted development and deployment of solutions demanded in our plan. We will explore high-potential transformational technologies to unlock unimagined benefits for current and future energy system customers.

Our plan recognises that innovation is vital to enabling decarbonisation while ensuring both the reliability of our network and affordability of our services for all of our customers.

We approach innovation mindful of the fact that the customer benefit matters more than our methodology. For instance, although an innovative solution will often deliver technical changes – for example, reduced reinforcement to connect low carbon technologies (LCTs), or faster restoration of customers' power for heat, transport and lighting – it's the benefit that the customers see that matters most. There will be technical solutions, information and data-based techniques, commercial agreements and other methods that enable those changes, and all are within the scope of our innovation strategy.

Our track record gives us confidence in harnessing the benefits of innovation. We have delivered more than £23m of benefits since 2015, with more to come, by rolling out innovation associated with developments such as improved low voltage (LV) fault management, flexible connection arrangements, and perfluorocarbon oil leak tracers into business as usual. Voltage management has created 4GW of capacity for customers to install domestic solar generation (creating a potential customer value of up to £75m).[1]

Our Innovation Strategy (see annex 5.1), developed collaboratively with our customers and stakeholders, sets out our high-level areas of focus for innovation in the 2023-28 period. It is aligned with, and complementary to, Ofgem's innovation vision[2] and the industry's joint innovation strategy[3].

The strategy covers both totex funded innovation and that funded by Ofgem's network innovation allowance (NIA), and it addresses both new innovation areas that will build the learning to enable us to capture customer benefits, and roll-out activities that will deliver those benefits.

1. Dependent on customer take-up of the opportunity. Based on our ground-mounted substations, 75 per cent require no work or tap settings only and 25 per cent require replacement with an upgraded transformer.
2. Ofgem Innovation Vision https://www.ofgem.gov.uk/sites/default/files/docs/2021/05/innovation_vision_2021-2025_final_24may2021.pdf
3. Joint Innovation Strategy https://www.energynetworks.org/assets/images/Resource%20library/At%20A%20Glance%20Summary%20-%20Gas%20and%20Electricity%20Network%20Innovation%20Strategy%202020.pdf

Driving benefits through innovation

Building on this, in 2023-28 we will seek to provide higher value and better services, connecting increased numbers of electric vehicles (EVs) and heat pumps, and catering for the resultant increased demand, while maintaining downward pressure on costs and ensuring vulnerable customers are not at a disadvantage in the energy system transition. The innovation-related benefits in our 2023-28 business plan build on an already high level of deployment within 2015-23. We plan to accelerate the deployment of innovation benefits as the programme matures though 2021-28.

We will do this through a focus on four strategic innovation outcomes that address the challenges we face:[1]

- developing and deploying technologies and creative solutions that enable faster, lower cost pathways to decarbonisation;
- working with partners to open up new channels that significantly, efficiently and effectively increase the exploitation of data flows across the whole energy system;
- increasing the reliability, resilience and security of the power grid to improve not only its own dependability, but also that of the overall energy system; and
- promoting and safeguarding the interests of customers, particularly those who may otherwise be significantly disadvantaged or left behind in the energy system transition.

Additionally, we will embrace our central role in the energy system by looking beyond the services that have been familiar to our sector, applying our thinking to the whole energy system and its supply chain, assisting communities and charities in their decarbonisation work, and adopting data techniques and traditional or novel assets as appropriate for efficient and effective investment.

Innovation is embedded throughout our plan, delivering £263m of net totex savings in the 2023-28 period.

Our plan contains £164m of investment in business-as-usual (BAU) innovation and roll-out of previously proven innovation in the 2023-28 period. This investment drives net totex efficiency savings of £263m embedded in our cost forecasts (69 per cent of the total efficiencies in our plan).

In addition to this, automating our connections interactions will lead to improved service levels, but we estimate that it will save customers using the connections process about £5m in the 2023-28 period.

Our dynamic voltage optimisation roll-out (see Consumer Value Proposition section and annex 1.5 Detail on our Consumer Value Propositions) using information from smart meters is estimated to generate £14.5m of energy bill savings for customers by 2028.

This is a total benefit to customers in excess of £280m in the 2023-28 period.

To be able to roll out more beneficial innovation learning beyond the 2023-28 period we are also investing now for the future where there is a reasonable likelihood of significant customer benefits.

We will invest £25m funded via Ofgem's network innovation allowance (NIA) mechanism. This significant innovation is associated with decarbonisation and the activities that support it, including customer vulnerability and ensuring customers can depend on their decarbonised energy supply. Additionally, we expect to bid for further funding via the Strategic Investment Fund (SIF), Innovate UK, Horizon 2020 or similar routes as appropriate bid topics become available. We set out more detail on our proposed use of NIA and SIF funding in annex 5.1 Innovation Strategy.

> **Innovation is key to ensuring Northern Powergrid leads in decarbonisation delivery and system dependability by extracting value and creating customer opportunities in open data, digitalisation and network and customer flexibility.**
>
> **Professor Phil Taylor**
> Pro vice-chancellor for research and enterprise, Bristol University

2023-28 period (£m)[2] Output area	Investment in BAU innovation and roll-out	Net cost savings from innovation
Decarbonisation	53.5	120.3
Reliability and Availability	21.4	23.7
Asset Resilience	20.1	77.9
Climate Resilience	3.5	0.7
Environment	36.5	40.3
Safety	11.2	-
Physical and Cyber Resilience	12.1	-
Customer Service	2.6	-
Vulnerability	1.9	-
Our Communities	1.0	-
Openness and Transparency	-	-
Subtotal: totex	**163.8**	**262.9**
Connections customer savings[3]	6.7	5.4
Energy bills savings[4]	7.9	14.5
Total	**178.4**	**282.8**

1. These strategic outcomes are discussed in greater detail in annex 5.1 Innovation Strategy.
2. Excludes 2023-28 NIA costs and benefits.
3. AutoDesign benefits in 2023-28 period.
4. Relates to cost benefits from our voltage optimisation CVP.

We have identified six key areas of transformational capability where we believe that a step change in knowledge and expertise is required in the 2023-28 period.

The majority of our innovation activity is associated with the areas of our plan that demand significant change and capability enhancement, which we refer to as 'pull' innovation. Pull factors include:

- the need to manage rapid load growth on the existing network, particularly at LV, driven by decarbonisation;
- the need to be able to model flexibility power flows and benefits, especially to address LV constraints;
- the requirement to analyse, understand and respond to changes in load diversity caused by mass adoption of LCTs and the flexibility techniques that we expect to emerge; and
- the desire to enhance the notification and connections process to facilitate increased low carbon installation and multi-vector load use (e.g. hybrid heat pumps).

£263m

of innovation benefits embedded in our 2023-28 costs

Strategic innovation outcomes

- **Charting the best course to net zero**
- **Collaboratively unlocking the value of open data**
- **Achieving next-level energy system dependability**
- **Ensuring all customers benefit**

Transformational capabilities

1 Identify opportunities to accelerate the benefits of flexibility

2 Develop sophisticated data management and analytics to inform energy system forecasting, planning and real-time decision making

3 Enhance the connections process to facilitate higher volumes and different types of connection, including the addition of loads via existing connection points

4 Increase the dependability of our customers' electricity supply

5 Remove barriers preventing access to the energy market for all customers including access to energy data, particularly those who are vulnerable, less advantaged or are not currently engaged or informed

6 Create capabilities to deliver a next-generation local energy network that links up whole system energy sources and vectors, balancing in real time

Innovation is also driven by the development of new technologies and techniques, often with the potential to disrupt traditional approaches. This 'push' innovation is harder to predict as it is generally associated with emerging technologies. An example from the recent past would be the rise of electric vehicles as a serious transport choice. Going forward, artificial intelligence (AI), 5G, and internet of things (IoT) solutions are likely to offer potential that has not yet been applied to situations such as ours. Self-driving vehicles are another example that could offer potential. But there will be other digitalisation technologies and data capabilities as yet unknown that might be just as important. We need to remain agile and ready to seize the opportunities they will offer.

Data and digitalisation is particularly relevant because it will offer both push and pull opportunities, especially as we move to DSO. Initially it will improve the way we deliver our existing services – connecting customers' load, keeping the lights on, and facilitating decarbonisation. But we expect this to evolve to enable a host of wider whole system benefits for customers and some of the two-way automated interfaces we will need are yet to be conceived. The Boston Spa Energy Efficiency Trial (BEET), combining network and customer data to drive automated system optimisation, is an embryonic example of what closed-loop blended data might do for us.

The relationship between the strategic outcomes, transformation capabilities and push and pull innovation motives is discussed further in annex 5.1 Innovation Strategy.

Innovation is also key to delivering our customer output commitments.

Innovation benefits drive many of the customer outcomes we are committing to in this plan.

Innovation has enabled simple techniques – such as changing voltage set points to improve access to our network for low carbon energy, freeing up capacity for customers – and we can build upon these as we go into 2023-28.

We aim to improve customer service by digitalising the connections and notifications process, improving network data quality and facilitating faster installation of customer equipment. This builds on the improved convenience and time and cost savings of our AutoDesign system.

Rethinking restoration through our use of SilentPower vehicles for small LV faults has reduced both emissions and running costs and we will expand this as we decarbonise further, rolling this solution out as part of our customer vulnerability plans.

Our microgrids roll-out (see Consumer Value Proposition section and annex 1.5 Detail on our Consumer Value Propositions) will improve the dependability of energy supplies customers need as they decarbonise and as the energy system moves to intermittent and seasonal renewable energy sources. This dependability benefit is particularly notable during extreme weather events driven by climate change.

We will improve operational performance via our innovation, including a richer understanding of our assets and of the implications and benefits of flexibility, minimising disruption on the network and improving scheduling of network reinforcement and renewal.

Collaboration is at the heart of our strategy to ensure maximum benefits from innovation for our region, the industry and wider sectors.

We are committed to maintaining a culture and environment within our business where new technologies and learnings are sought out, shared and embraced to provide a modern local energy network where improvements are always being made.

Innovation is deliberately not a siloed area. We source ideas widely across our organisation, from other companies within our ownership group, and from external organisations and institutions.

We have a well-established ethos of partnership and collaboration with a diverse range of organisations; our current innovation portfolio, including our customer-led distribution system (CLDS), activating community engagement (ACE), SilentPower, Integrated Transport Electricity and Gas Research Laboratory (InTEGReL), AutoDesign and Microresilience projects, is testament to that.[1] This has been reinforced by the Energy Innovation Centre (EIC) ranking us as the most collaborative electricity network.

This is set to continue as we develop existing relationships and actively seek out new partnerships and opportunities to collaborate. In a typical year about two thirds of the innovation ideas by value are suggested by third parties and 85 per cent of our innovation investment is with third parties. All innovation proposals we undertake will continue to be subject to review by our expert non-executive director with innovation oversight reporting directly into our board.

Our BEET and Community DSO Network Innovation Competition (NIC) bid represented two excellent examples of third-party-generated projects brought to us by a customer and engineering consultancies respectively. Ofgem's Strategic Innovation Fund will further foster the opportunity to develop collaborative and third-party driven projects in 2023-28, with more diverse parties and ideas taking part and opening up a wider set of benefits for customers.

Our approach to delivering innovation projects further embeds our culture of innovation. Project managers are selected from the parts of the business that will benefit from the eventual roll-out of the learning, and have responsibility for facilitating that roll-out. Members of our executive team take responsibility for the progress of our innovation activities in their operational units.

As part of our whole system approach to decarbonisation, it is essential that our collaboration includes other network companies and companies from other sectors. This includes working together to develop innovation projects but also disseminating the learning from the projects of others. We are doing that already through our work at InTEGReL and with Nissan, our discussions with the rail sector, and our dissemination of Distributed Storage and Solar Study (DS3)[1] learning to developers. This will only increase in the 2023-28 period.

1. Details of CLDS, ACE, SilentPower, InTEGReL, AutoDesign and Microresilience and other projects in our portfolio can be found at https://www.northernpowergrid.com/innovation.

Supporting our objectives

Ref.	Innovation transformational capabilities	Benefits	Impact on output areas: Decarbonisation	EAP	Safety	Reliability and Availability	Asset Resilience	Climate Resilience	Physical and Cyber Resilience	Customer Service	Vulnerable Customers	Our Communities	Connections	Openness and Transparency
IN1	Identify opportunities to accelerate the benefits of flexibility	— Allow use of low-cost energy at times of plentiful generation — Contain network costs by avoiding reinforcement — Facilitate faster connections and installations of customer equipment — Minimise disruption at times of reduced network or generation availability — Improved scheduling of asset reinforcement and renewal – lower cost, disruption to customers, smarter works coordination — A richer understanding of the implications and benefits of flexibility, how best to deploy it and the mechanisms to use it most effectively	●	○	○	●	○	●	○	●	○	○	●	○
IN2	Develop sophisticated data management and analytics to inform energy system forecasting, planning and real-time decision making	— More targeted, lower-cost reinforcement and flexibility purchasing — Allow energy matchmaking in the connections process, reducing connections costs — Interconnected systems giving faster speed of response, more efficient processes and easier access to information — New opportunities to exploit mass data streams through integration and access to key information — Improved scheduling of asset reinforcement and renewal – lower cost, less disruption to customers, smarter works coordination — Cost reduction via artificial intelligence (AI) in place of labour-intensive processes	●	●	●	●	●	●	●	●	●	●	●	●
IN3	Enhance the connections process to facilitate higher volumes and different types of connection	— Ensure that the electricity network is not a barrier to decarbonisation — Lower cost for connections — A quicker and more tailored connections service, driving improved customer satisfaction — Longer opening hours and more convenient access to our services — Transparency of connections design and pricing decision making — Greater internal capacity to facilitate more low carbon technologies (LCT) connections that contribute towards our net zero ambitions	●	○	○	○	○	○	○	●	○	○	●	○
IN4	Maintain the dependability of the energy system as seen by the customer during the energy system transition and decarbonisation	— Energy remains dependable even with a reduced number of energy sources — Customers can expect power to their homes particularly when they need it most (e.g. during storms) — Power for all uses including heat, transport, and information systems will be available throughout the seasons — Summer minimum and winter maximum demands and corresponding generation loads catered for	●	○	○	●	●	●	●	●	●	○	○	○
IN5	Remove barriers preventing access to the energy system, including access to energy data, particularly for those not currently engaged or informed, vulnerable or less advantaged	— Customers know they can depend on the whole energy system to provide power to meet their needs as they become more reliant on electricity — Customers support the work programmes and initiatives we run to manage the network — Customers are more inclined to transition to LCTs	●	○	○	●	○	○	○	●	●	●	●	●
IN6	Create capabilities to deliver a next-generation local energy network that links up whole system energy sources and vectors, balancing in real time	— All customers understand the benefits of a smart flexible energy system and know how to access them — Facilitating a fair and equitable transition to a low carbon energy system — A faster route to net zero with more customers able to access low carbon energy — Enhanced energy system resilience to physical and cyber disruption	●	●	○	●	●	●	●	●	●	●	●	○

Key: ● Major Impact ● Moderate Impact ○ No Impact

How engagement with you has shaped our plan

INNOVATION

Innovation

How we engaged with you:

- Innovation underpinned all discussions and was a sub-topic at two events, covering 61 stakeholders.
- In wave two we began testing options, engaging domestic, commercial and future energy customers. Innovation was a sub-topic at five events, covering 187 interactions.
- When refining plans in wave three, we discussed innovation at nine events, including surveys, workshops and conferences, with regulators, government, industry stakeholders and future energy customers.
- We finalised our plan in wave four, responding to queries, addressing gaps and testing overall acceptability. We engaged 192 customers and stakeholders across seven detailed sessions on innovation.

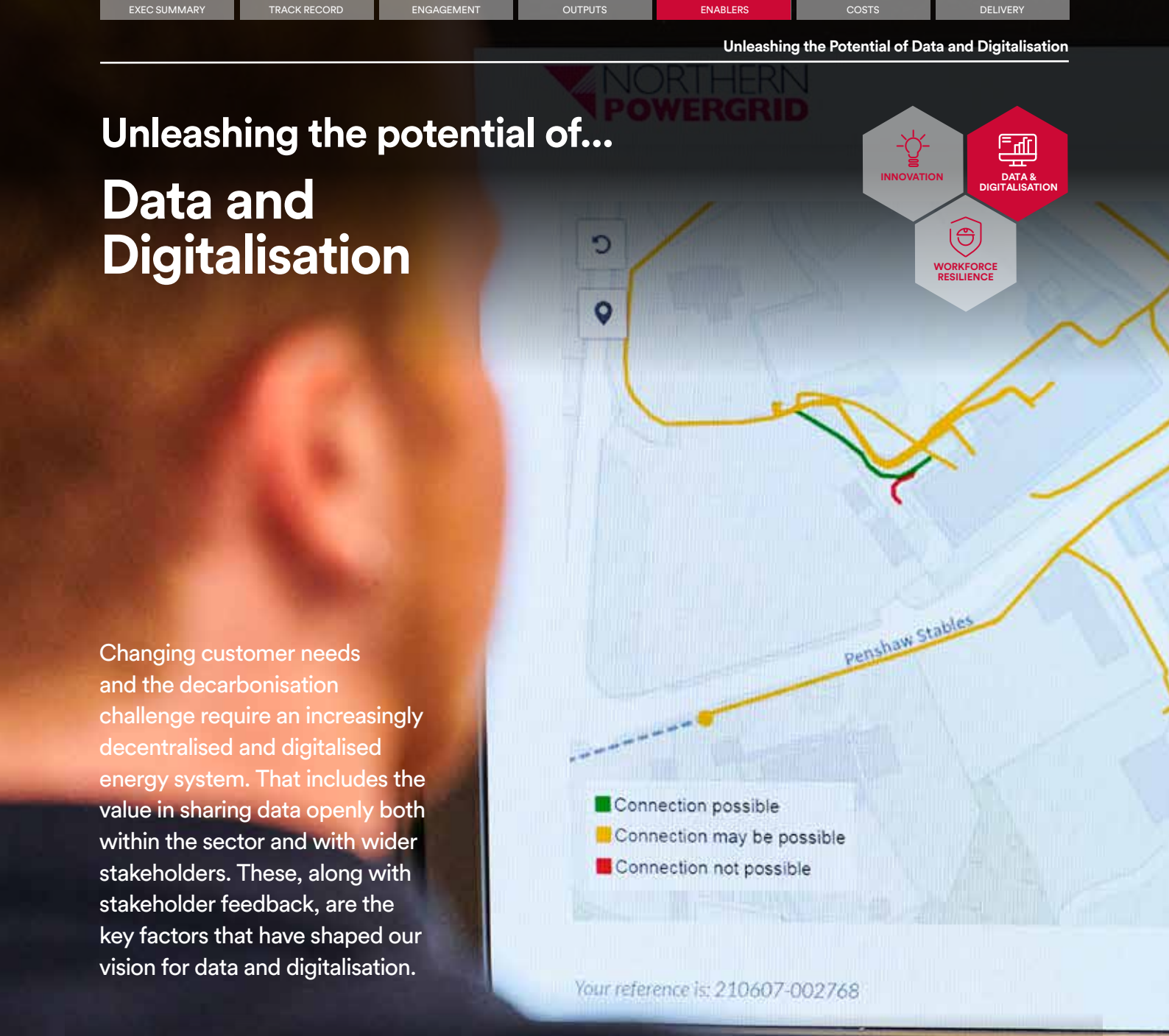
22 dedicated events

857 stakeholders engaged

What we have heard from you	How this has impacted our plan	Customer outcome ref	Annex detail
Be ambitious in innovation roll-out Stakeholders viewed innovation as crucial for successful plan delivery. They wanted us to be ambitious but demonstrate clear customer benefit.	**Our plan embeds £263m of totex efficiencies driven by innovation programmes** We will invest £164m to roll out innovation across our 12 plan areas, delivering £263m of totex efficiencies. Innovation activities are highlighted throughout our plan with a .	**Full plan**	Link
Fast-track flexibility Customers prioritised investment in accelerating flexibility deployment and engagement to encourage uptake.	**We have made accelerating the benefits of flexibility one of our priorities** Through our innovation activity we will work with stakeholders, industry partners and flexibility providers to develop current and future flexibility opportunities.	**IN1**	Link
Utilise data and digitalisation Stakeholders asked us to look at how innovative use of data and digitalisation can improve our plans.	**We will deploy innovative solutions as we roll out our data and digitalisation plan** Our £107m of planned data and digitalisation investment provides a major platform for innovation. We will leverage new solutions to provide enhanced open data services, improve forecasting, planning and real-time decision making.	**IN2**	Link
Use innovation to maximise the uptake of LCTs Stakeholders are keen for us to support the connection of more green generation and LCTs onto our network.	**We will remove barriers for connections** We will build on innovation projects such as AutoDesign, BEET and DS3 to streamline LCT connections.	**IN3**	Link
Prioritise network reliability and resilience Most stakeholders wanted ambitious innovation to support enhanced network reliability, considering this just as important as decarbonisation.	**Our microgrids roll-out will break new ground** Roll-out of our Microresilience innovation project into business as usual will demonstrate a blueprint for next-generation energy systems.	**IN4**	Link
Make sure our plans are fair and inclusive Stakeholders asked us to reflect on how innovation is supporting a fair transition to net zero.	**We will prioritise innovation projects that remove barriers to the energy system for vulnerable customers** Benefits for vulnerable customers will be a part of our assessment criteria for new projects.	**IN5**	Link

Unleashing the potential of...

Data and Digitalisation



Changing customer needs and the decarbonisation challenge require an increasingly decentralised and digitalised energy system. That includes the value in sharing data openly both within the sector and with wider stakeholders. These, along with stakeholder feedback, are the key factors that have shaped our vision for data and digitalisation.

We have been on our digitalisation journey for some time. In the 2015-23 period, we invested to capitalise on new and emerging technologies to increase our digital capabilities and secure your information and power supplies. We undertook significant investment of more than £21m in digitising our asset records and implementing system design tools to model a wide variety of operational conditions as we transitioned to a more active network operation. In the same period we invested £29m in cyber resilience, meaning that we can continue to secure your existing and future services while reducing costs. (Read more in the Physical and Cyber Resilience section.)

We are well advanced in the deployment of our smart grid enablers programme, which is transforming our ability to monitor, control and communicate with more than 860 major substations and 5,500 distribution substations in 2015-23. This programme allows us to respond in real time to information about power flows on our network, which contributes to reliability and availability. These examples are the building blocks in which we will continue to invest to build our digital capability. Our investments to date have provided a stable foundation, allowing us to focus on providing the technology to underpin the next phase of the journey. Decarbonisation, and all its opportunities and challenges, will be front and centre, but our comprehensive data and digitalisation strategy covers the entire plan. To deliver those requirements involves a relatively complex set of detailed, interconnected and inevitably technical workstreams. But the key guiding principles on which we have based our strategy are things that we think make sense to everyone in our business and to our stakeholders.

There are:

- **Openness and transparency –** enabling innovation and development of new markets while delivering net zero at the lowest cost.
- **Whole system efficiency –** preparing for both a cost- and carbon-optimised whole energy system.
- **Service excellence –** delivering seamless, efficient service with more choice and personalisation.
- **Cyber security –** responding to and mitigating the cyber threats of increased digitalisation.
- **Reduced cost –** driving lower-cost, efficient operations in both the front and back office.

We are planning to deliver an increased level of digitalisation of our network in both scale and sophistication. In some cases, that will call for a widespread roll-out of technology applications that we might already be experienced with. In others, we will need to augment our capabilities to keep pace with the requirements and unlock the value associated with more complex interactions.

In particular, we expect to significantly expand our use of data for planning and operation of network and customer assets and we are anticipating that that to lead to applications where mixed data sets (both from within and outside our system) combine with analytical and control capabilities to exert a level of automatic, closed-loop control over our assets and those owned and operated by others.

The pace of change will be determined by the need. It is not efficient to deploy solutions where there are no problems, but we must also be ready to efficiently deliver solutions when problems arise. To ensure that the technologies available at the earliest stage of maturity can continue to deliver at the highest levels of maturity, we have and will continue to select solutions that are:

- scalable, so can grow and shrink as our needs change;
- extensible, to allow us to take a modular approach to plugging in new capabilities; and
- interoperable, to drive a loosely coupled architecture that is flexible both internally and when connecting with external sources too.

In developing our initiatives, we have taken into account the requirement that our DSO operational systems must be capable of being cost effectively assigned to another party in future if this is needed. We set out our DSO Strategy annex why this would lead to poor outcomes for customers.

We plan to utilise cloud-based analytical services to initiate the capability early in our plans, providing common data warehousing early, but utilising the modular and scalable nature of this architecture to add artificial intelligence (AI) and machine learning when the time is right, growing the storage capacity automatically as the amount of data increases with our maturity. This model will also allow us to easily bring in external data sources systematically while providing the platform upon which we can build our open data portals and customer-facing analytical services.

Our extensive engagement has confirmed that you support our plans to open up our data and to invest in technologies needed to drive decarbonisation as part of the whole energy system.

We have engaged with our stakeholders specifically on data and digitalisation, while also ensuring that we reflect the reality that this is not an end in itself. It is a cross-cutting theme that runs right through our business plan and our associated engagement programme. The development of our digitalisation strategy and action plan (DSAP) is not a brand-new initiative. We have published three versions of our plan so far, engaging widely with our stakeholders as we have refined our thinking and aligned our data and digitalisation plan ever more closely with our wider business plan.

To ensure our plan is fit for purpose and focused on the right initiatives, we have undertaken research into stakeholder requirements and have engaged with multiple categories of stakeholders through a series of events, targeted engagements and subject matter expert conversations.

> **We will increase our open data products by at least 70 per cent, made possible by the investment we will make in our own analytics capabilities, an enabler for decarbonisation.**
>
> 
>
> **Paul Fitton**
> Head of information systems

In our latest iteration of DSAP we have formalised our stakeholder engagement methodology. In developing our plan we first developed a list of stakeholders that we wanted to connect with – a mix of new and established relationships selected on the basis of their industry, use of data and subject matter expertise. This included individual customers, organisations and institutions such as universities, central and local government, major industries and green energy groups. We then directly contacted this list, comprising more than 1,700 stakeholders, alongside distributing a press release and utilising social media to further publicise our DSAP, inviting further comment. Specifically using social media, we used polls to ask for feedback on key questions.

To ensure that we have sought well-balanced, specific and 360-degree feedback, we have incorporated it into each iteration of our DSAP, and introduced a continuous stakeholder review process, where we horizon scan for new stakeholders as well as constantly refining our stakeholder list to further understand their needs and interests so we can tailor our engagement.

Engaging discretely on data and digitalisation was challenging, as independently, our initiatives offer little consumer value in isolation of the business outcome they support. However, when we were able to engage on it alongside other areas of our plan, stakeholders were better able to contextualise the enabling nature of data and digitalisation and provide clearer insight. We have built this into our engagement methodology in our DSAP.

We have interacted with over 1,700 stakeholders through 32 events and activities across our regions, seeking their views and gaining input into our business plan which has shaped our data and digitalisation offering. We will continue to engage with, and respond to, our stakeholders' needs throughout the 2023-28 period.

Our data and digitalisation plan accounts for all the technology investments required to support decarbonisation and deliver the customer outcomes in the rest of our business plan.

Ultimately, we recognise that the costs of data and digitalisation are significant, but we are committed to keeping base costs flat compared to 2015-23 and will introduce new incremental investment only to support our plans for decarbonisation.

In total, we plan to spend £223.2m on data and digitalisation initiatives in the 2023-28 period, an average annual cost of £44.6m. This is a circa £7.5m increase compared to the average annual expenditure in the 2015-23 period of £37.1m, made up entirely of new investments to support decarbonisation. This expenditure includes £106.9m of capex and £116.3m of opex. For more detail on our data and digitalisation costs and benefits see our data and digitalisation justification.

Our entire suite of initiatives initiatives in our DSAP are closely aligned to our business plan areas. Each initiative has been mapped to at least one, but in most cases, multiple outcome areas that in turn deliver the benefits you will read about in other parts of our plan.

The key driver behind our data and digitalisation strategy is the need to support our plans for decarbonisation through our Distribution System Operator (DSO) strategy and Enabling Whole System Solutions.

Our data and digitalisation investment will ensure that we can facilitate our region's decarbonisation in a flexible, affordable way. We believe that the best way to deliver decarbonisation will be through a decentralised energy system based around locally connected renewable generation, electricity storage solutions and demand that can flex to help keep overall costs down, facilitated by a network that is smarter and more flexible than ever.

Our data and digitalisation strategy details the systems that we need to invest in during the 2023-28 period, while our DSO Strategy details how and why we will use these systems – see annex 4.2 DSO Strategy. Our investments in systems will enable us to capture, manage, analyse and share data – both for our own use and for our customers. A summary of the mapping between the two strategies is included in our DSO strategy.

New and increasingly more complex ways of managing and continuously balancing the network are key to our decarbonisation plans, and we need unprecedented levels of data and digitalisation to be successful. Our initiatives will provide the capability to optimise the management of distributed energy resources, customer flexibility, our low voltage (LV) network, new connections and our interaction with the wider market. Although we will primarily create and utilise these rich data sources, such as the digitalisation of the LV network, to ready ourselves for decarbonisation, we are able to utilise the same source data to produce the open data products and services we know you would like to see. Our approach to the capturing of source network data is detailed in our Network Visibility Strategy (annex 4.3).

We will significantly enhance our data and analytics capabilities, skills and platforms, enabling the capture and analysis of network and market data and increasing our ability to share high quality open data and create open data products and services in near real time.

To do this, we must first understand the quality and completeness of our energy system data, capture more of it, enhance its integrity and store it in a structured manner to share it across internal and external systems. That activity lays a foundation that means we can ensure that our open data is interoperable with other Distribution Network Operators (DNOs) and the Electricity System Operator's published models and datasets. We will use a data vocabulary that is consistent with industry standard (Data Management Body of Knowledge) while our data and digitalisation transformation office will further ensure alignment when designing data models, by adding additional application planning interfaces (APIs), formats and reporting of our datasets.

Once the data is cleansed, structured and stored, it can be analysed to extract value and inform decisions for network planning and network operations. Advanced analytics capabilities will be implemented allowing our planning and operations forecasting to be enhanced through further refinement of our power flow models and by supplementing our forecasting and scenario data to predict future power flows under different decarbonisation scenarios.

Data and digitalisation will enable us to offer you an improved, personalised, proactive service and give you choice in how and when you do business with us, including the ability to serve yourself. For example, we will enhance our AutoDesign tool so that connection customers can self-serve and generate quotations for LV demand and load increases and create budget estimates for new generation connections.

Supporting our objectives

Data and Digitalisation capabilities are essential to deliver our strategic outcomes.

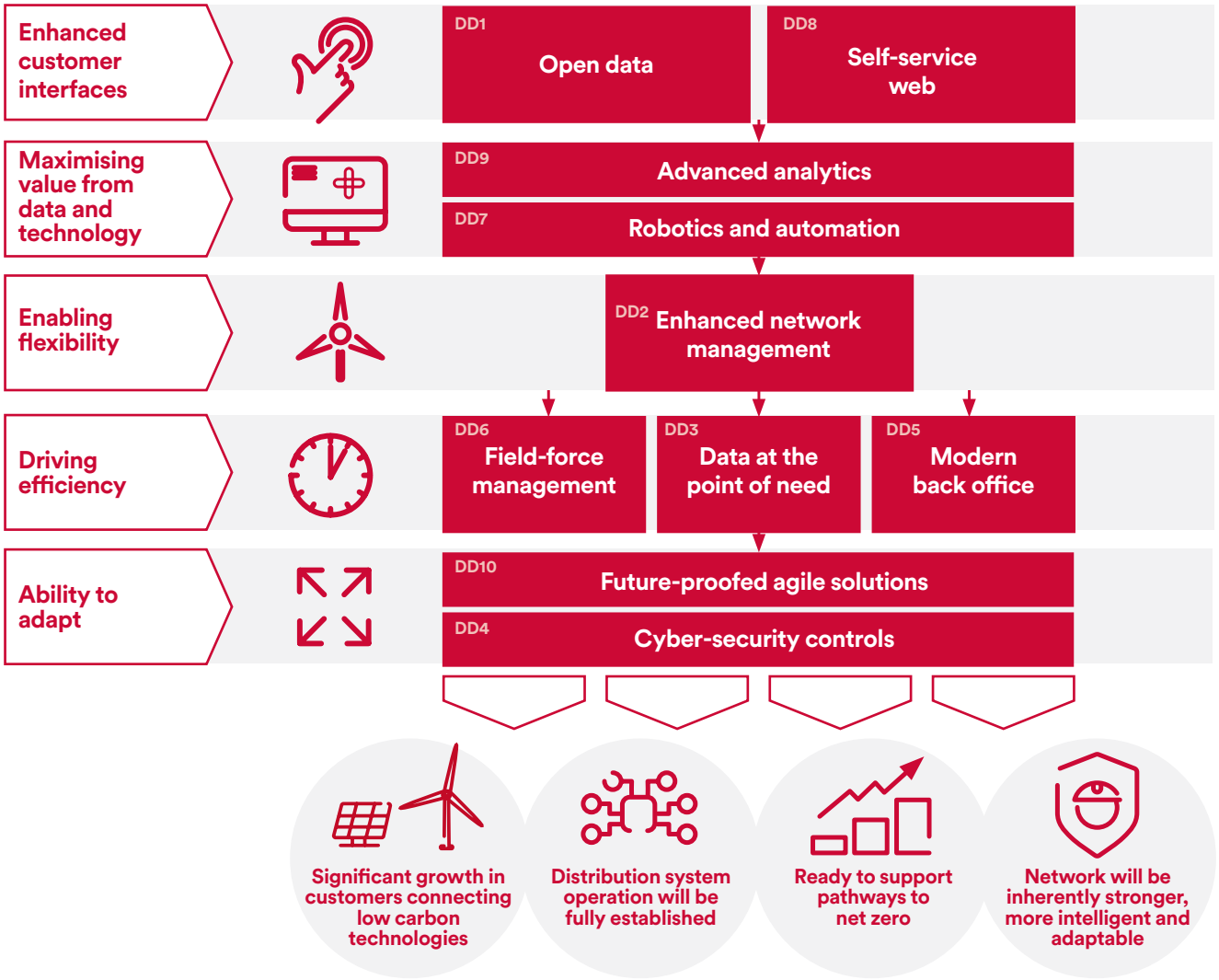
Our on-going stakeholder engagement has helped to identify initiatives, which we have grouped into 10 focus areas. These underpin both our decarbonisation outcomes and the improvements we are committing to across the rest of our plan.

In 2023-28 we will:

- DD1) provide high-quality **open data** to a wide audience so that stakeholders are empowered to become active participants in a deep and liquid energy market;
- DD2) upgrade technology and tooling to **improve network management**, planning and investment to increase efficiencies in operating the power network;
- DD3) introduce **data and applications at the point of need** in order to improve colleague efficiency and effectiveness;
- DD4) continue to invest in **advanced cyber controls** and tools to maintain a robust cyber-security posture, aligned to the threats emerging from increased digitalisation;
- DD5) **modernise the back-office environment** to reduce risk, secure information and improve colleague experience;
- DD6) introduce improved **field-force, work and asset management processes** to improve operational performance;
- DD7) deploy **robotics and automation** to reduce the cost of low-value, high-volume tasks and improve customer and colleague experience;
- DD8) implement **self-serve, personalised web technologies** to be ready for greater customer demand, providing insight and interaction portals to improve customer experience and reducing cost to serve;
- DD9) enable **advanced analytics** and real-time visibility of our assets to improve the operation of the power network; and
- DD10) provide **future-proofed, agile solutions** in order to be flexible enough to adapt to the change in the energy sector.

We will update our digitalisation action plan on a six-monthly cycle to show our progress and to further engage with our stakeholder to develop our approach.

Figure 1: data and digitalisation – our 10 focus areas



Our investments enable substantial benefits across our whole business plan.

Our investments in data and digitalisation are not solely targeted at delivering our decarbonisation ambitions, they underpin a wide range of benefits across our whole business and full range of our output areas. In Figure 2, we show how the 10 focus areas deliver the functionality required by each of our business plan output areas, demonstrating the holistic nature of our data and digitalisation strategy.

The investments made in data and digitalisation will enable substantial efficiencies assumed in our plan. In total £246m (65 per cent) of the £378m of totex efficiencies savings embedded in our plan for the 2023-28 period are underpinned by our data and digitalisation investments. Figure 3 demonstrates this by way of an example, showing how £18m of investments in advanced analytics capabilities and enhanced network management unlocks £62m of efficiency savings in the period.

The efficiency benefits from our investments in new or improved solutions alone are therefore larger than the total £223m which we will spend on D&D across the period, which includes all of the "business-as-usual" IT capabilities required to support our business. In addition to these benefits, our data and digitisation initiatives are also vital for unlocking the £30m of net consumer value delivered by our four CVPs.

Investment in data and digitalisation plans is also vital in underpinning the £465m of asset renewal and decarbonisation synergies we forecast between 202 and 2050. The LV monitoring systems deployed as part of DD2 and the advanced analytics capabilities such as digital twins developed within DD9 will allow us to prioritise the replacement of assets during 2023-28 in a way which optimises our investments for future load growth and asset condition, reducing reinforcement costs in future periods.

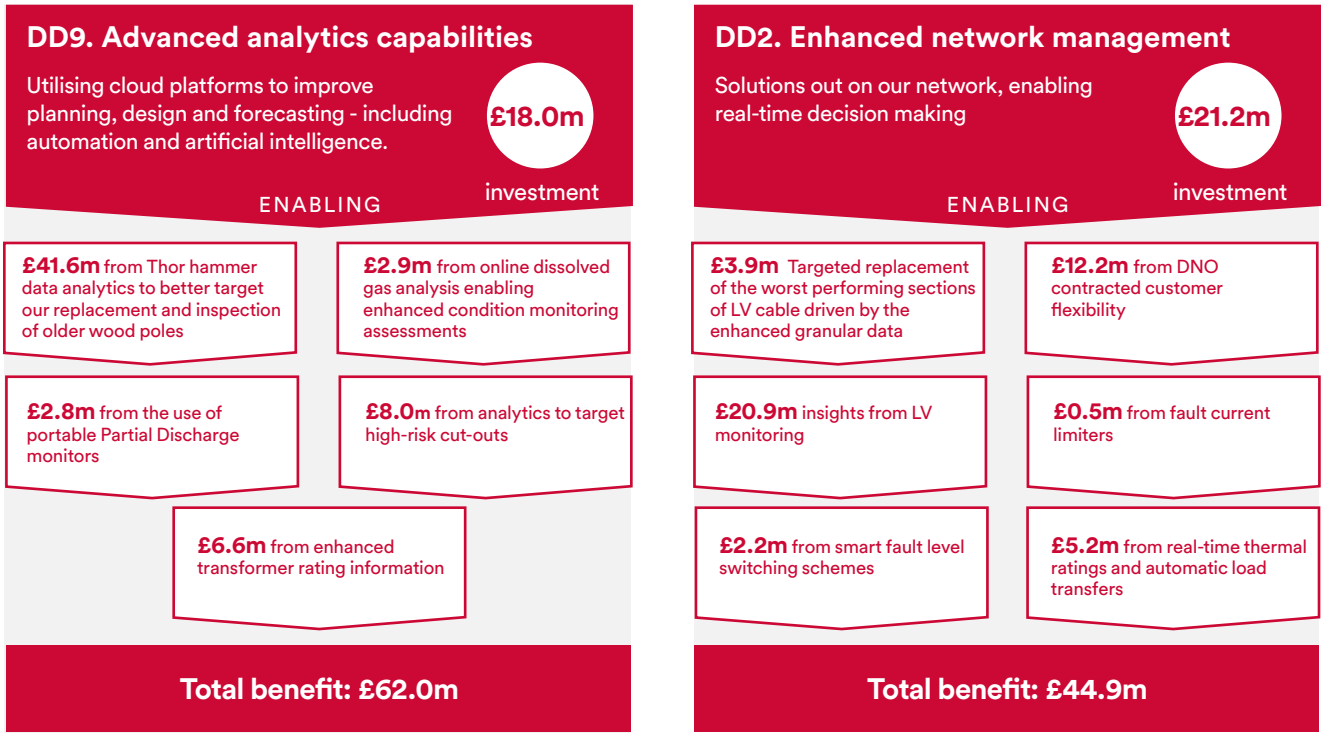
Finally, the investments made in open data and whole system co-ordination (for example, our planned communications link to the ESO) will unlock wider benefits to the whole system.

We set out in detail the full range of benefits enabled by data and digitalisation in our data and digitalisation justification.

Figure 2: data and digitalisation impacts across our plan

Focus areas		CAPEX (£m)	Impact on output areas: Decarbonisation	Environmental Action Plan	Safety	Reliability and Availability	Asset Resilience	Environmental Resilience	Physical and Cyber Resilience	Customer Service	Vulnerable Customers	Our Communities	Connections	Openness and Transparency
DD1	The journey to open data	9.3	●			◕	◕	◕		◕	◔	◕	◕	◕
DD2	Network management capability to enable net zero	21.2	●			◕	◕	◔	◔	◔	◔		◔	◔
DD3	Data at the point of need	8.2	◑			◑	◑	◔	◔					
DD4	Cyber security and resilience	11.1	◔			◔	◔		◔	◔	◔		◔	◔
DD5	Modern back office	2.9			◕					◑	◑		◑	
DD6	Field force management	7.1	◑			◕	◕			◔	◔		◑	
DD7	Robotics and automation	5.3	◔		◔	◔	◔	◔	◑	◔				
DD8	Enabling customers to self-serve	20.1	●							●	●	●	◑	◕
DD9	Advanced analytics	18.0	●	●		◑	◑	◑		◑			◕	●
DD10	Future-proofed agile	3.6	●	◔		◕	◕	◕	◑	◑	◑	◑	◑	◕
	TOTAL	106.9												

Figure 3: data and digitalisation capabilities unlocking savings in our plans



We are committed to a 'presumed open', best practice approach to data visibility.

One of the areas where we expect to see change is in relation to the role that we play in modernising energy data and making it more accessible to a wider set of customers, stakeholders We are committed to a 'presumed open', best practice approach to data visibility.

One of the areas where we expect to see change is in relation to the role that we play in modernising energy data and making it more accessible to a wider set of customers, stakeholders and partners. We are committed to following Ofgem's data best practice guidance principles and Energy Data Taskforce recommendations on the visibility of data and assets, especially regarding 'maximising value of data' and demonstrating adoption of the 'presumed open' approach. There is much to do to deliver on this; however we have started on the journey.

Our starting point is that all energy data is 'presumed open' – and then evaluating the justification for imposing any limits. This will be achieved by (1) taking security, privacy and compliance as a key driver in our new data platform, (2) identifying and agreeing a clear roles and responsibilities matrix in our new data governance structure and processes, (3) actively monitoring our data management dashboard, and (4) taking a continuous effort to empower all users, including our colleagues, with skills and awareness. For further details see our Workforce Resilience section.

Our plans include significant investment in the platforms, processes and skills to enable a more digital- and data-centric organisation able to meet the needs of a changing energy sector. We have identified and defined multiple data roles on our way to becoming a data mature organisation, including the roles of data custodian and data user(s). These roles will provide a dedicated data contact point for you, as potential data users, to raise queries or request additional core supporting information you might need.

We are developing an 'open data triage approach' along with transparent justification and mitigation processes for where our data cannot be shared. Open Data Triage is a process to systematically identify issues (privacy, security, commercial, negative consumer impact or legislation and regulatory barriers) with a dataset that limits their potential openness and then identify what techniques can be used to mitigate these issues.

We currently publish 14 manually refreshed open data sets including real-time power cut data. Based on what we have heard from you, we intend to increase the number of available data products and services by 70 per cent, 45 per cent of which will refresh in real time via automated processes delivered through APIs as well as dedicated portals. You will have access to at least 10 new open data products and services (already identified through stakeholder engagement) equating to gigabytes of interconnected data that can be layered over or combined with external and internal data and inputted into models and simulations, e.g. complex decarbonisation modelling.

We will provide access to our data through a user-centric and future-proof data platform using open standards such as RDF, XML, CGMES, CIM and the Dublin Core Metadata Structure.[1] At least 40 per cent of our key datasets will materially improve through data cleanse activities, which will become the cornerstone of our data catalogue. The data catalogue will have an external interface and links to sector open data aggregators so that you can understand the data we are providing, and we will create data dictionaries and usage vignettes that will accompany our open datasets, data products and services. This will be in place for all new open data products and services planned for 2023 and beyond.

We already have strong measures in place to protect our data and systems in accordance with security, privacy and resilience best practice so this is not considered a gap, but we will continue to strive to improve further in this area. We have a solid cyber-security footprint at present that robustly protects our corporate information. We have ISO 27001 accreditation, which deals with information security in our business operations and are working towards

1. The Dublin Core™ Metadata Element Set is a vocabulary of fifteen properties for use in resource description.

ISO 270019 accreditation, which applies similar principles to our operational technology environment.

We have cyber-incident response plans that incorporate the impact of a data breach, but we recognise that as our capabilities grow and we continue to publish more open data, we will need to keep pace.

Our data and digitalisation plans are ambitious, but we know they are deliverable.

In the 2015-23 period we have delivered £115m worth of technology initiatives including several £10m+ programmes of work that have spanned multiple years and delivered significant benefits. Our smart grid enabling activities are a good example of this and form a key building block of our plans for the 2023-28 period. We have also digitalised our entire suite network records, creating a network model containing a complete inventory of our assets, defined within a geometric space, replacing our legacy GIS systems. These projects have been highly complex with many variables and involved working collaboratively with technology vendors and partners.

We have developed a rigorous programme and project management approach which has seen us through these technology initiatives which we know will support us in the future, but we also know we need to embrace the uncertainty of a rapidly changing digital landscape. Agility and capacity to flex our initiatives to match the needs of our customers and business will be critical to our success as will be working with expert partners. We will work with technology agnostic, neutral partners such as the Digital Catapult and the Alan Turing institute alongside our existing partnership framework of technology specialists to deliver our plan. This type of partnership working will help us establish a link to digital skills and start-ups to embrace innovation and map our needs to the market. It will also ensure we challenge our thinking on evolving areas such as machine learning and AI as these capabilities develop.

We have fully costed our initiatives to include business change and have sequenced our plans, working with our strategic technology partners to ensure we can deliver using our existing delivery models, supplemented by new models that we will deploy in the period.

Our reliance on data and digitalisation means that it is essential that our data and digitalisation plans are deliverable and sustainable throughout 2023-28. Following a deliverability review, we have concluded it is necessary to employ a delivery model that utilises a mix of internal resources and external partners, such as the one we have in place today.

Each of our initiatives has been costed using a model that includes the required planning and design effort, the cost of the solution itself (covering hardware, software, testing, project management and integration costs), solution implementation and the business change required to ensure that we not only deploy technology, but we also embed it within the business.

We have also modelled resources across the five-year period to ensure we are clear on the internal capabilities to deliver the initiatives as envisaged and finally, we have sequenced the initiatives as programmes of work, factoring best practice insight from our strategic technology partners in setting out the plans to deliver the work required.

Finally, being part of Berkshire Hathaway Energy provides us with significant benefits, such as strategic relationships with software and hardware vendors, and a large economy of scale when it comes to system provision. We are able to utilise top-tier enterprise and application providers to provide a best-in-class integrated suite of applications. That core suite of capabilities covers almost all the requirements of our DSAP. The benefit of this approach is that our increasing reliance on data and digitalisation will be enabled by tried and tested systems and processes, at an efficient cost.

Data & Digitilisation focus areas		Milestones [1] *(Italics – deliverable in another plan section)*	Annex	Measure/[2] (Output / *indicative input*)	ED1 to date	ED1 forecast	ED2 target
DD1	**The journey to open data** – Understand, improve, and expand our energy system data and promote data transparency through Open Data.	**DD1.1)** Fully data best practice compliant by the end of 2023-24 **DD1.2)** Asset and energy system data linked by an integration layer by 2024-25 **DD1.3)** Open insights data portal capability launched by 2024-25 *(supporting DS03.1)* **DSO3.1)** *Open Insights data portal full functionality delivered by the end of 2026-27 CVP*	Link	**Data best practice compliant**	**50%**	**80%**	**100%**
				No. collaborative open data projects	*2*	*2*	*5*
				Availability of energy system data products[3]	-	-	**+70%**
DD2	**Network management capability to enable net zero** – Upgrade and implement new IS systems to enhance network management and decision making in real time to enable us to efficiently operate our distribution network in a decarbonisation era.	**DSO4.2)** *Enhance our Active Network Management (ANM) coordination and control to manage thermal, voltage and fault level constraints using a central and/or local management system to control flexible customer assets. Planned to deliver a complete set of capabilities by the end of 2025/26* **DSO4.6)** *Establish an Inter Control Centre Protocol (ICCP) link with the ESO, to allow real-time communication and data exchange, by 2026-27*	Link	**Availability of DERMS capability**	-	-	✓
				Availability of ESO ICCP link	-	-	✓
DD3	**Data at the point of need** – Introduce data and applications at the point of need in order to improve colleague efficiency and effectiveness.	**DD3.1)** Field-based colleagues have access to a new mobile collaboration platform by 2024-25 **DD3.2)** Internal, remotely accessible data platform made available to field colleagues by 2025-26	Link	*Field colleagues with access to mobile collaboration applications*	*20%*	*40%*	*100%*
				HR and training processes available to complete via mobile intranet	*40%*	*50%*	*100%*
				Customer digital experience score of 'good' or better	-	-	✓
				Bespoke satisfaction survey – data services[4]	-	-	**>90%**

1. Milestones will be updated in our DSAP every six months and managed using a change control mechanism.
2. Note that the metrics listed map to the focus areas and do not always have a 1-1 mapping to milestones. Numbers shown may be subject to rounding – see annex A1.4 – Key targets & measures for profiled targets.
3. Cross-reference to DSO3.
4. Cross-reference to CS3.

Data & Digitilisation focus areas		Milestones [1] *(Italics – deliverable in another plan section)*	Annex	Measure/[2] (Output / *indicative input*)	ED1 to date	ED1 forecast	ED2 target
DD4	**Cyber security and resilience** – Continue to invest in advanced cyber controls and tools to maintain a robust cyber-security posture, aligned to the threats emerging from increased digitalisation	DD4.1) Retain ISO 27001 and ISO 27019 certification in 2023 DSO4.6) *Deploy a resilient mobile voice communication system for our critical field colleagues by 2025-26*	Link	***Loss of information (material cyber breach)***[5]	*0*	*0*	*0*
				Loss of supply (material cyber breach)[6]	*0*	*0*	*0*
				Operational Technology Network Monitoring upgrades[6]	-	-	*700*
				BitSight score in 'Advanced' category	✓	✓	✓
				Continued compliance with NIS-D regulation	✓	✓	✓
				Telecoms estate managed within single asset repository linked to automated patching.	*50%*	*50%*	*100%*
DD5	**Modern back office** – Modernise the back-office environment to reduce risk, secure information and improve colleague experience.	DD5.1) Upgraded back office fully deployed by 2025-26	Link	**Hybrid cloud solutions deployed**	-	-	✓
				Reduction in technical debt attributable to back-office	-	-	**100%**
DD6	**Field force management** – Introduce improved field-force, work and asset management processes to improve operational performance.	DD6.1) Connections work able to be allocated automatically via mobile app by 2025-26 DD6.2) All applicable field work types able to be allocated automatically via mobile app by 2026-27	Link	*Work allocated automatically via work management system*	*0%*	*0%*	*60%*
				Reduction in avoidable "return to base" action taken by field colleagues	-	-	**25%**
DD7	**Robotics and automation** – Deploy robotics and automation to reduce cost of low value, high volume tasks and improve customer and colleague experience.	DD7.1) Roll out process mining across core business areas by 2024-25 DD7.2) Deploy RPA capability for customer services processes by 2024-25 DD7.3) Deploy master data management solution by 2025-26	Link	**Total number of processes with automation**	**0**	**5**	**50**
				Process productivity improvement through automation	-	-	**30%**
DD8	**Enabling customers to self-serve** – Implement self-serve, personalised services to meet customer demand and experience, implementing a customer insight and interaction portal and reducing the cost to serve.	DD8.1) New website, contact centre and scheduling capabilities launched by 2025-26 DD8.2) Data capture and social listening deployed by 2026-27 to feed automatic complaints root cause analysis. DD8.3) Upgrade self-serve customer connections platform to allow the generation of quotations for LC demand connections, load increases for existing connections, and budget estimates for new ones, by 2025-26 *VN1.3) Give our vulnerable customers more choice in how they engage with us by creating a fully digitised 'one-stop-solution' by 2024-25*	Link	**Number of digital contact channels** [7]	**5**	**5**	**8**
				Increase in customers using new self-serve functionality	-	*10%*	*30%*
				Open data portal for customers deployed	-	-	✓
DD9	**Advanced analytics** – Enable advanced analytics to improve the planning, design and operation of our distribution network.	DD9.1) Provide open access to the digital twin of our network by 2026-27 DD9.2) Completed implementation of single reporting, analytics, and information delivery platform for the Control Room by 2026-27	Link	**Availability of energy system data products (ODI-F)**[3]	-	-	**+70%**
				Colleagues using self-service analytics	-	-	**50%**
				Contractors accessing cloud analytics platform for safety portal	-	-	✓
DD10	**Future-proofed agile** – Provide future-proofed, agile solutions to be flexible enough to adapt to the change in the energy sector	DD10.1) Establish a cloud ready, DevOps management capability by 2023-24	Link	**Cloud financials solution implemented**	-	-	✓
				Cloud capital projects solution implemented	-	-	✓
				Cloud HR solution implemented	-	-	✓

1. Milestones will be updated in our DSAP every six months and managed using a change control mechanism.
2. Note that the metrics listed map to the focus areas and do not always have a 1-1 mapping to milestones. Numbers shown may be subject to rounding – see annex A1.4 – Key targets & measures for profiled targets.
3. Cross-reference to DSO3.
4. Cross-reference to CS3.
5. Cross-reference to PC1.
6. Cross-reference to PC2.
7. Cross-reference to CS1.

How engagement with you has shaped our plan

DATA & DIGITALISATION

Data and Digitalisation

How we engaged with you:

- In wave one we ran eight events with 529 stakeholders, focused on preparing employees and technology for a digital future.
- In wave two we began testing stakeholder ambition, with data and digitalisation a specific sub-topic at three events with 257 domestic and commercial customers, partners, stakeholders, SMEs and future customers.
- We refined our plan in wave three, engaging with domestic and rural consumers, SMEs, local authorities and government, Ofgem and industry representatives at 14 events, covering >800 interactions.
- We finalised our plan in wave four, responding to queries, addressing gaps and testing overall acceptability. We engaged 153 customers and stakeholders across seven detailed sessions on data and digitalisation.

32 dedicated events

1,771 stakeholders engaged

What we have heard from you	How this has impacted our plan	Customer outcome ref	Annex detail
Improve data quality and clarity Stakeholders asked us to make sure the data we publish is standardised, transparent and aligned with future customer needs.	**We introduced a set of data principles** We have set out principles in our plan that recognise data as an asset, and ensure it is F.A.I.R – findable, accessible, interoperable and reusable.	DD1	Link
Review data gaps and availability Stakeholders asked us to review the data that we make available and close gaps that limit customers and stakeholders extracting value from it.	**We will prioritise our release of data according to stakeholder feedback** We will work directly with stakeholders to ensure future data releases remain up to date and in-line with their needs.	DD3	Link
Do not compromise on data privacy or cyber security Effective management of customer data and data privacy remain a key issue for our stakeholders and customers.	**We remain focused on cyber resilience** Our plan invests in advanced cyber controls and tools, maintaining our ISO 27001 accreditation, and working towards ISO 27019 standard so we can secure sensitive data. Our plans have been reviewed and approved by Cyber Assessment Framework (CAF) accredited consultants.	DD4	Link
Ensure a choice of digital services Customers wanted a choice of digital channels, but felt human contact was also important, particularly for vulnerable customers.	**Our plan implements a range of new digital channels** We will prepare for increased customer demand through multiple new Customer Service self-serve channels while retaining an option of 100 per cent human contact.	DD8	Link
Invest to streamline LCTs connections Customers supported additional investment to enable uptake of LCTs.	**Our plan invests £6.6m to support LCT service development** Self-service and advanced analytics underpin a range of new services in our plan for LCT customers.	DD7 DD8 DD9	Link
Embrace uncertainty around net zero Stakeholders wanted us to plan for an uncertain future and invest to accelerate decarbonisation.	**The solutions we deploy will be future-proofed and agile enabling us to adapt** We have completed scenario modelling to ensure our plans are robust against a range of future energy scenarios.	DD2 DD10	Link
Be clear about the benefits of new technologies In our Emerging Thinking consultation, stakeholders supported our plans but asked us to explain the customer benefits more clearly.	**We updated our business plan material to more clearly show the benefits of our investments** We worked with stakeholders to design personas to guide the development of new services and articulate stakeholder benefits more clearly.	DD1-8	Link

Unleashing the potential of...
Our People

Our workforce and extensive contractor base are central to the delivery of our ambitious plans for the 2023-28 period and continuing to provide outstanding personal customer service.

The responsibility we carry as a major investor in the region and as one of the leaders in the journey towards net zero creates exciting opportunities for us to increase the pace at which we build an increasingly diverse, skilled and resilient workforce. We see that as so important that we have already begun some of the recruitment campaigns for over 100 of the new roles required to deliver this plan.

Our Workforce Resilience strategy is designed with these challenges and opportunities in mind. It underpins delivery for every area of the plan by focusing on four strategic priorities.

- **Expanding our workforce** – attracting, recruiting, training and developing more than 1,000 people to meet the immediate and future needs of our customers, driven by the decarbonisation agenda.
- **Investing in upskilling** – building more training capacity and capability to upskill our existing colleagues in the evolving technical, operational and digital skills required to manage the step-change in volume and complexity of data management that will be part of an increasingly smart, digitised and connected energy system.
- **Increasing workforce engagement and satisfaction** – continuing to actively engage with our colleagues and their trade unions to improve their experience, increasing the extent to which they feel empowered to innovate and take ownership to deliver the highest levels of service for our customers.
- **Becoming a more diverse, equitable and inclusive organisation** – opening up career and development opportunities for existing and future colleagues, attracting more talent from underrepresented groups, and enhancing our business innovation, decision making and delivery through more diverse teams.

Our workforce priorities are strongly supported by stakeholder feedback. During the COVID-19 pandemic our teams demonstrated strong personal resilience to quickly adapt so we could maintain our 24/7 services, underlining the critical role our people play in the region, with more than 85 per cent of our workforce designated as key workers.

As a major employer, we have an important role in the post-pandemic economic recovery in our region, to provide fairly paid, skilled jobs and progression opportunities for fulfilling careers at a secure business. Investing in the development and upskilling of our existing colleagues, we will use our recruitment power to help build a more diverse and inclusive organisation where we support equal access to opportunities for all.

An increasingly diverse and resilient team

Our workforce resilience plan for 2023-28 has been shaped, primarily, by the demands of the other parts of our business plan. It also sets out to meet the needs of our colleagues, who are the people who will deliver the outcomes we are committing to our customers. Our Delivery Strategy contains more detailed information on the key operational initiatives in 2023-28 that will help us achieve those outcomes.

The people agenda and the needs of our colleagues will evolve and we will continue to engage regularly with key stakeholder groups in 2022 and beyond to learn from experience and refine our action plan.

We will head into the future having made great strides on our people agenda over the past few years:

- creating over 1,000 job opportunities, largely through our workforce renewal programme, which has developed top class apprenticeship programmes that have enabled us to make significant progress to address the issue of an ageing workforce, while being able to tap into their vast wealth of experience as part of training the next generation of engineers and technicians;
- establishing a more locally focused delivery organisation to take the leadership of our service operations closer to our customers and their communities. This has improved the way we serve the diverse needs of the customer groups and natural geography of the areas we cover, and created new management opportunities for emerging talent;
- developing a new, modern technical competency framework in partnership with trade unions, refreshing the collectively bargained pay deals and creating the blueprint for co-developing future progressive framework agreements;
- maintaining high levels of loyalty that mean we have a good track record of retaining talented and skilled people in our business;
- improving the safety, security and well-being of our work environment for our colleagues with our lowest-ever accident rates and the introduction of new well-being support measures;
- developing a common 'job architecture framework' to organise roles across the business and strengthen career pathways;
- expanding learning and development programmes to help structure our colleagues' upskilling;
- enhancing the onboarding experience for new colleagues joining our business; and
- starting on the journey to address the gender pay gap by targeting recruitment of more women into the higher-paid engineering roles and supporting career development for all with a range of flexible working options.

We need long-term workforce capacity and capability to help us to decarbonise, reach net zero and take on the functions of Distribution System Operation (DSO).

We know that the significant growth in network investment means that we are going to need a larger workforce with a skillset that has evolved to meet the emerging needs of managing a smarter, more connected and digitised energy system that is underpinned by an enhanced data and digital infrastructure. We have factored in an additional £0.6m p.a. to cover the cost of upgrading our training and development facilities.

Our workforce	% of workforce	Men	Women
		80%	20%
Operational crafts	41%	96%	4%
Engineering and technical	31%	93%	7%
Business support	17%	33%	67%
Management and specialists	11%	56%	44%

24% (16) Women in senior leadership roles

5% (37) Women in engineering/ STEM roles

43.2 Average age

16 Average years length of service

We're excited about the career opportunities our plan creates for existing and future colleagues – including attracting and retaining talented people from underrepresented groups that better reflect the communities we serve.

Angie Patterson
Director of organisation development

Adding to our skillset

Digitalisation
managing a more digital network; smart technician roles

DSO
deploying and managing network flexibility

All colleagues
digital and analytics skills, customer service and communication

Management
building diverse teams and an inclusive workplace culture, optimising remote team working

Meeting the demand for skills

Through upskilling existing field staff, recruiting the next generation of engineers and technicians to replace those who retire and leave the business, as well as expanding the size of the workforce, our workforce renewal and training programmes will equip us with a highly skilled and resilient workforce.

We have already begun to accelerate our programme to grow the workforce. We are targeting to recruit over 100 roles during 2022, to help us build the necessary skills and capacity. Recognising the significant industry-wide challenge we face, we will not work in isolation. As we go forward, we will continue to collaborate across the energy sector through partnerships such as with Energy & Utility Skills and the National Skills Academy for Power.

Adapting to the significant increase in digital technologies and use of data that will become the norm in maintaining and managing the future energy system is a skills challenge for our entire workforce. We will introduce more specialist digital and data roles in our business, such as data scientists, but we also know that our upskilling programme must ensure that all colleagues are proficient in the new digital technologies and data management techniques that are relevant to their roles.

We will be expanding our innovation programme in 2023-28 as a key enabler for delivering our plan and our colleagues will play an increasingly important role in identifying opportunities to be innovative. We must ensure we create the environment for colleagues to think creatively and foster new ideas.

To attract a more diverse range of applicants, we will enhance our recruitment activities to reach and appeal to all underrepresented groups and create more opportunities to apply for careers with us. These changes will make our business more appealing to a broader range of potential colleagues. But to better reflect the communities we serve, we will focus particularly on women, people from ethnic minorities and those from less socio-economically advantaged backgrounds.

We recognise the business imperative to increase the diversity of our workforce and develop a more inclusive workplace culture along with the broader benefits these bring to the communities we serve.

Creating a more diverse, inclusive and equitable organisation is critical to ensuring we can meet the evolving needs of our business, our colleagues and our customers. In the past five years, around 27 per cent of new recruits were women and four per cent identified as being from a Black, Asian or minority ethnic (BAME) background. We want to attract more, talented people from a wider range of backgrounds to our company as we grow and develop our workforce.

In December 2021, we published our first Diversity, Equity & Inclusion (DEI) plan (see annex 5.5) which sets out the ambitious set of actions we are undertaking now and in the coming years to improve our own position, shaped by priorities we heard through colleague and stakeholder engagement.

The plan sets out our approach to DEI and the actions we will take to:

- bring in and develop the diverse skills required to deliver our current and future business needs;
- build a workforce with more varied backgrounds, perspectives and experiences to enhance our performance and contribution to the region; and
- open up the way we work to create a more flexible, inclusive and equitable workplace where there is space for everyone, people feel valued, confident and can thrive, leading to our business benefiting from a greater range of talented people who want to join our team and stay with us.

Support for our plan

"With the twin challenges of net zero and smart networks, we need to broaden and deepen distribution networks staff skills. We have discussed the strategic impact with Northern Powergrid to develop a plan to renew and rejuvenate its workforce that reflects our colleagues' passion for engineering excellence and superior customer service."

Mike MacDonald
Full time officer,
Prospect Union

Strategic recruitment approach to initiatives – how they work together

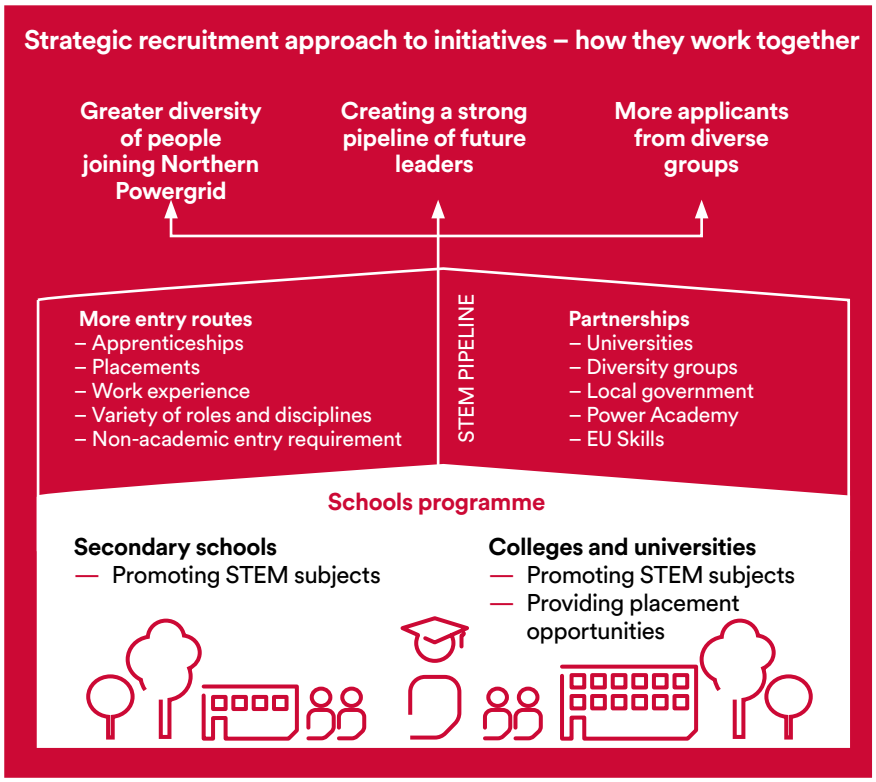
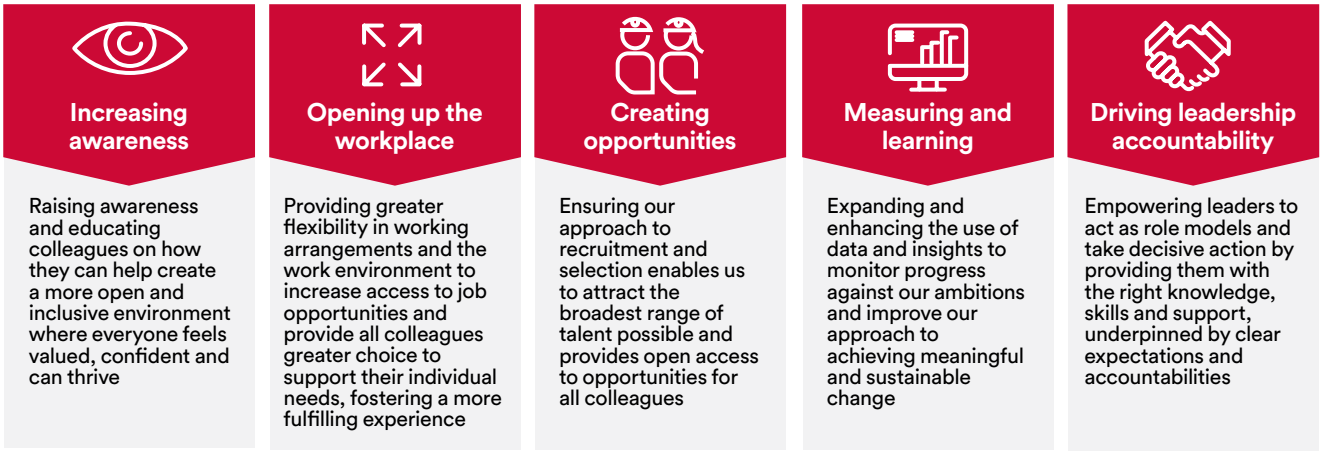


Figure 1: DEI priority areas of action



Our five priority areas of action, set out in Figure 1, reflect ongoing engagement with colleagues, our Customer Engagement Group (CEG), trade unions and other sectors guiding our approach. So far, the messages are clear:

- we should strive to be a more diverse, inclusive and equitable organisation;
- diversity goes beyond gender and ethnicity and we should be considerate of all demographics and characteristics, such as sexual orientation, neurodiversity and socio-economic backgrounds;
- everyone should have equal access to opportunities for new roles, development and career progression and roles should be awarded on merit;
- everyone has a role in improving diversity, inclusion and equity but the tone, direction and meaningful action come from the top; and
- we need to be open to learn from others in our sector, and beyond, to adopt good practice and coordinate our efforts to address sector-wide challenges.

Meaningful and sustainable change will be a multi-year journey. We are prepared for this and recognise the need to evolve our plan in line with our business and employee needs, and societal shifts.

We will be tracking and communicating progress against our core commitments and, as we enhance the quality and coverage of relevant employee data, we will set aspirational forecasts for greater diversity in our workforce. They represent realistic but stretching steps towards meeting our desired outcomes.

For example, our forecast for increasing the percentage of women at Northern Powergrid will reflect our ambition based on the positive actions we will take to attract and retain more women in the company.

We remain committed to recruitment processes that seek to identify the people who will best fit the needs of the company. So, in relation to increasing the involvement of any under-represented group, our focus will be on:

- broadening the pool of internal and external applicants by providing greater access to job opportunities to a more diverse set of candidates; and
- refining our selection processes so that they are better at recognising the potential that a person has to be a successful part of our team.

The way we structure and operate our business must evolve to meet new, changing demands in the 2023-28 period and to provide a rewarding experience for our colleagues.

Taking on the functions of DSO and other significant industry changes on the horizon mean that our organisation needs to be set up and structured effectively with flexible and efficient working practices that deliver a high-quality and reliable service for customers.

Our job architecture framework will be used to open up opportunities to:

- create clearer career pathways and development through improved visibility of roles and the requirements;
- enhance productivity through more effective team structures with clear distinction of accountability; and
- facilitate improved talent analytics, enabling identification of where changes to job design can improve access to opportunities for all.

We have a highly skilled and committed workforce. The average length of service is 16 years and to retain the valued skills, knowledge and experience we will:

- regularly engage with our colleagues to continuously improve how we operate and about their experience of working with us; and
- continue to build and maintain strong relationships with trade unions by engaging on all aspects of our people agenda.

The success of our business rests on the ability of our colleagues to do their jobs in a safe and secure environment. We have already introduced a network of mental health champions across the business, adopting a similar model to the successful safety representatives we have for field staff, focused on improved mental wellbeing. Mental health has, in particular, moved to the forefront during the COVID-19 pandemic and we will be expanding our programme of support measures for colleagues, to include:

- proactive awareness, personal resilience and mindfulness training;
- more workplace mental health champions, with regular training; and
- a range of practical support tools and resources for colleagues and managers.

We believe in shared values, goals and success. The different pay structures for all our colleagues have elements that reward the delivery of our business plan commitments and we will be continuing with this approach into the 2023-28 period. We explain more about our workforce plans in our Workforce Resilience strategy.

Our individual strategies for Innovation, Data and Digitalisation and DSO contain more information on how we see our colleagues enabling success in those areas of our plan.

Customer outcomes		Benefits	Deliverables	Output measure/[1] *indicative input measure*	ED1 to date	ED1 forecast	ED2 target
WR1	**Create more than 1,000 high-quality job opportunities and attract talented people to the energy sector**[2,3,4,5]	— Meet current and emerging customer needs, delivering on the significant increase in work volumes and changing demands — Future pipeline of highly skilled and experienced engineers — High-quality job opportunities, supporting the local economy — More opportunities for candidates from underrepresented groups	**WR1.1)** Create more than 1,000 new job opportunities through expansion of our Workforce Renewal and apprenticeship programmes, and develop new entry pathways across a variety of roles **WR1.2)** Review and upgrade recruitment processes to increase access to opportunities at Northern Powergrid and the attraction and hiring of talent from underrepresented groups **WR1.3)** Review and upgrade our internal and external selection approach to support equal access to opportunities with robust and inclusive processes **WR1.4)** Develop our education outreach programme, targeting underrepresented groups, to coordinate activities that promote our sector, uptake of STEM subjects and employment opportunities	**No. job opportunities created**	855	1,175	>1,000
				In addition, we will track: – *Average number of applications per role* – *% of applicants and % successful applicants from underrepresented groups (women, employees from ethnic minorities and employees from less socio-economically advantaged backgrounds)* – *No. of students engaged through activities to promote STEM careers*			
WR2	**Upskill and multiskill our workforce to provide rewarding career paths and develop the new capabilities required for managing our future energy network**[6,7]	— Highly skilled workforce with skill range to manage increasingly complex energy system — Rewarding careers for our workforce — Personal development and career progression	**WR2.1)** Provide a sector-leading training programme to equip our workforce with the evolving skills and techniques required to manage the future energy network **WR2.2)** Develop a new smart grid technician apprenticeship programme to train people for new, dedicated roles in managing the digital network and functions of DSO **WR2.3)** Train our people in data management, analysis and use of new technologies to accelerate adoption of enhanced data and digital capabilities throughout our business	**% employees completing training related to future skills**	-	-	100%
				In addition, we will track: – *% of colleagues attaining career progression*			
WR3	**Increase workforce engagement and strengthen partnerships with trade unions to become an even better, safer and rewarding place to work for our employees**[8,9,10]	— Improved levels of service for our customers — Improved mental and physical wellbeing — Improved job satisfaction	**WR3.1)** Enhance our colleague health and wellbeing programme and manager training to reduce the stigma around mental health, better identify colleagues in need of help, and provide a range of proactive, diagnostic and responsive support options **WR3.2)** Continue to actively engage trade unions on people and strategic issues to keep improving our colleague experience **WR3.3)** Improve our digital-enabled workforce planning capabilities to maximise deployment of our workforce to deliver an effective and efficient customer service	*% attendance rate*	*97%*	*97%*	*97.5%*
				In addition, we will track: – *% of new joiner retention after two years*			
WR4	**Increase the diversity of our workforce and develop a more inclusive workplace culture, supported by increasingly effective data insights**	— More talent from underrepresented groups joining and staying with the company — Opening up more job opportunities in all the communities we serve, supporting social mobility — More diverse teams enhancing innovation, decision making and delivery	**WR4.1)** Provide more flexibility in the working arrangements and range of benefits available to increase access to job opportunities and career progression, allowing all colleagues greater choice to support their individual needs **WR4.2)** Raise awareness and educate employees on D&I and, through ongoing top down and bottom up activities, help create a more open environment where people feel valued, confident and can thrive **WR4.3)** Extend and upgrade our Leadership Expectations framework to incorporate D&I expectations and equip leaders with the knowledge and tools to deliver these and act as role models **WR4.4)** Work collaboratively with external partners and fund research to develop innovative approaches to address key D&I challenges in our organisation and the sector	*% of women – total workforce*	*20%*	*Monitor in period*	
				% of women – engineering/ STEM roles	*5%*		
				% of women – leadership roles	*24%*		
				Mean gender pay gap in average hourly pay (%)	*21.4%*		
				In addition, we will track: – *% of employees from ethnic minorities (total workforce, engineering/STEM roles and leadership roles)* – *% of employees from less socio-economically advantaged backgrounds (total workforce, engineering/STEM roles and leadership roles)*			

Innovation | Data and digitalisation | Diversity, equity and inclusion

1. Measures are shown to track delivery of our customer outcomes. While 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 Decarbonisation DSO4.5) Up-skill and recruit engineers to use whole energy system thinking and DSO5.5) Create a team of Flexibility Relationship Managers.
3. Cross-reference Vulnerable customers VN2.4) Establish a new support team to provide additional on-site support.
4. Cross-reference Communities CO3.2) Establish 'Community Energy Advisors' in each of our regions.
5. Cross-reference Communities CO2.1) Develop relationships with educational institutes & CO2.3) Regional recruitment activity.
6. Cross-reference Physical & Cyber Resilience PC2.2) Develop and implement an OT Cyber specialist training programme.
7. Cross-reference Connections CN5.2) Up-skill LV/HV design engineers to facilitate better and more frequent discussions with customers on flexible connections.
8. Cross-reference Safety S1.1, S1.2, S3.1, S3.2 and S3.3 Colleague safety, health and well-being programmes.
9. Cross-reference Openness & Transparency 2.3) Trade union meetings with board.
10. Cross-reference Reliability & Availability RA.5) improving our ability to track and deploy staff.

How engagement with you has shaped our plan

WORKFORCE RESILIENCE

Workforce Resilience

How we engaged with you:

- In wave one we engaged more than 450 stakeholders at over 13 events.
- In wave two we began testing workforce priorities to develop a clearer picture of the drivers that will most impact workforce resilience – 380 stakeholders were engaged at 25 events.
- We refined our proposals in wave three, where workforce was a discussion point at nine events involving 417 stakeholders.
- In wave four we finalised our plan, responding to queries, addressing gaps and testing overall acceptability. We engaged 45 customers and stakeholders across three detailed sessions on workforce resilience.

50
dedicated events

1,297
stakeholders engaged

What we have heard from you	How this has impacted our plan	Customer outcome ref	Annex detail
Expand school outreach ambition levels Stakeholders valued our STEM activities in schools, but wanted more promotion to under-represented groups.	**Our education programme will target under-represented groups** We will set goals to reach under-represented groups through our schools programme, encouraging uptake of STEM subjects and employment opportunities.	WR1	Link
Promote energy careers Stakeholders strongly supported job creation and improved recruitment to increase awareness of Northern Powergrid careers, particularly within under-represented groups.	**Our plan creates >1,000 new job opportunities** We will refresh our recruitment approach to promote opportunities throughout our region and target under-represented groups to attract a diverse pool of talent.	WR1	Link
Focus on apprenticeships Stakeholders wanted us to prioritise apprenticeships, leveraging our programme to create opportunities for young people and those seeking new career challenges.	**We will expand our range of apprenticeships** For example, we will create a new Smart Grid Technician apprenticeship to deliver training for new roles in managing the digital network and functions of DSO.	WR2	Link
Invest in the workforce Academics and training partners highlighted the importance of upskilling and multiskilling our workforce to expand delivery capacity.	**We enhanced our plans around future skills** We will invest in equipping our workforce with the skills to manage the future energy network, including data analysis and use of new technologies.	WR2	Link
Support engagement and colleague wellbeing Stakeholders highlighted the need, particularly post pandemic, to offer a comprehensive support package for staff.	**We expanded the scope of our engagement, health and wellbeing programme** This will include manager training to reduce the stigma around mental health and better identify colleagues in need of help. We will actively engage trade unions and colleagues on our development plan to create a high-performing culture.	WR3	Link
Proactively address diversity Stakeholders recognised the need for increased diversity in our workforce.	**We have developed a comprehensive Diversity, Equity and Inclusion plan** Our plans set out the actions we will take to attract, retain, and develop a more diverse workforce and create a more inclusive workplace.	WR4	Link

EXPLAINING OUR COSTS

Over the course of the 2023-28 period we plan to spend a total of £3.3bn,[1] which equates to £661.3m per year. Four of our 12 output areas account for 89 per cent of our total costs: Asset Resilience (34 per cent), Decarbonisation (26 per cent), Reliability and Availability (23 per cent) and Connections (6 per cent).

In our best view planning scenario, total expenditure increases by £192.3m p.a. (41 per cent) compared to the average we are expecting for the 2015-23 period. As figure 1 shows, this increase is driven primarily by the need to enable the ambitious decarbonisation pathway our country is on. In total 96 per cent of the increase in our total expenditure across our 12 output areas is driven by decarbonisation.

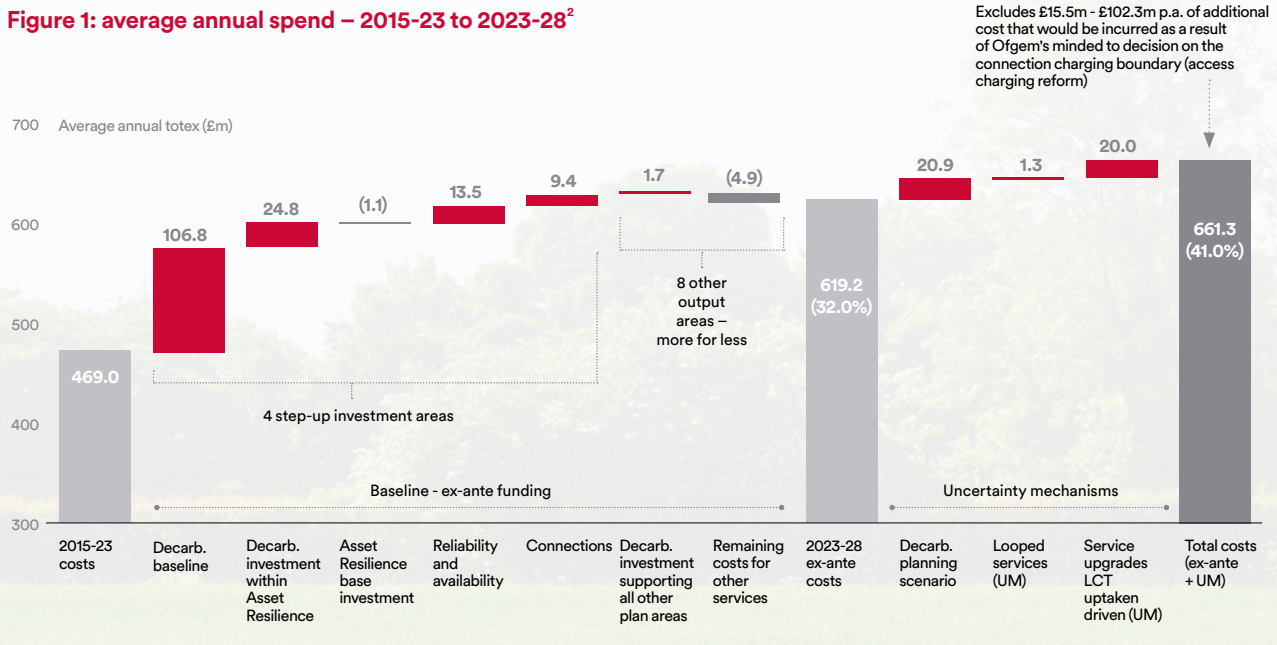
- **Decarbonisation** base plan expenditure, required to provide significant amounts of new capacity to cater for growth in technologies such as heat pumps (HPs) and electric vehicles (EVs), and to add the required digitalisation and smart grid enabling solutions, totals £147.8m p.a. This is an increase of £106.8m p.a.
- **Asset resilience** expenditure is our largest area of expenditure; it increases by £23.7m p.a. to a total of £226.7m p.a. to keep our assets in good condition and retain their resilience. This includes £24.8m p.a. of 'two-for-one' investment opportunities, where through achieving synergies in our programmes, we will efficiently add extra network capacity required for future decarbonisation pathways as we replace or refurbish degraded parts of the network. Otherwise, costs reduce by £1.1m p.a.
- The investment needed to deliver the significant **reliability** improvements we are targeting accounts for a further £13.5m p.a. increase compared to the current period.
- Supporting a just transition, we forecast our base **connections** costs will need to increase by up to £9.4m per annum as we socialise the cost of upgrading services to 100 amps in our customers' properties, making them net zero ready by ensuring they can charge an electric vehicle and install a heat pump.
- A further increase of £1.7m p.a. is driven by the impact of our **decarbonisation objectives in some of the other output areas of our plan**. This includes £1.0m p.a. in our environmental action plan to reduce our emissions as a business.
- Costs in the **remaining eight output areas** of our plan will reduce by £4.9m p.a whilst delivering substantial service improvements.

We have carefully calibrated our proposed level of ex-ante funding to ensure our network remains positioned, whatever pathway scenario emerges in the period, to deliver on all credible future pathways to net zero. This level of ex-ante funding is £619.2m p.a. representing a 32 per cent increase compared to the 2015-23 period.

Incremental costs above this are proposed to be funded through uncertainty mechanisms (UMs) dependent on actual levels of low carbon uptake in the period so our customers only pay for actual volumes of work required in the period. Under our planning scenario, a further £42.1m per annum would be funded through uncertainty mechanisms related to decarbonisation uptake, looped services and service upgrades beyond the levels covered by base ex-ante funding. Further detail on this is set out in our Managing Uncertainty and risk section and Uncertainty Mechanism annex.

The costs set out in this section of our plan exclude the potential impact of Ofgem's access charging reform (as discussed in the Connections section of our plan. We estimate that our costs could increase from anywhere between £15.5m to £102.3m p.a. with a best view estimate of £45.2m p.a. Full details on these highly uncertain additional costs and our impact assessment are set out in Socialisation of costs (annex 4.5).

Figure 1: average annual spend – 2015-23 to 2023-28[2]



1. The costs covered in this plan are part of 'totex'. Totex generally consists of all the expenditure related to our regulated activities that are under our control and are funded through the price control. Some costs we incur are not defined as totex as these are either funded directly by the customer or are 'pass-through' costs; these are covered in the 'non-activity based costs' section.
2. All costs are stated in 2020-21 prices.

An overview of our costs

Figure 2: totex by output area and variance to 2015–23 period

£m	2023-28 expenditure (p.a.)			Variance to 2015-23				
	ex-ante	UM	Totex	Decarbonisation-related costs	Reliability and availability	Costs for other service improvements	Total	%
Decarbonisation	147.8	22.1	169.9	128.9	-	0.0	128.9	314.4%
Reliability and Availability	153.8	-	153.8	0.0	13.5	0.0	13.5	9.6%
Asset Resilience	226.7	-	226.7	24.8	-	(1.1)	23.7	11.7%
Connections	19.4	20.0	39.4	29.4	-	0.0	29.4	294.0%
Subtotal	547.7	42.1	589.8	183.1	13.5	(1.1)	195.5	49.6%
Environmental Action Plan	27.0	-	27.0	1.0	-	(1.8)	(0.8)	(2.9%)
Safety	3.0	-	3.0	0.0	-	0.0	0.0	0.0%
Climate Resilience	16.2	-	16.2	0.0	-	(6.2)	(6.2)	(27.7%)
Physical and Cyber Resilience	14.3	-	14.3	0.3	-	(1.3)	(1.3)	(8.3%)
Customer Service	4.8	-	4.8	0.0	-	0.8	0.8	20.0%
Vulnerable Customers	3.9	-	3.9	0.0	-	3.1	3.1	387.5%
Our Communities	1.6	-	1.6	0.4	-	0.6	1.0	166.7%
Openness and Transparency	0.7	-	0.7	0.0	-	0.2	0.2	40.0%
Subtotal 8 other output areas	71.5	-	71.5	1.7	-	(4.9)	(3.2)	(4.3%)
Totex	619.2	42.1	661.3	184.8	13.5	(6.0)	192.3	41.0%

By any measure, this represents a significant investment in our region. It also presents a great opportunity to save money for the long term. The similarities and overlaps that exist in the two biggest components of our plan create lots of potential for 'two-for-one' efficiencies – and we have factored that into our cost projections.

It is our responsibility to find and release those benefits on behalf of our customers, which can be very significant. For example, the £24.8m p.a. of 'two-for-one' synergistic investments that we have factored into our asset resilience programme amounts to £124.2m over five years in a programme of around £1.1bn. Our analysis shows that the long-term benefits of that investment is likely to be over £450m because we invest a relatively small premium to create additional capacity as we renew the asset. That capacity will ultimately be needed on the decarbonisation journey, well within the lifetime of those new assets – so the future reinforcement cost is avoided. It works the other way too. The 2023-28 decarbonisation investment creates 'two-for-one' resilience benefits, without which the asset resilience costs in our plan would have been higher.

In order to provide a detailed breakdown of our costs that reflects the services we provide and the cost categories that our regulator uses to analyse the performance of companies, we have mapped the overall costs against our 12 output areas and Ofgem's cost categories (see figure 3).

- The cost increases we expect are primarily driven by the need for greater network investment to support decarbonisation. Away from that most significant factor, the other driver of the increase in network investment costs is asset resilience, which is lower than it would be if we were not going to get the asset health improvements that will be a by-product of the decarbonisation investments but is higher than the current spend levels because it incorporates the synergistic investments that will create long-term savings.
- Decarbonisation also drives a £27.4m p.a. increase in our indirect costs (closely associated, business support and non-operational capex), which drives 80 per cent of the variance in these areas relative to the current period (£34.3m).

The profiling of our total expenditure (shown in figure 4) increases during the 2023-28 period from circa £600m in year one to over £720m in years four and five. This profile is most heavily influenced by our forecasted load related network investment, with all other totex categories being broadly flat across the period. The timing of investment within load related network investment reflects the projected increase in substation and circuit loading based on our best view planning scenario and the points in time when the affected assets require investment to mitigate network constraints. As low carbon technology (LCT) uptake is projected to increase more steeply towards the end of the period, consequently so does our required network investment.

We believe that our plan strikes the right balance between enabling the drive towards decarbonisation, improving services for customers, and keeping customer bills low. The significant cost efficiencies that we have factored into our projections, coupled with reductions in financing costs, help to limit the impact on customer bills of the major investment that we are proposing to make and our approach to UMs ensures customers only pay for decarbonisation investment that is required in the period.

Figure 3: totex by output area and high level Ofgem cost category

£m	Ofgem cost category							
	Network investment			Network operating costs	Closely associated costs	Business support costs	Non-operational investment	Total
	ex-ante	UM[1]	Total					
ED1 totex			195.9	121.9	84.1	48.6	18.5	469.0
Decarbonisation	73.3	22.1	95.4	0.0	19.9	6.8	6.8	128.9
Reliability and Availability	13.1	-	13.1	(3.0)	(0.1)	(0.1)	3.6	13.5
Asset Resilience	17.1	-	17.1	6.70	(0.1)	0.0	0.0	23.7
Connections	7.3	20.0	27.3	0.0	2.1	0.0	0.0	29.4
Environmental Action Plan	1.8	-	1.8	0.0	(2.3)	(1.3)	1.0	(0.8)
Safety	(0.0)	-	(0.0)	0.0	0.0	0.0	0.0	0.0
Climate Resilience	(2.7)	-	(2.7)	0.4	(2.4)	(1.5)	0.0	(6.2)
Physical and Cyber Resilience	0.3	-	0.3	0.0	(1.1)	(0.1)	(0.4)	(1.3)
Customer Service	0.6	-	0.6	0.3	(0.1)	0.0	0.0	0.8
Vulnerable Customers	(0.0)	-	(0.0)	0.5	0.7	1.3	0.6	3.1
Our Communities	0.3	-	0.3	0.0	0.0	0.7	0.0	1.0
Openness and Transparency	(0.0)	-	(0.0)	0.0	0.0	0.2	0.0	0.2
Totex variance	111.0	42.1	153.1	4.9	16.8	5.9	11.6	192.3
ED2 totex	306.9	42.1	349.0	126.8	100.9	54.5	30.1	661.3

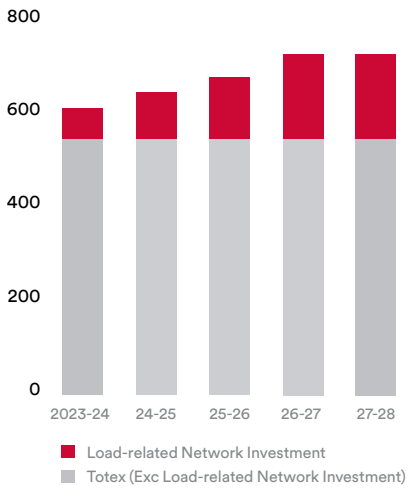
- The investments needed to facilitate decarbonisation would, on their own, increase the bill by £6.65.
- The additional resilience investment we are proposing will add a further £1.30.
- Our proposals to make the network more reliable would push it up another £0.70.
- Increased connections costs increase the bill by £1.52.
- But everywhere else we will do more for less, which, alongside significantly lower financing costs, knocks off £2.52.
- When combined with the other factors that impact customer bills, including a regulatory depreciation period that spreads the costs fairly across generations, the result is an overall increase in bills of £7.65 in our planning scenario. This represents a eight per cent bill increase in return for significantly improved service levels and a 41 per cent increase in investment.

Keeping bills low for our customers and providing value for money means constantly challenging ourselves to be more efficient in how we deliver our services. In the remainder of this section we explain how we are controlling our costs through efficiency and innovation.

It includes the reason why we are confident that these costs are efficient, representing a significant improvement on what is already an industry-leading efficiency performance. It also includes breakdowns of our main cost categories, focusing particular attention on areas where our costs are materially changing compared to the current period, descriptions of the options we have considered and justification for our choices.

For stakeholders who want to examine our cost projections and justification more closely, annex 6.2 Our Costs in Detail provides even more information.

Figure 4: annual totex expenditure profile 2023-28



1. Reflects 2023-2028 uncertainty mechanisms only

Ensuring our plan is efficient

Our long-term approach is to minimise the total cost of running our network, and in doing so deliver the best value for money for our customers.

We are confident that our plan is efficient and offers excellent value for money for customers, because we are:

- building on an unparalleled track record of maintaining costs close to a challenging benchmark over more than a decade; and
- including significant further efficiencies in our plan for customers:
  - £378m of totex efficiencies embedded in our plan;
  - £465m of decarbonisation synergy savings beyond the plan period, from 2029 to 2050; and
  - £136m of financing savings forecast in the 2023-28 period.[1]

The sub-sections below expand on these four strands of evidence.

The foundation of this plan, our existing cost base, is efficient.

Our plan builds on our existing cost base, which currently supports our 'baseline' activities. The efficiency of our current costs is therefore both:

- the first step in evaluating the efficiency of the costs in this plan; and
- an important element of our track record.

In assessing our existing cost base, we have focused on comparisons with the other companies operating in our sector. They undertake the same activities and offer the closest possible comparison.

Total cost benchmarking shows our entire cost base is efficient compared to our peers.

Total cost benchmarking is the only approach to benchmarking that fully accounts for trade-offs between different parts of the cost base. Doing so avoids the risk of these trade-offs distorting the outcome.

To provide an entirely objective, externally set measure of our cost efficiency, we have used the same 'top down totex' approach that our regulator used during the previous price control review. In addition:

- we have presented the results for each of the last two regulatory periods, covering 10 years of data in total, to illustrate our long-term approach to efficiency; and
- we have also presented results using a customer-centric cost driver that was externally endorsed at the last price control review,[2] and with and without our regulator's adjustment for labour cost differences in London and the South East.[3]

The headlines are that:

- our group level results are consistently close to an upper-quartile totex benchmark, within about one to two per cent;
- other companies have seen their efficiency fluctuate but only we have maintained efficient costs over more than ten years; and
- each of our licensees has costs below the efficiency benchmark on at least one of the two cost drivers used, demonstrating that they each have efficient costs.

The group level results supporting these headlines are set out at figures 5 and 6.

Figure 5: total cost regression benchmarks using the 2015-2023 price control review top down cost driver

	Costs over 2010-15				Costs over 2015-20			
	Regional labour cost adjustment				Regional labour cost adjustment			
	Not applied		Ofgem 2015-23 level		Not applied		Ofgem 2015-23 level	
	Efficiency	Rank	Efficiency	Rank	Efficiency	Rank	Efficiency	Rank
Northern Powergrid	**99.89%**	**2**	**101.38%**	**2**	**100.83%**	**2**	**102.27%**	**3**
ENW	107.00%	3	108.81%	4	99.91%	1	101.43%	2
WPD	113.86%	6	115.64%	6	112.92%	5	114.60%	6
UKPN	109.85%	5	106.53%	3	100.88%	3	98.14%	1
SPEN	110.32%	4	111.81%	5	112.94%	6	114.46%	5
SSEN	92.21%	1	91.67%	1	105.44%	4	104.69%	4

Figure 6: total cost regression benchmarks using customer numbers as a cost driver

	Costs over 2010-15				Costs over 2015-20			
	Regional labour cost adjustment				Regional labour cost adjustment			
	Not applied		Ofgem 2015-23 level		Not applied		Ofgem 2015-23 level	
	Efficiency	Rank	Efficiency	Rank	Efficiency	Rank	Efficiency	Rank
Northern Powergrid	**99.68%**	**1**	**101.98%**	**1**	**102.68%**	**3**	**102.47%**	**3**
ENW	104.37%	2	107.23%	3	99.69%	1	99.83%	2
WPD	113.31%	6	116.02%	6	114.43%	4	114.26%	5
UKPN	107.51%	3	105.57%	2	101.73%	2	97.77%	1
SPEN	110.62%	5	112.94%	5	114.62%	5	114.19%	4
SSEN	108.33%	4	108.09%	4	122.72%	6	119.36%	6

1. Calculated using a 5.8 per cent cost of equity – Ofgem's working assumption of 4.65 per cent would increase the saving.
2. See Ofgem's cost assessment working group study on totex benchmarking, undertaken by Frontier Economics.
3. The water regulator (and the appeal body for the water sector, the Competition and Markets Authority) has also concluded these types of adjustment can be unnecessary, depending on the cost driver used.

The disaggregated benchmarking of our cost base confirms us as a leading operator in some cost categories, and closer to the middle of the pack in others. Although the analysis does provide some useful insights, disaggregated benchmarking suffers from some serious problems, primarily that it cannot take into account the trade-offs that are essential to a business optimising its total costs, which is what matters in the end. For those reasons, we do not support its use as the basis for a regulator setting cost targets for companies. What can be said is that combining these benchmarking results supports all the same conclusions as the total cost benchmarking.

More detail supporting each of these results are set out in annex 6.3 Cost Benchmarking, including licensee level results.[1]

Our track record of achieving value for money for our customers through sustainably low long-term costs is second to none.

The results set out in figures 5 and 6 also demonstrate our unparalleled long-term track record of achieving value for money for our customers through sustainable cost control.

Our efficiency position is consistently strong; not only on our latest costs but also over a much longer period. Our efficiency record stretches back to before 2010, where we consistently benchmarked well on the basis of the costs and methods that Ofgem analysed at the time. Our performance has been sustained over many years and reflects our continued focus on minimisation of totex to deliver strong outputs for customers.

We believe that this track record means that our customers can be confident that not only can we achieve the low costs that are factored into the starting point for this plan, but we can credibly commit to continuing to achieve them.

Substantial cost efficiencies embedded

We have embedded £378m of totex efficiencies in our plan, equivalent to 11 per cent of our total 2023-28 forecast costs, while delivering more for customers.

As well as starting from an efficient base, we have also embedded sizeable efficiency benefits into the plan. We have sought to optimise our plan across the entirety of our cost base and output commitments. This has yielded totex efficiencies of £378m as shown in figure 7.[2]

Our efficiencies are rooted in our optimised approach to planning and delivery.

Our efficiency performance, both historically and in prospect, is the consequence of an active approach to system management that we have been applying for many years. At its core, it has four components.

- **Clear strategic focus** – on minimising the totex required to deliver our outputs.
- **Clarity of output objectives** – the objectives of our investment strategy are to:
  - ensure all the credible pathways to decarbonisation remain open beyond 2028;
  - maintain a resilient and reliable network, particularly in relation to extreme weather;
  - contribute to the resilience of the wider system; and
  - adhere to the legal requirements placed upon us in respect of health and safety and environmental impact, etc
- **Exhaustive optimisation at the planning stage** – we deliver our outputs at least totex by seeking out synergies across activities, plans and options, over time and across the network; and also by assessment and execution of some careful and conscious trade-offs (within the technical and legal limits we are allowed to operate in) where objectives may conflict.
- **Continued optimisation in real time** – as new information comes to light we don't just stick to the plan, but we are continually evaluating scope for further cost reduction or output enhancement.

Effective electricity system planning reflects the understanding that any investment or intervention on the network will both be long-lived, and will also impact on assets and interventions elsewhere on the network, affecting both costs and outputs. This creates the need to, at its core, solve a highly complex spatial optimisation problem over multiple time periods, which requires high skills and enabling technologies to be deployed, both at the planning stage and in real time.

While the need to invest in the decarbonisation of the energy system at the scale we are contemplating is new, our approach to minimising the costs of doing so (in combination with all other costs on the system) has been developed over many years and gives us confidence that our plan is efficient. Indeed, we have actively sought out the 'two-for-one' benefits that the investment in decarbonisation can create on the system as a whole.

Figure 7: totex efficiencies embedded in our plan

Totex efficiencies	2023-28 benefit £m	Description
Volume efficiencies	**94.2**	Synergistic and innovative solutions in our core asset renewal programme
Unit cost efficiencies	**31.8**	Unit cost efficiencies relative to our 2025-23 unit costs
Flexibility and smart grid solutions	**155.5**	Benefits factored into our investment plan from using flexibility first and smart grid solutions
Core asset plan targeting	**65.8**	Enhanced monitoring to improve targeting of asset refurbishment, unrelated to decarbonisation
Service improvement	**31.1**	While delivering higher levels of service across all of our business plan, 8 of our 12 business plan sections are doing that for less overall cost
2023-28 plan – embedded efficiencies	**378.4**	**Equivalent to 11% of our forecast totex**

1. We have absorbed within this assessment some region-specific factors that add to our direct costs, such as operating in sparse areas and also with unique network configurations. Depending on how our regulator assesses costs, these factors could become relevant later in the price review.
2. More detail on our embedded cost efficiencies is set out in annex 6.2: Our costs in detail.

Long-term synergy savings

Our plan optimises asset renewal requirements with decarbonisation priorities...

As well as the cost savings we have factored into our plan for 2023-28, the way we respond to decarbonisation presents many 'two-for-one' opportunities for our customers beyond 2028 – provided that we maximise synergies between reinforcement and asset renewal investment.

If we were setting our plan without the future imperatives of net zero, we would plan to spend approximately £863m on asset renewal – which we term our baseline asset renewal scenario. This would inevitably create some additional capacity, for example because some assets are only available in larger sizes today than when they were first installed. But this would be limited; and not necessarily that well targeted.

Instead we have developed an optimised asset renewal plan, which will create significant additional capacity in the areas that most need it; and limit the increase in total cost to £124m by minimising asset renewal expenditure on those areas where the future requirements for additional capacity are less certain. Specifically, we will:

- use the latest data from network monitoring and analytics to ensure effective identification of priorities, whichever pathway to net zero is followed, and deploy capacity increasing solutions such as full substation replacements, overhead line rebuilds and circuit overlays, where the network constraints are the most onerous and will bite soonest under any scenario; and
- defer asset replacement where there is less certainty over future network capacity requirements, and where we judge we can accept and manage the risk of ageing assets through enhanced inspections or monitoring combined with asset life extension techniques.

...to create £465m of decarbonisation synergy savings between 2028 and 2050.

Our optimised asset renewal and enhancement plan will cost £987m and is the basis for the costs set out in this plan; a net increase of only £124m compared to our baseline plan.

Figure 8: cost-benefit of our optimised plan (relative to our baseline plan)

Costs £m	Approach		Variance
	Baseline plan	Optimised plan	
2023-28	863	987	124
Post-ED2: 2028-50	589	-	(589)
Total	**1,452**	**987**	**(465)**

The additional capacity it will deliver will future-proof sections of our network that, if not reinforced now, would require expenditure of up to £589m between 2028 and 2050; reinforcement that we can confidently predict will be required over this time frame under the government's 10-point plan for net zero.

This future saving of £589m for an £124m investment in the coming five years represents a real-terms return of £465m, which translates to about a 375 per cent financial return for our customers.

In the context of the overwhelming feedback from our stakeholders that we need to meet the net zero challenge, we think this trade-off is worthwhile. Much of this additional risk falls directly on us, and so is ours to accept and manage (provided Ofgem allows a reasonable rate of return on our investments).

Even where part of the risk falls on our customers, for example if old assets cause more power cuts, we are exposed to these outcomes through Ofgem's incentive schemes and so our interests as asset managers are fully aligned with those of our customers.

Further savings from financing

Our plan also includes £136m of financing savings in the period.

Ofgem sets a number of key financial parameters in its determinations that have a material impact on allowed revenue. The parameters for 2023-28 will lead to lower financing costs – reflecting the savings that we and other companies expect to be able to make in capital markets.

Figure 9 summarises the impact of each key financial parameter that totals a £27m annual reduction in allowed revenue (£136m over the 2023-28 period).

Our estimate of the potential savings based on a 5.8 per cent cost of equity is lower than it would be using Ofgem's working assumption of 4.65 per cent, since we do not think that equity finance can be obtained as cheaply as Ofgem has assumed in its working assumption (in businesses such as ours, which also have a large amount of debt finance). Further information on financing parameters is set out in our Financing section.

Figure 9: savings from key financing assumptions [1]

Key financing assumptions	2015-23		2023-28	Revenue impact (p.a.) £m
Inflation basis	*RPI*	*CPIH*[1]	*CPIH*	
Allowed cost of equity	6.00%	6.98%	5.80%	(15.4)
Allowed cost of debt	2.03%	3.01%	2.09%	(20.6)
Gearing	65%	65%	60%	8.7
Total				**(27.3)**

1. See Ofgem, 2004, DPCR4 final proposals, page 77; rebased to use the Office for National Statistics' Consumer Prices Index including owner occupiers' housing costs (CPIH) rather than the Retail Price Index (RPI), assuming a 100bps delta between the two measures.

Investing in the network

At £349.0m, average annual investment will be £153.1m higher than in the current period, primarily to enable the decarbonisation transition.

Network investment is by far the largest component of our cost base. It accounts for over half of totex. We have made it clear throughout this plan that the transformation in energy use that is part of the decarbonisation path that our nation is taking has a major impact on our investment plans.

While decarbonisation is the major driver of the increase in investment, around £1.1bn of the £1.7bn of expenditure needs to be deployed around the network to ensure that:

- the asset base stays in good condition for the long term;
- reliability and resilience are increased, particularly to severe weather;
- safety and other legal standards are maintained; and
- the environment is protected.

In developing our plans, we have continued our approach to minimising totex to deliver our outputs. Two key themes run throughout the cost categories below: first, they result from a detailed optimisation of our costs, reflecting the different synergies and trade-offs that exist, both across the network and over time. Second, once that plan has been developed, we keep driving efficiency in our plan by assessing options to select the best approach to deliver, and by continuing our approach of monitoring and driving down unit costs.

The expenditure covered within the network investment category underpins our delivery commitments in all 12 output areas. In particular, the primary drivers of the improvements we are targeting are in relation to decarbonisation, asset resilience, connections and reliability and availability.

In 2015-23 we expect to spend £195.9m p.a. on network investment, which contributes to our overall position as the most efficient group in our sector on a totex basis. Under our planning scenario, we expect these investments to increase by £153.1m p.a. (78.2 per cent) in the 2023-28 period relative to the current period. This increase is mainly driven by the need for reinforcement and operational IT and telecommunications (IT&T) investment to enable decarbonisation.

Our network investment for the 2023-28 period is broken down across Ofgem's cost categories as shown in figure 10.[2] In total, £210.7m of the total £1.7bn network investment is covered by uncertainty mechanisms (12 per cent) relating to decarbonisation uptake and looped services within reinforcement (£110.7m) and service upgrades in connections (£100.0m).

The profile of our network investment rises through the period driven by load related investment following the profile of low carbon technology uptake through to 2028. Non-load investment is broadly flat with a decreasing profile in non-load other expenditure offsetting an increasing profile in asset renewal. The decreasing profile in non-load other is a result of our plan being front-end loaded on two major programmes – PCBs and HV network automation/remote control. The first of these is forecast to complete by 2025 in line with legislation and the second is phased to maximise customer reliability benefits in the period.

In order to ensure that our overall total costs are efficient, we focus on making investment decisions that deliver synergies across our various obligations, achieving multiple benefits wherever possible. In order to identify these opportunities and target our investments, we utilise a number of analytical techniques in determining the level of network investment needed. These include:

- asset risk modelling using common network asset indices methodology (CNAIM) that drives 65 per cent of asset replacement expenditure;
- statistical population modelling;
- historical performance analysis;
- socio-demographic analysis;
- techno-economic intervention modelling; and
- analysis of the external environment.

Our use of data and analytics will increase very significantly in the coming period. In particular, we will be deploying much more granular network monitoring and intelligence in order to monitor and pinpoint emerging trends and requirements: see Network Visibility Strategy within Annex 4.2 DSO Strategy. This will enable us to make the most of flexibility in energy use from customers and integrate smart grid solutions into our network operations. These will be important tools in the management of uncertainty and optimisation of interventions enabling us to get ahead, and stay ahead, of the curve connecting up to 831k electric vehicles and 251k heat pumps in line with our best view planning scenario in the period. This will allow our customers to reduce their carbon emissions and maximise the use of low carbon energy on our network.

We have carried out extensive optioneering on every major category of network investment. In each area, we have identified the range of feasible investment options or strategies. Having eliminated any options that do not deliver acceptable outcomes, we have weighed up the costs and benefits, factoring in the stakeholder feedback we have received. We select the option that delivers the best overall value for money, including any benefits associated with keeping open options in an area where there is significant uncertainty. This detailed analysis is set out on our Engineering Justification Papers.

Key drivers of unit cost efficiency are our contracting and procurement strategies because much of the activity involved in our network investments is carried out by contractors or a large proportion of the costs are associated with the supply of major pieces of equipment. This brings the benefits of competitive pressure and market innovation into our cost base and helps us manage our resource needs across peaks and troughs of network investment. It also gives the option to bring in the specialist expertise and equipment that we might need for a particular set of investments, without customers having to fund the upfront costs of training and costly machinery which we may not need to use very often. On the other hand, if is more economic to bring the work in-house, we have the option to do that. See our delivery strategy annex.

2. Includes Rising and Lateral Mains.

Figure 10: network investment costs

Cost area £m	2023-28 total ex-ante	2023-28 total UM	2023-28 total Totex	2023-28 average	2015-23 average	Variance £	Variance %
Load related expenditure	477.8	210.7	688.5	137.7	26.7	111.0	415.9%
Reinforcement	405.0	110.7	515.7	103.1	21.1	82.0	388.8%
Connections	72.8	100.0	172.8	34.6	5.6	29.0	517.9%
Non-load: asset renewal	677.9	0.0	677.9	135.5	121.4	14.1	11.6%
Refurbishment	72.7	0.0	72.7	14.5	14.9	(0.4)	(2.7%)
Asset replacement (inc. RLM)	573.6	0.0	573.6	114.7	101.7	13.0	12.8%
Civil works	31.6	0.0	31.6	6.3	4.8	1.5	31.3%
Non-load: other	379.0	0.0	379.0	75.8	47.8	28.0	58.6%
Operational IT and telecoms	101.4	0.0	101.4	20.3	6.7	13.6	203.0%
Flood mitigation	6.1	0.0	6.1	1.2	6.2	(5.0)	(80.6%)
Quality of supply (inc. WSC)	69.2	0.0	69.2	13.9	4.8	9.1	189.6%
Environmental	59.4	0.0	59.4	11.8	3.2	8.6	268.8%
Legal and safety	50.0	0.0	50.0	10.0	6.9	3.1	44.9%
Overhead clearances	24.5	0.0	24.5	4.9	1.2	3.7	308.3%
Diversions and easements	68.4	0.0	68.4	13.7	12.7	1.0	7.9%
Other	0.0	0.0	0.0	0.0	6.1	(6.1)	(100.0%)
Network investment	**1,534.7**	**210.7**	**1,745.4**	**349.0**	**195.9**	**153.1**	**78.2%**

Load-related expenditure will increase by £111.0m annually compared to 2015-23 as a result of the impact of decarbonisation on projected reinforcement requirements and connections activity.

Decarbonisation represents the single largest cost driver for 2023-28 relative to the current period. Our planning scenario for enabling net zero drives our forecast reinforcement to increase by 389 per cent, equivalent to £82.0m p.a. of which £22.1m is subject uncertainty mechanisms for decarbonisation uptake and looped services (see the managing uncertainty and risk section of our plan).

We will take a flexibility-first approach to network investment through prioritising flexibility-enabling actions as set out in our DSO strategy. Our plan contains a blend of price-driven and DNO-contracted customer flexibility, smart solutions and conventional network reinforcement to deliver the best value for our customers.

- We will invest in flexibility enablers as part of our DSO Strategy investment of £92.4m, which includes £21.1m in low voltage (LV) monitoring to increase visibility of network conditions and capacity constraints.
- We have assumed that customers will be flexible in their electricity usage in response to price signals from suppliers and use of smart management systems, which help to smooth the demand profile saving £107.9m in avoided reinforcement costs.
- We will manage constraints by deploying DNO-contracted customer flexibility of £5.0m and network flexibility through £8.4m of smart solutions. These actions combined with the LV monitoring proposed in our DSO Strategy save £155.5m in network costs during the 2023–28 period.
- We will build additional capacity where there is more certainty in future growth through £453.5m of load-driven network reinforcement and £62.1m of fault-level investment.[1]

We will upgrade our approach to planning our HV and LV networks in the 2023-28 period to ensure we select the right network areas for intervention and then select the optimal solution for them. Our process will build on richer sets of data from enhanced network visibility, forecasting of LCT growth, asset health and availability of flexibility. This data combined with analytical assessments will identify areas for investment. Using that information, the right selection of customer flexibility, smart grid solutions or network reinforcement can be deployed.

The synergies available vary across the network, and we are actively seeking these out and optimising them. For example, the low voltage infrastructure has a very high probability of requiring additional capacity in all plausible net zero pathways and over half of our reinforcement investment is to increase capacity on the low voltage network. This will provide customers with the necessary infrastructure to maximise use of low carbon energy, allowing contribution to whole system flexibility and delivering short-term losses benefits, so the risk of stranded assets is very low.

In contrast, the synergies are less widespread at the higher voltage levels, and this has required us to critically assess potential high-value extra high voltage (EHV) projects to ensure they are needed in multiple decarbonisation pathways in order to minimise asset stranding risk.

Our analysis and discussion around our decarbonisation supporting investment plans are set out in more detail within the Scenarios and Investment section of our plan and its accompanying annex Scenarios and investment (annex 4.1).

Our within price control, DUoS funded connections costs are fundamentally driven by projections of customer behaviour in the region.

1. Including customer flexibility and smart grid solutions

Decarbonisation and net zero will have a material impact on both the volumes and types of connections we expect to be making in the period, and therefore the value of reinforcement required. We are already seeing increased connections-driven reinforcement activity in the current period even without the increased stimulus that may come from Ofgem's access charging reforms. Our forecasts align to our latest forward view of accepted connections into the 2023-28 period with forecasts for LCT growth overlaid in line with our planning scenario.

A major driver of our connections costs is our forecast for the socialisation of service upgrades at customers' properties to a 100 amp standard, making them net zero ready for the connection of an electric vehicle and a heat pump. The total cost of this activity in our plan is £23.1m per annum. Only £3.1m of costs per annum are included in our baseline ex-ante view of totex in line with levels of LCT update we are seeing on our network today. The remainder, up to our planning scenario, is proposed to flow through a 'pay-as-you-go' uncertainty mechanism according to levels of LCT uptake in the period. More detail on this is set out in our annex Socialisation of costs (annex 4.5).

Investment in asset renewal, driven by our condition and asset risk management approach, will be £135.5m per annum.

The core objective of our asset renewal programme is to maintain the underlying condition of the asset base over the long term and manage the risk associated with asset failure. This activity is central to ensuring we meet our Electricity Safety, Quality and Continuity Regulations (ESQCR) obligations.

In the context of decarbonisation, we are targeting an additional benefit: to help reduce the long-run cost of increased electrification. To do that we will target asset replacement at the highest priority asset risks, and where we are investing, we will assess the likelihood of that part of the network experiencing capacity constraints along the decarbonisation pathway out to 2050. This will deliver acceptable levels of asset resilience with more than half of the investment providing future capacity benefits for decarbonisation.

Our projections assume that we will encounter situations where an asset is a candidate for renewal investment, but there is uncertainty in future network capacity requirements. In these circumstances we plan to manage the risk through enhanced inspections or monitoring combined with asset life extension techniques, deferring asset replacement.

Throughout our programme our general approach will be to look to release network capacity by installing upsized assets where increased capacity can be provided at low incremental cost.

We use extensive condition and performance monitoring to inform our investment decisions and ensure timely replacement. Across all asset classes we considered the following options, which are discussed in more detail across our suite of Engineering Justification Papers (EJPs):

- replace on failure – increasing risk profile impacting fault volumes and associated costs;
- refurbishment – preserving the asset to its original design performance by means of replacement of components on a like-for-like basis;
- risk-based replacement – preventing an increase in faults and associated rise in fault repair costs. In this case, assets are returned to the start of the lifecycle and often replaced with more capable, higher capacity equivalent assets; and
- bespoke options specific to either the project or the asset in question.

Management of our overhead lines is our single largest asset renewal investment area and is driving a 55.7 per cent increase in cost.

At this point in our network's lifecycle the age and health profile of our overhead line wood pole asset base is the key driver of our asset renewal costs and the dominant feature of the risk profile across all voltages.

- A significant proportion of the wood pole population is more than 50 years old.
- Due to this profile, risk within this asset base is projected to continue to increase by a further 29 per cent by the end of the 2023-28 period without intervention.
- We also have a large population of steel poles supporting the LV overhead network, which carry a significantly more expensive unit cost relative to wooden structures (costing three times more on average to replace).

We are proposing to adopt a 15-year programme to manage the pole population condition and begin to bring risk down over the longer term.

- We will use innovative pole condition assessments using Thor hammer technology to extend asset lives, replacing individual poles where condition and risk are unacceptable.
- We will replace overhead line circuits in areas where low carbon technology (LCT) uptake is high.

Low-performing legacy cable types mean that our underground cables require investment of £34.8m per annum to maintain reliability.

Our low voltage underground networks are poorly performing in terms of fault rates compared to other DNOs due to the proportion of some relatively unreliable legacy cable types:

- Our Northeast population of Consac cables makes up only 12 per cent of the network but accounts for more than 50 per cent of LV underground network faults.
- Yorkshire's population of obsolete aluminium neutral waveform cables also drives a relatively high fault rate performance

Widespread low voltage monitoring will enable more 'surgical' interventions to address condition and performance issues – enabling us to address more circuits than under the current approach.

We are targeting maintaining existing fault rates at HV-132kV through replacement of poorly performing cable sections and use of enhanced partial discharge monitoring.

We will manage the environmental impact of our fluid-filled cables by increasing the use of perfluorocarbon tracer (PFT) tagging and exploring the use of self-healing cable technology.

Our approach to managing our substation plant expands our approach to asset life extension.

We will expand our approach and implement innovative ways of achieving life extension through the use of enhanced asset monitoring such as online dissolved gas analysis (DGA) saving £2.9m in the period. We will also prioritise replacement of assets that also deliver capacity increases required by our net zero pathways.

We will continue to target the replacement of individual distribution substation components wherever practical and economic with consideration of full substation replacement undertaken on an as-needed basis only.

There is a change in our protection strategy as we start to replace early microprocessor relays.

Replacement of protection relays has historically occurred at the same time as the plant they are associated with due to the asset life of the relay technology being used. One-off and standalone replacement of relays was limited to poorly performing relays.

The early microprocessor relays have a lower asset life expectancy compared to their electrometrical counterparts and therefore cannot be replaced at the same time as their associated plant. 2023-28 starts to see the replacement of these relays on a risk basis at a cost of £23.7m.

Our approach to building and civil assets continues to be to replace deteriorated assets that are beyond economic repair requiring an investment of £6.3m per annum.

Substation civil elements will always deteriorate with age and exposure to the weather. Failure to maintain the integrity of substation roofs, doors and walls could lead to unrestricted access, which in turn gives rise to an increase in the risk of death or serious injury to a member of the public from contact with live electrical plant.

Substation civil assets are visually inspected for obvious signs of deterioration annually, with a more thorough dedicated civil inspection carried out on a five-year cycle. These inspections drive our intervention programmes.

The vast majority of our civil assets are in good condition and are not showing obvious signs of deterioration. Often the first sign of issues is water penetration into the interior fabric of the substation; this can cause issues if the leak is onto live electrical equipment and also accelerate the corrosion of the plant.

Similarly, the majority of substation doors and boundary fences are in good condition. These assets are often the first line of defence in preventing third party access to our equipment and must be kept in good condition to maintain compliance with our legal obligations.

Investment in operational telecoms increases by £13.6m per annum compared to 2015-23 driven by key enabling initiatives in our DSO Strategy and resilience improvements.

Our investments will build on our large-scale operational telecoms work carried out in the 2015-23 period concentrating on improving the resilience of the network to meet future and emerging requirements and supporting the DSO transition.

As with all infrastructure asset bases there is a baseline investment requirement for the refurbishment and replacement of equipment. Operational telecoms is no different and we must maintain our existing towers, microwave links, telecoms batteries and pilot wire infrastructure.

We are also overlaying the baseline requirement with the need to improve the resilience of the network via additional communication links providing increased capacity and redundancy.

Our existing emergency voice communication is expected to be retired during the period so we will build a resilient private voice network across the network utilising digital mobile radio (DMR) technology. This is used in major power outage situations or Black Start events where existing commercial mobile voice communications is not able to provide voice service for operational activities.

As part of our plan we are embarking on a multi-period programme to enhance our low frequency demand disconnection relay schemes to reduce the unplanned interruption impact on customers resulting from frequency excursions and mitigate impact of generation on performance, such as the event the UK experienced in August 2019.

The need for more reliable local low voltage networks will increase due to the electrification of the transport and heat sectors. This means improvements through conventional and innovative technology are an important part of our plan. We will use ground-breaking pre-fault detection and data analytics to target deployment of fault management devices and replacement of poor-performing assets.

Our flood defence investment is £5.0m per annum lower than the current period due to the level of resilience that we have already achieved.

In response to stakeholder feedback we have invested significantly in flood defences in the current and previous price control period. Our strong delivery in this area means our investment in the next period can reduce while continuing to increase the level of overall flood resilience.

Flood defence investment decisions are determined via an Energy Networks Association (ENA) risk-based methodology. It is prescriptive in terms of the level of protection to be applied for substations at risk of flooding based on the consequence of failure.

By the end of the 2015-23 period our network will be compliant with the defences prescribed by the methodology - Engineering Technology Report (ETR) 138. We plan to make incremental enhancements to some existing major substation defences to maintain them to revised flood risk assessments and to increase them to a higher level of resilience.

We will defend distribution substations that have higher consequence of failure. The protection of distribution substations falls outside the scope of ETR 138; however, where a specific requirement is identified for a particular substation (e.g. where a substation has been previously affected by a flood event or a substation that feeds critical infrastructure) flood mitigation measures will be deployed.

We will invest £9.1m more per annum compared to the current period in quality of supply improvements delivered through technology deployment and targeted network upgrades.

We will install significantly higher volumes of remote switching and network automation on our high voltage networks to improve service levels for customers and bridge the gap to the capabilities of other networks (see the Reliability and Availability section).

The automation will be targeted at our worst-performing circuits, thereby simultaneously improving services for our customers that receive lower than average service levels.

The automation programme will involve 8,600 automated switches at a total cost of £64.8m. This will be a mixture of ground- and pole-mounted automated switches, which we expect to split 70:30.

A further £4.3m of investment will be directed towards improvements for our worst-served customers (WSC).

In order to tackle performance for our population of 2,835 WSCs, we have designed a £4.3m scheme that will upgrade assets supplying our rural communities and install automation to help restore supplies faster. This will significantly improve the level of service they receive and reduce the number of interruptions they experience by at least 25 per cent.

Environmental costs will increase by £8.6m per annum to deliver against expanded obligations and support decarbonisation.

Compliance with polychlorinated biphenyls (PCBs) legislation is the largest increase in costs within this area.

- We have followed the ENA-developed statistical model to evaluate the likely volumes of equipment we will have to replace and estimate that 7,901[1] pole-mounted transformers will need to be removed from the network at a cost of £42.8m.
- This includes the replacement of these units with amorphous core equivalents, which will reduce losses and improve the network's efficiency. This carries an incremental cost of £12.8m (included within the £42.8m) and is proven to be cost-effective over the life of the asset via Cost Benefit Analysis (see CBA 25 100kVA 1ph PMT Amorphous and CBA 26 315kVA 3ph PMT amorphous).
- These costs are only present in the first three years of the period as we are forecasting to remove all contaminated equipment by 2025 in line with the deadline in the legislation.

We will incur costs in relation to our oil pollution mitigation scheme. Latest environmental surveys have highlighted a significant number of existing transformer bunds that have experienced a material loss of integrity and are no longer fit for purpose. We will reline the existing bunds with innovative coating that will completely reinstate the bunds' integrity.

Our plan continues our successful stakeholder-led programme to underground overhead lines in National Parks and Areas of Outstanding Natural Beauty (AONB) at the same run-rate as 2015-23.

Further details can be found in our Environmental Action Plan (Annex 4.6).

Delivering on our legal obligations and operating a network that is safe for operators and the public requires a £3.1m per annum increase in expenditure compared to the current period.

Clearance infringements are identified through our inspection programmes. Our latest data shows that an investment of £4.9m per annum is required in 2023-28 to comply with our ESQCR obligations to maintain clearances to overhead lines representing nearly a 300 per cent increase on 2015-23 levels of expenditure. We will undertake further light detection and ranging (LiDAR) surveys to enhance our data availability and quality enabling us to efficiently identify clearance issues and target their resolution. The solutions we adopt to resolve clearances will factor in the capacity requirements for net zero and the need to de-loop services as required.

We will continue our risk-based management strategy for asbestos management. Our interventions will continue to be focused on the asbestos that poses the greatest risk to operators working with our substations.

Our approaches to fire prevention and mitigation, substation security and metal theft remain unchanged to the current period.

1. Excludes synergy of 500 units delivered through our reinforcement programme.
2. LiDAR is a technology used to create high-resolution models of ground elevation.

Operating our network efficiently

Figure 11: network operating costs (NOCs)

Cost £m	2023-28 total	2023-28 average	2015-23 average	Variance £	Variance %
Faults	429.6	85.9	85.8	0.1	0.1%
Inspections and maintenance	124.1	24.8	19.6	5.2	26.5%
Tree cutting	55.8	11.2	9.4	1.8	19.1%
Smart meter interventions	5.9	1.2	4.2	(3.0)	(71.4%)
Other NOCs	18.4	3.7	2.9	0.8	27.6%
Network operating costs	633.8	126.8	121.9	4.9	4.0%

In the 2015-23 period, we expect to spend £126.8m per annum on NOCs, which represents an efficient starting point for our 2023-28 business plan costs. As we show in Annex 6.2, Cost Benchmarking, we are a leading operator on a totex basis, which is the most robust way to evaluate efficiency. The NOCs category is an example of where, taking those costs in isolation, we benchmark in the 'middle of the pack' on a disaggregated basis but that 'penalises' money we spend in this category that saves money elsewhere to contribute to efficient aggregate total expenditure.

In the 2023-28 period, we expect our NOCs to marginally increase by £4.9m (4.0 per cent) p.a. driven by increases in inspections and maintenance, and tree cutting costs.

The profile of NOCs across the period is almost entirely flat profiled. There are some minor exceptions to this, for example smart meter intervention costs are only present in the first 3 years aligning with projected national roll-out completion targets. Similarly, our plan includes periodic network inspection costs such as LiDAR to survey our overhead lines which only occurs in two of the five years.

Our plan holds fault costs broadly flat compared to the 2015-23 period while targeting significant service improvements.

Faults expenditure is the largest component of NOCs accounting for about 68 per cent of the total.

Our plan holds fault costs flat in the 2023-28 period (marginal 0.1 per cent increase) while delivering significant service improvements as set out in our Reliability and Availability plans. Our plan targets 12 per cent fewer and 25 per cent shorter power cuts, a 50 per cent reduction in the number of customers experiencing 12-hour faults and a 15 per cent reduction in six-hour faults on our network. These major service improvements will be funded by driving efficiencies whilst allowing us to hold our fault costs flat to current levels.

Our plans in this area include some exciting initiatives to keep downward pressure on costs and improve service levels. That includes making more use of new technology that will improve our ability to respond to power cuts, including the deployment of technology that will enable early warning of faults and more precise fault location and the use of more SilentPower battery generators.

When disaggregated, our fault costs are in line with the industry median costs. We will maintain our efficient position, whilst at the same time delivering significant improvements and managing rising cost pressures. Our fault costs are largely driven by our underground network; low voltage and high voltage underground faults make up 75 per cent of our total network operating costs. Time and cost is invested in fault location and excavation activities. Our plan assumes investment in low voltage monitoring equipment will yield efficiencies in fault location, reducing the costs associated with that element, enabling us to absorb cost increases in the use of generation to restore power more quickly.

Inspections and maintenance will increase by £5.2m p.a. to facilitate additional domestic property safety inspections.

We expect that our planned inspections expenditure will be £6.7m p.a., £2.1m (46.8 per cent) higher than the average in the 2015-23 period. The two main areas of increased cost pressure are:

- The addition of new activity for domestic cut-out inspections, adding £4.8m of new expenditure to our plan (£1.0m p.a.); and
- Moving from a simple time-based assessment every 10 years to a condition and risk-based assessment through more frequent inspections using innovative Thor hammer technology. While this will add £0.4m to our inspection costs, we estimate that this change in approach will deliver net efficiency savings of £41.6m in the period from the deferral of asset replacement.

Our planned maintenance expenditure is expected to be £18.1m per annum, £3.1m (20.5 per cent) higher than the average in the 2015-23 period. This is due the increased use of perfluorocarbon tracer (PFT) technology and innovative self-healing cable additives to identify and remediate leaks in fluid filled cables as set out in our Environmental Action Plan (Annex 4.6). These approaches drive additional costs of £3.9m and £0.8m p.a. respectively but unlock net efficiency savings of £34.0m and £6.3m respectively over the period through reduced asset replacement.

Vegetation management costs will increase to address the emerging risk associated with ash tree dieback.

Vegetation management costs are £1.8m (19.1 per cent) p.a. higher than 2015-23, driven by the need to do more work to address the impact of ash tree dieback (£0.6m p.a. increase) and the incremental costs to manage clearances to tower bases and substations (£0.5m increase). Our costs include the introduction of LiDAR surveys allowing us to drive efficiencies by better targeting our vegetation management works. The surveys will cost £3.5m driving net savings of £0.7m in foot patrols and an estimated £10.4m in ash tree dieback costs whilst also enabling lower cut volumes beyond 2028.

The smart meter roll-out has been extended beyond the original 2020 deadline to June 2025. During the roll-out, meter operators identify circumstances which would prevent smart meters being fitted at a customer's premises that require DNO intervention. We expect to spend £5.9m in total and £2.0m p.a. resolving barriers to facilitate the smart meter roll-out for the first three years to its completion (equivalent to an annual average cost of £1.2m over the whole period, some £3.0m p.a. lower than in the current period).

Supporting our business

Figure 12: indirect costs and non-operational investment

Cost £m	2023-28 total	2023-28 average	2015-23 average	Variance £	Variance %
Incremental indirect costs associated with decarbonisation:					
Closely associated costs	84.0	16.8	0.0	16.8	N/A
Business support costs	13.0	2.6	0.0	2.6	N/A
Non-operational investment	40.0	8.0	0.0	8.0	N/A
Sub total – decarbonisation	**137.0**	**27.4**	**0.0**	**27.4**	**N/A**
Closely associated costs	504.6	100.9	84.1	16.8	20.0%
Business support costs	272.7	54.5	48.6	5.9	12.1%
Non-operational investment	150.0	30.1	18.5	11.6	62.7%
Total costs	**927.3**	**185.5**	**151.2**	**34.3**	**22.7%**

Our indirect costs and non-operational investment in 2023-28 will be £185.5m per annum, £34.3m higher compared to the current period. Our core indirect costs are actually coming down slightly (as shown in figure 13) as we find more efficient ways to provide a better service to our customers.

The overall uplift in support costs is driven by the need to support new DSO activities and significantly higher activity levels for decarbonisation. Overall new support costs for decarbonisation account for the vast majority (80 per cent) of the increase at £27.4m per annum.

This category of costs is one in which our track record on efficiency benchmarks strongly. Taking these costs in isolation, we benchmark as the leader in the industry on a disaggregated basis, partly because some of the benefits of expenditure we make elsewhere manifesting themselves as savings in this area. As ever, we encourage our regulator to focus on assessing an efficient aggregate totex - Annex 6.3: Cost Benchmarking provides more details on our efficiency assessment.

Decarbonisation-related indirects drive efficiencies across the whole system on the path to net zero.

Our decarbonisation strategy is to embrace and manage uncertainty to ensure all credible pathways to net zero remain open. Central to this is a flexibility-first approach, enabled through a blend of smart grid and DSO initiatives, smart grid solutions, customer flexibility and targeted network reinforcement. This approach requires an additional £27.4m of indirect costs per year compared with current levels. These costs fall broadly into four types:

- costs to establish and operate DSO to enable customers to make the right choices (£12.4m);
- costs to support the targeted investment in reinforcement (£11.4m);
- costs to support the service upgrade programme (£2.2m);
- costs incurred in remaining on our own path to net zero as an organisation (£1.0m); and
- costs of increasing work within our communities (£0.4m).

Our continued transition to DSO requires investment in non-operational IT systems and bringing additional individuals into the business to ensure we have the right skills and tools to deliver the changes required. As our DSO Strategy shows, the establishment of an active DSO is a key enabler of customer flexibility and has the potential to generate £155.5m savings of investment on the grid. Consequently, the costs incurred here have the important purpose of driving down the total costs of achieving net zero.

In addition, the scale of the increase in our network investment programme (£153.1m p.a., an uplift of about 78 per cent) does mean that we need to increase our indirect costs in order to support these new levels of activity. It is critical that this net zero transformation proceeds efficiently and that customers can connect LCTs to our network. Ensuring we have sufficient network design, control centre, stores and engineering capacity to accommodate activity levels in line with our planning scenario is a vital enabler to achieve that objective. Many of these resources are technical in nature, are scarce in the labour market and require significant periods of training. Our plan is therefore set to mitigate the risk of these resources becoming a bottleneck to the required levels of network investment by ensuring that we have appropriate capacity in place.

Another key feature of decarbonisation-related indirect expenditures is that they drive a wider efficiency benefit. DSO-related costs create the opportunity to save significant investment during 2023-28 and beyond; while the indirect costs associated with the enhanced investment programme are necessary to ensure that the programme is efficiently planned and continuously optimised.

In figure 13 we show the detailed breakdown of where we expect to require the £34.3m of increased expenditure and what it will support. As well as the increase in costs associated with decarbonisation, we will also spend more on activities where stakeholders have made it clear we should play a more prominent role in the future, such as providing enhanced services for vulnerable customers and taking greater action in our communities.

Our stakeholders have been clear that we must do more than just keep the lights on.

As part of supporting our reliability improvement plans, we will invest £16.6m in fault management and location devices to support service improvements on our LV network.

Figure 13: indirect costs and non-operational investment – detailed breakdown

Cost £m	2023-28 total	2023-28 average	2015-23 average	Variance	
				£	%
Core indirect costs	741.7	148.4	149.3	(0.9)	-0.6%
Incremental indirect costs associated with decarbonisation:					
Indirect costs in support of the DSO	62.0	12.4	0.0	12.4	-
Indirect costs to support the rollout of the additional investment in the network	57.0	11.4	0.0	11.4	-
Indirect costs to support the service upgrades programme	11.0	2.2	0.0	2.2	-
Investment in electric vehicles	4.5	0.9	0.0	0.9	-
Investment to reduce building and substation energy use	0.5	0.1	0.0	0.1	-
Costs in support of communities	2.0	0.4	0.0	0.4	-
Subtotal – costs driven by decarbonisation	137.0	27.4	0.0	27.4	-
Additional tools and instruments in support of low voltage automation	16.6	3.3	0.0	3.3	-
Costs in support of vulnerable customers	19.5	3.9	0.8	3.1	387.5%
Costs in support of communities	6.0	1.2	0.6	0.6	100.0%
Indirect costs for the Customer Engagement Group	3.5	0.7	0.5	0.2	40.0%
Costs for a training centre	3.0	0.6	0.0	0.6	-
Base indirect costs and non-op capex	**927.3**	**185.5**	**151.2**	**34.3**	**22.7%**

More broadly, our stakeholders (including our regulator) have been explicit that in 2023-28 we must play a fuller and more prominent role in our region. We have developed an ambitious set of proposals to deliver on this, which are set out in the Openness and Transparency, Communities, and Vulnerable Customers sections of our plan. Meeting this step-up in expectations means that we will invest more in these areas than we have done previously. We will:

- formalise, enhance and increase the scale of the services we currently provide to vulnerable customers, rolling out our programmes more widely across our regions and introducing new measures to ensure that no one is left behind as we transition to net zero – spending around £3.1m p.a. more than we do now (nearly a five-fold increase);
- be a force for good in our communities, leveraging our position in our region to make a positive contribution. Our plan more than doubles our investment in social initiatives when we are completing major investment works in our communities, including tree planting, support for local schools around STEM, employability skills, energy efficiency and support for community energy groups;
- retain our Consumer Engagement Group (CEG) on a permanent basis to scrutinise the delivery of our business plan commitments. This will cost around £0.7m p.a.

Having tested these plans with our stakeholders we believe that, although this represents a material increase in expenditure, our programme matches their required levels of ambition, targets the areas they care most about and delivers excellent value for money.

Totex figures are stated on a basis consistent with Ofgem's business plan financial model, the following adjustments are included and have been applied to the activities to which they relate:

- deduction of disallowed related party margins
- inclusion of cash proceeds from sales of assets and scrap
- inclusion of revenue associated with value added services (DRS 8)

Non-activity based costs

Non-activity based costs tend to be non-discretionary and not directly driven by work on our network.

Overall, we expect there to be a 16 per cent reduction in our non-activity costs in 2023-28 relative to 2015-23. This is mainly driven by a significant reduction in costs associated with in pension deficit funding costs due to efficient management of our defined benefit scheme.

A full breakdown of these costs is shown in Our costs in detail (annex 6.3).

Pass-through costs

- Licence fees – Ofgem determines how much we pay for our distribution licence fee. Annual license fees have increased by 14% relative to the 2015-23 annual average assuming that the level of fees in 2021-22 continues throughout the 2023-28 period.
- Business rates – the level of business rates is set by the Valuation Office Agency (VOA) and is reassessed on a periodic basis. The next valuation is due to be implemented from April 2023. Our forecast assumes a 5 per cent increase relative to the 2015-23 period.
- Exit charges – Ofgem determines how much we pay to connect our network to the National Grid. Our forecast assumes a 10% increase relative to average levels in the 2015-23 period reflective of National Grid's latest forecast.
- Smart meter enablers – these costs include expenditure on additional IT assets and services that are specifically associated with the systems required to access, store, process and use smart meter-derived data. These show a 9% increase from level experienced in the 2015-23 period. During the current period we have seen the level of costs increase from £1.2m in 2015-16 to £4.9m in 2020-21. Our plan assumes costs remain in line with the level of expenditure experienced in 2020-21.

Other non-activity based costs

The largest element of non-activity-based costs is our pension deficit payments; our treatment follows the requirements specified by Ofgem. Our pension deficit is calculated by an actuary every three years. The deficit as of 31 March 2019 was agreed with the trustees in 2020 to be £146m, with a recovery plan of deficit repair payments of £30m p.a. plus RPI continuing until March 2023, followed by two years of £15m p.a. plus RPI. The actual allowance for the 2023-28 period will be agreed every three years with Ofgem, to align with the triennial cycle for the pension scheme. The next triennial valuation will take place as of 31 March 2022. This is the basis of our cost submission for future periods in line with Ofgem guidance.

The average annual pension deficit repair contribution has reduced by 87% from the ED1 period reflecting the expectation that the deficit will be repaired by 2024.

As part of our 2019 triennial agreement with the trustees, we introduced a stranded surplus mechanism to avoid unnecessary payments to the pension scheme. Under the mechanism, the deficit repair contributions could be reduced by up to 100%, if the funding position improved. The improved funding position experienced in 2021 resulted in the £30m due in November 2021 being suspended. The company will not be required to pay this amount into the scheme unless the funding position deteriorates and falls below the agreed threshold.

Figure 14: non-activity based costs

Cost area £m	2023-28 total	2023-28 average	2015-23 average	Variance	
				£	%
Pass-through costs	429.9	86.0	80.8	5.2	6.4%
Other non-activity based costs	12.7	2.6	25.0	(22.4)	(89.6%)
Total activity based costs	**442.6**	**88.6**	**105.8**	**(17.2)**	**(16.3%)**

Real price effects (RPEs) and ongoing efficiency

On average over time, many of the inputs we use will increase in price faster than the Office for National Statistics' (ONS) CPIH measure of inflation that is embedded as standard in our revenue allowances.[1] These input cost changes are called real price effects (RPEs). The flip side of this is that we continually look to get better at what we do, helping to offset rising input prices.

One of the clearest examples of an RPE comes from real terms pay growth, which reflects productivity growth across the economy and is why living standards tend to rise over time. For example:

- From January 2000 to 2021, average earnings in the economy rose 23 per cent in real terms, above CPIH, or one per cent p.a.
- This has happened over a period that included the dot-com slowdown, global financial crisis, the austerity that followed and, most recently, the COVID-19 pandemic.
- Even in a pandemic year (2020), the Bank of England recently found that the average pay settlement held up at 2.5 per cent,[2] i.e. 1.7 percentage points above CPIH inflation.

Labour is our biggest input, and for a high proportion of our staff we need to recruit from specialist pools of labour that have at times seen faster wage growth than average. We are also exposed to fluctuations in the prices of materials such as copper or aluminium through the cables and transformers that we need to buy to improve our network.

Over 2023-28, Ofgem has said that it will only make allowance for these costs through indexation mechanisms. This policy means that our customers will bear the risk of fluctuation in prices, while we will be exposed to the risk of a mismatch between the price of inputs we actually use and the indexation mechanism. As a result, it is crucial that the indices are well constructed.

Unlike RPEs, ongoing efficiency will be set as a fixed assumption by our regulator.

This section of our plan sets out our proposals for RPEs and ongoing efficiency.

We have engaged economic experts to review the evidence and develop a balanced approach to indexation design.

To ensure Ofgem's policy is executed as successfully as possible, and to achieve a balanced outcome, we are proposing indexation for RPEs that has been calibrated by independent experts, the economic consultancy NERA, based on the available evidence.

RPEs are an economically complex subject, which is why the involvement of economic experts is important. We commissioned this essential study jointly with other Distribution Network Operators (DNOs) for three reasons:

- The DNOs are undertaking essentially the same activity and we expect our regulator to apply the same approach to the entire sector.
- Jointly tendering is more cost-effective than each DNO commissioning a similar study.
- Pooling each DNO's data on input price changes, for example for transformers and cable, allows a better justified approach to indexation to be developed.

Figure 15: breakdown of RPEs

Cost area	Justification	Share of sector costs	Proposed index
General labour	Across the economy there is indisputable evidence that wages tend to grow faster than CPIH inflation	**30%**	Indexed using: — ONS private sector weekly earnings — ONS annual survey for hours and earnings median hourly earnings
Specialist labour	As with general labour, the evidence of labour RPEs is indisputable. In this category the benchmarks are tailored towards electrical and civil engineering	**36%**	NERA index based on: — BEAMA electrical engineering labour — BCIS PAFI civil engineering[A] — BCIS electrical installations – cost of labour — BCIS PAFI electrical engineering
Materials (capex)	Electricity distributors use specialist components that become part of their networks like cable and transformers and wood poles. Prices depend heavily on commodity prices, which can be volatile	**18%**	NERA index based on: — ONS wood, sawn and planed for domestic market — BCIS PAFI pipes and accessories, aluminium — BCIS PAFI pipes and accessories, copper — BCIS electrical materials — BCIS RCI infrastructure materials (FOCOS)[B]
Materials (opex)	Similar to capex materials, but with indices tailored towards a lower weight on major network components	**3%**	NERA index based on: — BCIS RCI infrastructure materials (FOCOS)
Plant and equipment	As well as components that become part of the network (materials), DNOs use various items of plant, such as generators, tools and road transport	**7%**	NERA index based on: — BCIS PAFI plant and road vehicles

A BCIS – the Building Cost Information Service (BCIS) of the Royal Institution of Chartered Surveyors (RICS); PAFI – the BCIS price adjustment formulae indices
B RCI – the BCIS resource cost indices; FOCOS – the BCIS infrastructure resource cost indices

1. CPIH: Consumer Prices Index including owner occupiers' housing costs.
2. See Bank of England, February 2021, Monetary Policy Report, page 30.

NERA has used data from the sector to benchmark the input price changes the sector has actually seen against the various candidate indices that could be used for an RPE mechanism. This has resulted in a data-led evaluation of the RPEs that the sector is most likely to face going forwards.

This allows us to propose evidence-based indexation for our key input categories.

The table in figure 15 provides a summary of the indexation we propose based on the NERA report, along with a brief summary of the justification.

The full two-part NERA report can be accessed from the RPEs and ongoing efficiency annex (6.4).

We have also engaged economic experts to review all the available evidence on ongoing efficiency.

Although input prices such as labour costs and specialist materials tend to rise faster than CPIH inflation, we will also get better at what we do over time. This means we will not need to use as many inputs to deliver the same outputs.

Similar to RPEs, understanding the scope for ongoing efficiency is an economically complex subject. We have therefore also commissioned NERA to review the evidence on behalf of all electricity distributors.

To ensure a balanced view, NERA has triangulated evidence including:

- the standard dataset used in this area when evaluating comparator sectors, which is EU KLEMS;
- analysis of actual DNO productivity over the past decade;
- economy-wide productivity estimates; and
- forecasts from economic commentators of productivity growth.

All four sources of evidence point to lower values of ongoing efficiency than have been assumed in Ofgem's recent regulatory decisions, and NERA concludes that the range 0.1 per cent to 0.5 per cent "defines the widest range of assumptions that could reasonably be derived from the evidence".

For the purposes of this business plan, we have adopted the most challenging assumption within this reasonable range, of 0.5 per cent.

Making it happen

We have set out a significant increase in activity levels and the development of Distribution System Operation (DSO) capabilities.

Our plan is to invest over a third more every year than we have in the current period in total (see Costs section). This is overwhelmingly driven by the need to ensure that we open up potential pathways for our region to decarbonise.

We've set out more on our delivery plans in our:

- Delivery Strategy annex 7.1
- DSO plan section annex 4.2
- Digitalisation Strategy and Action Plan, annex 5.3
- Workforce Resilience annex 5.4

We are expanding our capabilities for DSO.

In order to efficiently support decarbonisation goals, we must enable a smart, flexible energy system where we actively manage the more complex power flows on distribution grids such that we can optimise the value for the system.

In our plan we invest in information technology systems, skills and data to enable optimal use of our assets and sharing of information to facilitate the most cost-effective route to decarbonisation. This is a significant change for our business but we are confident we can manage the risks that come with such a transition because of our track record and the strength of our DSO, Data and Digitalisation, and Workforce Resilience strategies.

We are building on a strong base and track record in the 2015-23 period. See our Track Record section.

We are already well underway in modernising our network through our smart grid enablers programme and investments in smart meter supporting systems.

- We have been actively testing the flexibility market, running flexibility expressions of interest and rolling out around 440MW of flexible connections across our active network management (ANM) areas.
- We are now routinely collaborating with a variety of industry stakeholders in developing Distribution Future Energy Scenarios (DFES) and engaging on our forecasts through an open data platform.
- We have focused our innovation portfolio on preparing for the future through projects such as customer-led distribution system (CLDS) and trialling vehicle-to-grid smart charging.

Our strong track record of delivering against our forecasts gives us confidence that we can deliver our plan. Throughout 2015-23 our investment has closely tracked in line with our plan. We are delivering our network health targets and meeting or exceeding our 53 business plan commitments for the current period.

Gearing up to deliver

Our plan sets out a robust strategy detailing how we will develop our DSO capabilities.

We will invest in systems and skills to deliver a significant upgrade in our data capture and analytics capabilities alongside deploying flexibility and stimulating markets to optimise our system efficiently. Building on activities in the current price control period, some key elements of our strategy include:

- Investing £21m in rolling out LV monitoring such that 50 per cent of our ground-mounted substation networks are covered by 2028, a continuation of an ongoing programme we have already been successfully implementing during the 2015-23 period.
- Building on the successful implementation of our AutoDesign platform by delivering an easy to use customer portal for a range of existing and new data sets, expanding today's tool to include different voltage levels and to include new and existing customer connections.
- Expanding our use of flexibility, to optimise network assets, building on learnings from flexibility tenders we have been running since 2018.

> **We have a proven track record of delivering at industry-leading levels of cost efficiency. Through engagement with our supply chain, we know we can deliver our ambitious ED2 plan and enable regional decarbonisation.**

Andy Bilclough
Director of field operations

Our cross-cutting plans for Data and Digitalisation and Workforce Resilience both centre on the need to support the DSO transition.

Our DSO strategy describes the use cases for the systems that will be delivered through the data and digitalisation strategy.

- Through our deliverability review we have concluded that to deliver our ambitious outcomes, it will be necessary to employ a delivery model that utilises a mix of internal resources and external partners.
- Each of our initiatives is costed using a model that includes planning and design, the cost of the solution itself (covering hardware, software, testing, project management and integration costs), solution implementation and business change to ensure that we not only deploy technology, but we also embed it within the business.
- We have also modelled resources across the five-year period to ensure we have the internal capabilities to deliver the initiatives as envisaged.
- We have sequenced the initiatives as programmes of work, factoring best practice insight from our strategic technology partners in setting out the plans to deliver the work required.

To successfully deliver DSO functions, we must attract people with new skills and expertise to our business, as well as upskilling our existing workforce. To ensure we achieve this, our plan will see us:

- evolving our training programmes to upskill our industrial and technical workforce;
- increasing our training delivery capabilities and capacity to accommodate the higher volumes of people to be trained;
- bringing colleagues with specialist data management skills into the business, through both recruitment and procurement;
- improving the core data skills of our current colleagues; and
- engaging our workforce on the transition to DSO to be clear on the impact it will have on their roles and how their skills will need to change.

2023-28 will also require a material increase in investment in the network.

When delivering DSO functions we will monitor, manage and then, only if necessary, reinforce our network. The scale of the change that is required to decarbonise means that even though we have adopted this flexibility-first approach, opening all the credible pathways to net zero will still require a material increase in network reinforcement. Network investment costs in total increase by over 78 per cent in our 'best view Planning Scenario' – see our Costs section – which assumes that:

- about 941,000 electric vehicles (EVs) will be connected to our network by 2028 compared to about 31,000 today; and
- over 309,000 heat pumps (HPs) will be connected, an increase of over tenfold compared to today – see our Scenarios and Investment section.

Our current delivery strategy (annex 7.1) for much of the work that is required in 2023-28 is to continue our outsourced model with contractors across our region. This allows us the flexibility to scale resources to respond to the delivery challenge. By using strategic framework agreements we are able to award contracts for significant programmes of work that are designed to be scalable in line with requirements.

Through tender processes we identify all of the appropriate contractors across our region that are able to deliver the contracts, including those able to respond to changes in scale. We have a proven track record of delivering large programmes of work this way. We know that providing we plan ahead properly, our contractors will flex their resource capacity in anticipation of the demand. Our engagement activity tells us that we have a supply chain that is eager and able to support us in meeting our delivery challenges.

We are already preparing to deliver.

Since submitting our draft plan we have developed detailed implementation plans for our 2023-28 initiatives. We have already began recruitment of internal resources to scale our delivery capacity alongside establishing the necessary framework agreements with our supply chain delivery partners.

Impact assessment

Plan area	Activity levels	Performance levels	Headline changes vs. 2015-23	Key features of our delivery plan
Decarbonisation – Scenarios and Investment	↑	↑	— Nearly four times increase in network reinforcement — Dynamic system planning and forecasting	— Scale contractor resources through strategic framework agreements
Decarbonisation – DSO Strategy	↑	↑	— Open data platform — Flexibility procurement — Installation of 10,000 low voltage (LV) monitors and their ongoing management	— Increase number of people working to fulfil DSO functions to c. 50 — Scale existing LV monitoring programme — *Data and Digitalisation initiatives below*
Decarbonisation – Whole System	↑	↑	— 196 large-scale sites with voltage optimisation — Roll-out of 30 innovative microgrids	— Build on innovation outcomes — Recruit and train further staff to install smart grid equipment
Environmental Action Plan	↗	↗	— 8,401 polychlorinated biphenyl (PCB)-driven pole-mounted transformer changes — Four times increase in perfluorocarbon tracer (PFT) for cable leakage	— Scale existing supply chain through strategic framework agreements — Leverage 'hot glove' resources for live-line working where possible
Asset Resilience	↗	↗	— Synergistic planning using latest decarbonisation forecasts	— Deliver programmes through strategic framework agreements
Reliability and Availability	↑	↑	— 8,600 high voltage (HV) automated switches and enhanced LV technology at 9,000 locations (c. double 2015-23 run-rate) — Substantial increase in overhead programmes	— Scale existing supply chain — Multiskill operational teams
Safety	↔	↗	— Expansion of safety management system to our contractor base	— Invest in new safety and driving training programmes and systems
Climate Resilience	↔	↗	— A further 45 flood defences — Vegetation programme for ash-tree dieback	— Adapt existing programmes and supply chain for 2023-28 volumes
Physical and Cyber Resilience	↔	↗	— Enhanced physical security at all of our Critical National Infrastructure-designated sites — Replacement power-resilient telecoms solution	— New OT cyber-specialist recruitment and training programme — New solutions to detect threats and respond to attacks
Customer Service	↗	↗	— Increase broad measure of customer service (BMCS) score to 93.5%	— New technology to offer greater choice to customers
Vulnerable Customers	↗	↑	— Reach 70% of eligible high-risk customers with Priority Services Membership (PSM) recruitment — Enhanced on-site welfare support for >6 hour power cuts	— Increase customer support vehicles — Establish new arrangements to provide additional on-site support
Our Communities	↗	↗	— Additional £0.6m on social programmes to improve the network and community	— Establish community energy advisors — Upskill external partners on decarbonisation — Multiskill operational teams
Connections	↑	↑	— 20% faster small works lead times — Expansion of AutoDesign self-service — Capacity to accommodate significant increase in low carbon technology (LCT) connections/service upgrades	— Build on existing systems — Develop our digital platforms to enable customers to self-serve and facilitate mass LCT uptake
Openness and Transparency	↔	↗	— Sustainable procurement policy aligned to ISO 20400 — 98% of our suppliers compliant with our responsible procurement charter	— Modify our procurement approach — Work with our supply chain to obtain accreditation
Enablers				
Innovation	↗	↗	— Flexibility product development — Harnessing flexibility at low voltage to resolve LV network constraints	— Continue our delivery model of internal resources working with new and existing external partners
Data and Digitalisation	↑	↑	— C. 50% increase in investment (+£7m p.a.) to deliver data and flexibility outcomes — Enhanced data governance	— Mix of internal resources and external strategic partners — Recruitment and training for data skills
Workforce Resilience	↗	↗	— Create >1,000 new job opportunities — Build a more diverse workforce — Develop regional and national skills	— Upskilling and recruiting our workforce with data science, digital, commercial and technical engineering expertise

Key: Activity/performance levels vs. 2015-23 ↑ / ↓ Significant increase/decrease ↗ / ↘ Increase/decrease ↔ Broadly similar levels

Financing

Our stable and robust financial position is supported by the long-term outlook of our shareholder, the Berkshire Hathaway Energy group, which is ultimately owned by Berkshire Hathaway Inc.

Our approach to financing the business reflects Berkshire Hathaway's long-term outlook and preference for sustainable capital growth over dividends. The financial flexibility offered by this approach helps us maintain the highest credit rating of any of the standalone network groups.

Our proposed financing package will provide the funding to deliver the ambitions set out in this business plan.

All stakeholders agree that the cost of capital for 2023-28 will be lower than our regulator's assumption at the last price control review. While there is uncertainty over the exact cost of capital, and in particular, a reasonable range for the cost of equity finance that the evidence supports, we believe our regulator has – over the past few years – given way to pressure, failed to take proper account of that evidence, and attempted to set returns at too low a level.

This section takes as its starting point the working assumption for the cost of capital and specific stress-tests that our regulator has required. It also signals those areas where we think the evidence justifies a different approach.

Ofgem's assumptions for cost of capital are too low, especially given the pivotal nature of the sector in the net zero transition.

Ofgem's current working assumption for the cost of equity, of 4.65 per cent plus the Office for National Statistics' Consumer Prices Index including owner-occupiers' housing costs (CPIH), is too low. It is below the marginal cost of equity and risks deterring investment in the distribution network at a time when the need for investment is acute.

Ofgem's approach does not match the methodology taken by the Competition and Markets Authority (CMA) in its recent redeterminations of price controls for the water sector. And since the cost of equity is difficult to measure exactly, giving regulators a degree of discretion, the net zero context in electricity distribution makes it especially important that our regulator does not set this value too low. In reaching our own view, we have worked with financial expert Oxera to review the evidence. It has concluded that the cost of equity for companies in our sector is between 5.8 per cent and 6.9 per cent.

We have also been engaging with stakeholders to show them the impact on bills over the long term of both an appropriate cost of equity – which can be no lower than the 5.8 per cent at the bottom of Oxera's range – and a regulatory depreciation period that establishes a fairer share of the costs across current and future generations of customers. Our views on all these points are expanded on in annex 7.2 Financing.

Nonetheless, Ofgem requires that this plan, and the various financial tests it includes, is set out based on Ofgem's current working assumption, so that is what we have set out below.

The cost of raising new debt is at an all-time low and is expected to stay low for some time.

The cost of new debt over the 2015-23 period has also been very low, reducing the average cost of Distribution Network Operator (DNO) borrowings and, therefore, the costs that need to be factored into network charges.

Our plan adopts Ofgem's working assumption of a 2.087 per cent (real, pre-tax) average allowance for debt costs for 2023-28. It is based on Ofgem indexing debt allowances to a 17-year trailing average of the cost of long-term utilities debt, including its initial estimate of the various additional costs of borrowing that DNOs can expect to incur.

The working assumption will be replaced by a final calibrated index after Ofgem has seen company business plans and been able to better forecast expected debt costs. We set out more details on this area in annex 7.2 Financing.

The debt interest rates that are eventually factored into our charges will ultimately depend on how debt market conditions evolve over the coming years, not on the 2.087 per cent working assumption, or on what people today think the debt index might do.

Our dividend and tax policies are backed by a shareholder with a track record of reinvesting heavily in our business.

Equity finance is essential to ensuring the long-term financial sustainability of any business. And dividends are one common way that a return is paid on this type of finance.

Our shareholder's preference has generally been to operate with slightly more equity in the financing structure than the notional 35 per cent that Ofgem currently assumes for price-setting purposes, to allow the financial flexibility necessary to deal with any uncertainties we may face over the 2023-28 period. Ofgem's working assumption for 2023-28 is 40 per cent equity finance.

Our dividend policy is to only pay dividends after having due regard to available distributable reserves, available liquid funds and the financial resources and facilities needed to enable us to carry on our business for at least the next year. The level of dividends paid is set to maintain sufficient equity in the company so as not to jeopardise its investment grade issuer credit rating.

Over 2015-21, we have so far paid £322m in dividends.[1] Over the same period £996m was reinvested into the business. These dividends are largely retained within the UK group. In the first six years of this regulatory period only £150m was paid to our shareholder.

Northern Powergrid and our ultimate parent company, Berkshire Hathaway, have a responsible approach to tax. We are classified as having a 'low' risk profile with HMRC and, while we do not pay extra tax unnecessarily, we do not operate aggressive corporate tax-planning schemes or artificial structures designed to reduce UK tax payments by exploiting complex tax loopholes. We manage our tax affairs transparently and in a way that is compatible with the requirements for HMRC's low-tax-risk classification.

The tax costs included in this plan use the methodology that Ofgem uses to calculate appropriate allowances.

How costs are spread over time will be critical to future generations.

The capitalisation rate is the proportion of our totex costs that are added to the regulatory asset value (RAV) and then spread over many years in our allowed revenue. Those cost allowances that aren't added to RAV flow immediately into our allowed revenue.

Our plan uses a 71 per cent capitalisation rate. This means that for every £1 of totex allowances that we spend, 71p will be added to the size of our financial investment (RAV additions), while 29p will be charged immediately to customers through our allowed revenue in the same year. This assumption is set to maintain a consistent policy with the current regulatory period. It also has the benefit that it avoids compounding an intergenerational fairness problem that Ofgem's regulatory depreciation policies have created in 2015-23, which is set to become even worse if they do not change course.

Once costs have been added to the RAV, they must be paid back over time. The technical term for them being paid back is regulatory depreciation and, until they are paid back, interest must be paid in the form of the cost of capital.

Ofgem's current policy is that new investments will have a regulatory depreciation period of 45 years. We use this standard assumption for the assessment of financial risk that Ofgem has asked us to undertake.

However, we also believe that this long regulatory depreciation period disproportionately pushes the cost of decarbonisation onto future generations because those costs will stay in our financial asset base for a long time, during which they will attract inflation and a return, which compounds over the long term, to increase the amount that is ultimately charged to customers. In and of itself, there is nothing wrong with a mechanism for spreading some of the cost of investment over time. It's an appropriate part of financing a long-term business. But it is essential to strike the right balance. Under these circumstances, a shorter regulatory depreciation period would enhance intergenerational fairness and make the sector more stable over the long term. The longer the depreciation period, the greater the cost burden that falls on future generations.

We do not think it is appropriate to push the cost of net zero onto future generations, or to find other ways of hiding the cost. But this is what extending the regulatory depreciation period on business as usual investments does, since their cost is deferred to future generations instead, allowing net zero costs to be offset for the current generation. All of this just stores up costs for the future, meaning a bigger private investment on which the cost of capital has to be paid, even if the service being delivered wasn't changing at all, raising risks to investors in the process.

And the Government's net zero review, undertaken by HM Treasury, has recently concluded the same thing based on a completely separate, bottom up, review of the public policy issues around funding net zero costs.

"Seeking to pass the costs of net zero onto future taxpayers through borrowing would deviate from the polluter pays principle, would not be consistent with intergenerational fairness nor fiscal sustainability, and could blunt incentives. This could also push up the economic cost of the transition"

HM Treasury, October 2021, Net Zero Review – analysis exploring the key issues, executive summary, page 8.

We set out more details on this issue in the section on Customer Bills.

As with all our costs, we have managed our pension costs efficiently.

Pensions are part of the benefits we offer to employees. In our case, they are a more significant cost to the company because our industry carries historical pension commitments that were protected by law at privatisation.

We took action more quickly than other companies to control our pension costs by closing our final salary pension schemes to new joiners in stages between 1995 and 1997. This was 10-15 years before almost all other distribution network companies stopped offering defined benefit pensions to their new joiners as standard. As a result, we are much further along the path than many of our peers in seeing that cost burden diminish.

But there are still some obligations to meet to those employees who were offered those benefits at that time. This plan includes the cost of our final salary scheme in line with objective actuarial calculations and the outcome of the most recent triennial review conducted with the trustees, along with the cost of our defined contribution scheme (which does not require actuarial calculations because our contributions are fixed, and which is set in line with similar, efficient, private sector organisations). The final salary pension deficit repair element of our cost allowances will be trued up by Ofgem to the actual values, which will depend on factors such as changes to interest rates and investment performance.

During 2023-28 we will efficiently manage the pension deficit and avoid a stranded surplus accruing in the scheme.

Investment is essential to support the transition to net zero. Our investor's long-term outlook and prudent financial policy gives us the financial stability to fund the ambitions set out in this plan.

Louise Bennett
Treasurer

1. £138.8m Northeast; £183.4m Yorkshire.

We do not use excessive debt finance or risky financial instruments, so our business is robust to risks.

We have an obligation to maintain an investment-grade credit rating – which in our case means maintaining a BBB- or higher rating with Fitch Group and S&P and a Baa3 or higher rating with Moody's. In practice we target a higher rating, of A- and A3, because this provides the business with financial flexibility in unexpected circumstances, and also for potential major increases in investment requirements, such as those associated with decarbonisation. Targeting a lower rating would mean issuing more debt finance (and paying the equity this replaces as dividends). But this can be costly to reverse in the future, for example because debt is more expensive to buy back in the open market once it has been issued.

We have assessed ourselves against a threshold of BBB+ or Baa1 for the credit tests set out in this business plan. This allows a modest amount of clearance compared to the very bottom of the investment grade range, and helps avoid the risk of unexpected circumstances pushing metrics below acceptable levels. The table below illustrates the results of this approach for each of the key debt financial ratios, on the basis of the 'notional company' that Ofgem uses to normalise differences across companies.

Taking Ofgem's current working assumptions for the relevant financial parameters and our plan, our business would have strained metrics on Ofgem's credit tests in the 2023-28 period, both overall and on the interest cover (AICR or PMICR) and FFO to net debt metrics. These financeability challenges would however be addressed if Ofgem took some simple steps that are justified for other reasons, specifically:

- adopting a cost of equity that reflects the evidence that this parameter should be higher; and
- reversing its recent policy on regulatory depreciation (which is inappropriately depressing today's distribution charges and pushing the cost of the net zero transition onto future generations).

In annex 7.5 Credit metrics and annex 7.2 Financing we provide a set of more detailed financial projections, results based on our actual (as well as notional) debt costs and equity structure, give more detail on our underlying analysis, and provide more background on the credit rating process (including the qualitative factors that rating agencies can also take into account).

Figure 1: assessment of credit metrics (notional company basis)

Key: credit ratings
A3
Baa2
Strained

	2023-28 average	
	Northeast	Yorkshire
Opening gearing	60.00%	60.00%
Funds from operations (FFO) interest cover (including accretions)	3.77x	3.65x
FFO interest cover (cash interest)	4.28x	4.13x
Adjusted interest cover ratio (AICR) or post maintenance interest cover ratio (PMICR)	1.36x	1.36x
Nominal PMICR	2.00x	2.00x
FFO/net debt	11.00%	10.40%
Retained cash flow/net debt	9.10%	8.50%
Moody's implied rating	Baa3	Ba1

In support of our overall assessment of our financial risk, we stress-tested the business against short- and long-term risks using scenarios that Ofgem specified.

As Ofgem's cost of equity is too low, some of our overall and underlying credit metrics are likely to fall below the investment grade threshold in some of the stress test scenarios, as well as the base case scenario. We set out the full results in our Credit metrics (7.5) and Financing annexs (7.2).

Figure 2: financial stress test scenarios

Scenario	Stress tests
Interest rate	±1% compared to forward implied rates as per the base case in each year (for risk-free rate (RFR), London interbank offer rate (Libor) and iBoxx inputs)
CPIH	±1% in each year
Retail Price Index – CPIH divergence	±0.5% from assumed wedge, applied to either RPI or CPIH
Totex	±10%
Return on regulatory equity	±2% compared to base assumption
Proportion of inflation linked debt	±5%

Balancing ambition with affordability

Our stakeholders have been clear about the need for decarbonisation and investment, but they also expect us to focus on affordability – our plan strikes this balance.

Our plan proposes a 41 per cent increase in investment to enable decarbonisation for a modest eight per cent increase in customer bills. This would take the average domestic customer bill to around £99, an increase of 15p per week. In this section we explain how the bill you pay is made up and the key choices that influence it.

Most of our customers will never see a bill from us. Instead they receive a much larger bill from an electricity supplier that charges for everything – including distribution costs but also the generation of the electricity used by customers, transmission costs, a range of environmental and social programmes and the costs of the electricity supplier itself.

For the average domestic customer our charges currently represent about £90 per year, less than 15 per cent of the total electricity bill.

As well as our 3.9m home and business customers, we have many other types of customer, such as 250,000 commercial businesses and 30,000 industrial customers. More details on the bill impact for these other types of customer are provided in annex 7.2 Financing.

Ofgem is currently considering how our charges should be structured and who should pay the costs of connecting to our network. We have developed this plan based on the current charging framework, which we believe Ofgem should retain. We do not believe Ofgem's proposals will be good for customers as they will lead to an inefficient system. We have set out more detail in our Socialisation of costs (annex 4.5).

> **While our spend increases because of decarbonisation, we know we need to keep bills affordable and ensure fairness between generations. We believe our proposed business plan strikes the right balance for our customers.**

Owen Sutherland
Head of financial planning

Customers pay for some of the costs of investing in and maintaining our distribution network immediately, but a large portion will be paid for over a much longer period.

Our plan for 2023-28 will see us spend totex of over £660m p.a. to open up all the credible pathways for decarbonisation, improve the performance of the network, and deliver an enhanced service everywhere else. This is about a third more than we invest each year at the moment.

Not all of our costs are paid immediately by customers. About 71 per cent of what we spend relates to investment in equipment that will last for anything from several years right through to several decades. Because of that, those costs are recovered in your bills over a long period, called the regulatory depreciation period, currently 45 years. The other 29 per cent is paid immediately.

The 45 years can be thought of like the life of the financial asset, or the length of a mortgage. The longer this financial asset life is, the smaller each year's repayments will be, but the more interest will be paid over time.

The regulatory depreciation period has been increasing over 2015-23, from 20 years to 45 years, under Ofgem's existing policies. This is similar to allowing current customers to take a partial payment holiday on new investments – but, like a payment holiday on a loan, it stores up costs for the future. This policy disproportionately benefits the current generation of customers at the expense of future generations.

We think this outcome is unfair. It would amount to us all agreeing that there is a need to invest in the decarbonisation journey, but relying on the next generation to pay for most of it while we take a payment holiday.

The Government has also concluded that this type of policy, funding net zero through storing up costs for future generations, is wrong since the policy would ignore the polluter pays principle and other public policy objectives.

We believe Ofgem should shorten the regulatory depreciation period, back closer to the levels last seen around 2015, to support intergenerational fairness, and avoid today's children and young adults from having to bear an even greater portion of the burden of transitioning to net zero. This would also bring Ofgem into line with the Government's analysis of the key issues around net zero. With a shorter regulatory depreciation period, customers would stop taking a payment holiday, and would finish paying for today's investments sooner. This would avoid future generations funding as much growth in our financial asset base.

Our customer bill also includes a range of other costs.

A customer bill also comprises:

- corporation tax – where the rate is increasing from 19 per cent today to 25 per cent over 2023-28;
- a return for investors (those equity and debt investors who are funding the 71 per cent of cost that is not recovered immediately);
- the impact of various regulatory mechanisms, which will be determined by Ofgem – we have assumed these will not have any effect on this plan; and
- various other costs that we have to incur, for example our share of transmission charges, business rates on our properties and network, and our share of the cost of running central smart metering data services.

For further details, please see:

- Annex 7.2 Financing
- Annex 7.4 Decarbonisation uncertainty & Ofgem uncertainty mechanisms
- Annex 7.5 Credit metrics

We heard your thoughts on how our proposals would impact your bills.

We engaged extensively on the level of ambition and customer outcomes in our plan and the associated investment requirements to deliver them (see annex 3.1 Enhanced engagement process). In order to enable stakeholders to make informed decisions, we explained the potential bill impact associated with the various different options being explored from early in the process.

As we moved through the different stages of the engagement process, we continued to explain the potential impact on your bills, investment decisions and the period in which costs are recovered. This was shared each week with our citizens panel and also published on our Emerging Thinking website and also consulted on through publication of our draft business plan to ensure your voice was represented in our planning.

Our business plan acceptance testing involved surveyed about 1,500 customers by telephone and about. 8,000 by email.

The bill impact that results from every aspect of our plan, including our dialogue with our customers, is set out in the charts below.

Figure 3 shows what the bill impact would be under Ofgem's working assumption financial parameters, including the cost of capital that we think is too low to cover our costs, and pushing a lot of the costs of decarbonisation onto future generations by using 45-year asset lives (regulatory depreciation period). We have also included our best view of the cost to customers of Ofgem's proposed change to the current charging framework. If Ofgem sets this price control, our charges in 2023-24 would be about £1 higher than in 2022-23, at £92.

Figure 4 shows what the bill impact would be under our proposed financial parameters (namely, an appropriate cost of equity), with the issues surrounding regulatory depreciation periods that load extra costs onto future generations addressed, and where Ofgem does not go ahead with its proposed change to the current charging framework. This would see our charges increase by about £8 extra in 2023-24, to £99. We think this still represents extremely good value for everything we are offering.

Figure 3: Ofgem view – domestic customer bill impact (2020-21 prices)

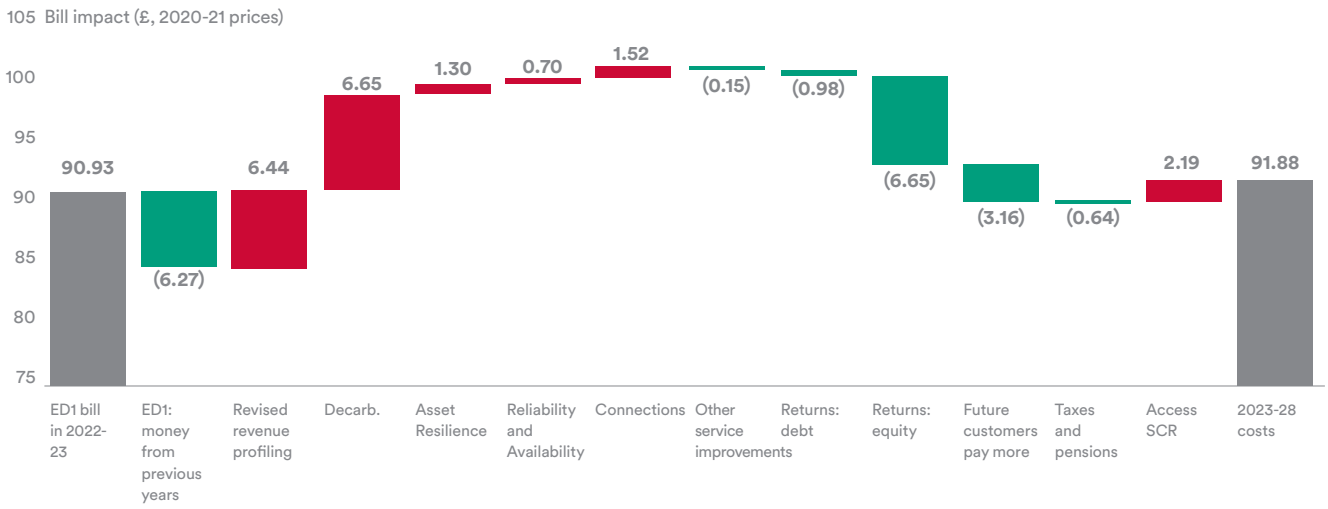
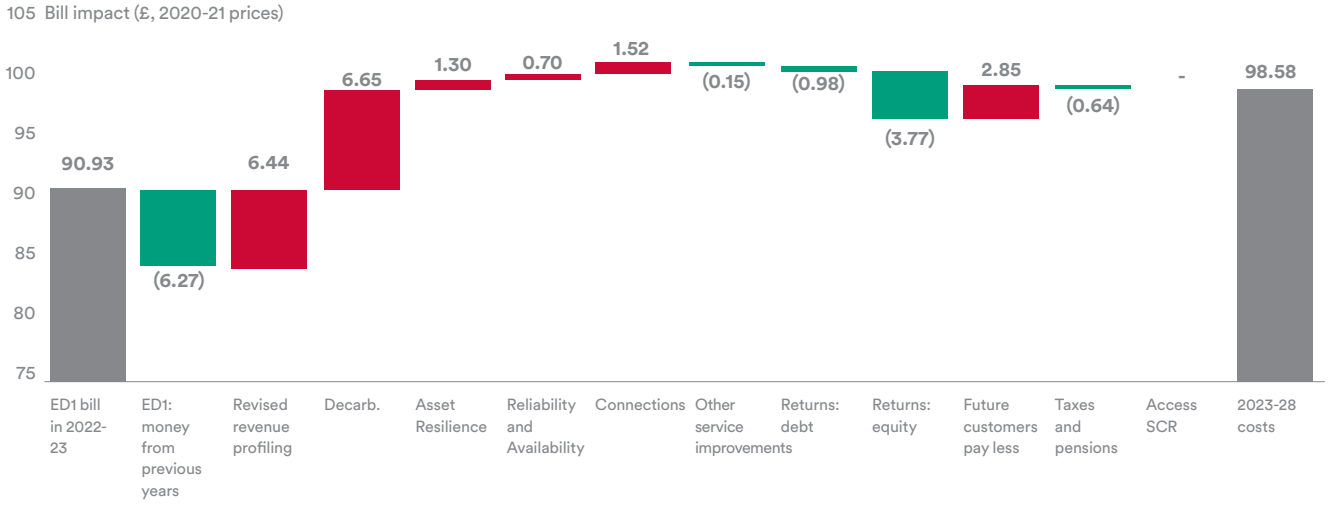


Figure 4: our view – domestic customer bill impact (2020-21 prices)



Managing uncertainty and risk

As a business we manage a wide range of risks on a day-to-day basis, ranging from the immediate issues that could delay restoration of a power cut through to long-term risks to our asset base that could raise our costs if not mitigated. Part of the rationale of having a regulated, privatised network business is to allocate risks to the regulated company to manage, insulating bill payers and taxpayers from them.

This section of our plan:

- focuses on the regulatory mechanisms that can be used to mitigate some of these risks;
- sets out our track record of accepting and managing risk on behalf of customers; and
- provides an introduction to decarbonisation uncertainty.

We will manage risks on behalf of customers wherever we are best placed to do so.

We have the ability and experience to manage a wide range of risks and, in line with best practice regulation, it is right that we continue to bear these risks as the party best placed to manage them. We are therefore proposing no additional regulatory uncertainty mechanisms beyond those our regulator thinks offer good value to customers and should be in place for our whole sector.[1]

We will take on and manage all the risks that aren't covered by these mechanisms within the cost allowances set out in this business plan.

Ofgem's consumer challenge group gave clear feedback that companies ought to manage risks.

In the recent review of transmission and gas distribution business plans, the consumer challenge group said: "The weaker performers proposed a wide range of additional uncertainty mechanisms, in which risks that the companies were better placed to manage, were passed on to consumers."

This is consistent with our own understanding of the views of stakeholders and how we can best serve our customers – by accepting and managing risks on their behalf. It is also consistent with our view that, apart from in truly exceptional cases, uncertainty mechanisms that are justified for one electricity distribution company would be justified for the entire sector.

Our track record on accepting and then managing risk is well established.

Our track record is demonstrated by two key pieces of evidence:

- This is the second price control in a row where we have proposed no additional regulatory uncertainty mechanisms as part of our business plan.
- We are continuing to effectively manage the risks in the current 2015-23 regulatory period so that expenditure is broadly in line with our cost allowances.

The pace and pathway of the net zero transition is the biggest uncertainty we know about.

Decarbonising the economy will require significant changes, including how transport is fuelled and buildings are heated. This will lead to electricity distribution networks being used much more, but we don't know the exact end point or the timing of when these changes will happen. For example, we don't know the:

- rate of uptake of low carbon technologies (LCTs) such as electric vehicles (EVs) or heat pumps (HPs);
- extent to which peak demand will shift due to price-driven customer flexibility.

The investments set out in this plan will be needed very soon under any realistic net zero scenario.

The costs in this plan – under our Planning Scenario – are based on the level of investment that we forecast will be necessary under the government's 10-point plan, and on the number of HPs being used in homes and EVs on our roads that this plan would involve.

In this plan we have also distinguished between:

- those costs that we think are necessary under any scenario for the low carbon transition, and that should be funded through up-front cost allowances; and
- those costs that could be funded through an uncertainty mechanism that counts the pace of uptake, and uplifts allowances if uptake is sufficiently high.

We give more details overleaf of our assessment to determine the baseline level of cost allowances and how the uncertainty mechanism arrangements could work.

1. We include in annex 7.4 Uncertainty Mechanisms a brief summary of the uncertainty mechanisms Ofgem currently proposes and which Ofgem will keep under review until the end of the price control process.

We need to invest enough over 2023-28 if we are to avoid storing up critical delivery risk.

In our assessment of the level of funding that should be allowed under any scenario, the determining factor is avoiding future deliverability risks that could make us a barrier to the country's ambitions for decarbonisation.

If we invest too little in our network over 2023-28, then this will store up more investment for the future. And if too much investment is stored up then the risks to delivery of this investment will grow and become unmanageable.

In a detailed assessment we have established that, if we invest according to the lowest credible uptake scenarios (DFES system transformation) over 2023-28, and society then upgrades its ambition to be on one of the higher credible uptake scenarios by 2035, the investment needed from 2028 onwards is highly likely to be undeliverable. This would be especially the case for upgrading the local cables and wires that we use to distribute electricity to homes and businesses – because it may well not be possible to increase delivery capacity of this type of work quickly enough, given skill shortages and the strong likelihood that supply chains will be constrained. And if these local networks cannot be upgraded quickly enough, people won't be able to use HPs and EVs in the way that they would like to without overloading the network. This in turn could prevent the country meeting its ambitions.

If we instead invest at a level between DFES system transformation and our planning scenario (in line with the CCC headwinds scenario), we would reduce the future delivery risk substantially, because we would be:

- able to scale up our delivery capability over a longer and more achievable timescale; and
- store up less investment for the future in the first place.

Although there could still be a significant future delivery challenge under this scenario, it is much more likely to be of a scale that is achievable.

Mitigating a potentially critical risk to the country's decarbonisation pathway is of substantial value to the country.

And the cost to energy consumers of mitigating this risk is not actually that high, even if uptake is slower than the level of uptake assumed in our baseline allowance proposal.

- Even on the slower-uptake scenarios, the same upgraded assets will still be needed soon after the end of the 2023-28 period.
- The net present value (NPV) cost to energy consumers of upgrading the assets slightly earlier than is needed, in some cases, is much smaller than the total cost of the investment.
- Part of this NPV cost would be paid for through reductions in distribution system losses of electricity, so there is a benefit to energy consumers of slightly accelerating some investment.[2]
- Lastly, a substantial subset of these assets is growing old and will also need to be replaced before then for asset condition reasons; since demand is growing it will still make sense to renew them with larger assets.

Of course, if the actual uptake of LCTs is higher than the CCC Headwinds scenario during 2023-28, then simply keeping up the pace our region has set will itself mitigate future deliverability risk.

We set out our analysis and results in details in annex 7.4 Decarbonisation uncertainty and Ofgem uncertainty mechanisms.

Uncertainty mechanisms will also be put in place to manage unexpected eventualities.

While it is important to set sufficient baseline allowances to mitigate future deliverability risk, establishing a level of investment that DNOs can progress, there is still considerable uncertainty around the timing and nature of the net zero transition.

Baseline allowances may need to flex upwards, in particular if there is rapid uptake of EVs and HPs during 2023-28 that our proposed level of baseline allowance cannot accommodate. And our regulator has already decided that there will be uncertainty mechanisms in place to adjust cost allowances as more information becomes available.

These uncertainty mechanisms will need to be developed in detail over the months ahead, but this plan sets out the approach we favour. In all cases our proposals focus on ensuring funding only flows when there is a clear need, and that companies face strong incentives to manage cost on behalf of customers. This includes:

- A main mechanism driven by the speed of uptake of EVs and HPs going above a pre-defined threshold, that baseline allowances are set to accommodate, to cover the cost of most network improvements that help meet the needs of large groups of customers.
- A set of ancillary mechanisms based on customer requirements for improvements to their specific connections.

We think that allowances should increase based on the number of EVs and HPs in service.

Our favoured mechanism entails a volume driver that would provide additional funding for each additional EV or HP that is in use, above the pre-specified uptake level that our baseline allowance proposal is set to accommodate. So, if uptake rises above the volumes entailed in the CCC Headwinds scenario, we would receive a set amount of funding to enable us to invest to accommodate the additional uptake in demand.

A mechanism based on the number of EVs and HPs in use, not on the volume of work a network company chooses to do, would have the advantages that:

- It would create clear and strong incentives for us to reduce the additional costs of accommodating more demand on the system wherever we can, which should stimulate cost savings that benefit customers in both the short and long run.
- Additional funding would only be provided if there was a clear and verifiable need, triggered by the pace of decarbonisation, providing comfort to consumers that, if they are asked to fund additional costs, these costs will be both needed and efficient.

2. Energy is always lost when electricity flows through network assets such as cables. Bigger assets typically mean less resistance and lower losses. Lower losses means lower generation costs across the whole system.

Customer requirements to improve their own connections should also be funded based on the number of requests.

Beyond the primary uncertainty around the speed of EV and HP uptake, we also see a number of related areas where volumes are driven by customer requests that are hard to forecast now. In these areas it again makes sense to update allowances as more information is made available to avoid windfall gains and losses.

Shared service cables: service cable is the part of the network that covers the last few yards to the property. In some cases the service cable is shared between two or more properties and is known as a looped service. Where one of the customers sharing this service intends to install an EV or HP, this may increase load on the looped service to the point where we need to 'unbundle' multiple properties, installing a separate service to each (or alternatively installing a bigger shared service cable). Like other service or fuse upgrades, there is significant uncertainty around the volume of looped services that will need to be unbundled, and consequently the costs. We propose that this risk be managed with another volume driver, for example providing a unit cost allowance for each connection on a looped service upgraded to a 100-amp connection.

Service cable and fuse upgrades: the way we recover the costs of upgrading customers' service cables and fuses has been clarified by our regulator. That has confirmed that the cost of doing that work should be borne by the customer base as a whole, rather than the individual customer whose service is being upgraded. Such upgrades may be necessary, for example, to enable customers to charge an EV at their property, or to install an HP. The uncertainty around the speed of uptake of EVs and HPs, and how this will relate to premises that currently have smaller service arrangements, means that it is impossible to accurately predict how many service upgrades we will need to perform over 2023-28, and the resulting level of costs. We propose that a volume driver be put in place to manage this uncertainty, for example providing a fixed allowance per service or fuse upgraded to 100 amps (with upgrades beyond this size being funded by the customer). We have provided more detail in annex 4.5 Socialisation of costs.

Changes to how connection costs are recovered: our regulator has also proposed changes to the way that we recover the costs of connecting larger projects to our network, which would mean less of this being charged to the connecting party. Costs we will no longer recover from them will instead be recovered through our general network charges from all connected customers.

The impact that this policy change will have on connecting customers' behaviour, and our reinforcement costs, is highly uncertain. But it is likely to lead to a higher volume of connections and to customers asking to connect to parts of the network that are more congested and more costly to accommodate new customers on, because larger customers will no longer need to recognise the full cost impact of their decisions. That is why we do not believe that our regulator should make these changes. But if they are made, we propose that a volume driver be used to manage this uncertainty, providing a cost allowance based on the number and size of new connections to the network. We have provided more detail in annex 4.5 Socialisation of costs.

More work is needed to design this set of uncertainty mechanisms and other companies have made some very different proposals, but we look forward to working with our regulator and other stakeholders to get this right.

Back-stop reopeners can also be used to reset arrangements if they would give rise to unjustifiable gains or losses.

Of course, we also recognise that forecasts are often wrong, and there comes a point where a regulator may need to protect energy consumers and investors from unjustifiable gains or losses. We would also propose that these uncertainty mechanisms should be supported by fail safe reopeners, where appropriate. If it becomes clear during 2023-28 that the uncertainty mechanism was not working as intended, then the reopener should kick in and the mechanism be reset, to provide an additional layer of protection to customers.

This is especially important for the main mechanism, comprising base allowances plus a volume driver, which is likely to account for the large majority of the costs in question. In the current arrangements, our regulator already has in place a back-stop reopener uncertainty mechanism which, if operated in an agile manner, could allow it to reset the relevant allowances and then allow the price control to continue with the same strong incentives. If the calibration of our current reopener was maintained, while moving to shorter price control period where customers will receive a bigger share of any cost changes, the potential windfall in either direction could be as low as £15m.

You can read more about our proposed uncertainty mechanism designs in annex 7.4 Decarbonisation uncertainty and Ofgem uncertainty mechanisms.

We also expect to manage a broader range of uncertainties.

The table below illustrates with examples the range of the known uncertainties, other than the decarbonisation pathway, that we currently expect to manage on behalf of our customers. We will do so within the cost allowances set out in this plan, and under the generic mechanisms that cover all risks, unless Ofgem develops additional mechanisms for the sector ahead of the price control being finalised. Potential sector-wide mechanisms are being actively considered by Ofgem in some of these areas, and if they are put in place they will be applied to our plan. As well as the above risks, we also expect to manage a broad range of unknown uncertainties within the cost allowances we set out, provided that none of these risks become critical enough to trigger Ofgem's backstop mechanisms. While we cannot know in advance where these risks will emerge, it could include similar risks to those that materialised in the 2015-23 period, such as significant unanticipated investments that we made in cyber defences, and our accelerated and extended programme of flood defences to mitigate growing extreme weather risks, all of which we managed within our cost allowances.

Figure 1: examples of risks we expect to manage within the 2023-28 period

Risk	Description
Public and employee safety	We have an extensive electricity network in close proximity to the public and that our employees also need to work on. The legal framework for managing these risks exposes us to potentially major fines if we fail to do so appropriately.
Employment law and taxation	Changes in employment law, or new legal judgements on unclear areas, can lead to significant changes in employment costs, as can changes in taxes such as employer national insurance contributions.
Type defects	Specific assets can have defects that make them more susceptible to failure. Where these emerge, we may need to accelerate replacement.
Diversion requirements	The majority of our assets are sited on other people's land, with specific rights of tenure. We deal with large volumes of requests to move assets, which can expose us to varying levels of cost.
Contaminated assets	Various historically installed assets carry known contamination risks, such as asbestos or lead paint, that we need to manage and remediate where appropriate.
Metal theft	Our assets can be a target for theft, particularly when copper prices rise. This can result in costs to us from asset repair, poor scores on reliability incentives, and from investing more to reduce the risk.
Un-indexed unit cost variations	Ofgem plans to implement indexation of certain costs, such as employment or materials costs, instead of its previous approach of providing baseline allowances for average increases. Although allowances for these variations are necessary, the available indices are imperfect and expose us to additional risks.
Refinancing requirements	Ofgem sets its cost of debt index so that its expected allowance covers the expected costs of the sector but each company has a unique refinancing profile and is exposed to the risk that its cost of refinancing happens to be exceptionally high.

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