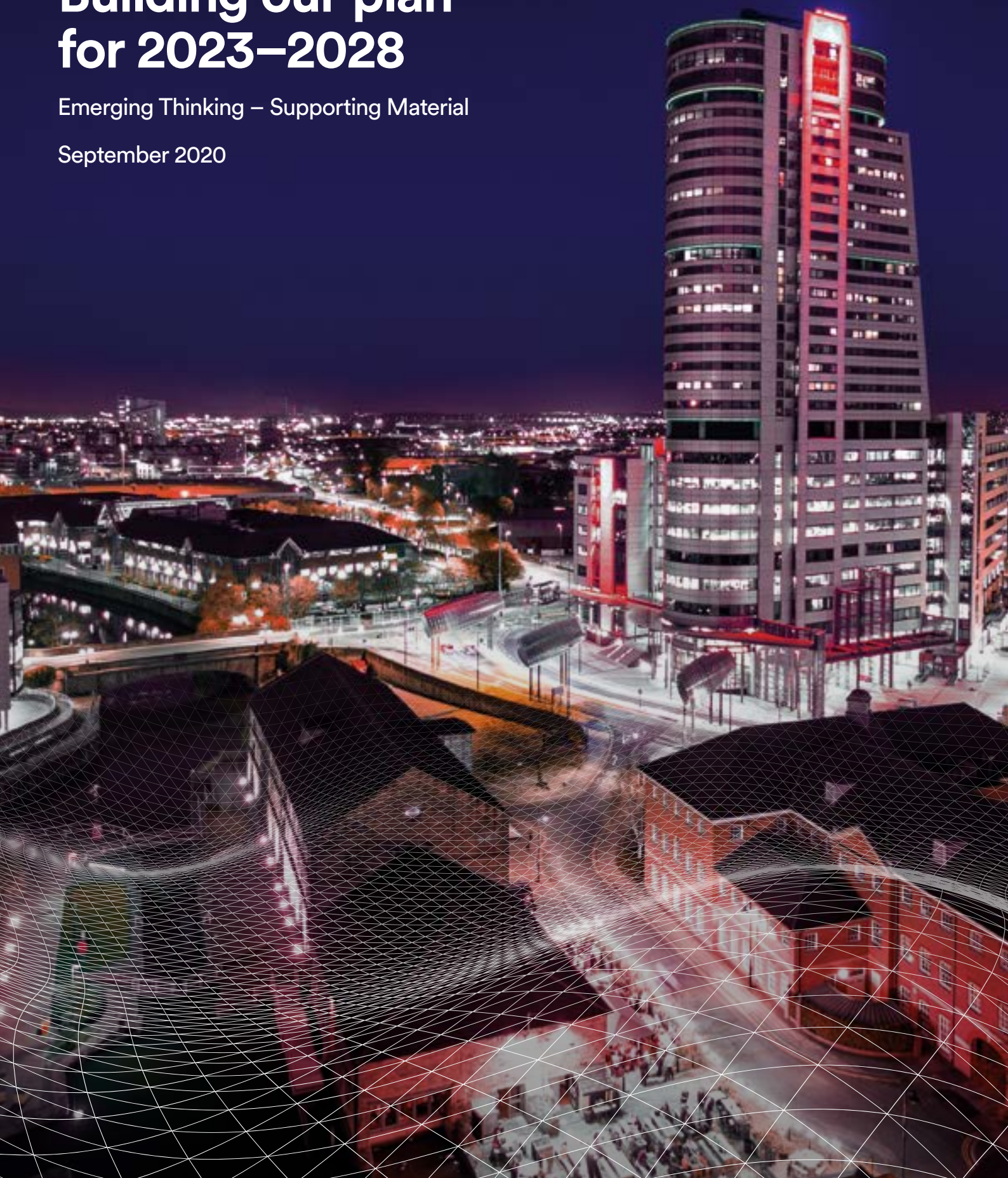
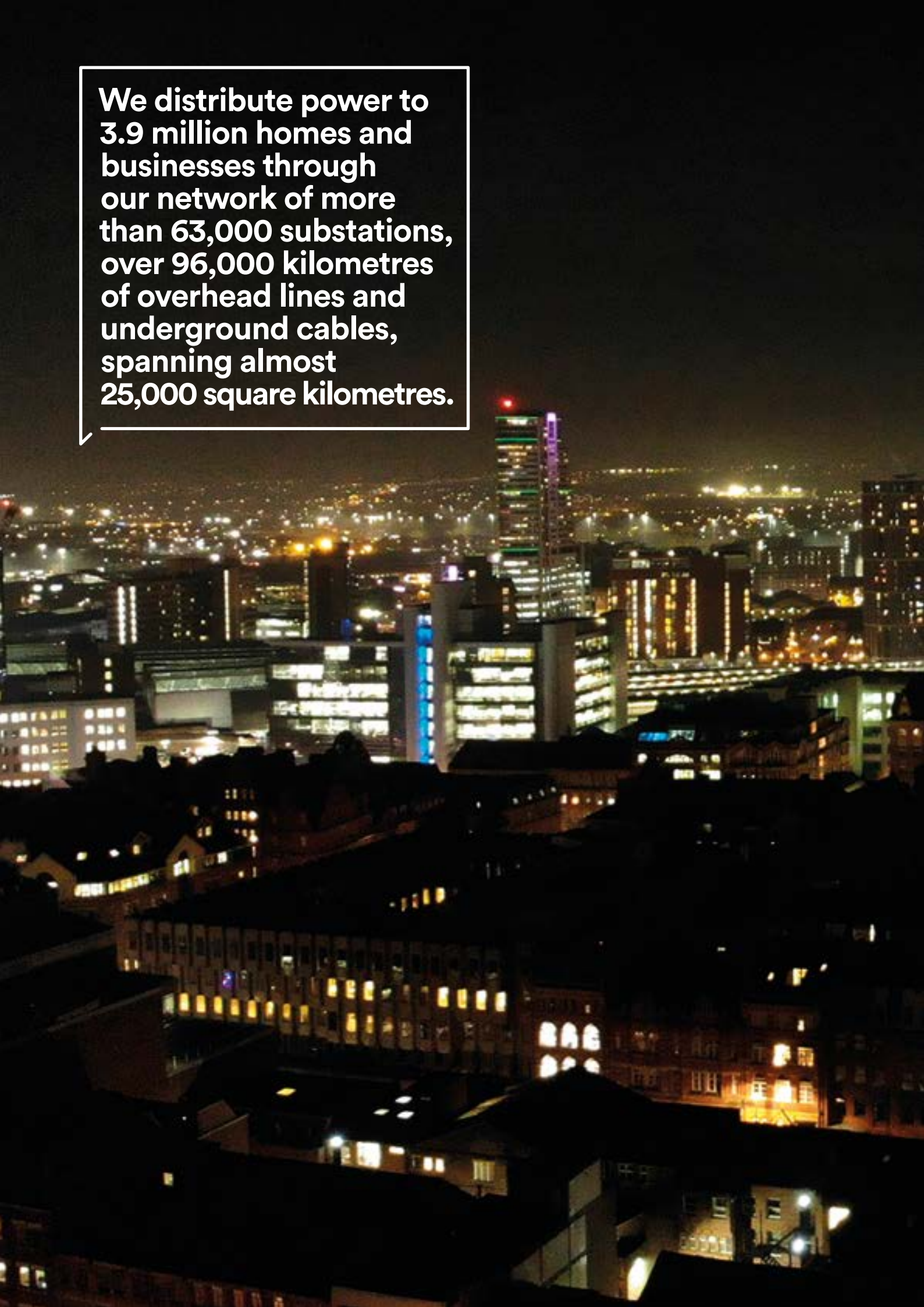
NORTHERN POWERGRID

Building our plan for 2023–2028

Emerging Thinking – Supporting Material

September 2020




We distribute power to 3.9 million homes and businesses through our network of more than 63,000 substations, over 96,000 kilometres of overhead lines and underground cables, spanning almost 25,000 square kilometres.

Our Emerging Thinking

Setting the scene

Deliver an environmentally sustainable network

Maintain a safe & resilient network

Meet the needs of consumers & network users

Explaining our costs & bills

Next steps

Annexes

Setting the scene

Exploring choices with you

At this time of unprecedented change in the energy industry, it is vital that we hear from you about your priorities, needs and expectations.

So far, we have been asking you open questions to understand your priorities. This publication seeks to feed back on the insights we have gained so far. It enables us to continue our open engagement with you so we can better understand your views on some of the key choices that need to be made in forming our business plan for 2023-28 (RIIO-ED2).

In the summary document to Emerging Thinking, we set out our vision for the business that has been informed by your priorities. We also introduce the key strategic choices, relevant to all stakeholders, that will shape the direction of our plans in RIIO-ED2.

In this part, we start to unpack different ways we might go about delivering on our vision for you and some of the choices that need to be made in balancing the priorities. To do this we have broken our business down into 12 performance areas[1], informed by the priorities we have heard from you. These areas are all aspects of our business where we deliver tangible outputs for you. Whilst this is a simplification of a complicated business that has lots of interrelated parts, it enables us to explore our plans and seek feedback from you in a simple and manageable way. It also enables you to explore elements of our plans that are of most interest to you.

In each performance area we set out five calibrated levels of service that we could deliver for you in RIIO-ED2. These levels of service vary in the amount of change (and cost) they would represent relative to what you see from us today. They are provided to stimulate feedback from you and to help us refine our plans.

For each level of service we provide a high-level estimate of the total annual cost and impact on an average domestic customer bill (or the cost of a new connection). Whenever you see bill impact throughout this document, it shows the impact of choices per annum for the next 45 years, assuming all other things remain equal[2].

The levels of service we present in Emerging Thinking are by no means set in stone. We are still developing our plans. However, they are provided to frame a range of possibilities of what we could deliver in order to seek your views. For instance, you may like specific features of a number of levels of service that we set out in any given area. If so, please provide us with that feedback as it's valuable insight.

We introduced indicative stakeholder perspectives and packages of outputs we could deliver in the summary document to Emerging Thinking. These packages represented a combination of selections in the 12 performance areas of our plan. You can create your own packages on our interactive Emerging Thinking website[3] and provide us with qualitative feedback that will help us develop our plan. We want to hear your views.

Key questions for you

1
Which of the 12 performance areas are priorities for you?

2
Are we missing any priorities you would like to see here?

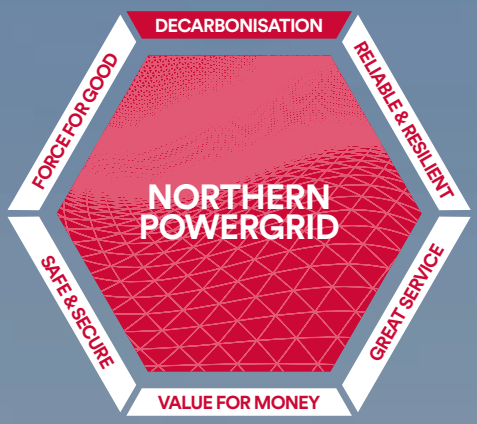
[1] The 12 performance areas are organised in line with Ofgem's business planning guidance – deliver an environmentally sustainable network; maintain a safe and resilient network; and meet the needs of consumers and network users.
[2] This assumes the recovery period remains unchanged in RIIO-ED2 and beyond in line with Ofgem's current policy.
[2] http://engage.northernpowergrid.com/planning-for-2023-28

Exploring the choices behind our vision

One vision

Delivered through 12 performance areas

Supported by four key enablers (innovation, digitalisation, people and collaboration)



For you to explore

and provide us with feedback to further develop and refine our plans

To build your own plan

with costs and bill impacts
For example....

Level A
Your current package… but at a lower cost

Maintaining output performance whilst reducing costs through continuous improvement that drives cost savings.

Level B
Enhanced performance… for the same spend

Enabled by innovation, we will increase output performance levels, deliver cost savings and/or reduce risk for customers – achieving strong benchmarked outcomes.

Level C
Major upgrade

Story changing performance driven to sector leading levels, fuelled by groundbreaking innovation, to deliver better value for money through superb service, cost savings and/or reducing risk for customers.

Level D
Breaking new ground

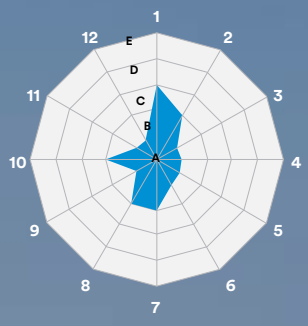
Building a new narrative, likely the result of multiple groundbreaking innovations, to develop and deliver new services and new ways of operating and/or accepting and managing new risks.

Level E
A new world

Reinventing what we deliver and how we deliver it through innovation that shifts the paradigm for the business – taking us to a new place for customers – delivering results faster and at scale.

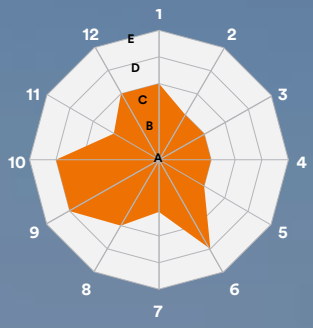
Example 1

Enable the pathway to net zero by 2050, whilst making use of efficiency savings elsewhere in the business to deliver enhanced performance in targeted areas.



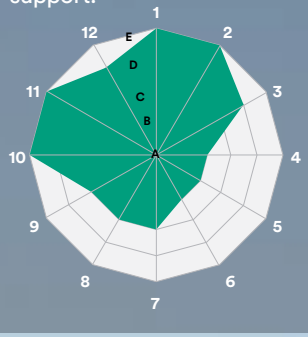
Example 2

Enable the pathway to net zero by 2050, but continue to pursue improvements in reliability and customer service.



Example 3

All out focus on climate change and community support.



Key

1 Decarbonisation
2 Business carbon footprint
3 Environmental protection
4 Safety
5 Long-term network performance & condition
6 Reliability & availability
7 Climate change adaptation
8 Physical & cyber security
9 Customer service
10 Connections
11 Our communities
12 Openness & transparency

Engaging with you

Our aim is to develop a business plan that meets the different and wide-ranging needs of our stakeholders.

We engage regularly with customers and stakeholders on how we run our business. The scale of this engagement has been growing during the current RIIO-ED1 period, and we are already using these insights to inform how we run our business day-to-day and also how we shape our plans for the next price control period, RIIO-ED2 (covering the period 2023 to 2028).

In our engagement so far we have been asking open questions, listening carefully to your views and building a view of your priorities for RIIO-ED2.

In addition to our regular engagement, we are carrying out a focused and extensive engagement programme to develop our RIIO-ED2 business plan. The programme started in September 2019 and will help us to challenge and develop our thinking in every aspect of our business and ensure that our plan delivers on your priorities.

This programme of work is building on the engagement we have carried out during RIIO-ED1. We are constantly looking for ways to improve our approach, including responding to learning from Ofgem's Stakeholder Engagement and Consumer Vulnerability (SECV) assessment process and our accreditation against the AA1000SES stakeholder engagement standard.

Our programme for RIIO-ED2 is our most extensive, ambitious and far-reaching stakeholder engagement programme to date.

We have developed a stakeholder charter, outlined below, which sets out our promise to you: to ensure that we run high quality engagement that ultimately reflects your views in our plan, in a transparent and evidence-based manner.

Throughout our engagement the dialogue will remain open – new priorities may emerge at any stage and these will be captured and considered within our plan development.

1 Stakeholder Led

- Our engagement is flexible, shaped by your priorities and evolves as outcomes become more defined
- Early, deliberative engagement informs the structure of our plans and initial working assumptions to test with you

2 Representative & Inclusive

- Everyone in our region has the opportunity to contribute to our plans so that all voices are heard from across the diverse communities we serve
- New and innovative techniques are used to engage with those of you who are 'hard to reach'

3 Open & Transparent

- You are actively encouraged to participate in our planning process
- You are kept informed of our decisions and rationale throughout the engagement process

4 Accessible

- Engagement methods are flexible, varied and unrestrictive to accommodate your differing needs
- We will educate you as required to help you understand our business and the options available so that you can make better-informed decisions and provide richer input

5 Responsive & Adaptive

- Best practice and lessons learned inform our approach
- Our programme is flexible, evolving and adapting to change as we learn more about your needs

Wave 1
Open Engagement
2019 – Q2 2020

- **Development of our approach** including a regional model of representation and inclusivity
- **Analysis and assessment of engagement** to date to identify key themes and priorities
- Development and delivery of **tailored engagement plans**
- **Initial consultation** with an open agenda, seeking and testing early views and identifying areas for further exploration

Wave 2
Refinement
Q3 2020 – Q1 2021

- **Open consultation on our Emerging Thinking** for RIIO-ED2, presenting options and tailoring specific activities to engage key consumer and stakeholder groups
- An extensive and robust programme of **qualitative and quantitative engagement** to understand your needs and 'Willingness to Pay'
- **Refinement and testing** of plans based on your feedback

Wave 3
Finalising & Refreshing
Q1 2021 – Dec 2021

Initial business plan submission – July 2021

Final business plan submission – Dec 2021

- **Sharing final plans and testing** your support for them
- **Adapting our plans** before finally submitting them to our regulator, Ofgem

Our Customer Engagement Group (CEG) is scrutinising our engagement.

We established our Customer Engagement Group (CEG) in September 2019. The CEG is a group of ten independent experts led by Chair, Justin McCracken, charged with scrutinising our RIIO-ED2 business plan and the quality of engagement undertaken to inform it.

The group meets monthly with Northern Powergrid and helps to ensure that customers' needs and views are reflected in our plans which is particularly important in the rapidly evolving low-carbon energy landscape.

The CEG operates in an open and transparent manner, publishing updates about its work on www.ceg.northernpowergrid.com. The CEG will publish a report on its findings alongside our business plan submissions to Ofgem in 2021.

Ofgem will reflect on this report, alongside our plan, as a source of challenge or validation of the approach we took when developing our plan.

Our engagement with you to date:

3,500

Over 3,500 stakeholder views heard, through multiple channels, to shape our priorities

>800

Stakeholders attended our stakeholder summit and online round tables, >85 local and national politicians, >560 external partners

80

Members of our new consumer panels have met 6 times

To get involved please:

Visit: engage.northernpowergrid.com
Follow us on Twitter: @powergridnews
Follow us on Facebook: @northernpowergrid
Email us at: yourpowergrid@northernpowergrid.com
Write to us at: Stakeholder Relations, Northern Powergrid, 98 Aketon Road, Castleford WF10 5DS

What we are hearing from you

In our engagement with you so far, we are hearing these key messages:

1
"**Decarbonisation** is a priority and you see us playing a major role in facilitating the transition to net zero, including providing access to energy system data"

2
"The **safety, reliability and resilience** of our network remains a top priority, arguably increasingly so as more reliance is placed on electricity in day-to-day life"

3
"You expect us to show leadership on **environmental protection,** including reducing the carbon footprint of our operations"

4
"You want us to continue to take a leading role in **supporting vulnerable customers** and to consider going further, including facilitating a socially inclusive transition to net zero"

5
"You want us to do this whilst **keeping bills low**"

By stakeholder group, this is what you are telling us:

Domestic customers

- Provide a reliable network, particularly given increased future reliance on electric vehicles
- Prioritise support for vulnerable customers during an interruption
- Provide proactive, personal and flexible customer services with a blend of human and digital interactions
- Work harder to create a greener future and explain what this means and costs
- Focus on reducing emissions, not simply offsetting
- Spread investment costs evenly across the region but support low-carbon ambitions

Vulnerable customers

- Increase awareness of our services and the support available for vulnerable customers
- Provide immediate contact and transparent updates during an interruption, via a range of channels
- Share Priority Services Register (PSR) data across utilities to provide a more consistent service to vulnerable customers
- Prioritise support associated with fuel poverty and affordability
- Support a socially-inclusive decarbonisation transition by anticipating impacts on vulnerable groups

Communities and businesses

- Provide tailored services to SME customers who have specific needs during an interruption due to their size
- Develop flood protection strategies which actively consider business stakeholders
- Adopt a more unified approach to tackling global challenges like climate change and carbon reduction
- Examine best practice from other sectors

Energy suppliers

- Improve the quality of information and communication provided to distributed generation owner operators
- Provide more communications during outages including estimates of outage duration and restoration times
- Facilitate access to network data and associated tools to help utilities extend the scope of works on offer to client

Local and central government

- Long-term planning is essential for transitioning to a low-carbon future
- Prepare flexible investment plans that can adapt to new policies
- Understand regional and local plans to meet net zero, to help plan effectively for future network needs
- Collaborate extensively with the UK Government and other stakeholders to develop resilient infrastructure

Expert stakeholders

- Maintain robust action plans for managing cyber security risks, including risks associated with smart meters
- Provide reassurances about the capacity of the network for future electric vehicle/infrastructure needs
- Take action to reduce fluid leakages or recover more fluid, to reduce ground pollution
- Expand visual amenity and undergrounding projects beyond Areas of Outstanding Natural Beauty into urban areas
- Support the roll-out of smart meters by providing additional customer access to smart meter data

Employees

- Introduce an e-learner management system to improve the induction and training of technical staff
- Adapt working and training practices that are more inclusive for employees

Regulators

- Share information with the regulator about cyber security non-conformities
- Include the embodied carbon impact of our assets in any environmental action plan

By performance area in our business, this is what you are telling us:

Decarbonisation

- Provide reassurances over the capacity and resilience of the network to support the uptake of electric vehicles
- Be responsive to local energy plans within our region – close engagement and flexible plans are needed
- Engage extensively on the issue of decarbonisation – educate, raise awareness and illustrate what the low-carbon transition means for you

Business carbon footprint

- Reduce business carbon footprint in support of net zero
- Collaboration is key – strategies to decarbonise across all sectors in the region need to be aligned to deliver solutions

Environmental protection

- Environment is now amongst your top business plan priorities
- Build on the successful programmes in the areas such as reducing oil/fluid loss and undergrounding our power lines in Areas of Outstanding Natural Beauty
- Air quality, waste reduction and biodiversity are becoming increasingly important

Safety

- Safety remains a top priority
- Share safety information with those who need it most
- Collaborate with other network companies

Reliability & availability

- Reliability remains a top priority alongside safety
- Improve restoration time accuracy when the power goes out

Long-term network performance & condition

- Consider future generations when making investment decisions
- Use an independent expert panel to scrutinise the technical aspects of our plans

Climate change adaptation

- Flooding remains a key issue
- Recognise the links between climate change and decarbonisation
- Identify interdependencies in our plans with other utilities

Cyber & physical security

- Cyber security is a complex issue that requires expert input
- High standards and secure platforms are expected that are able to respond to the latest threat information and protect customer data
- Consider investing more in CCTV security around substations

Customer service

- Make even greater use of technology to aid a simplified, quicker service
- Prioritise vulnerable customers during power cuts
- Support customers in fuel poverty

Connections

- Offer more technical support and advice for connection applications
- Access to network data is becoming increasingly important
- Expand the range of flexible connections solutions

Our communities

- Affordability and accessibility are key to enabling a socially inclusive net zero transition
- Tailor and target our social and environmental programmes to meet the needs of our regions and local communities
- Build relationships with local experts and trusted partners to better understand and meet the needs of our communities

Openness & transparency

- Partnerships and collaboration are important across a variety of goals; including protecting the network, supporting vulnerable customers and achieving net zero
- Ensure that your personal data is safe

Throughout the document we use this icon to highlight areas where our plans are specifically responding to your feedback

Building from solid foundations

A story of strong delivery in RIIO-ED1

Our track record of delivery so far in the 8-year RIIO-ED1 period (2015 to 2023) is strong. We are on track to deliver our 53 business plan commitments for the price control period. In many cases we expect to significantly exceed our targets, whilst spending in line with the tough cost allowances that were set for us by our regulator, Ofgem. In doing so, we will deliver on the overarching promise we made in our plan: to give you 'more for less'.

We have delivered significant network reliability improvements in the period so far. There are 28%[4] fewer power cuts, and, when they do happen, they are now 31%[4] shorter – compared to the targets we set of 8% and 20% respectively. These improvements have been delivered by making targeted investments, including investing in innovative technology such as network automation and remote control switches. These technologies allow us to remotely control and switch back on parts of our network after a fault has occurred, allowing us to get the power on much more quickly. Our investments have also laid the foundations for further service improvements for you in future.

We have made step-change improvements in the level of protection that our network has to external threats, such as bad weather or cyber-attacks. We have invested £31.1m in our flood defence programmes, expanding our programme by 56 sites (compared to our original commitment) in response to increased flood risk. A total of 212 sites will have been protected with flood defences by the end of the period.

Cyber threats were not considered to be a significant risk when we made our RIIO-ED1 business plan, but as the threat has grown, we have found cost savings elsewhere in the business that have enabled us to invest £25.6m in new cyber defences.

Customer service improvement has been a key priority for us in RIIO-ED1 and we are delighted to have delivered a step change improvement in customer satisfaction so far in the period (a 6.7 percentage point improvement to 89%). We have made investments in new technology, such as our customer relationship management system, and 'customer-first' training for our front-line and contact centre teams. We now provide more tailored services for our vulnerable customers and have increased the range of support we can offer. During RIIO-ED1, customer satisfaction with our connections service has also increased by 9.7 percentage points.

We hope our strong track record in delivering on our promises gives you confidence in our capacity to deliver more for you in the future, building on the solid foundations we have put in place in RIIO-ED1.

But before we get there, there is still more we need to do in the remainder of RIIO-ED1 to deliver our commitments. We are determined to improve our satisfaction levels even more to be amongst the industry leaders. Other networks are ahead of us in some areas and we are determined to catch up. There are also parts of our business that have experienced delays in some work programmes so far in RIIO-ED1 – we are committed to delivering on these by 2023.

28%
Fewer power cuts RIIO-ED1 to date

£25.6m
Investment in RIIO-ED1

[4] Unplanned, excluding exceptional events – reduction relative to business plan baseline, 2012/13

How we are doing against our RIIO-ED1 commitments

Key strategic priorities	ED1 Target	ED1 2019/2020	ED1 Forecast	Key initiatives
Costs & outputs: efficiently deliver our £3bn ED1 investment programme				
Total costs – ED1 to date (variance to allowances)	£3,043m (0%)	(-£75.4m) (-3.8%)	£3,043m (0%)	— ED1 cost efficiency programme
Outputs (variance to target)	100%	66.8% (+4.3%)	100–110%	
Safety: reduce our accident rate by 50%, enhance our cyber security defences				
OSHA accident rate[5]	0.22 (-50%)	0.14 (-67%)	0.09 (-79%)	— Safety engagement, training and audits — Vehicle telematics — Cyber security investment (£25.6m) in ED1 including delivering NIS-D requirements
Customer service: improve customer satisfaction to become a leader in the industry				
Overall customer satisfaction	85%	89.0% (+6.7pp)	93.0% (+10.7pp)	— Customer Relationship Management technology across our core service lines — Proactive communication and web services
Day+1 complaint resolution	85%	84.7% (+30.9pp)	88.0% (+34.2pp)	
Connections: improve connections customer satisfaction, whilst reducing routine lead times by 30%				
Connections customer satisfaction	>85%	88.4% (+9.7pp)	92.5% (+13.8pp)	— Face-to-face services — Quotations-on-site for small works connections — AutoDesign self-service for connection budget estimates — Flexible connections
Small works lead time (LVSSA & LVSSB only (2-4 plots))	-30%[5]	52.8 days (-27.1%)	38.0 days[6] (-47.5%)	
ICE penalty	Nil	Nil[7]	Nil	
Reliability & availability: increased network resilience, 20% shorter and 8% fewer unplanned power cuts				
Customer minutes lost[8]	-20%	40.6 (-30.6%)	-40%	— Regional operational delivery teams — Network automation and remote control — Trialling fault prediction technology — Flood defence investment programme
Customer interruptions[8]	-8%	48.1 (-27.9%)	-30%	
Flood defence upgrades	156	187	212[9]	
Environmental protection: minimise our impact on the environment				
Oil/fluid lost to ground	-15%	33,810 litres (-36.5%)	-46%	— Fluid-filled cable replacement — Roll-out of innovative solutions such as thermal imaging cameras for SF_6 loss and self-healing cables
Carbon Footprint	-10%	33,365 T (-44.1%)	-48%	
Social obligations: extend our range of differentiated services for PSR customers				
Stakeholder Engagement and Customer Vulnerability score	8.00 (2nd)	6.71 (3rd)[10]	8.00 (2nd)	— Partnerships providing support to the most vulnerable in our region — Enhanced use of data to provide tailored services for our priority service customers
Smart & sustainable networks: enable the Transition to DSO and support the national smart meter roll-out				
LCT generation connected	No target set	2.9GW	4.3GW[11]	— Distribution Future Energy Scenarios (DFES) — £83.4m smart grid enabling investment — Market testing for flexibility services — Active Network Management roll-out

[5] Reduction relative to business plan baseline – 2013 calendar year
[6] Reflects wider ED1 business plan commitment to reduce routine end to end connection lead times. 2019/20 actuals relate to LVSSA and B lead times only
[7] 2018/19 performance: 2019/20 determination expected in Q4 2020
[8] Unplanned, excluding exceptional events - reduction relative to business plan baseline, 2012/13
[9] Surveys have revealed defences at an additional 63 sites already meet required flood defence standards
[10] of 6 DNOs
[11] Reflects accepted schemes. Final connection dates are subject to change

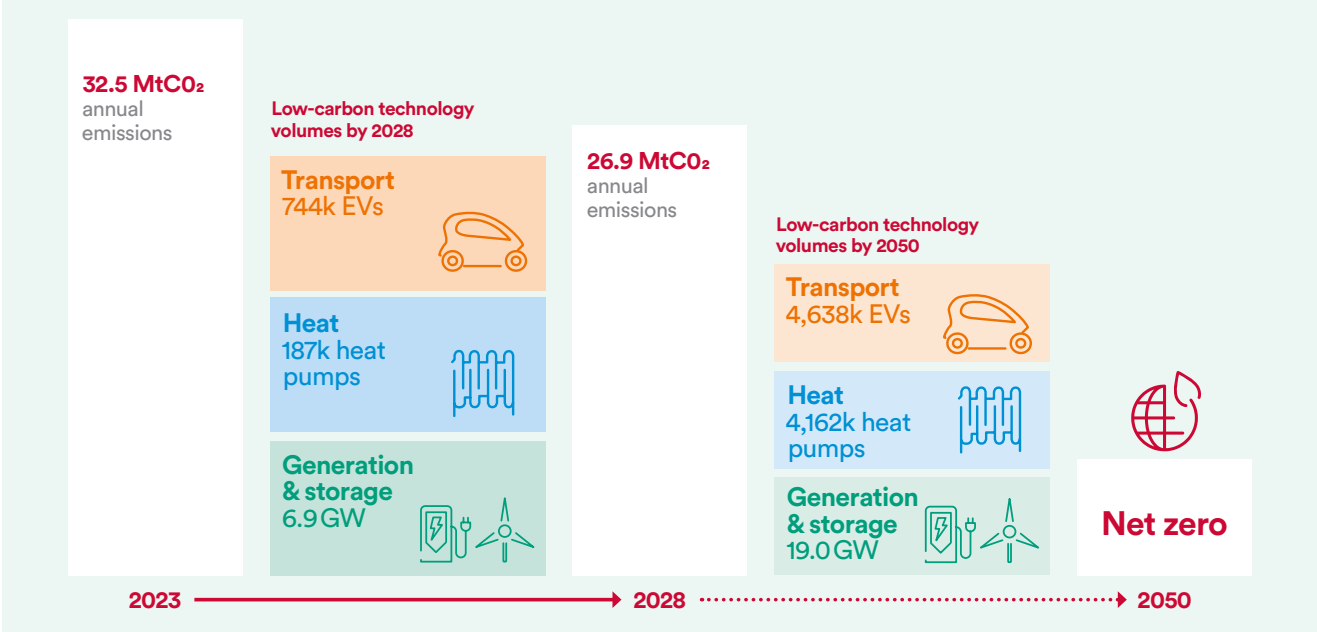
Deliver an environmentally sustainable network

DECARBONISATION

1.Decarbonisation

Decarbonising the energy system

A transformation in how we use and generate energy is required to drive our region's carbon emissions towards net zero. The 2023–28 period is a significant part of this journey.



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

Last year the UK Government committed to achieving net zero greenhouse gas emissions by 2050[1]. By 2028, the end of the next price control period, the country needs to be well on the way to a fully decarbonised energy system. This is one of the most significant transformations in our industry and we have a leadership role to play.

We've already done a lot of work to lay the foundations for the additional capability that will be needed on our network to deliver decarbonisation. The country's electricity system will evolve to meet an increasing uptake of low-carbon customer technologies (LCTs) such as heat pumps (HPs) and electric vehicles (EVs) that need to be rolled out at scale in the coming years. We have used three example domestic customer profiles to illustrate what a day in the life might look like in 2028, alongside the role that Northern Powergrid could play (see Annex 1).

The next five-year period marks a significant phase of this net zero investment. Our overall objective is to deliver investment in our network to set us on the right track for achieving the UK Government's net zero goal by 2050, while remaining able to adapt our plan to changing requirements in the longer term. This transformation will require investment, so it is essential that we do it as efficiently as possible.

We have worked with a wide range of customers and stakeholders to develop our Emerging Thinking for decarbonisation. This engagement has built on our 'DSO v1.1 Distribution System Operator Development plan'[2] which was published in October 2019 and informed the scenarios and options we are presenting for further consultation.

We are advocates of a 'flexibility first' approach to managing and developing the network and we are looking to develop proposals that will support customers becoming more flexible in their use of energy. We think that is the way to achieve the twin objectives of decarbonisation and least overall cost. Practically, a flexible approach will involve customers being paid by us to change when they use their electricity so that they get the most out of the network that they pay us to provide for them. It also means that we will use more and more smart technical solutions to make the network more flexible.

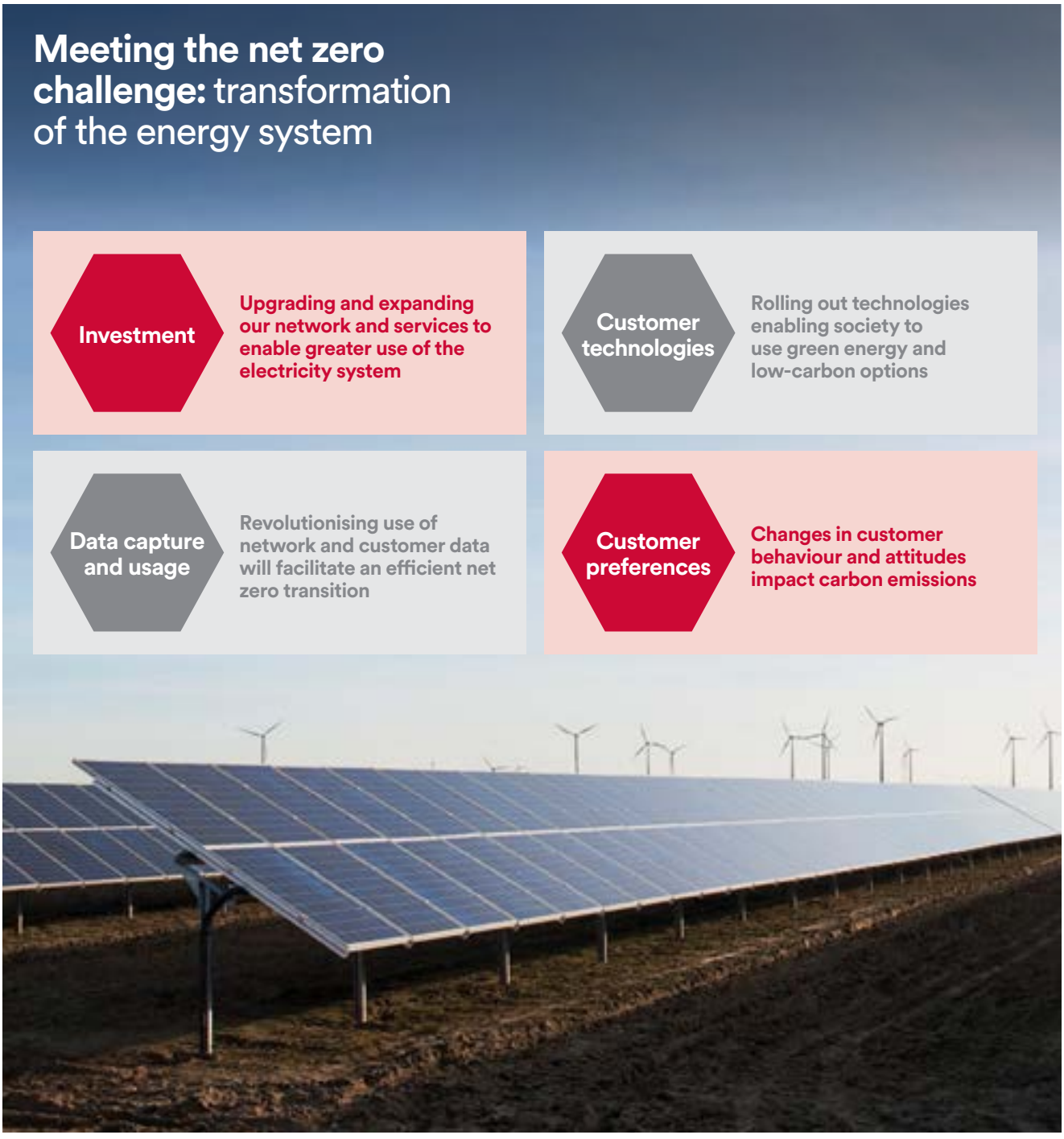
Those solutions will revolutionise the way that we capture and harness valuable data about power flows on our network. By using both customer flexibility and smart solutions for network flexibility we will reduce the amount of expensive, traditional network reinforcement that is needed to support what is set to be a large increase in the use of electricity. Innovative use of data will also deliver additional benefit to customers as we make energy system data available to other organisations, who we expect will use it to improve their service to customers (for example, an energy supplier that rewards a customer for using electricity when there is a surplus of green energy, such as in the middle of the night when the wind is blowing).

[1] Net Zero – the UK's Contribution to Stopping Global Warming, Committee on Climate Change, May 2019
[2] DSO v1.1, October 2019, can be found at https://www.northernpowergrid.com/asset/0/document/5139.pdf

We have a clear sense of where we are going and what solutions will get us there, but the exact details of how we will make the transition remain open. We'd like to get your thoughts on the pathway to net zero as this will shape our plans for the next five years. There are four key questions to explore with you in this Emerging Thinking phase of our business planning.

— **How electrical** will the transition to green energy be?
— **How local** will the energy system be?
— How can we encourage our customers to be **flexible** in their energy practices?
— **How fast** will our region pursue decarbonisation?

Decarbonisation will be best achieved through close collaboration with our stakeholders. The most cost-effective, resilient and sustainable solutions will almost certainly be those that optimise the whole energy system, not just our own network. We know that we have a central role to play in this, but we also need support from others, including policymakers. For example, market participants will need to be able to access data that will facilitate efficient investment and help create a functioning flexibility market. We also need an economic environment that encourages investment in low-carbon technologies (LCTs) that will drive the pace of decarbonisation in our economy.



Net zero requires a radical shift for both us and our customers

Action is required to decarbonise in an inclusive way across our communities

Electricity consumption and generation patterns will change as the country decarbonises heat and transport, which means that there will be increased reliance on the electricity network. We need to plan now for the radical changes that will be necessary on our network in the future, and support our stakeholders to capitalise on the opportunity that decarbonisation presents to stimulate wider investment in our region. We want to hear your priorities so that we can balance them and play our part in setting us all on a path to net zero.

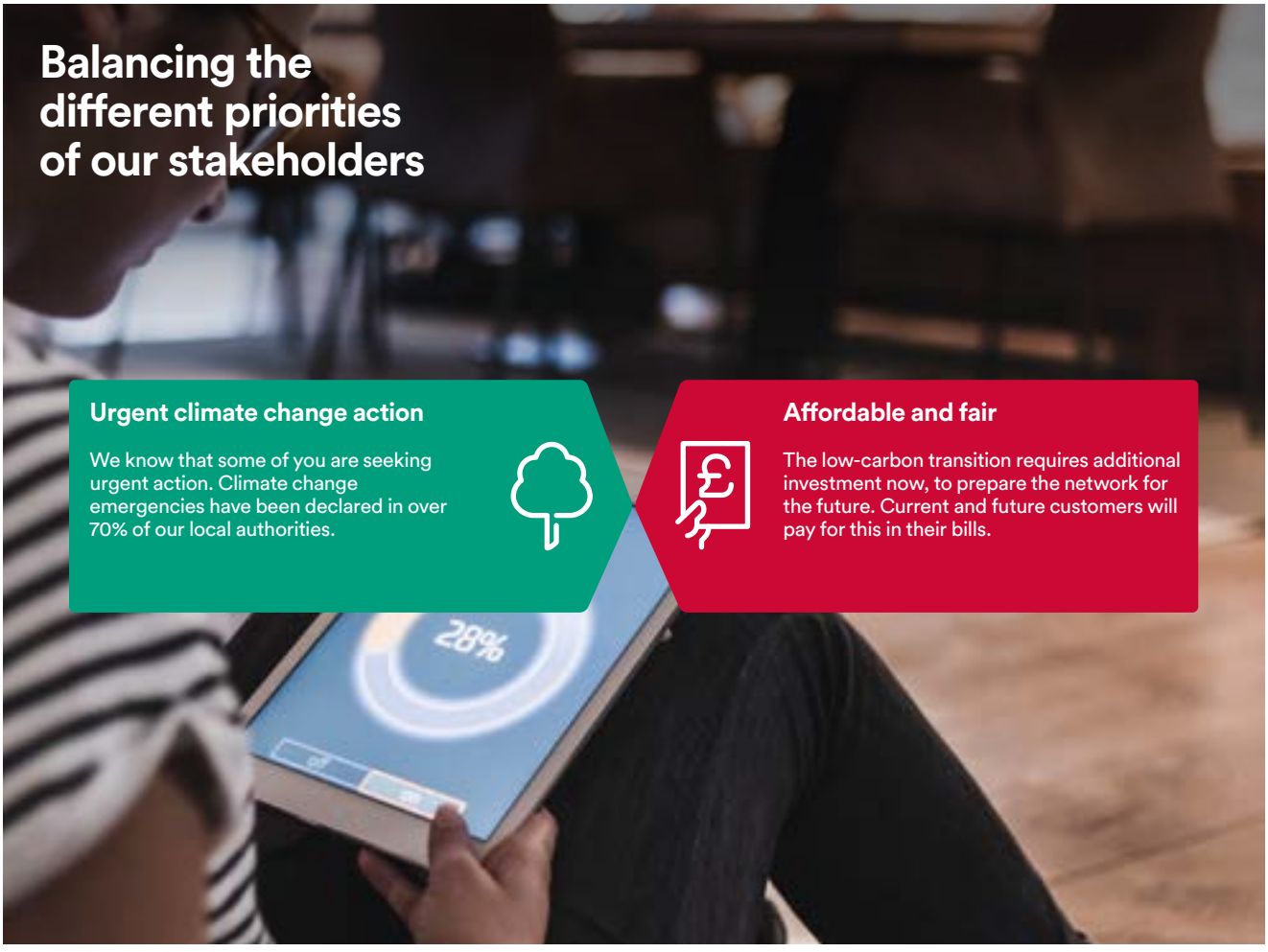
Principles for a just transition

It is important that, from the outset, we have a clear view of what is needed to ensure that the transition not only happens, but that it happens in a way that is fair.

We think that involves:

- supporting the creation of **green jobs and development of skills** –deploying talent in our region
- **embracing digitalisation** – using innovative solutions to deliver decarbonisation efficiently and effectively, while enabling people from all parts of society to benefit from the opportunities the low-carbon transition brings, including those more vulnerable to power cuts or on lower incomes
- keeping downward pressure on costs by being **efficient and fair** – including network costs, energy costs and advocating for fair national policies on how costs are shared between customer groups.

The added dimension of the economic impact of the COVID-19 pandemic only increases the need for a comprehensive path towards clean regional growth. Decarbonisation presents us with a major opportunity to drive the green recovery in our region in the wake of unprecedented challenge and is essential for the national levelling-up agenda.



Four key questions about the future will determine how decarbonisation is achieved

How electrical?

— 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 Government about the energy system as a whole, for example whether heat is provided by electric heat pumps and/or hydrogen boilers. This may 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 five years, we expect the amount of connected generation and storage to more than double.

How flexible?

— More flexible demand and generation means that our role is increasingly about controlling and optimising the bi-directional flow of low-carbon energy through the 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).
— We have a 'flexibility first' mindset and will prioritise investment in solutions that facilitate and drive flexibility.
— We want to understand from you what we can bring to market to support you to become more flexible.

How fast?

— How quickly we reduce carbon emissions will be heavily dependent on the rate at which renewables displace gas generation and customers take up low-carbon technologies for transport and heat. Accelerated investment creates the opportunity for more carbon reduction and makes a quicker pathway easier to achieve.
— Different parts of our region will go 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.
— We want your views on how much we should invest to enable a faster, more flexible pathway.

Illustration of the impact of customer flexibility on demand

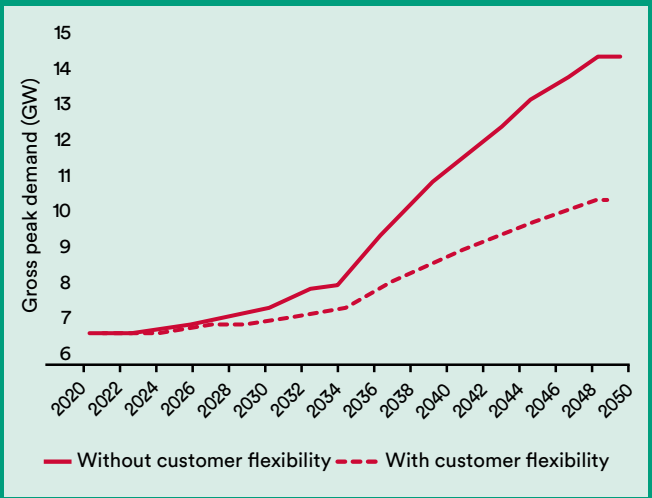
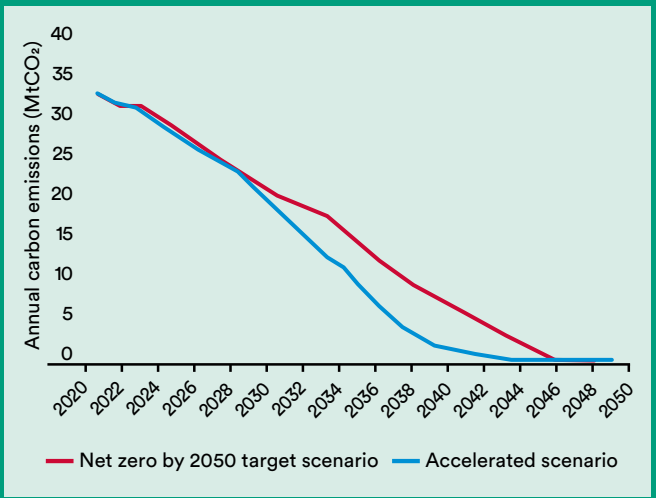


Illustration of the impact of accelerated investment on carbon emissions



Charts based on net zero scenario modelling used to inform our Emerging Thinking and described further on page 20.

Innovation and digitalisation are leading to an increasingly local low-carbon energy system

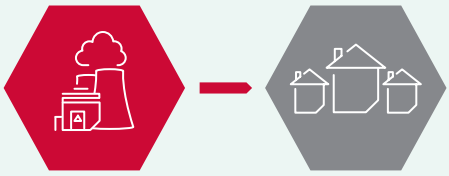
Decarbonisation involves more than just a shift from fossil fuels to green energy; it is driving structural change in how the whole energy system functions.

There is consensus across our industry that a more decentralised energy system is the best option for customers.

We anticipate increased levels of co-ordination and collaboration between the local powergrid and the other parts of the energy system. That means we must dovetail our actions with those of others, including energy suppliers and network companies.

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. 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.

Innovation projects supporting a decentralised system

Collaboration with Northern Gas Networks to understand optimal whole-system solutions for customers. The gas network may be able to help the electricity network decarbonise faster and at a lower cost.

Boston Spa Energy Efficiency Trial (BEET) is using smart data combined with automatic voltage control equipment to enable optimisation of customer energy bills.

Microresilience and **Silent Power** projects will enable us to start implementing and operating microgrids that maximise the output from renewable generators and protect customers with connections to local generation from power cuts.

Benefits of a decentralised distribution system

It maximises value of existing energy assets by flattening peaks on the network and increasing the energy flow through the network.

It ensures renewable energy is used productively.

The blend of investment solutions

The solutions that we will invest in to transition to net zero fall into four main groups. We will offer a blend of these solutions to meet higher load and changing supply and demand patterns on our network.

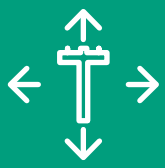
The appropriate mix of these solutions will be determined in part by how much customers change the way they use electricity, and what we do to drive that change.

We will ensure that investments that facilitate customer and network flexibility are prioritised to optimise investment overall.

Smart grid and DSO enablers

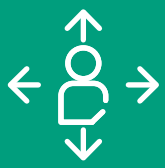
- We invest in technology (typically IT, instrumentation and communications) which allows us to optimise the energy flows through the network by managing both customer and network flexibility
- We can also share this information with other industry parties to support a whole-systems approach to decarbonisation
- Our current Smart Grid Enablers programme gives us the ability to control and analyse how the network is operating in real time and therefore target our investment efficiently
- The national roll-out of smart meters will give us more real-time data on how the network is being used and power cuts. This extra information, used in conjunction with our smart grid solutions (below), will allow us to optimise asset investments

Network flexibility – Smart grid solutions



- We invest in field-based equipment that allows us to operate the local network in a more active manner, allowing us to use near real-time data to automatically reconfigure or adjust settings to release capacity to where it's needed
- Smart solutions can often be more effective when used in conjunction with customer flexibility (below). For example, we are proposing significant investment in low voltage monitoring to provide visibility of where new EVs could be connected to our network in 2023–28

Customer flexibility – Contracted and energy price-driven flexibility



Customer flexibility comes in two forms:

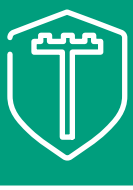
DNO-contracted flexibility

- We pay customers directly to either increase or reduce their electricity use or production
- This enables customers such as EV owners to use digital technologies to optimise the charging patterns of their vehicles
- This could spark a revolution in the use of low voltage flexibility to manage local networks and provide whole-system benefits for customers

Energy price-driven flexibility

- We expect customers to respond to price signals in their electricity bills from energy suppliers by flexing their consumption patterns to when there is a surplus of green electricity available
- More flexibility from customers can avoid the need for us to invest in network solutions to increase capacity entirely or delay the need for investment until later
- This should also result in overall cheaper energy bills for customers

Network reinforcement



- We reinforce our physical assets by replacing or upgrading cables, switches and substations to expand the capacity of our network in response to load growth
- We invest once we have sufficient certainty about where additional capacity is required on our network, rather than waiting for this load growth to happen
- Network 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

Revolutionising data capture and usage

Across all four solutions, making the best use of data on consumption and generation patterns will be critical. This also underpins our transition to Distribution System Operator (DSO) and our ability to run an efficient and reliable system which optimises the use of our asset base.

The upgrade to our control systems will enable us to monitor, control and communicate with our substations, enabling us to respond to real-time information about the energy flow in our network and facilitate the optimum use of customer flexibility in a decentralised system.

We will also provide data and information to customers, the market and parties such as local authorities who are creating Local Area Energy Plans. By providing data to competitive energy market participants they may tailor what they can offer for customers and deliver improved services. We support the recommendations of the Energy Data Taskforce and are already collaborating with partners such as the Open Data Institute to take practical steps to make the vision a reality.

How we will deploy our investment solutions

We have carried out modelling to form a clearer view of what we need to do next

We have explored different scenarios varying the degrees of decentralisation, electrification, customer flexibility and the uptake of LCTs on the electricity network. These scenarios were created using assumptions about core elements of energy generation and consumption over the next 30 years.

We have drawn three key conclusions from our modelling which are driving our decarbonisation approach in our Emerging Thinking plan.

Flexibility first

We will choose customer flexibility and network flexibility ahead of network reinforcement

— Customer flexibility can reduce or delay the need for investment to increase network capacity, therefore keeping bills lower

— We envisage a world where a market for flexibility is embedded in every part of the network, allowing customer demand to be despatched to balance renewable power. This system would quickly find the lowest cost low-carbon solution

Business plan objective

We will choose customer flexibility wherever it is possible and cost-effective as the default intervention to respond to changing demands on the network. We will work with other industry parties to incentivise customers to be flexible in order to mitigate climate change as cheaply as possible

Network investment

Where necessary, we will reinforce the network to enable an upturn in customer low-carbon technologies in 2023–28

— Whatever the longer-term pathway – be that a scenario with high levels of electrification of heat and transport, or with high use of hydrogen as a fossil fuel replacement – there is little difference in the expected load growth during 2023-28 that will impact our network

— Required change over the next five years will largely be driven by the uptake of electric vehicles (EVs), with more significant impact from decarbonisation of heating not expected until the 2030s when the technology is expected to be widely and affordably available

— Therefore the minimum level of investment required to meet the expected load growth in the next investment period is similar even in a more accelerated scenario targeting net zero before 2050

— Network reinforcement continues to be a key part of our investment to enable customers to reliably access energy markets and earn revenues in return for their flexible electricity use or production

Business plan objective

We will plan investment that as a minimum keeps the region on track for the net zero ambition and is flexible to change

Going further, faster

Staying ahead of the curve, we would invest to create the opportunity for a faster, more flexible pathway

— We do not expect the speed of the overall pathway to significantly impact required investment during 2023-28 but we will monitor the rate of LCT uptake in the period to ensure that we are facilitating potential future pathways

— To do this we need an appropriate balance between certainty and flexibility to be included in the regulatory framework. This will ensure that we can be agile to the actual rate of change and that customers only pay for what is needed as we progress along the pathway

Business plan objective

We will make efficient investments that provide flexibility to cater to the different pathways society may take to net zero

Collaboration is essential to a successful whole energy system low-carbon transition

The most efficient and effective outcome for decarbonisation will be achieved through close collaboration across industry partners, policymakers and customers.

Local authorities

A good example of this is how we are working with local authorities (LAs) and other stakeholders in our region to explore Local Area Energy Plans (LAEPs). We are sharing our Emerging Thinking scenario modelling results through an open data platform, allowing LAs to see what we think will be the range of future energy needs across our region.

We are also discussing the use of localised generation to support local energy requirements, with the aim of lowering whole-system losses. Working with local stakeholders supports a joined-up approach to driving regional decarbonisation.

A number of important policy areas need to progress if we are to facilitate decarbonisation as efficiently and sustainably as possible. We are active participants in this work, but we are not the decision makers. We are looking to those people to press ahead and conclude the work we need them to do.

Government

— Policy implemented by the Government will drive the direction of net zero and incentivise society to make the necessary changes to achieve it. These policies will be essential for this decarbonisation journey and are also a key part of stimulating clean growth, in particular in the wake of the COVID-19 pandemic.

Ofgem

— To reflect the uncertainty on the pace of LCT uptake, we have proposed a mechanism that would allow our price control to be linked automatically to the amount of LCT that customers deploy[3]. This would have the dual benefit of allowing us to respond to higher LCT volumes requiring more investment, whilst ensuring that customers only pay for network investments that are required.

— Ofgem is working to establish a process of half-hourly settlements[4] for domestic and small business customers. In other words, those customers will pay for energy in half-hour periods throughout the day in the same way that larger industrial users have done for years. Coupled with the smart meter roll-out, these changes form the foundations of the price driven and DNO-contracted customer flexibility markets. Successfully establishing this market is key to our flexibility first objective, allowing us to deliver decarbonisation as cost efficiently as possible.

— Part of establishing a just transition is the reform of network charging. We are an active participant in the Ofgem programme that is reviewing how charges may enable decarbonisation in a manner that does not disadvantage those customers without the knowledge or resources.

Information Commissioner's Office and BEIS

— We need to be able to monitor the power flows and load growth in real time across our network right down to the domestic level. To do this we need to be able to share data securely across the energy sector. This is why we are seeking the right to securely access and share energy system data with other DNOs and the Electricity System Operator (ESO) (National Grid). This information will allow us to capitalise on customer flexibility, and manage potential network constraints before they arise as connections to our network increase. It will also allow us to deliver the very best levels of reliability for all of our customers as we transition to net zero.

Energy suppliers and the ESO

— To effectively harness customer flexibility, we need energy suppliers to complete the smart meter roll-out and offer new services to customers such as flexible time of use tariffs to incentivise flexible customer behaviour.

— We expect to work with energy suppliers and the ESO to incorporate our contracted flexibility services within propositions that may be taken up by customers. Our mutual aim must be to make flexibility as rewarding and as easy for customers as possible by ensuring that our services and information are co-ordinated and matched wherever possible.

[3] Known as a volume driver, which is a mechanism that varies the revenue we earn to pay for the investment needed to prepare for the uptake in LCT within a tolerance band in line with the volumes of LCT that materialise on our network during the price control period.

[4] Half-hourly settlement reconciles differences between a supplier's contractual purchases of electricity and the demand of its customers on a half-hourly basis. Using smart meter data, half-hourly settlement provides an opportunity to make the settlement process more accurate and timely, and act as an enabler for new products and services, helping to reduce bills and environmental impact.

The illustrative scenarios in Emerging Thinking are built up of three key components

Earlier we explained how our decarbonisation approach in the 2023-28 period was informed by our modelling results. This approach drives the cost components in the service levels we are presenting in Emerging Thinking. These are detailed below.

Cost components of decarbonisation investment

Flexibility first – promoting customer and network flexibility

- Our blend of solutions starts with investment in the systems and processes that enable us to promote customer flexibility and harness network flexibility as efficiently and effectively as possible
- The benefits from investment in these systems will continue to have a positive impact on customer bills in future price control periods as the investment won't need to be repeated
- The service levels we are presenting assume low, moderate and high levels of customer flexibility respectively. This drives the overall network reinforcement cost

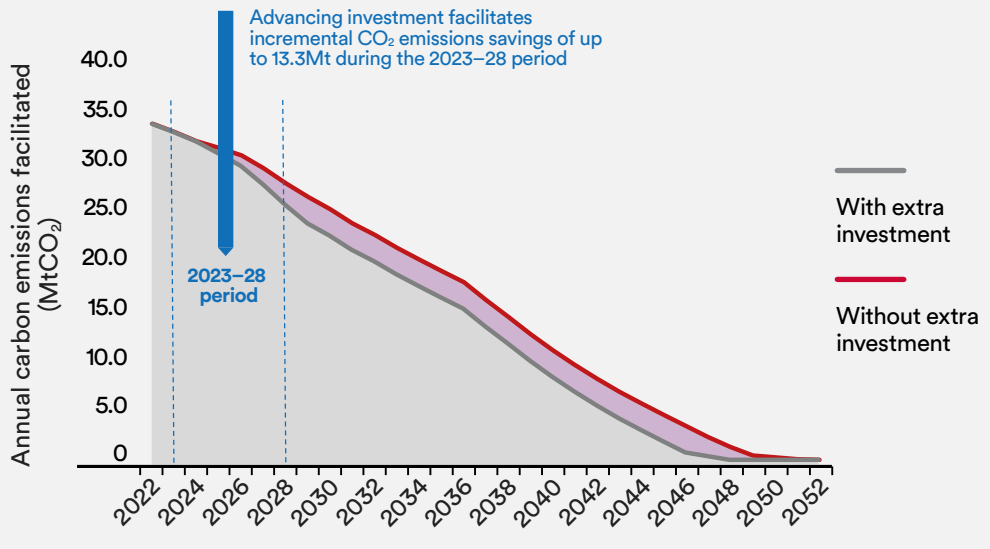
Network investment – as required in 2023-28

- The service levels we are presenting contain the minimum investment that meets the needs of our load growth forecasts for 2023–28
- At each level, in-period required investment is highest in a low flexibility scenario and lowest with high flexibility

Going further, faster – for a faster, more flexible pathway

- Delivering additional investment to create the opportunity for carbon reduction at an earlier stage on the net zero transition facilitates a greater reduction in CO_2 emissions sooner if some regions want to go faster. This approach would mean we are always ahead of the curve for the pace of decarbonisation, no matter the rate of LCT uptake
- To understand your appetite for investing now for the network of the future, we are presenting possible investment levels that create the opportunity for carbon reduction ranging from no advancement to bringing forward two years' worth of the expected decarbonisation investment need from a future price control period

Illustration of carbon emissions savings facilitated by investing to create the opportunity for a faster, more flexible pathway



We are presenting three examples of plausible packages of investment for 2023-28 that would keep us on track or ahead on the net zero transition

Throughout Emerging Thinking we are presenting five service levels for each business plan section. For decarbonisation levels, the first two are shown for reference only – they would not allow us to stay on track for net zero by 2050. In effect, these levels of expenditure would assume other solutions would come along that do not involve electrification of heat and transport.

This is very unlikely to happen. The three levels that represent significant progress in flexibility market development, customer technologies, additional investment and data to enable us to support pathways to net zero by 2050 are all explored further in this section of our thinking.

Service levels *inconsistent* with net zero by 2050

Level A
Today's service at lower cost

Level B
Enhanced service for the same spend

Service levels *consistent* with net zero by 2050

Level C
Major upgrade

Level D
Breaking new ground

Level E
A new world

The table below shows how, across all three service levels for net zero, we are proposing to deploy the blend of four solutions available to us to tackle decarbonisation in the major cost components of our decarbonisation plan – *flexibility first, network investment* and *going further, faster.*

The differences between each level are highlighted with a + symbol.

Flexibility first

Network investment

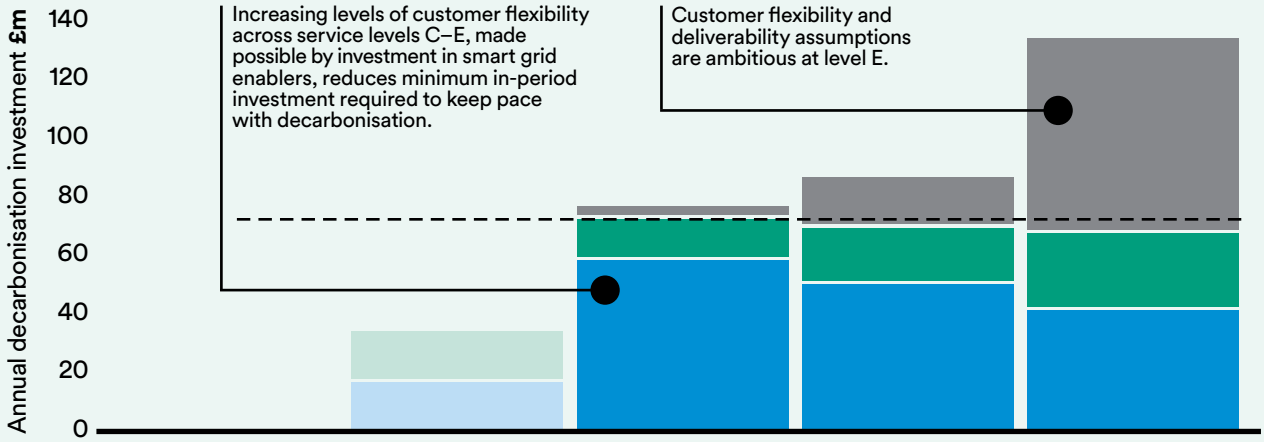
Going further, faster

Level C: Major upgrade			
Smart grid and DSO enablers	— Investment in people and processes to facilitate customer and network flexibility, including low-voltage (LV) monitoring management centre, Active Network Management system, and data sharing/storage with suppliers and Electricity Systems Operator (ESO) — Offering new services to the ESO, using the inherent flexibility in the network to provide a demand side response service		
Network flexibility	— 50% of urban substations fitted with monitoring to provide LV visibility — Deployment of smart grid voltage solutions, real time thermal ratings and automatic load transfers		
Customer flexibility	— Low DNO-contracted flexibility – extra-high voltage (EHV) only	— Network reinforcement to meet low-carbon load and renewables growth	
Network reinforcement			— Asset upsizing – extra capacity for little increased cost when improving an asset's condition

	Flexibility first	Network investment	Going further, faster
Level D: Breaking new ground			
Smart grid and DSO enablers	— Investment in people and processes to facilitate customer and network flexibility, including LV monitoring management centre, Active Network Management system, and data sharing/storage with suppliers and ESO — Offering new services to the ESO, using the inherent flexibility in the network to provide a demand side response service **+ Enhanced optimisation of customer energy bills through voltage reduction using smart meters**		
Network flexibility	— 50% of urban substations fitted with monitoring to provide LV visibility		
Customer flexibility	**+ Investment in moderate amount of DNO-contracted flexibility – offering new propositions for domestic and small business customers** **+ Moderate price-driven flexibility**		**+ Investment in moderate amount of additional DNO-contracted flexibility**
Network reinforcement		**+ Network reinforcement to meet load growth – less than C due to higher customer flexibility**	— Asset upsizing – extra capacity for little increased cost when improving an asset's condition **+ Six months' future period investment brought forward**
Level E: A new world			
Smart grid and DSO enablers	— Investment in people and processes to facilitate customer and network flexibility, including LV monitoring management centre, Active Network Management system, and data sharing/storage with suppliers and ESO — Offering new services to the ESO, using the inherent flexibility in the network to provide a demand side response service — Enhanced optimisation of customer energy bills through voltage reduction		**+ Smarter systems to enhance system resilience made possible by more dynamic generation and flexible load, including LV overload protection and more sophisticated low frequency demand disconnection** **+ Development and operation of microgrids to maximise output from renewable generators as well as resilience and customer service improvement**
Network flexibility	— 50% of urban substations fitted with monitoring to provide LV visibility		**+ Further 30% of urban substations fitted with visibility monitoring for higher levels of EV and heat pump roll-out**
Customer flexibility	**+ Investment in high amount of DNO-contracted flexibility – offering new propositions for domestic and small business customers** **+ High price-driven flexibility**		**+ Investment in high amount of additional DNO-contracted flexibility**
Network reinforcement		**+ Network reinforcement to meet load growth – less than D due to higher customer flexibility**	— Asset upsizing – extra capacity for little increased cost when improving an asset's condition **+ Two years' future period investment brought forward** **+ Advancing trigger level for generation reinforcement at EHV substations, enabling faster customer deployment of renewable generation and storage**

The graph below shows how the cost components in each level build up to the total annual cost of decarbonisation. Today's spend is shown as a reference to the proposed investment values relative to costs from the current price control period.

Decarbonisation service levels – annual costs breakdown



Service level	Today's spend	Major upgrade	Breaking new ground	A new world
How flexible?	Minimal customer flexibility	Low customer flexibility	Moderate customer flexibility	High customer flexibility
How fast?	Off target for net zero by 2050	On target for net zero by 2050	On/ahead of target for net zero by 2050	On/ahead of target for net zero by 2050
Outcomes enabled		C	D	E
Electric vehicles – ED2 total		**744k**	**744k (+104k)**	**744k (+440k)**
Heat pumps – ED2 total		**187k**	**187k (+21k)**	**187k (+88k)**
Generation and storage connected (GW) – ED2 total		**6.9**	**6.9 (+0.3)**	**6.9 (+1.1)**
GHG saving potential ($MTCO_2$) - now to 2050		**143.5**	**143.5 (+16.0)**	**143.5 (+69.0)**

Key

Going further, faster | Flexibility first | Network investment | – – Baseline level of investment to keep pace with decarbonisation by 2050 in a no-flex world

DECARBONISATION

Decarbonisation
Exploring the choices…

Service level A Your current package – but at a lower cost	Service level B Enhanced performance – for the same spend	Service level C Major upgrade	Service level D Breaking new ground	Service level E A new world
Not on track for net zero emissions by 2050	**Not on track for net zero emissions by 2050**	**Net zero by 2050 driven by largely network solutions, assuming only low levels of customer flexibility are available**	**Net zero by 2050 or earlier with increased customer flexibility, reducing network reinforcement costs, with investment brought forward to go further, faster**	**Net zero by 2050 or earlier – high customer flexibility means lower reinforcement costs. Significant investment to enable accelerated pathways**
– Reducing costs in this area would not cater sufficiently for the load growth forecast in 2023-28 – It would assume very slow progress to net zero and/or that other solutions to net zero come along that do not involve electrification of heat and transport – All modelling carried out by us and others suggests that this is unlikely to happen	– Current levels of investment would not cater sufficiently for the load growth forecast in 2023-28 – It would assume slow progress to net zero and/or that other solutions to net zero come along that do not involve electrification of heat and transport – All modelling carried out by us and others suggests that this is unlikely to happen	– Low levels of customer flexibility take-up from industrial and commercial customers and no domestic customer flexibility – Largely traditional network reinforcement solutions – upgrading cables and substations to support greater load – Investment in smartgrid solutions – low voltage monitoring to facilitate flexibility and EV uptake – Smart grid enablers to provide data sharing with other industry partners, enabling whole energy system optimisation – Minimal investment to accelerate decarbonisation	– Moderate customer flexibility from industrial and commercial, and domestic customers – Network reinforcement costs are therefore lower than level C – Incremental investment in smart grid enablers to support greater flexibility – Investment to go further, faster on decarbonisation by bringing forward six months' worth of spend from future periods	– High customer flexibility from industrial and commercial domestic customers, both by customers contracting with us and by responding to price signals from other parties to flex their supply and demand – Network reinforcement costs are therefore further reduced from option D – Further investment in low voltage network monitoring ensures the capabilities for high flexibility levels – Increased investment to accelerate decarbonisation by bringing forward two years' worth of spend from future periods

Key measures – by 2028

Customer flexibility		Low	Moderate	High
Number of EVs		744k	848k	1,184k
Number of heat pumps		187k	208k	275k
Generation and storage connected		6.9 GW	7.2 GW	8.0 GW
GHG savings potential – now to 2050		143.5 $MtCO_2$	159.6 $MtCO_2$	194.3 $MtCO_2$

What will it cost?

Total annual cost	£43.7m (-3%)	£45.0m	£85.3m (+90%)	£95.2m (+112%)	£140.5m (+213%)
Annual bill impact	-£0.06	£0.00	+£1.81	+£2.25	+£4.29

Responding to stakeholder feedback…

	Support the transition to net zero	Support the uptake of electric vehicles	Be responsive to local energy plans	Provide reassurance on capacity

Conclusions

The work we have done to inform our Emerging Thinking on decarbonisation reinforces our view that:

Flexibility first minimises cost

We are urging customers to optimise the value of their existing assets by becoming more engaged with the energy system – and we will incentivise them to do so. This will drive efficiency in our investment in the low-carbon transition and therefore keep electricity bills low, noting that other companies and policy makers also need to play their part to make this a success.

Our own flexible approach using smart grid solutions on the network provides different routes to decarbonise, recognising that there is a range of possible pathways and we will need to respond to customer needs that will evolve over time.

Although there is a lot we do not yet know, we can be clear about the initial steps

We are clear about the decarbonisation steps for the next five years on the path to net zero by 2050. The good news is that it does not rely on settling every detail upfront – there is still room for choices along the way. Our plan is about the important next steps to 2028.

There is choice for the timing of investment to support carbon reduction

Investment now is essential if we are to successfully facilitate decarbonisation, but we are asking you to guide us in how fast you want us to go in the next five years.

We will get this done in consultation with our stakeholders

This is a highly significant time for our region to deliver economic growth that is also low-carbon; the post-COVID context makes that even more important.

Key questions for stakeholders

1

We will make the most of the benefits of **customer flexibility** where it is available. This, combined with smart solutions, will be a cost-effective way of reaching net zero.

a. What actions could we take that will support and incentivise you to be more flexible in your electricity use over the next five years?

b. How much do you think we should rely on this versus relying on more expensive but more certain network reinforcement options?

c. What do we need to do to encourage more flexibility providers in the market?

2

How much should we bring forward **future investments** to increase network capacity and enable faster pathways to net zero?

3

Given there are different levels of ambition across our region for how fast we should get to net zero, what practical steps can we take to support **local area energy plans**?

4

We think we have a key role to play in facilitating a fair and **socially inclusive** low-carbon transition that brings benefits to all, not simply those with more knowledge and resources. How do we most effectively do this?

BUSINESS CARBON FOOTPRINT

2.Business carbon footprint

Why planning for net zero operations is relevant to RIIO-ED2.

We are key players in driving the region towards a low-carbon future. Primarily this is because of our role in the energy sector to enable the low-carbon transition. But it is also because we are a business operating at the heart of the communities we serve. That is why decarbonisation begins at home: with our own operations. Whilst the scope of the net zero 2050 target extends far beyond the RIIO-ED2 period, this price control forges the initial pathway for achieving this target. Therefore we must start our planning and investment now if we are to achieve net zero operations whilst at the same time minimising the production of greenhouse gases during the transition.

To achieve net zero operations we must remove greenhouse gas emissions that are a product of us running our business. Our sources of emission include fleet, contractor and company car miles, other business travel, and office, depot and substation energy use. We also use a greenhouse gas as an insulator in the switchgear in our network and sulphur hexafluoride (SF_6) which is 22,800 times more potent than CO_2. Leakages of SF_6 also contribute to our total carbon footprint.

Another contributing factor to our carbon footprint is electrical losses. This is where a portion of electricity, historically generated from carbon productive energy sources such as fossil fuels, is lost from our network as it passes through cables, transformers and other equipment.

Losses are a natural and essential side-effect of running a distribution network. But we work to minimise them where possible, factoring them into our investment decisions[5].

As we move into a world of increasingly low-carbon electricity generation, we cannot simply focus on reducing the losses on our existing network, for example, by installing bigger cables. This is because the energy system is evolving and will become more reliant on low-carbon technologies and generation. We will need to take a holistic view and consider the benefits of the low-carbon generators, and weigh this against increases in network losses through the flexible connection of these generators, using solutions such as active network management. In other words, our mindset needs to shift to managing net carbon emissions across the whole energy system, as opposed to minimising losses on our own network.

Business carbon footprint (BCF) – the total greenhouse gas emissions produced as a result of our business operations expressed in tonnes of carbon dioxide.

Whilst the UK energy system continues to include carbon-intensive power sources, we are in a transitionary period. Reducing electrical losses should be balanced with the efficiency and availability of power sources being used in order to ensure that we are meeting the needs of our customers.

What we have done so far: strong progress in RIIO-ED1 sets us up for a step change in RIIO-ED2.

So far in RIIO-ED1, we have significantly outperformed our carbon footprint reduction targets, including business carbon footprint (BCF) and SF_6 losses.

This has led us to set more stretching commitments in these areas. Although we are pleased with these improvements, we know that ambition for decarbonisation has increased since RIIO-ED1, so it is right that we are doing far more in this area.

Our current BCF is 43.7% lower now than when we set our RIIO-ED1 business plan[6], which is c. 33,621 tCO_2e, and for SF_6 losses our current levels are 44%[7] lower at 63kg per annum. The roll-out of innovative technology has helped achieve these outcomes; for example, the use of thermal imaging cameras to proactively detect SF_6 leakage from our switchgear and target it for repair. We've also commenced the transition of our largely diesel powered fleet to plug-in hybrid and fully electric powered vehicles. With over 800 vehicles on our fleet, this will be a process that will continue into RIIO-ED2.

We are a business operating at the heart of the communities we serve. That is why decarbonisation begins at home: with our own operations.

Geoff Earl – Director of Safety, Health and Environment

[5] Electrical losses are not required to be included in our business carbon footprint numbers under Ofgem's reporting requirements. But as they have a significant impact on the environment, we explicitly factor losses into our investment decisions and report annually on our performance (in our Environment Report).

[6] Figures for 2019/20 regulatory year which includes carbon footprint of our contractors, reduction relevant to our ED1 business plan baseline of 59,700.

[7] Compared to our ED1 business plan target of 112kg.

What we are hearing from you: Our engagement with you to date tells us that the environment is high on your priority list.

Environment was ranked as the second most important business plan priority in our stakeholder benchmarking survey.

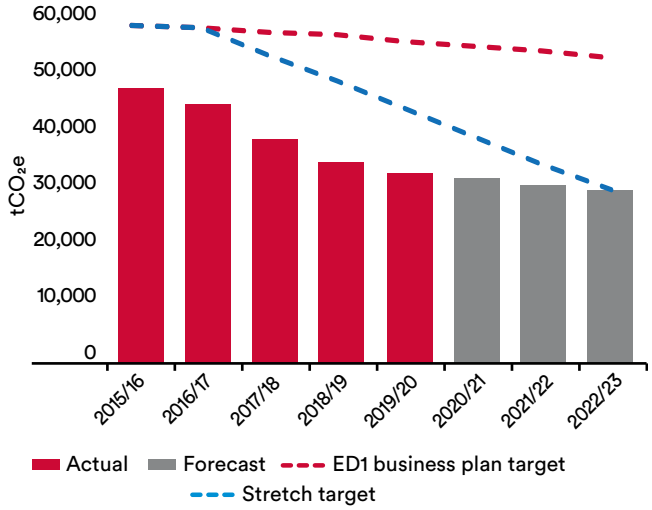
We have heard that you want us to lead the way in this area. We also understand that you want us to collaborate – strategies to decarbonise across all sectors in the region need to be tailored to meet the varying requirements of different customers and geographic areas of our region.

In particular we have heard that you want to see a reduction in greenhouse gases from our operations. In response, we are preparing to trial alternatives to SF_6 in our high voltage switchgear.

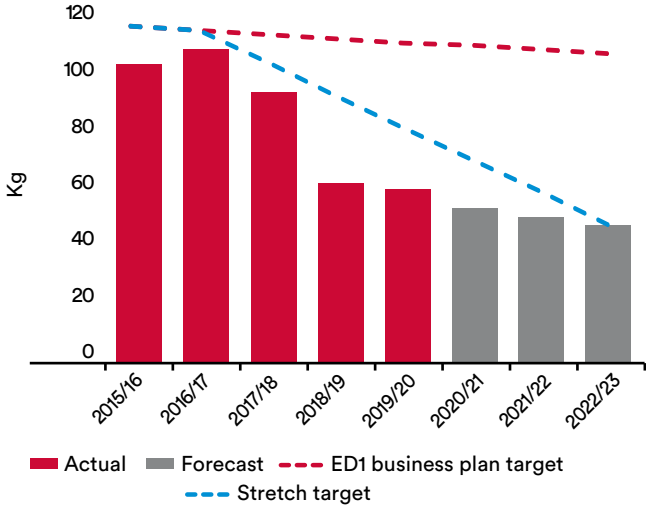
Developing our plans: Our plans for RIIO-ED2 must as a minimum set us on a course to achieve net zero in our own operations by 2050, with options to accelerate this transition.

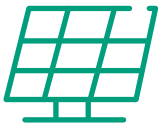
We are considering how to accelerate decarbonisation by looking at what makes up our carbon footprint and considering what we could do to reduce our impact, and the relative cost per tonne of emissions of each of these steps. Knowing what the options are, and the cost-effectiveness of each one, is allowing us to explore with you how fast you want us to decarbonise our emissions. As part of this, we would like your views on whether carbon offsetting is an appropriate solution in some cases, especially where it is cheaper than alternative options, or whether you would prefer us to spend more to implement measures to directly reduce our own emissions.

Business Carbon Footprint (including contractors)



SF_6 loss





60%

Of our substations would have solar panels in our service level E scenario.

90%

Of our car ownership scheme would have ultra-low emission electric vehicles in our service level E scenario.

Environment was ranked as the second most important business plan priority in our stakeholder benchmarking survey.

Siobhan Barton – Head of Stakeholder Relations

Some options could become more cost-effective as we progress towards the end of RIIO-ED2, such as ultra-low emissions vehicles (ULEVs). Other options may need to be prioritised due to changes in policy and legislation, such as the use of SF_6.

Framing choices to explore with you...

We have developed five levels of service for you to consider that differ in the scale of the changes we make to reduce our business carbon footprint and the timeframe over which our operations can become net zero.

The five levels start in Level A with us continuing to run our current schemes to reduce our business carbon footprint, but at a lower cost than today. Levels B and C cost more than Level A and include an expansion of our current schemes, which will help us to become certified against an external standard for energy use management, and will further reduce our business carbon emissions. Level D represents a fundamental shift in our approach, including making more significant changes in the carbon intensive parts of our business, which would set us on a course to achieve net zero operations by 2040. To achieve this, we would install renewable energy generation at 30% of our major substations, and more than 50% of the cars available under our ownership scheme would have ultra-low emission electric vehicles. In Level E we accelerate all of these significant changes, setting us on a course for net zero operations by 2035. This would involve solar power being installed at 60% of our major substations and over 90% of the cars available under our ownership scheme having ultra-low emission electric vehicles.

Key questions for you

1
How fast do you want us to decarbonise our own emissions?

2
How much do you value us adopting more expensive, radical options to decarbonise our activities faster than net zero by 2050?

3
What is your view on carbon offsetting? Should this be included in our option set, and if so, what should the balance be on this relative to measures that directly reduce our own emissions?

BUSINESS CARBON FOOTPRINT

Business carbon footprint
Exploring the choices…

Service level A Your current package – but at a lower cost	Service level B Enhanced performance – for the same spend	Service level C Major upgrade	Service level D Breaking new ground	Service level E A new world
Net Zero Operations beyond 2050	**On track for Net Zero Operations by 2050**	**On track for Net Zero Operations by 2045**	**On track for Net Zero Operations by 2040**	**On track for Net Zero Operations by 2035**
– Replace around 20 fleet vehicles each year with ULEVs – Achieve gradual indirect carbon reductions for office and substation use through changes to the energy generation mix from our suppliers – Maintain current environmental programmes to reduce SF_6 emissions in our operations	– Replace around 30 fleet vehicles each year with ULEVs – a 50% increase – >10% of company cars to be ULEVs – All new substations to be installed with renewable generation (e.g. solar) – Improve energy management at our offices to internationally certified standards – Support contractors to reduce their emissions by >5% – Begin to acquire non-SF_6 emitting plant/equipment for new purchases – Proactively replace all equipment with highest SF_6 emissions (>10kg p.a.)	– Main offices/depots to be sustainably managed in line with international BREEAM standard for energy and water use, health & wellbeing, pollution, transport, materials, waste & ecology – Retrofit 10% of major substations with renewable generation to provide direct renewable supplies – More stretching improvements beyond service level B initiatives on fleet management, company cars, contractor emissions and SF_6 emissions	– Further sustainability initiatives at main offices/depots in line with international BREEAM standard – install solar panels, bicycle parks, new breakout areas – Retrofit 30% of major substations with renewable generation – More stretching improvements beyond service level C initiatives on fleet management, company cars, contractor emissions and SF_6 emissions	– Significant expansion of environmental initiatives – Replace over 65 fleet vehicles each year with ULEVs – a 235% increase – Renewable generation at major Northern Powergrid sites for our own supply – Retrofit 60% of major substations with renewable generation – Support contractors to reduce their emissions by >15% – Replace all leaking equipment with new non-SF_6 alternatives

Key performance measures

Business carbon footprint				
29,055 tCO_2e	28,155 tCO_2e (-3.1%)	27,950 tCO_2e (-3.8%)	27,600 tCO_2e (-5.0%)	27,020 tCO_2e (-7.0%)

What will it cost?

Total annual cost				
£1m (-44%)	£1.7m	£4.4m (+159%)	£9.5m (+458%)	£16.1m (+841%)
Annual bill impact				
-£0.03	£0.00	+£0.12	+£0.35	+£0.64

Responding to stakeholder feedback…

Reduce carbon footprint	Collaborate with third parties	Air quality is becoming increasingly important	Initiatives should stretch across all aspects of operations

3.Environmental protection

Environmental respect is one of our core principles as a business.

Beyond carbon and greenhouse gas emissions, the nature of our business is such that our operations pose a range of further potential environmental impacts. This includes the environmental impact of our offices, depots, and vehicles, as well as the activities we carry out to maintain and repair our network. We know that mitigating these environmental impacts, alongside our carbon emissions, is your second highest business priority.

What we have done so far: We are on track to significantly out-perform our RIIO-ED1 environmental commitments and we have set stretch targets to go further by 2023.

Our performance in this area benchmarks well compared to our peers, and we are near the top of the pack on a number of key environmental protection measures, including length of cables undergrounded, and the amount of oil and fluid lost to ground[8]. We have reduced single-use plastics in our offices by 70% over the last two years and continue to work with our wider supply chain to remove plastics and other packaging from the tools, plant, equipment and materials we purchase.

An example of our strong performance is on reducing oil and fluid leakage. Oil and other fluids are used as electrical insulators in a significant amount of our equipment, and play an important part in the safety of our operations. Leakage of this oil and fluid to the ground, however small, presents a risk to the environment. We committed to reducing oil and fluid leakage by 15% in RIIO-ED1 and we have already surpassed this, achieving a 37% reduction to date[9].

We have achieved this through continued investment in engineering solutions to reduce the risk of oil loss, such as cable replacement and installing oil containment bunds at our substations sites. We have also implemented innovative solutions, including PFT[10] tracers and self-healing cable fluid additives. We have set a more stretching target to go further by 2023: we are now aiming to reduce oil/fluid loss by 47% and replace 224km of fluid-filled cables. This would amount to 67% more than our original RIIO-ED1 commitment[11]. Our work in this area contributes to our company-wide Environmental Management System (EMS) accredited to ISO 14001.

We use our EMS to guide our operational controls and our assessment of risks and opportunities.

While reducing our oil/fluid loss can have a big impact, it is not that visible to you. In contrast, one of the most visible environmental impacts we have is our overhead power lines. We are particularly conscious of this as we have four National Parks, five Areas of Outstanding Natural Beauty (AONBs) and five Heritage Coasts in our region. We committed to undergrounding 100km of overhead lines in AONBs and we are on track to deliver this programme two years earlier than planned. Following engagement with our stakeholders we have committed a further £2m for an additional 20km of cables to be moved underground by 2023 to further reduce the impact of our overhead lines on protected landscapes.

Area of outstanding natural beauty (AONB) – is an area of high scenic quality which has statutory protection in order to conserve and enhance the natural beauty of its landscape.

224km

We are now aiming to replace 224km of fluid-filled cables.

£2m

We have committed a further £2m for an additional 20km of cables.

[8] Normalised for network length.
[9] Reduction relevant to our ED1 business plan baseline of 53,245.
[10] Perfluorocarbon (PFT) tracers: an additive put into fluid-filled cables. We detect leaks by 'sniffing' the specific chemical structure of this additive in the ground above the leak, locating leakage from above the ground.
[11] Reduction relevant to our ED1 business plan target of 133.6km.

What we are hearing from you: We should set targets and initiatives for continued reductions in our environmental impacts.

You are telling us that we should continue to lead the way in this area. You are telling us that it is not only the business activities that we are responsible for, but that we should set standards for protecting the environment throughout our supply chain. The impact of fluid-filled cables continues to be identified as a priority area. You expect us to take a proactive approach to fluid leakages and industry experts have also highlighted that this should be an area of focus. We are receiving encouraging feedback from representatives of the National Parks and AONB regarding our undergrounding work. They would like to see our programmes continued into RIIO-ED2.

Developing our plans: We expect our RIIO-ED2 environmental plans to continue progress made in RIIO-ED1, rolling out innovative technologies, whilst expanding the scope of our commitments into new areas.

We expect to make environmental commitments that continue the success we have had in the areas such as oil/fluid loss and undergrounding in AONB into RIIO-ED2. We also expect to widen our commitments to encompass other areas such as air quality, waste reduction, minimisation of single use plastics from our supply chain and biodiversity, at levels driven by the outcomes of our stakeholder feedback.

Innovative solutions will continue to play an important role in our environmental programme in RIIO-ED2. For example, we have a collaborative project in progress with UK Power Networks and scientific partners trialling the use of 'self-healing cables' on our network. This is an environmentally friendly additive which when added to our existing fluid-filled cables helps to self-seal small leaks. This could not only reduce oil/fluid losses, but provide an opportunity to defer asset replacement expenditure and deliver cost savings for customers in RIIO-ED2. We are developing our plans for roll-out of this solution onto our network in RIIO-ED2.

Framing choices to explore with you…

The five levels of service we've developed to share with you start in Level A with us continuing to reduce oil loss and underground our assets at today's rates, but at a lower cost than today. Levels B and C cost more than Level A and include the use of innovative methods to drive further environmental benefits. To achieve this, we would introduce self-healing cables to reduce oil loss, drive improvements in biodiversity at our sites, and extend our undergrounding programme to also cover areas outside of designated AONB. Level D includes a fundamental shift in our approach, where we extend the scope of our environmental programmes to parts of our supply chain. For example, we would ensure our contractors increase their recycling, while also expanding all of our schemes that drive environmental benefits in Levels B and C. In Level E we would expand the scope of our environmental change programmes to all areas of our supply chain. We would tightly control the packaging and use of plastic in our supply chain, while also further expanding the scope of our other initiatives.

Key questions for you

1
How ambitious would you like us to be in the extent and scope of our environmental programmes?

2
How far should we go in considering environmental impacts outside of our direct activities and into our wider supply chain?

3
Is there anything missing from our plans that you would expect to see?

You expect us to take a proactive approach to fluid leakages and industry experts have also highlighted that this should be an area of focus.

Gordon Walker – Environmental Manager

Environmental protection
Exploring the choices…

Service level A Your current package – but at a lower cost	Service level B Enhanced performance – for the same spend	Service level C Major upgrade	Service level D Breaking new ground	Service level E A new world
Continuing to reduce our environmental impact, focusing on visual amenity and oil loss	**Expansion of our environmental programmes to include biodiversity improvements**	**Improvements in oil loss, visual amenity and plastic use in our supply chain**	**Innovative self-healing cables further reduce oil loss and environmental improvements made in our supply chain**	**Significant expansion in all environmental programmes including in our supply chain**
– Reduce the number of visible overhead lines in Areas of Outstanding Natural Beauty (AONB) by installing underground cables – Increase recycling capabilities at our depots – Reduce the amount of oil leaks from our cables through new technology	– Expand programme of undergrounding cables in AONB by 5% – Trial flora & fauna enrichment at 50 sites – Introduce 'paperless office' initiatives at head office sites	– Expand programme of undergrounding cables beyond AONB (+15%) – Introduce flora & fauna enrichment at 100 sites – Reduce waste in the materials we use by introducing restrictions on supply chain packaging	– Deploy 'self-healing' cable technology, treating 20% of existing underground cables – Introduce packaging and material restrictions in our contracts with key suppliers – Expand programme of undergrounding cables in AONB by 30% – Introduce flora & fauna enrichment at 200 sites	– Supply chain packaging and plastic tightly restricted and controlled – Doubling in our programme of undergrounding existing overhead lines in AONB – 'Self-healing' cable technology deployed into 40% of our existing cable on the network – Replace additional 50% route length of fluid-filled cable – Introduce flora & fauna enrichment at 300 sites

Key performance measures

% oil/fluid loss from network				
1.2%	1.09%	0.97%	0.85%	0.50%
% undergrounded in AONBs				
1.4%	1.6%	1.7%	1.9%	2.8%
% sites with biodiversity gain				
3%	9%	15%	21%	52%

What will it cost?

Total annual cost				
£4.6m (-4%)	£4.8m	£7.2m (+48%)	£9.5m (+96%)	£17.0m (+252%)
Annual bill impact				
-£0.01	£0.00	+£0.10	+£0.21	+£0.55

Responding to stakeholder feedback…

Build on existing environmental initiatives	Expand programme to underground cables in beauty spots	Collaborate with partners	Bio-diversity is increasingly important

Maintain a safe & resilient network

SAFETY

4.Safety

The safety of our employees, contractors and the public is, and will always be, our number one priority.

We take a risk averse and proactive approach to safety management in our business, and we are always on the lookout for opportunities to effectively reduce risks. This makes our operations safer for our people and the public. In many cases, this results in us going beyond the minimum standards required of us by law because we believe this is the right thing to do.

An example of this is our investment in innovative arc-flash protective workwear for our workforce in RIIO-ED1. This is the latest in protective clothing that has technical fabrics that form a barrier to destructive electrical arc energy. To date, this technology has helped protect several colleagues from the harmful effects of accidental electrical flashover from electrical equipment.

We also work hard to deliver public safety programmes. Our safety awareness campaigns in schools reach around 52,000 children per year, and we work with agriculture, construction and road haulage to raise awareness of the risks of working too close to our assets.

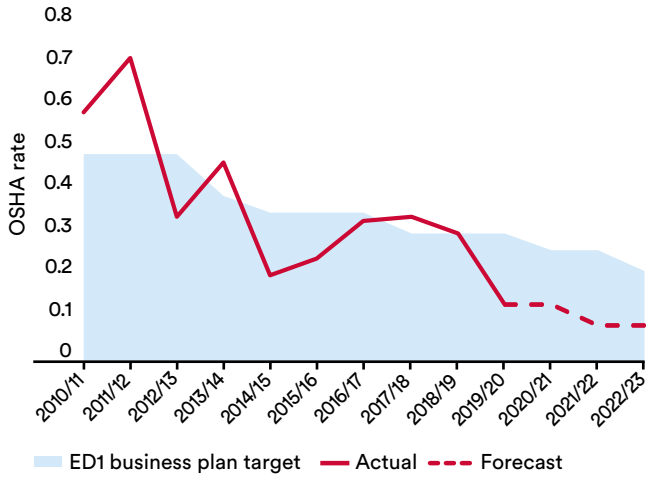
What we have done so far: our track record on safety is very strong and we have made tremendous progress as a company and an industry.

Accident rates in the industry are over 95% lower than they were in 1990 when the electricity industry was privatised.

Our own accident rate[1] has reduced by 79% since we set our business plan targets[2], putting us ahead of our commitment to halve our accident rate by 2023 (the end of RIIO-ED1).

We are proud to say that this commitment to ensure the safety of our people leaves us with a very small absolute number of accidents in our business each year. In 2019/20, we incurred just three recordable accidents in a workforce of over 2,450. We also achieved 391 consecutive days without a recordable incident.

Accident rate (OSHA)



Although we operate in a sector with an outstanding safety record, our comparative performance is also strong and we are amongst the leaders in our industry. In the 2020 Energy Networks Association safety performance report we incurred the fewest number of RIDDOR[3] recordable lost time accidents in our sector.

Our supply chain plays a vital role in the service we deliver to our customers. We have taken our contractors on a similar journey of continuous improvement in risk reduction and they have responded positively reducing recordable accidents by 66% over the past ten years.

[1] Based on Operational Safety and Health Administrators (OSHA) rate. It is a US based measure of reportable work-related accidents (per 200,000man hours). It includes major incidents leading to absence and less severe injuries leading to restricted duties or the prescription of drugs as treatment or therapy. See www.OSHA.gov

[2] Baseline of target set in our ED1 business plan was 2013 calendar year performance

[3] A UK accident rate that measures the number of accidents that are reportable under the UK's Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995 (RIDDOR)

Flashover –
a continuous electric discharge of high current which flows through an air gap between conductors. This generates a very bright light as well as intensive heat. An arc flash is typically caused by a short circuit.

What we are hearing from you: engaging to find new ways to reduce safety risks.

Our accident rate is now so low (approaching zero) that incremental gains are very hard to achieve. But that will not stop us looking for improvements every day to take risk out of our business and operations. To help achieve this as best as we can we have begun engaging with our key stakeholders in this area. To date, this has included the Health and Safety Executive, who are responsible for enforcing legislation; our employees; trade unions; schools; and the farming community.

So far, you have told us you would like us to use a more collaborative approach to safety by creating more partnerships with local organisations to promote safe working, and ensure safety information is shared with those who need it; for example, the agricultural community.

Developing our plans: in RIIO-ED2 new safety opportunities and challenges will open up.

We will always look to equip our colleagues with the latest in protective workwear. As these technologies are created and improved upon we will adopt them.

New data and digital tools, particularly to track fatigue management and vehicle data analytics, offer opportunities for us to improve our day-to-day safety management and become more predictive in approach.

The COVID-19 pandemic of 2020 has tested our emergency response and business continuity plans. We're pleased to have been "there for our customers when they needed us most" whilst maintaining outstanding levels of service. It is perhaps too early to predict the legacy of COVID-19 on our future operations but it is clear to see that some of the adaptations we have needed to make, such as enhanced hygiene measures and reduced business travel, may form part of our future plans to deliver more sustainable and lower risk operations.

We will also be on the front foot to assess and mitigate any safety concerns that emerge for our employees or the general public as more low-carbon technologies connect to our network.

Framing choices to explore with you...

We have developed five levels of service for our work going forward, which offer differing approaches for how we roll-out new technologies and adapt our ways of working to reduce risks.

The five levels start in Level A, where we continue to use existing technologies and working patterns to maintain our current low levels of safety risk, but at a lower cost than now.

Levels B and C include adopting new technology our operational colleagues, and more targeted safety awareness campaigns – both costing more than Level A, but reducing safety risk further.

In Level D we start to fundamentally shift the way we work, introducing new technologies to further reduce the safety risk for our operational teams and to only work with sub-contractors with a leading safety record on a par with our own.

In Level E we expand the roll-out of new technologies to substantially reduce the need for our operational colleagues to work on site, materially reducing associated safety risks.

Key questions for you

1
Do you agree with our philosophy to continue to put workforce and public safety at the heart of our operations?

2
Do you think we should spend a little more to improve the safety of our operations even further in the future?

3
Are we doing enough to raise awareness of safety for at risk groups and the wider public?

4
Is there anything else we should be considering as we work on embedding safety in our business plan?

Our safety awareness campaigns in schools reach around 52,000 children per year.

Simon Keightley – Safety Manager

SAFETY

Safety
Exploring the choices...

Service level A Your current package – but at a lower cost	Service level B Enhanced performance – for the same spend	Service level C Major upgrade	Service level D Breaking new ground	Service level E A new world
An industry leader in safety performance	**Proactive interventions to further reduce safety risk in our operations**	**A champion for health and safety with our third party contractors, local communities and sector partners**	**New technology-led safety measures and further fatigue risk reduction**	**Artificial intelligence, automation and robotics takes safety to new levels**
– Supporting colleagues with 250 managers and 60 mental health first aiders trained – Over 50,000 school children receiving safety talks/lessons – Telematics and reversing cameras installed in all fleet vehicles	– New app to monitor colleague fatigue risk – Reducing road risk by installing vehicle avoidance technology in 60% of our fleet – Over 55,000 school children receiving safety talks/lessons – At least four campaign collaborations with agricultural and haulage industries per year – Enhanced safety performance from our contractors with increased audits and inspections	– Targeted safety awareness campaigns/ events for higher risk sectors and communities – Carry defibrillators in our fleet vehicles for public use – Vehicle avoidance technology in our full fleet	– Innovative wearable technology for our colleagues to monitor risk and promote wellbeing – Reducing road risk with Artificial Intelligence driver assistance systems in all fleet vehicles – Only working with contractors who have a leading safety record	– Increasing network automation and remote control capability to reduce the need for our colleagues to attend fault sites – Trial self-driving vehicles in our fleet – Collaborate with agricultural and construction sectors to develop GPS solutions for large vehicles coming close to overhead lines

Key performance measures

Recordable accidents				
2	No change	No change	No change	No change
Preventable Vehicle Accidents (PVAs)				
19	18 (-5%)	16 (-15%)	14 (-25%)	8 (-60%)
Overhead line contacts				
33	30 (-10%)	20 (-40%)	13 (-60%)	7 (-80%)

What will it cost?

Total annual cost				
£12.8m (-4%)	£13.3m	£15.0m (13%)	£34.2m (157%)	£36.1m (171%)
Annual bill impact				
-£0.02	£0.00	+£0.08	+£0.94	+£1.02

Responding to stakeholder feedback...

Raise awareness of safety risks for those who need it

Support our communities with social programmes

Collaborate with high-risk sectors

5. Long-term network performance & condition

Maintaining a safe and reliable network is at the heart of what we do, day in day out.

To ensure that our network is developed efficiently over the long term, we spend a lot of time in optimising our investment decisions to maximise the life of our existing assets and make a cost-efficient investment decision for our customers.

This part of our business plan is large as it covers a broad range of different activities. It includes: monitoring the health of our assets remotely; inspecting assets in person; fixing any assets that we have identified as being at risk of failure; and replacing assets that have become too old or where we have identified that they are at high risk of fault (refurbishment or replacement work). This work maintains the health of our assets over the longer term, which in turn prevents faults occurring on our network, and ultimately reduces the number of power cuts that you experience. It also ensures that our assets remain safe to use and prevents accidents.

The work in this area accounts for a large part of what we do day to day, and for this reason it makes up a large proportion of our total costs. We are very conscious of the impact that this work has on your bills, and for this reason we only replace assets when we really need to. At the same time, we know that we cannot under-invest in the work we do in this area, as it is critically important for us to maintain the health of our assets for both existing and future customers. If we did not do this, we would steadily increase the risk of faults on our network over the long-term and increase the risk of accidents. Waiting to fix assets until they break would ultimately be a more costly approach, as it is almost always more expensive to fix something once it has broken.

We therefore adopt a balanced approach to asset management, which is most efficient over the longer term. In particular, we do not simply replace assets once they have reached a certain age, as age alone is not a perfect indicator of an asset's condition and likelihood of failure. In our view it would be unnecessary to replace some assets based only on their age. Instead we also rely heavily on information on the condition of our assets to make more informed investment decisions. We use detailed data about the condition and performance of our equipment (that we have gathered from our inspections) to inform our replacement, refurbishment and maintenance programmes. This approach ensures we make informed decisions and optimise when we intervene. Our confidence in our investment planning processes is supported by an annual external audit and validation against industry.

The investment plan –
a rolling ten-year view of investment and operating cost requirements, and the associated benefits expected from the investment. It is reviewed every year with our shareholders and then formally adopted by our Board.

For those of you who are car owners, this area of our work can be pictured as checking your tyres for sufficient tread or bulges, and taking your car to the garage for a service and MOT. It is a necessary requirement of owning a car to get an MOT and to replace parts when any issues are identified – this ensures it is safe to drive, reduces the risk that you break down and ensures the car lasts for as long as possible. While you may not notice the impact of the service when it is carried out, and equally would be unlikely to notice a deterioration straight away if you did not service the car, it is a requirement to ensure the car keeps running safely. Regular servicing of cars will also save you costs in the long term as it will identify potential faults before they become more significant issues, and avoid costly and dangerous accidents (e.g. a tyre blowing on the motorway) over the long term. In contrast, other parts of our plan such as reliability are more focused on the short term and relate to fixing assets as quickly as possible when faults arise and reducing the impact of power cuts on our customers. The car analogy for that type of work is having a spare tyre ready in the boot, and using it to replace a puncture when it happens, so you can get driving again as quickly as possible.

We are on track to achieve our RIIO-ED1 targets, improving the 'health' of the network up to 10%, while helping network users get more out of existing assets.

By the end of the period we will have invested £1,305m and will have added 266MW of capacity to our network. This includes replacing 2,000kms of overhead line and 4,000kms of underground cable and the replacement or refurbishment of 10,000 items of plant at our distribution and major substation sites.

We report annually to our regulator, Ofgem, on the underlying health of our network assets as a measure of the work we do in this area. We share our performance on industry defined measures of asset health, criticality and risk, providing transparency on the condition of our network. We are meeting the targets on these asset risk indices overall (forecasting to over-deliver by up to 10%) while spending in line with our cost allowances. This provides a strong foundation for future periods.

To ensure that our network is developed efficiently over the long term, we spend a lot of time in optimising our investment decisions to maximise the life of our existing assets and make a cost-efficient investment decision for our customers.

Peter Collinson – Investment Planning and Delivery Manager

What we are hearing from you: we know you care about responsible network management and want us to make the right investment decisions today and for future generations.

You have told us that our ability to deliver on our investment plans is particularly important in building our credibility. You also want us to make sure we collaborate with local stakeholders in the planning and delivery of our network investments.

While technical aspects of our asset management approach need to meet regulatory, statutory and industry requirements, we understand that you also want us to be open to external technical input and challenge. The cornerstone of engagement in this area will be our independent 'Technical Panel', who will scrutinise and challenge the technical aspects of our plan to provide an extra layer of assurance that we are making the right decisions for you. Meanwhile we will continue to engage with you, and other stakeholders, around the key choices, including the pace and timing of investments to improve performance of the network.

Developing our plans: 2050-ready approach

As ever, we must manage ongoing safety risks to the public and operators whilst maintaining compliance with environmental legislation. A key feature of our investment approach in RIIO-ED2 will be ensuring we deliver net zero-ready asset replacement solutions, that means as much as possible when we touch an asset we make it ready for 2050 by upgrading its capacity or functionality.

Framing choices to explore with you…

We have set out five levels of service that differ in the focus, strategy, approach and scale of our asset investment programmes.

Where we talk about reducing the risk of faults – this should all be considered over the long term, as the work we do in this part of our business plan is to improve the health of our assets over the long term.

In service Level A we focus more on refurbishing assets rather than replacing them. While this approach helps to minimise costs over the next five years, and should broadly lead to similar levels of reliability during RIIO-ED2, there will be a risk of some more faults in some parts of our network (mostly rural areas or for domestic customers).

Level B will see a slight improvement in the risk of asset failures over RIIO-ED2 which improves the certainty of maintaining underlying levels of reliability. This approach assumes that we will react by increasing investment in future periods to maintain risk as the overall asset base deteriorates through ageing.

Levels C and D include a significant increase in investment relative to the RIIO-ED1 average to start to improve the long-term health of the asset base. The impacts of this will be a gradual improvement in asset failure rates as we expect the dependency on electricity to increase in future as people rely more on electricity to heat homes and to charge their cars, so these levels are most compatible with higher levels of decarbonisation. Level D includes an increased emphasis on the use of asset replacement solutions.

Level E represents a paradigm shift, where we invest in new technology to better monitor the condition of our underground assets. This will allow us to significantly reduce the risk of assets failing over the next five years and also over the long term. In future (i.e. 2028 and beyond), this would allow us to reduce the costs associated with fixing assets when they fail, so would lead to lower fault costs as well.

Key questions for you

1
How much would you like to see us pursue new monitoring technology in RIIO-ED2 that has the potential to significantly reduce costs in future periods?

2
What more could we do to work collaboratively, including with other utilities and local authorities, to deliver whole energy system benefits, minimise customer disruption and improve efficiency?

3
What interdependencies with other infrastructure providers should we be considering in our investment plans?

4
Is there anything missing from our plans that you would expect to see?

LONG-TERM NETWORK PERFORMANCE & CONDITION

Long-term network performance & condition
Exploring the choices…

Service level A Your current package – but at a lower cost	Service level B Enhanced performance – for the same spend	Service level C Major upgrade	Service level D Breaking new ground	Service level E A new world
Broadly similar levels of reliability performance but with a risk of some more faults on some parts of the network	**Slight improvement in risk of asset failures producing increased certainty in maintaining reliability levels**	**Higher levels of investment to deliver long-term reduction in fault rates**	**Long-term reduction in fault rates while delivering a net zero ready network**	**Significant, targeted investment to deliver larger reduction in faults and lower future costs in ED3 and beyond**
– Balancing overall network risk for the long term, considering benefits for the whole energy system – Refurbishing assets to extend their life – keeping bills low whilst maintaining a safe and reliable network – Deferring investment to future periods where possible – Age and time-based inspection regimes – Addressing significant public and operator safety risks	– A shift in the balance towards asset replacement from refurbishment of our assets to maintain current condition and improve long-term performance – Deploying new technology to proactively monitor the overhead network and identify issues earlier – Use of LIDAR technology to improve overhead network knowledge and target improvements	– Wide-scale asset replacement and refurbishment to improve current condition and significantly improve long-term performance – A more stable network through investing more in assets sooner – More advanced, real-time asset condition assessments allowing proactive investment before equipment fails	– Major programme to replace our worst condition assets, significantly improving long-term network performance – Minimising the deferral of investment to future years, whilst installing net zero ready equipment going further, faster to accelerate decarbonisation – Real-time monitoring of major assets allowing for efficient targeting of investment	– Major long-term investment programme to replace underground assets now, accelerating reliability benefits and significantly reducing costs in ED3 and beyond – Wide-scale roll-out of real-time monitoring capabilities on our LV network – Real-time condition/ performance data used to proactively target investment before power cuts occur

Key performance measures

	Service level A	Service level B	Service level C	Service level D	Service level E
% of network replaced/refurbished	0.6%	0.7%	1.0%	1.3%	1.4%
% reduction in probability of asset failure (improvement in long-term network performance/reliability)	0%	6%	18%	23%	30%

What will it cost?

	Service level A	Service level B	Service level C	Service level D	Service level E
Total annual cost	£214.3m (-3%)	£219.9m	£284.1m (+29%)	£358.1m (+63%)	£378.6m (+72%)
Annual bill impact	-£0.25	£0.00	+£2.88	+£6.20	+£7.12

Responding to stakeholder feedback…

Keep bills low

Consider future generations in investment decisions

Provide assurances on network capacity

Support the transition to net zero

RELIABILITY & AVAILABILITY

6.Reliability & availability

What we have done so far: we have significantly improved the reliability and availability of our network.

Our overall performance is strong – our supplies are available 99.98% of the time, and the majority of you experience no supply interruptions in a given year. We also have a strong story of improvement in RIIO-ED1. We're proud to be on track to significantly out-perform our RIIO-ED1 commitments, having already reduced the number of power cuts by 28% and their length by 31%[4] in the period so far.

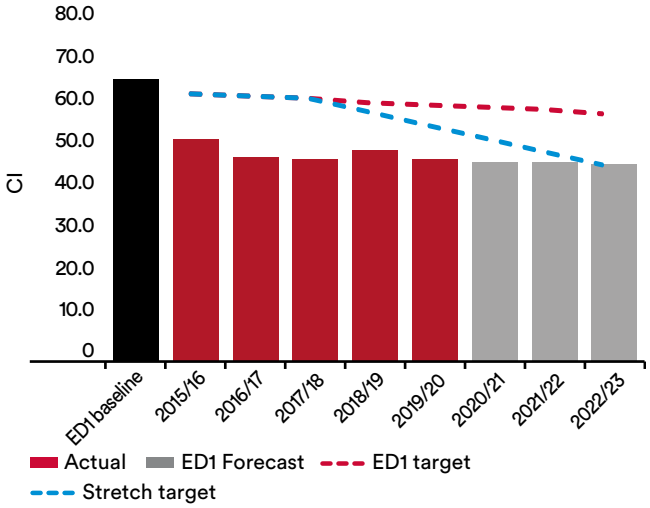
If all power cuts were spread out equally across our 3.8m customer base, that would result in each customer only being off supply for one 40 minute period each year. This number is a system wide average; the reality is the majority of our customers experience no interruptions in their supply during any given year, whereas a small number will experience several power cuts of varying durations.

Whilst long-term investment reduces the risk of faults on the network over the long term, the work we do in this part of our business plan relates to what we do when faults happen and identifying faults that are likely to happen in the short term. Our action in this area reduces the number of customers affected by faults when they happen, reduces the length of power cuts and improves our response to faults (see also **long-term network performance & condition** section).

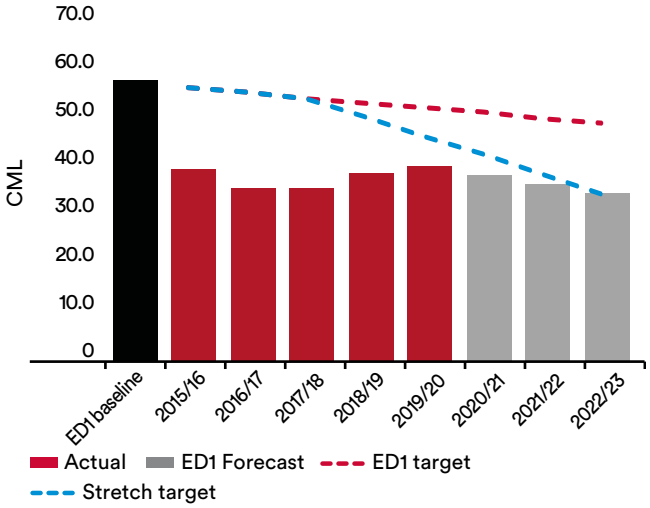
We have made good progress relative to our peers in the performance of our high voltage (HV) network during RIIO-ED1, particularly through reducing the number of customers who experience power cuts and the length of time they are off supply. Improvement on our low voltage (LV) network has, however, been a particular challenge. Our performance at LV ranks at the back of the pack relative to others due to some particularly challenging cable types installed decades ago on our network.

In RIIO-ED1 we will have invested £822.4m in upgrades, focusing on some of the least reliable parts of our network. But we know there is more to be done to improve the performance of our LV network.

Customer interruptions (CI) – Unplanned



Customer minutes lost (CML) – Unplanned



We've invested significantly in innovative technology to modernise our power grid.

We've increased the number of remote control operation points on our high-voltage (HV) network in RIIO-ED1. This allows us to remotely operate switches on the network from our control rooms and get customers back on supply without waiting for one of our engineers to travel to site. We've invested £1.8m so far in automated power restoration system technology (APRS) on our HV network, enabling automatic reconfiguration of the network in response to faults. This technology speeds up the process of restoring supplies further, turning potentially 15 minute interruptions into short ones lasting less than a minute.

£1.8m

We've invested £1.8m so far in automated power restoration system technology (APRS)

[4] Unplanned, excluding exceptional events – reduction relative to business plan baseline, 2012/13.

Reliability & availability – Customer interruptions (CI)
The number of power cuts, regardless of duration, provides a measure of network **reliability** for a customer.

Customer minutes lost (CML)
While the duration of power cuts, regardless of the number, provides a measure of network **availability** for a customer.

In parallel, we have invested £4.5m on technology to monitor our LV network and we are using smart reclosing equipment on problematic networks. This is decreasing the number of power cuts our customers experience and allowing quicker resolution when faults do occur.

In parallel with network upgrades we have also enhanced our local operational response.

It would be expensive to install remote switching everywhere, so in areas where those switches are not installed we need to get our workforce to the site of faults quickly. During RIIO-ED1 we moved to a localised operating model, geographically optimising where our people are based and improving our response times to faults.

We have more than a third fewer customers experiencing power cuts lasting more than 12 hours.

We moved to a 12 hour restoration guaranteed standard for our customers in 2015 in line with regulatory requirements. In the event of a failure against the guaranteed standard we make automatic payments of £100 to customers (above the mandated amount) and £200 for vulnerable customers.

We have introduced a range of tailored proactive communications around planned power outages.

Sometimes we have to turn off parts of our network to carry out essential maintenance and asset upgrades meaning planned power cuts are needed. However, we know that planned power cuts can sometimes be as disruptive as unplanned ones.

In RIIO-ED1 we have introduced a suite of proactive communications, including reminder text messages and real-time updates, to keep customers up-to-date as our engineers carry out on-site work. We also implemented a new policy where planned outages are only scheduled for daylight hours, and, during the worst winter months, we aim for planned outages to last for no longer than 4.5 hours where possible. Customer satisfaction with our planned power cut service is high with our customers scoring us >9/10.

What we are hearing from you: Maintain reliability as demand on our network increases with the transition to net zero.

Whilst the exact transition pathway to net zero by 2050 remains as yet unclear, we do know there is likely to be an increased reliance on electricity for heating and transport. This will make it even more important that our network is reliable and available for you. This is already the case for our vulnerable, electrically-dependent customers.

Targeting performance for some of our worst-served customers on some of the poorly performing parts of our network is an improvement opportunity for us. Whilst this won't move our system-wide average performance numbers as much, it has the potential to make a big difference to the customer experience of those impacted.

Developing our plans: We will continue to deliver improvements, with innovative technology enabling us to target hot spots on our network.

We know reliability has consistently been a top priority for you, ranking first in our stakeholder priorities research. We will therefore continue to look for ways to improve the reliability of our service. The improvements we have made in RIIO-ED1 have set up a solid platform to do this.

Because of our significantly improved performance in RIIO-ED1, particularly at HV, which impacts the greatest numbers of customers, continued incremental benefits will become harder to achieve. This means our rate of improvement is likely to slow somewhat. But there are still further enhancements we can make to our network that will reduce the frequency and duration of power cuts even more – if you agree that this represents value for money.

Whilst the exact transition pathway to net zero by 2050 remains as yet unclear, we do know there is likely to be an increased reliance on electricity for heating and transport.

Greg Farrell – Head of System Engineering

To deliver improvements from here, our work will become more targeted at poorer performing parts of our network. Further expanding our remote control and automation capabilities on our HV network will be a continuing feature of our plans.

We are also trialling an exciting new technology (Foresight) on our LV network, which has the potential to predict faults before they occur, offering opportunities for deployment in RIIO-ED2.

Framing choices to explore with you...

We have developed five levels of service for you to consider which differ in the extent to which we roll out new technologies and change our operations to reduce the number and length of power cuts.

The five levels we've developed to share with you start in Level A with us continuing to dispatch operational colleagues out quickly to respond to faults – delivering today's reliability levels but at a lower cost. Levels B and C cost more than Level A and make greater use of new technologies to help us restore more faults remotely so we can respond faster. In Level D we fundamentally shift our response to power cuts by starting to roll-out Foresight fault prediction technology that would help us to identify faults that are about to happen. Level E includes a more significant roll-out of these technologies, so we can substantially reduce the number of power cuts and their length, with a particular focus on delivering much better service for our customers on worst-served parts of our network. Levels D and E in this part of our plan are related to faults that are likely to happen in the near future.

RELIABILITY & AVAILABILITY

Key questions for you

1
How might your reliability expectations change as we transition to net zero?

2
Do you think our present level of reliability is good enough, or do you think we should be going further?

3
How should we balance our reliability investment between delivering improvements for a minority of customers that experience some of the worst performance on our network and improvements that deliver for larger numbers of worst-served customers?

4
Is there anything missing from our plans that you would expect to see?

RELIABILITY & AVAILABILITY

Reliability & availability
Exploring the choices…

Service level A Your current package – but at a lower cost	Service level B Enhanced performance – for the same spend	Service level C Major upgrade	Service level D Breaking new ground	Service level E A new world
Maintain a highly reliable service – network available 99.98% of the time	**Double-digit percentage improvements in number and length of power cuts while delivering targeted improvements for worst-served and vulnerable customers**	**Further significant system-wide improvements in reliability levels**	**Major improvements in areas where our reliability performance varies the most through deployment of innovative technology**	**Levelling up of reliability performance across our network driven by widespread roll-out of innovative technology**
– Maintain existing technology on LV network – Use smart meter data (once available) to better inform how we prioritise reliability improvements – Adoption of operational best practices to respond to faults on our network	– Continued roll-out of Automated Power Restoration System (APRS) on our HV network – Target investment in areas where customers are most regularly impacted by power cuts/ network reliability – Increase our use of mobile generators to provide electricity to vulnerable customers during power cuts	– Accelerated roll-out of existing and new technology on the LV and HV network – Harness smart meter data for fault management and to develop asset replacement programmes – Broader programme to improve service for the most frequently impacted customers	– Extensive programme to address reliability issues for most frequently impacted customers – Commence roll-out of innovative fault prediction technology on our LV network – APRS across the majority of our HV substations – Smart meter data processing capabilities	– Significant improvements for frequently impacted customers – narrowing the range of performance experienced on our network – Widespread roll-out of fault prediction technology on the LV network – Advanced smart meter data processing capabilities – Use of geospatial analytics to inform deployment of resources in response to faults

Key performance measures

Customer interruptions (CI)				
46	-10%	-20%	-27%	-35%
Customer minutes lost (CML)				
35	-10%	-14%	-23%	-34%
Interruptions >12 hours				
3,600	-25%	-50%	-75%	->80%
Max interruptions for worst-served customers per annum*				
16	-10%	-20%	-35%	->50%

What will it cost?

Total annual cost				
£112.7m (-2%)	£115.2m	£119.8m (+4%)	£129.3m (+12%)	£142.7m (+24%)
Annual bill impact				
-£0.12	£0.00	+£0.20	+£0.63	+£1.23

Responding to stakeholder feedback…

Use technology to provide a better service

Utilise smart meter data to improve services

* includes short interruptions
CI – Customer Interruptions: No. of customers whose supplies have been interrupted (>3mins) per 100 customers per year
CML – Customer Minutes Lost: Average duration of supply interruptions per customer per year

Our approach to resilience

The resilience of our network and operations underpins the critical services we provide to our customers.

Building a resilient network requires us to adapt to external factors in an evolving landscape, including changing weather patterns and the threat of malicious attacks on our assets. Our methodology for improving resilience closely follows the National Infrastructure Commission framework for resilient infrastructure systems. We undertake regular threat assessments, analysis and modelling to assess risk and carry out proactive asset hardening to resist and absorb any impacts. This includes developing a smarter, more interconnected network to recover quickly if defences are overwhelmed.

When incidents do occur, we have mature and well developed Major Incident Management Plans (MIMP) in place to minimise disruption to our network and customers. The recent outbreak of COVID-19 has demonstrated our ability to enact these plans and the resilience of our workforce, helping us to safely maintain continuity of our essential services.

Our plans are under continual refinement to ensure that they remain current and relevant. Long-term resilience is embedded into our core asset replacement plans to ensure the assets we install today are fit for the environment in which they will be operating in the future.

For example, at the time of writing our RIIO-ED1 business plan, cyber security was not the significant risk it is today. However, as the risk grew and evolved, we quickly adapted to develop and implement new resilience strategies during the period.

Collaboration is a key part of our resilience approach.

We work with Local Resilience Forums (LRFs) and multi-agency partnerships which consist of public services, relevant agencies and other supporting bodies to plan and formulate joined-up responses to emergency events.

Strong industry collaboration and stakeholder engagement allows us to build actions into our business planning to enhance resilience.

We are innovating in the area of resilience.

We have two projects in our innovation portfolio, Micro Resilience and Resilient Homes, exploring new ways to enhance resilience for customers in remote areas of our network as well as those who are medically dependent on electricity. These innovative solutions are allowing us to become more targeted in our resilience approach.

The following sections cover climate change adaptation and physical & cyber security – our two most significant resilience risks.

CLIMATE CHANGE ADAPTATION

7.Climate change adaptation

Extreme weather events are occurring more often and the scale of their impact is getting bigger.

We know that keeping the power on during a weather event is critical to homes, businesses and the emergency services. At present, flooding is the most common weather event that causes disruption on our network. Our flood defence programme is in line with the national standard[5] to ensure that our substations are physically protected against floods to the appropriate level.

What have we done so far: we have increased our flood defences.

In response to stakeholder feedback on our initial RIIO-ED1 plans, we increased the scale of our flood defence programme to protect more sites across our network and also accelerated our programme. So far in RIIO-ED1 we have invested £31.1m in enhancing flood defences at 187 of our sites and we will have completed our full programme of 212 upgrades by December 2021, more than one year ahead of schedule.

As well as flooding, the impacts of climate change we are already seeing are: high wind storms causing widespread disruption, particularly impacting our overhead network; summer droughts reducing the effectiveness of earthing systems necessary for network safety; gradually increasing temperature reducing the amount of energy that the electrical networks can transmit; and changing vegetation growth patterns and species diversification which makes our network more vulnerable to high winds and storms.

Our overall maintenance approach means we can be very responsive to extreme weather events as they hit the network. Through our asset investment programme, we target the worst performing parts of our network, building additional resilience to bad weather into the system. In the event of asset failure on our network, we can rely on our stock of asset spares, which ensures we have sufficient amounts of critical parts to hand so we can quickly replace them to get your power on again.

During an incident, our response is designed to minimise the impact on you. We have a well-established framework to prioritise faults that impact the most customers, and we use a combination of automation and on-the-ground field work to restore service to as many customers as possible, as quickly as we can. Our team is, and will continue to be, the cornerstone of our fast response to extreme weather incidents. Our Major Incident protocols bring in experienced executive leadership to oversee incident management and increase the number of staff available to respond. We are also a member of a mutual aid arrangement between all DNOs where, in an emergency, team members and resources are shifted from those areas of the country least affected to those with the highest level of network damage and disruption.

The UK's climate is becoming wetter – the highest rainfall totals over a five day period are 4% higher during the most recent decade compared to the last. Furthermore, the amount of rain from extremely wet days has increased by 17% in the same period.

What we are hearing from you: flooding is still your main concern.

Flooding risk remains a top concern in our region and you want us to continue to prioritise investment to mitigate the impacts it can have on our communities. You would like all parties to work together to a common goal at both national and local levels.

You expect to see a continuation and extension of co-ordinated efforts through network companies, government bodies and local resilience partners. We agree that staying closely aligned to Defra, the Met Office and other network operators is essential for maintaining a uniform national approach to this global issue.

Developing our plans: our focus in RIIO-ED2 should be to maintain resilience in line with the latest climate predictions.

Our flood defence programme will continue into RIIO-ED2 but fewer upgrades will be required due to the major improvements we have delivered in RIIO-ED1.

A key focus in RIIO-ED2 will be on maintaining sufficient resilience to deal with the operational impact of more extreme weather events caused by climate breakdown. We need to give particular thought to the new types of assets that are being deployed on our network (e.g. new smart technologies) and how to best ensure that these assets – that have the potential to support decarbonisation – are also resilient to climate change.

We will use the Met Office's updated predictions (UKCP18) to inform our risk assessment for the future and our investment strategy. UKCP18 provides updated observations and climate change projections out to 2100 in the UK and globally.

We are now reviewing our climate change risk assessment and assessing whether it needs to be updated to reflect the latest climate predictions and science. The upgrades and replacement plans we make will be informed by these revised projections.

[5] The national standard is referred to as Engineering Technical Recommendation 138 (or ETR 138).

Framing choices to explore with you...

We have developed five levels of service that differ in terms of the level of co-ordination with other organisations, and our strategy to reduce our exposure to extreme weather events.

The levels we've developed to share with you start in Level A with maintaining our current defences against more extreme weather events, but at a lower cost to you. Levels B and C cost more than Level A, but deliver more collaboration with other utility providers and local organisations to strengthen our current defences and ensure a more co-ordinated response to the increased number of weather events that we expect to see caused by further climate breakdown. These two levels also include more targeted investment to reduce our exposure to weather events in high-risk areas, such as more extensive vegetation clearance and targeted undergrounding to reduce exposure of our overhead network to high winds. Level D presents a radical change to our approach adding greater levels of interconnection between sites to provide alternative back-up options during weather events and moving assets out of at-risk areas. Level E takes this further with a more fundamental shift in our strategy with significant relocation of our assets away from high-risk areas to substantially reduce our exposure to climate change.

CLIMATE CHANGE ADAPTATION

Key questions for you

1
In response to the likelihood of more extreme weather events in future, how should we trade off the option of investing now to deliver more resilience against the option to wait, spend less now, but then accept the risk of more and bigger impacts on the service we deliver for you?

2
How can we better co-ordinate climate change adaptation plans with those of other utilities and local authorities to deliver better local responses? How much co-ordination do you want to see and in what ways?

3
Is there anything missing from our plans that you would expect to see?

Flooding risk remains a top concern in our region and you want us to continue to prioritise investment to mitigate the impacts it can have on our communities.

Dave Sillito – Head of Major Projects

CLIMATE CHANGE ADAPTATION

Climate change adaptation
Exploring the choices…

Service level A Your current package – but at a lower cost	Service level B Enhanced performance – for the same spend	Service level C Major upgrade	Service level D Breaking new ground	Service level E A new world
Maintaining current strong levels of network resilience	**Enhanced cross-sector collaboration and investment to build resilience to floods and high winds**	**Expanded asset relocation and replacement programmes to build further resilience to floods and high winds**	**Mitigation of evolving risks such as wildfires and interconnection of major sites to defend against more high-impact, low-probability events**	**Comprehensive investment and cross-sector approach addressing future climate change impacts from the low-carbon transition**
– Maintain existing flood defences installed at all large substations which provide resilience (foreseen at the time) for the next 40 years – Maintain our comprehensive vegetation management programme to protect overhead lines from tree damage during storms and strong winds – Climate change risk assessment – analysing the latest climate science enabling us to anticipate future impacts	– Cross-utility sector projects to build new or strengthen existing flood and wind defences in shared locations – Increase undergrounding of overhead lines to reduce exposure to wind events – Increase vegetation clearance, prioritising areas most at risk as wind events increase in terms of both frequency and severity	– Regional cross-sector planning for co-ordinated resilience, sharing resources where interdependencies exist – Relocate or automate overhead assets in known flood plains – Innovative treatment of poles affected by flooding – Upgrade overhead lines as part of asset replacement programme to protect against climate risks	– Increase electrical interconnection between major substations to be used as paired back-up sites – Defending our assets against the risk of wildfires and droughts – Proactive, cross-sector test exercises to drill operational response to major events	– Divert or relocate assets from areas that will be impacted by changing land use in the low-carbon transition, e.g. farming land used for tree-planting (carbon capture) or wetlands impacting access to our equipment – Relocate major substations located in future tidal flood plains – Relocate or change types of assets exposed at high elevation in hard to access locations, e.g. rural fields

Key performance measures

	Service level A	Service level B	Service level C	Service level D	Service level E
% of major sites at risk of a 1/1,000 flood event	35%	34%	23%	19%	12%
% of HV network with enhanced resilience to severe wind events	54%	60%	75%	80%	100%

What will it cost?

	Service level A	Service level B	Service level C	Service level D	Service level E
Total annual cost	£17.8m (-14%)	£20.7m	£24.4m (+18%)	£38.2m (+84%)	£48.0m (+131%)
Annual bill impact	-£0.13	£0.00	+£0.17	+£0.78	+£1.22

Responding to stakeholder feedback…

Service level B	Service level C	Service level D	Service level E
Flood risk is a key issue	Better collaboration between utility companies	Consider future generations in our decision making	Identify the links between climate change and decarbonisation

8.Physical & cyber security

As a provider of essential services, and the owner and operator of critical national infrastructure, security is a key focus area for us.

When we prepared our last business plan (in 2012/13 for RIIO-ED1), cyber-crime was not the mainstream threat it is today. Instead, metal theft was our main security concern, and so our focus was on improving substation security to minimise illegal access to our sites. In the period to date, we have spent £25.8m to maintain and upgrade physical defences at operational sites. By the end of RIIO-ED1 we will have also delivered a £4.5m investment in our Physical Security Upgrade Programme (PSUP). This means that seven of our most critical operational and non-operational sites will meet more stringent national security standards. These investments have enabled us to build a state-of-the-art security alarm receiving centre bringing the monitoring of all our security alarms into a dedicated 24/7 management hub.

What we have done so far: During the RIIO-ED1 period, the landscape changed, and cyber-crime became a much bigger challenge.

Every year cyber-crime rises in scale and complexity. It is imperative that we physically secure our assets and that we have measures in place to deny access to our IT systems from those who would seek to steal information or cause damage and customer disruption via cyber-attacks.

Although we had no dedicated funding to do so, we reacted to this new challenge quickly. We formed a new cyber security team in 2017 to deliver a major programme of security upgrades across our IT systems.

By the end of RIIO-ED1 we will have invested £25.6m on cyber security enhancements delivering a step-change in our capabilities, funded by cost savings that we have made elsewhere in the business. We have also made the best use of our physical defences, as physical security and cyber security go hand-in-hand in defending against cyber-crime. Physical barriers such as fences, doors and access controls are our first line of defence, and are just as important as technology solutions on our systems.

Physical Security Upgrade Programme (PSUP) – a national programme initiated by the Secretary of State and now governed by BEIS. Its role is to deliver physical security upgrade solutions.

We apply globally recognised standards and best practice to our security operations.

Our security controls are benchmarked against international standards (specifically, CIS CSC20[6]) and we are ISO27001 certified across our operational systems and those that process customer, employee and financial information. By 2021 we are targeting certification against the ISO27019 international standard specific to systems used by the energy utility industry. These additional standards will support the new European cyber framework directive (NIS-D). NIS-D has introduced new requirements for the IT systems that directly support our essential service. Our focus will be on continuously improving our controls in line with these rising external standards. Doing so will reduce the risk to our network by better defending our critical systems.

What we are hearing from you: You want us to keep risk as low as possible when it comes to security.

You have told us you want to see secure platforms and cyber security, focused around automation of threat information and recovery of data. Additionally, you want industry collaboration and for us to learn from best practice employed by other network companies.

Developing our plans: In RIIO-ED2, we do not expect to require the same step-change in approach as in RIIO-ED1, but we will need to continuously improve to respond to new and evolving threats.

Cyber and physical security threats are now ever-present and there will be a continual need to invest in order to maintain our high level of security whilst the threats we face evolve. This will be required both in maintaining our day-to-day security operations and investing in enhancements and upgrades as new threats emerge.

In support of the NIS-D regulation and our own cyber security improvement plan, we will continue to carry out future risk modelling that includes a threat assessment, enabling us to decide what further investments to make. We will focus our controls on preventing incidents that impact our essential services, our customer information and which will minimise the impact of any successful breaches. We will fully align the in-scope systems to the ISO27019 standard, equip our people with the skills and tools to operate in a cyber-safe way and meet any ongoing requirements of PSUP.

[6] Centre for internet security.

Cyber and physical security threats are now ever-present and there will be a continual need to invest in order to maintain our high level of security whilst the threats we face evolve.

Paul Fitton – Head of Information Systems

We don't expect this to be the case, but if there is an unforeseen shift in the nature of security threats or the way these are posed, we will respond to them quickly. We have demonstrated during RIIO-ED1 that we can respond rapidly and effectively to new threats.

Security challenges will continue to evolve as connectivity increases in RIIO-ED2.

As we transition towards the role of a DSO, we will face new challenges associated with increased digitalisation. For example, moving traditional IT hardware to cloud-based solutions will mean we have to adapt the way we secure our information as it will no longer be stored within the confines of our sites. Open data presents an opportunity but also a cyber challenge. On the one hand, we want to increase availability and sharing of information to facilitate the decarbonisation agenda but, on the other hand, we need to ensure the security of systems and information.

Framing choices to explore with you...

We have set out five levels of service that differ in terms of the deployment of smart technologies to identify threats and the level of physical security at our major sites.

The five levels start with Level A where we ensure that all our internal IT systems are consistently well protected and we increase physical security at our most at risk sites – delivering similar levels of protection to today but at a lower cost. Levels B and C cost more than Level A and deliver higher levels of protection, with enhanced responses to attacks. They include greater rollouts of technologies such as cloud-based security solutions and increased physical security controls at major sites. Level D introduces a radical shift in our response to cyber-attacks, with significant investment in automated Artificial Intelligence (AI) controls. Level E extends this investment to detect threats as robustly as possible, using widespread smart AI technology whilst also expanding extensive physical security measures to all major sites.

PHYSICAL & CYBER SECURITY

Key questions for you

1. **What do you see as the major current security threats to utilities businesses?**
2. **How do you think these threats are likely to evolve over time?**
3. **How well do you think our levels of service provide appropriate mitigation against future physical and cyber threats?**
4. **How far should we go in terms of proactively identifying and protecting against future threats that are currently unforeseen? Should we more be reactive or proactive?**
5. **Is there anything missing from our plans that you would expect to see?**

£25.8m

spent to maintain and upgrade physical defences at operational sites in RIIO-ED1 to date.

Open data presents an opportunity but also a cyber challenge.

PHYSICAL & CYBER SECURITY

Physical & cyber security
Exploring the choices...

Service level A Your current package – but at a lower cost	Service level B Enhanced performance – for the same spend	Service level C Major upgrade	Service level D Breaking new ground	Service level E A new world
Strong controls against the risk of physical and cyber-attacks, protecting customer information and the energy network	**Advanced protection at some of our highest risk sites reducing the risk of cyber compromise on the network**	**Wider roll-out of advanced protection to our high-risk sites, further reducing the risk of compromise on our network**	**Roll-out of state-of-the-art controls and next generation technology allowing for enhanced detection and response to threats**	**Near full coverage of our business with state-of-the-art detection and controls, including facilities and systems that support decarbonisation**
– Maintain our strong cyber defences, responding to new threats as they emerge – Upgrade our older internal systems to improve standards of protection and resilience – Upgrade physical security at our highest risk sites with CCTV, Perimeter Intruder Detection Systems (PIDS) and high-security doors at 150 major substations	– Invest in more adaptable and flexible IT systems by moving 25% to cloud technology – Increase cyber threat detection capability across our network – Recruit and train more dedicated cyber specialists to respond to potential attacks – Install enhanced physical security controls at 25% of our major sites	– Extend cloud technology coverage to 50% of systems – Extend use of detection sensors to our substations – Develop automated responses to the most common cyber threats – Install enhanced physical security controls at 50% of our major sites	– Make our IT infrastructure more resilient to threats with AI controls and 75% of systems moved to cloud technology – Enhance cyber-attack detection controls with advanced analytics – Further enhance our response to potential security events with automated AI controls – Install enhanced physical security controls at 60% of our major sites	– Cloud-based security solutions for >95% of our systems – Smart, AI-based threat detection and response to protect our systems and the digitalised power network – Extensive physical security controls at all of our major sites

Key performance measures

Cyber breaches				
0	0	0	0	0
Endpoints[7] secured (circa)				
10,000	37,500 (+275%)	75,000 (+650%)	112,500 (+1,025%)	150,000 (+1,400%)
% reduction in number of metal thefts				
-5%	-10%	-20%	-30%	-45%

What will it cost?

Total annual cost				
£13.6m (-4%)	£14.1m	£24.1m (+70%)	£27.5m (+94%)	£37.4m (+164%)
Annual bill impact				
-£0.03	£0.00	+£0.45	+£0.60	+£1.04

Responding to stakeholder feedback...

Extend use of CCTV at substations

Protect our key sites

Uphold high standards of security

Operate secure IT systems

Automate threat detection and response

7 An Endpoint is a remote computing device that communicates back and forth with a network to which it is connected, e.g. desktops and servers

Meet the needs of consumers & network users

CUSTOMER SERVICE

9.Customer service

Our aim is to be the best energy company in serving our customers.

In our RIIO-ED1 business plan we committed that all aspects of customer service would become faster, more reliable and better communicated at no extra cost, and we're on track to deliver on that promise.

What we have done so far: we have delivered a step-change in our customer service levels in RIIO-ED1.

Overall customer satisfaction with the services we provide has improved by 6.7 percentage points (pp) in RIIO-ED1 to date to 89.0%. In parallel, the number of complaints we receive has reduced by 43.7% since the start of RIIO-ED1 and we have increased the proportion that we resolve in one day by 30.9pp to 84.7%.

These improvements have been achieved through significant investments in enabling technology. This includes a £4m investment in a customer relationship management system, alongside enhanced 'customer first' training for every colleague and a redesign of our core processes to put customers first. We now offer an expanded range of communication channels to support our traditional methods such as telephone and text, including social media channels and web chat functions. This gives our customers a choice as to how to transact with us, reflecting the shift in communication expectations towards mobile-first methods.

We have also introduced a range of online self-service offerings making it easier for customers to transact with us, for example, our interactive power cut map, self-service for disconnections quotations and small works budget estimates, booking minor engineering services and accessing our network records.

We have enhanced our range of services for vulnerable customers.

Since the beginning of the RIIO-ED1 period our role in supporting vulnerable customers has evolved. Our Consumer Vulnerability strategy ensures our vulnerable customers can receive extra support when accessing our services.

We have some of the highest levels of vulnerability in the UK within our regions. There are 416,000 households living in fuel poverty in our regions, 13% of the population of Yorkshire and the North East (compared to 11% nationally).

In RIIO-ED1, through in-depth research and data acquisition, we have developed a comprehensive programme of support for vulnerable customers and significantly increased our efforts to promote, raise awareness of and recruit to our Priority Services Register (PSR) in collaboration with partner organisations. We currently have over 937,000 households on our PSR, an increase of 67%.

PSR customers receive tailored support during a power cut. All of the calls we receive from customers go directly through to a member of our dedicated Priority Services team in our Contact Centre so that we can respond to their specific needs as quickly as possible. They receive proactive and regular contact throughout power cuts and deployment of generators for medical equipment.

In parallel, we have significantly widened our partnerships with organisations to offer vulnerable customers a range of further advice and support services.

937,000

Households on our PSR, an increase of 87% since the start of RIIO-ED1.

£4m

Investment in our customer relationship management system.

Despite the improvements we have made in RIIO-ED1 so far, there is more work for us to do to be amongst the leaders in our industry.

Standards in the industry are very high. Customers now score network companies 9.2/10 on average. Within a tightly bunched industry we rank 4th (out of 6), only 2.6 percentage points behind the leading company. We have a number of initiatives still to deliver in the remainder of RIIO-ED1 and we remain confident that by 2023 we will be amongst the leading pack.

Our focus is on delivering initiatives that make a difference to our customers. We want to make contact with us even easier, provide more accurate and timely information and use advanced data analytics to enhance our services and operational response.

Throughout the remainder of the RIIO-ED1 period we will continue to develop our understanding of vulnerability, the changing needs of our customers and enhance our Priority Services propositions in response. We will focus on improving regional data so we are better equipped to target services towards the needs of the communities we serve.

The national smart meter roll-out has faced continuing challenges and delays.

When we developed our RIIO-ED1 business plan it was envisaged that the national roll-out of smart meters would have been substantially completed by 2020. However, the supplier-led national roll-out has faced continuing technical issues and delays.

In September 2019, the Government announced an extension to the roll-out deadline by four years to 2024, which will take it into the RIIO-ED2 period.

Approximately 2 million smart meters have been installed in our region, for just over 50% of our customer base. Only 200,000 of those are second generation smart meters with full functionality, as technical issues with the telecommunications network delayed the roll-out in our regions. This limits the benefit that we can deliver on behalf of our customers.

This however has not deterred us. We have continued to support the roll-out, promptly resolving safety issues where they have arisen and we have been preparing our internal systems to receive smart meter data.

Customer satisfaction (Broad Measure of Customer Satisfaction) – the independent satisfaction survey utilised by all DNOs, providing consistent comparators for customer satisfaction.

We still see significant potential value in being able to integrate smart meter data with our customer, network and operational data so that we can:

- improve customer service by proactively responding to smart meter outage alerts; and
- improve network planning by enhancing future demand forecasting on the LV network.

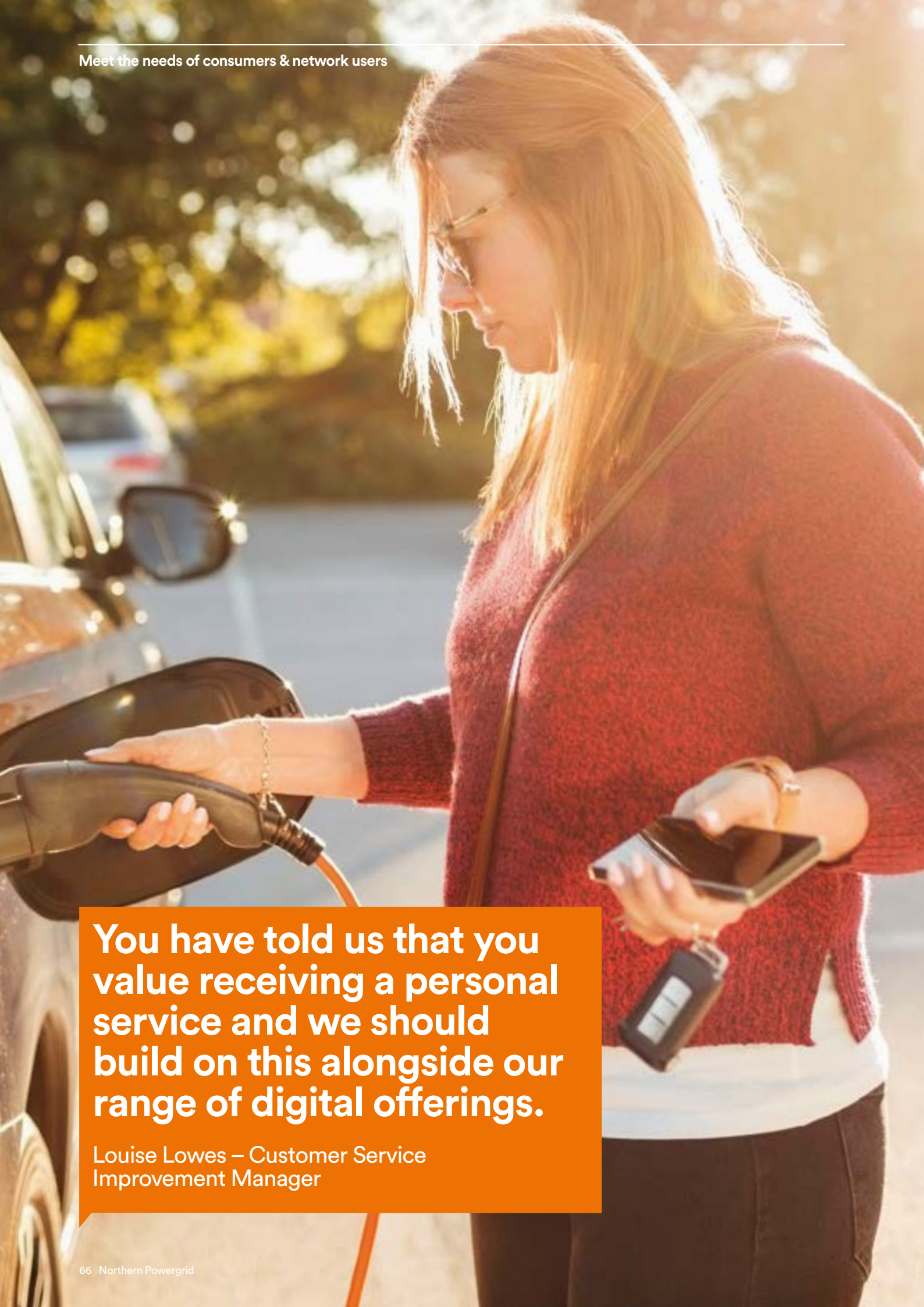
We have a number of projects either in-flight or ready to commence in the remainder of RIIO-ED1 that will establish capabilities to make more advanced use of smart meter data once it becomes available.

What we are hearing from you: personal service is important and we could do more for you in collaboration with our partners.

You want to see more collaborative working between utility companies, using partnerships and local knowledge to provide simplified access to information for customers. This includes a unified registration and contact points for our PSR.

You have told us that you value receiving a personal service and we should build on this alongside our range of digital offerings.

You have also told us the promotion of our PSR can be improved, and that we should utilise links with the other parties such as the health profession to increase awareness and support those living in fuel poverty.



You have told us that you value receiving a personal service and we should build on this alongside our range of digital offerings.

Louise Lowes – Customer Service Improvement Manager

Developing our plans: Our customer-facing enabling technology platform positions us well to respond as customer expectations continue to evolve.

In RIIO-ED2 we expect the availability of more advanced customer analytics and digital technologies to enhance the service we provide. The continuing roll-out of smart meters and increasing availability of smart meter data to improve our services will be a key dynamic in the period.

We need to make digital technologies simple for everyone, particularly our vulnerable customers. We will maintain a choice of contact channels for all, in particular ensuring that we engage with 'hard to reach' customers so they can access all of our services and benefit from the additional support programmes we're able to provide.

Our customer service offerings will need to evolve as we transition to a low-carbon energy system.

We expect to see a change within our customer base with increasing numbers of demand and generation customers, some of which will be selling their flexibility to either us or other parties in the energy system. These will include large generators and storage customers and domestic EV drivers. Customer service will need to encompass buyers and sellers of this flexibility who will require new and different support services including information and data analytics from us.

By 2028 we could see over a million customers in our region wanting to use EVs and hundreds of thousands choosing electrical heating. These are customers that may have little to no interaction with us today as standard. Customers will want a seamless experience to connect and utilise their new smart flexible electrical loads like electric vehicles, heat pumps and high efficiency electrical heating.

In support for decarbonisation, we will make more data and information available for our customers. We will use our expertise to support customers in the decarbonisation transition, educate them on our role in the energy system and sustainable practices to support the uptake of flexibility to lower energy bills.

Framing choices to explore with you…

The five levels of service we've developed to share with you start in Level A with us continuing to provide a multi-channel communication service and providing additional support for vulnerable customers during power cuts, but for less money than today. Levels B and C cost more than Level A and include more use of digital platforms to provide enhanced services and even more ways to get in touch with us. Level D includes a fundamental shift where we offer a much more tailored and personalised service. This new offering will include a range of flexible appointments over seven days a week[1], and we will provide targeted support for vulnerable customers including decarbonisation advice and support. In Level E we will extend this radical change in our approach to offer 100% human contact for all inbound callers, and use data analytics to expand the support and advice we offer customers in relation to decarbonisation.

Key questions for you

1
What should our customer experience look and feel like in the future, particularly in support of the decarbonisation transition?

2
What could we introduce to better support vulnerable customers?

3
What are your expectations of how we make best use of the data from smart meters?

4
Is there anything missing from our plans that you would expect to see?

EVs

By 2028 we could see over a million customers wanting to use electric cars.

2 million

Approximately 2 million smart meters have been installed in our region.

[1] Excluding Connections – see our Connections section for details of our proposed levels of service.

CUSTOMER SERVICE

Customer service
Exploring the choices…

Service level A Your current package – but at a lower cost	Service level B Enhanced performance – for the same spend	Service level C Major upgrade	Service level D Breaking new ground	Service level E A new world
Delivering a great service every day	**More choice for a great customer experience and enhanced support services**	**Enhancing our range of digital and personalised services**	**Tailored and personalised service for customers who need it the most, utilising data analytics to provide proactive customer experience across multiple channels**	**Personal, fast, flexible and value for money customer service, seamlessly combining data and digital technology to deliver best in class service**
– Contact us 24/7 via your channel of choice including a range of self-serve options – 5 day appointment service (am/pm) for planned works – 75% of calls answered by a human – Proactively keeping you informed during planned and unplanned power cuts via your preferred method – A dedicated contact centre team and additional support for vulnerable customer during power cuts	– Introducing new contact channels such as Instagram and WhatsApp – Deployment of our support vehicles to benefit vulnerable customers even when there's not a power cut – Provide you with energy efficiency advice via trusted third parties – Enhancing the personalised service we provide by using enhanced data and digital tools	– 7 day service for planned work, am/pm/evening slots – 80% of calls answered by a human – Greater use of technology to support self-service and for those who require it, increased capacity for personalised support via our contact centre – NPg app for all service needs – Deployment of more digital technology to support more efficient, intuitive services – Increased face-to-face affordability advice for vulnerable customers – Supporting you in the transition to decarbonisation through our contacts with you	– A range of flexible appointments available 7 days a week for planned works – 90% of calls answered by a human – Providing you personal energy efficiency advice, using smart meter data – Targeted and tailored support for our most vulnerable customers, including outreach services and support for decarbonisation – Operational field technology integrated with central systems to support a seamless service experience	– Enhanced use of data analytics to support customers with the transition to decarbonisation – 100% of calls answered by a human – Integrated proactive communications into smart home technology devices – Use of national customer data records enabling fully integrated proactive customer communications as a critical service provider (including for vulnerable customers)

Key performance measures

Overall customer satisfaction				
≥93%	≥93.5%	≥94%	≥95%	≥96%
Convenience (days of week/time slots)				
5 days; am/pm	5 days; am/pm	7 days; am/pm/evenings	7 days; named/next day	7 days; named/next/same day/2hr slot
% calls answered by a person				
75%	75%	80%	90%	100%

What will it cost?

Total annual cost				
£4.5m (-4%)	£4.7m	£5.8m (+24%)	£7.0m (+48%)	£7.6m (+62%)
Annual bill impact				
-£0.01	£0.00	+£0.05	+£0.10	+£0.13

Responding to stakeholder feedback…

Use technology to provide a better service	Prioritise vulnerable customers during power cuts	Raise awareness of decarbonisation and what it means	Support the transition to net zero
Provide accurate restoration times	Provide a simple, quick service	Provide a personal service	
		Use smart meter data to provide a more personalised service	

CONNECTIONS

10.Connections

A responsive, flexible and cost-efficient connections business is essential to supporting regional economic growth and the net zero transition.

Being able to connect to our network in a timely and cost-efficient way has always been important. It is now more in focus as we transition to net zero and more local generation and low-carbon technologies (LCTs), such as electric vehicles and heat pumps, come onto our network.

Our customer base for connections is already diverse including demand, generation, storage and (increasingly) flexibility services customers. It will become more diverse over time. Currently, most of our domestic customers rarely require a connection, and therefore require support and guidance throughout the process. In contrast, some of our larger and more frequent connections customers (e.g. housing developers or wind farms) have ongoing order books with us and multiple projects on the go at any one time, and the type of support they need is different.

It's therefore important that we have a range of cost-effective and flexible connection offerings for our customers. We must ensure that all customers have the information they need to make informed decisions around where, when and how to connect to our network.

What we have done so far: We are making good progress in delivering the connections commitments we made in our RIIO-ED1 plan.

We knew we needed to deliver a step-change in the connections service we provided during RIIO-ED1 to improve customer service and speed up the process. So far we have made good progress, and are ahead of our plans in some areas. We have reduced small works connections lead times by 27%, putting us on track to deliver our commitment of 30% faster routine end-to-end connections lead times by the end of the period. We've introduced better payment terms for small works connections (for example those needing to install a few EV chargers or connect a small housing development) meaning those customers only need to pay up to 12 days before the works begin, often supporting cash flow for smaller local firms. Our customer satisfaction for small works customers reflects our efforts, and has increased 9.7 percentage points to 88.4% overall satisfaction rating.

30%

We are on track to deliver our commitment of 30% faster lead times.

88.4%

Our customer satisfaction has increased by 9.7% to 88.4%.

Flexible connections – new, more flexible and innovative connection solutions will provide lower cost alternatives and facilitate more projects to proceed. Traditionally, connections in highly utilised parts of our network could lead to significant reinforcement, which in turn could lead to material cost increases.

We have improved services with a number of new free digital functions, including an innovative and national award winning self-service tool (AutoDesign) which reduces the time to get budget estimates for low-voltage connections from 10 days to just 10 minutes. This new tool is particularly useful for customers exploring the connection of electric vehicle chargers. We have also improved interactive generation and demand heat maps that allow customers to better assess information on available capacity on our network.

The cost of connecting to our network in constrained areas has been reduced by deploying Active Network Management. This brings more flexibility to the network and reduces the need for reinforcement, which can in turn reduce the costs of connection for customers.

What we are hearing from you: We have been engaging with a range of key groups and individuals on our connections services.

You have told us that access to network information and mapping data, via enhanced and secure digital channels, is important to you. You want us to extend the provision of the network information we make available and make it easy to understand and access.

You want us to continue to create online tools where you have the option to self-serve. But we also know that not all customers want to self-serve. Given the forecast increase in electric vehicles and heat pumps connecting onto our network, a lot of this will need to be accommodated through online self-serve tools, but will also require us to provide direct support for our customers in getting connected.

You have identified cost, speed of the overall process and, separately, speed of quotation as key areas for improvement for RIIO-ED2 across all work types.

Developing our plans: whilst we have made significant service improvements in RIIO-ED1, there is more we can do to improve our services in RIIO-ED2.

As well as the key theme surrounding the significant increase of electric vehicles and heat pumps and how we need to accommodate those, there are three other emerging areas of focus for our RIIO-ED2 connections plans: network data services; flexible connections; and tailored services.

Network data services include providing open access to data via expanded digital services for people who want to connect to our network.

Flexible connections are becoming particularly important due to the amount of LCTs we are forecasting to connect to the network during RIIO-ED2 and beyond. Traditionally, connections in highly utilised parts of our network could lead to significant reinforcement, which in turn could lead to material cost increases for the connections customers. New, more flexible and innovative connection solutions will provide lower cost alternatives and allow more projects to proceed.

Tailored services provide customers with a choice, in both the way in which they interact with us and the enhanced services they can access.

Framing choices to explore with you…

We have developed five levels of service that differ in how we serve connections customers, including the amount of information we provide online.

The levels we've developed start (in Level A) with us continuing to deliver quotes and on-site works at the same speed as we do today, coupled with some online options for self-service but at a lower cost than today. Levels B and C cost more than Level A but include expanded advisory services for our domestic connections customers and community energy groups, including vulnerable customers; greater provision of information online including self-service tools and more information on our network capacity for our larger connections customers; and providing quicker quotations and on-site connections. Customers will also be able to select a specific time and date for their connection to suit their needs. We are also seeing a significant uptake in electric vehicles and heat pumps and need smarter automated systems to allow these to seamlessly flow through the connections processes where required. Level D includes a fundamental shift in our connections service so that it becomes much more focused on enabling a quicker and smoother pathway to net zero. To achieve this we will: further enhance self-serve portals; get small works customers quoted and connected faster; and introduce more flexibility onto the network through revised connection agreements, network access arrangements and more innovative and flexible solutions. We will also seek to provide our customers with a next working day connection service for short duration works. In Level E we will extend this radical change in our approach to drive forward decarbonisation, by enabling all customers, large or small, to trade flexibility; whilst delivering quotations and connections even quicker for our small works customers, whilst giving them the flexibility to seek a same working day connection service for short duration works. Further details can be found in Annex 4.

CONNECTIONS

Key questions for you

All connections customers

1
Which part(s) of our current connections process would you like to be able to self-serve?

2
Which part(s) of our current connections process would you like additional face-to-face, phone or digital support?

3
Is there anything missing from our plans that you would expect to see?

Medium and large connections customers

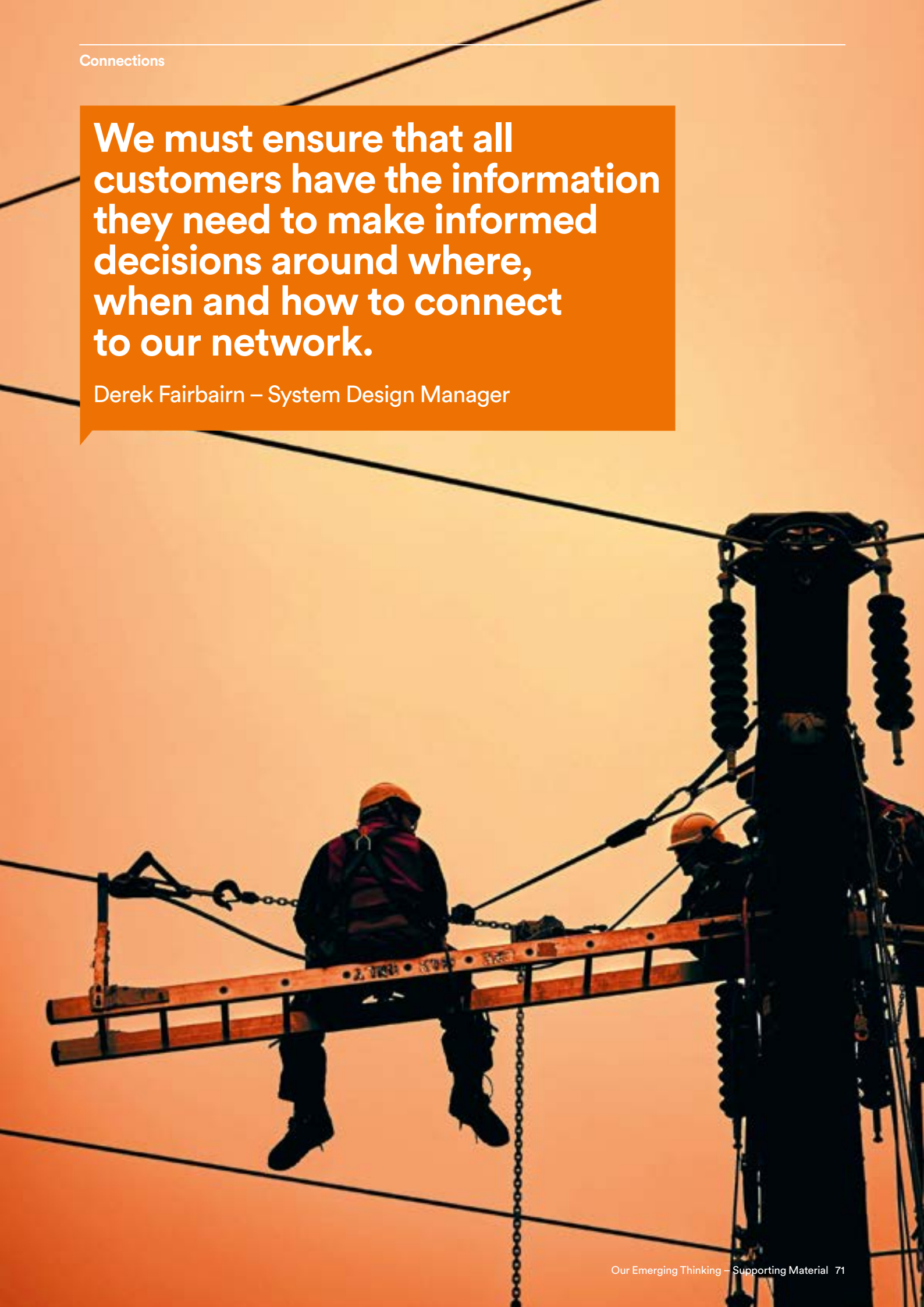
4
What flexible connections and/or flexibility services/offerings would you expect to see from us, and what support would you need to participate in them?

5
What network data would you like to be made available, in what format and what would it help you to do?

You want us to continue to create online tools where you have the option to self-serve.

We must ensure that all customers have the information they need to make informed decisions around where, when and how to connect to our network.

Derek Fairbairn – System Design Manager



CONNECTIONS

Connections
Exploring the choices…

Service level A Your current package – but at a lower cost	Service level B Enhanced performance – for the same spend	Service level C Major upgrade	Service level D Breaking new ground	Service level E A new world
Providing you with personal and online supported service offerings	**Enhancing the personal service we provide and providing more online self-service tools**	**Delivering smarter, quicker and flexible connections and supporting the LCT uptake**	**New measures to facilitate mass LCT uptake, flexible connections & variable network access**	**High levels of network flexibility and connectivity to drive, enable, support & accelerate the low-carbon transition**
All customers – Single point of contact to guide/support you throughout the connections process – Online self-service tool for generating LV quote estimates **Small works** – 'Quote-on-site' service to generate instant quotations for new connections **Medium & large works** – Online heat maps for major substations to view existing capacity levels for new connections – Gradual expansion of flexible connections into Active Network Management (ANM) enabled networks	**All customers** – A new, free advice service to help you identify the most viable and cost-effective solution for new connections, EVs and heat pumps – Supporting you through the application process with free checking and advice service for domestic customers and community energy groups (incl. vulnerable customers) – New self-service tools for LV demand and generation connections – Publishing more information online about our LV and HV network to inform your connections decisions **Small works** – Connecting you 10% (4 days) faster (quotation and delivery)	**All customers** – Publishing LV heat maps using LV monitoring & smart meter data – Targeted engagement with industry bodies and industrial & commercial customers about connections – Providing assurance on network capacity availability – Facilitating significant volumes of EVs & heat pump connections **Small works** – Connecting you 20% (8 days) faster (quotation and delivery) – Customers able to select a specified date/time for services **Medium & large works** – Procuring flexibility contracts with new and existing customers – Publishing more information online, including capacity and network performance	**All customers** – A comprehensive online self-serve connections portal **Small works** – Next day service available for short duration works – Connecting you 35% (13 days) faster (quotation and delivery) **Medium & large works** – Actively promoting capacity curtailment guarantees and trading arrangements – More flexible connections via a network capacity & curtailment trading platform and peer-to-peer trading of access rights – Publishing more comprehensive network data, with combined Long-Term Development Statements and interactive heat maps – Re-negotiate existing agreements for customers to connect LCT	**All customers** – Enabling the low-carbon transition with a smart network that is managed locally and can facilitate mass uptake in flexible connections **Small works** – Same day service available for short duration works – Connecting you 40% (16 days) faster (quotation and delivery) **Medium & large works** – Access or facilitate, on behalf of customers, flexibility arrangements between commercial parties as a means of providing additional network capacity over network reinforcement and potential cost savings

Key performance measures

% Customer satisfaction				
92.5%	93%	93.5%	94.5%	95.4%
Small Works: Time to connect – Days				
38	34 (-10%)	30 (-20%)	25 (-35%)	22 (-40%)
Volume of connected EVs and heat pumps				
160k EVs | 50k heat pumps	275k EVs | 56k heat pumps	410k EVs | 85k heat pumps	750k EVs | 150k heat pumps	950k EVs | 200k heat pumps

What will it cost?

Total annual cost				
£10.9m (-4%)	£11.4m	£11.9m (+4%)	£12.8m (+12%)	£13.5m (+18%)
Annual bill impact				
-£0.02	£0.00	+£0.02	+£0.06	+£0.09
Avg. cost of connection – single domestic connection (see Annex 4 for details of pricing assumptions, other connection types and service provision)				
£1,248 (-4%)	£1,300	£1,371 (+5%)	£1,405 (+8%)	£1,460 (+12%)

Responding to stakeholder feedback…

- Use technology to provide more efficient connections services
- Provide tailored connections advice
- Share more network data
- Support vulnerable customers
- Lower costs and provide quicker connections
- Make smarter use of network capacity and flexible connections
- Provide flexible connections including innovative solutions and network access arrangements
- Support the net zero transition

11.Our communities

We are more than an infrastructure provider. Every member of our team is part of their community and we can use our business to be a force for good.

We power the everyday lives of our customers in Yorkshire, the North East and northern Lincolnshire, putting us at the heart of our communities and the regional economy. We have a far-reaching impact on the communities we serve and we have a desire to do more.

We invest £1 million each day on maintaining and upgrading our network, much of which finds its way into the local economy through the supply chain. We are also a major employer in the region, providing well paid, high skilled jobs that offer exciting long-term career opportunities.

What have we done so far: We strive to be a force for good in delivering wider positive impacts in our local communities.

By the end of ED1 we will have created 1,000 new job opportunities across our region. Our Workforce Renewal and apprenticeships programmes to train the next generation of engineers have so far seen more than 414 new recruits join us since 2015.

We have developed our partnerships with local organisations to provide advice and specialist support on a range of topics to our customers – such as safety awareness, vulnerability, affordability, fuel poverty and local sustainability. This role has grown over time and, as our partnerships have matured, we have become a major funder of key third sector services such as Citizens Advice in Newcastle and Leeds.

414 recruits

Number of new engineering recruits that have joined us since 2015.

£1m

Amount we invest each working day on maintaining and upgrading our network.

What we are hearing from you: You recognise and value the contribution we can make in our communities.

Through our engagement so far you are telling us:

- You think us being a “good corporate citizen” is particularly important and that we should seek to play a role in supporting regional economic development.
- You’d like to see us play a bigger role fostering community energy.
- You want us to continue our focus on creating new job opportunities and playing an active role in the pipeline for future skills.
- You want us to focus on maximising the impact of our social programmes by working with partners, such as charities and energy suppliers, to help promote initiatives and combine resources.
- You’d like to be kept regularly up to date about what we’re doing, how it’s making a difference and how you can get involved.

Developing our plans: We believe the single biggest thing we can do to support our communities is to help everyone to benefit from decarbonisation and the opportunities that it provides.

We have always been proud of the role we play in our communities but we know the next few years are likely to be even more important as we deal with the wider economic and social climate, and new approaches to energy as the UK strives to meet net zero targets. With this in mind, we will ensure that our RIIO-ED2 plans are sustainable and drive forward long-term positive change for society.

We see two key elements of this – supporting communities on the pathway to net zero; and creating skilled job opportunities in an inclusive manner that helps to promote social mobility.

Playing our part in a socially inclusive transition to net zero.

We are acutely aware that different people will be affected by decarbonisation in different ways. While some people will be keen to buy electric vehicles and solar panels, and want to connect these to our network, others will be unable to easily afford and benefit from these low-carbon technologies. Similarly, some people will be willing to be more flexible in the way they use energy and may benefit from flexible energy tariffs, while other people will be unable to adapt their energy usage patterns (e.g. if they are medically dependent on electricity).

We believe the single biggest thing we can do to support our communities is to help everyone to benefit from decarbonisation and the opportunities that it provides.

Jim Cardwell – Head of Policy Development

Overall, this means that different people's circumstances are likely to affect the way they respond to decarbonisation and the benefits of decarbonisation are unlikely to be evenly spread across the population. We therefore believe we have a critical role to play in being a champion for making the playing field more even and we want to explore with you how we can best go about doing this, and how ambitious we should be.

In the more immediate term, we face an industry-wide challenge to recruit enough people to fill the gaps that will be left by the significant proportion of our workforce that is reaching retirement age. Our Workforce Renewal and apprenticeship programme has been a success since its introduction in 2009.

This programme will continue to be a key feature in maintaining resilience in our workforce and bringing new talent into the business in RIIO-ED2.

Our recruitment and training programmes are a significant way in which we can support our northern economies by providing local employment opportunities.

Like the whole utilities sector, we know we have work to do on the issue of our gender pay gap and increasing the diversity of our workforce. Our aim is to build the diversity of our workforce to better reflect the communities we serve through more comprehensive and targeted recruitment campaigns. We will also continue to collaborate with our industry and academic partners to promote STEM (Science, Technology, Engineering and Mathematics) subjects in schools, to help to attract more people to our sector from diverse backgrounds.

Framing choices to explore with you…

We have set out five levels of service for RIIO-ED2 that differ in the level of ambition of initiatives that support our wider communities. We'd like your feedback.

The five levels start in Level A with us continuing our comprehensive training and apprenticeship programmes whilst working with our partners to run targeted social programmes, related to employability, affordability and vulnerability. Levels B and C cost more than Level A and include an extension of our social programmes to include an expanded focus on community energy, with advice and support on how to decarbonise and use cleaner energy. We also increase our work building STEM skills in schools and promoting diversity. In Level D we build skills hubs in our regions and introduce an integrated social impact model that would lead to a radical shift in our asset investment approach, where the investment decisions we take are more informed by social issues. In Level E we set out to be a regional leader for sustainable development. We would lead collaborative initiatives between local organisations to ensure that everyone swapping to one specific type of low-carbon energy.

Developing a skilled workforce to meet the decarbonisation challenge

Key questions for you

1
How far should we reach out beyond our traditional core functions as a DNO to play a larger role with our communities and in civic society?

2
If we do expand our role in driving forward benefits for communities in our region, what should we focus our effort on and which activity do you think would have the most impact?

3
How are our current affordability programmes meeting community needs? What should we be doing differently in RIIO-ED2 and how should they be funded?

4
How can we work best with our communities to recruit and invest to develop a skilled workforce for the future?

5
What more could we do to build an increasingly diverse workforce that reflects the regions and communities we serve?

6
What more could we be doing in general to address the wider challenges facing our regions and communities?

Our communities
Exploring the choices…

Service level A Your current package – but at a lower cost	Service level B Enhanced performance – for the same spend	Service level C Major upgrade	Service level D Breaking new ground	Service level E A new world
Targeted support, in collaboration with our partners, for communities and customers most in need. Skilled jobs created in our regions.	**Increased reach of our social programme and support for community energy**	**Comprehensive coverage of our social programmes across the region, supporting those most in need**	**An integrated 'social impact' model that informs asset, social and environmental investments. Leverage socio-economic benefits of decarbonisation and take a leading role in community energy**	**Regional leader driving sustainable development**
– Create 400 new apprenticeship and graduate roles through our Workforce Renewal programme – More than 400 school pupils educated on energy careers and STEM skills – Support over 4,000 of our most vulnerable customers with energy affordability advice – £50k fund to support local community energy initiatives – >5% of our investment schemes to have bespoke social-benefit programmes in our local areas	– Extension of existing outreach programmes to support customers with energy information, promote careers in energy and fund community energy initiatives – Advice to individual customers and micro-businesses on how they can decarbonise and leverage their assets to enable a socially inclusive energy transition – Enabling social mobility with enhanced work in schools on STEM skills, promoting diversity and inclusion	– Targeted support across our region to encourage uptake and growth of clean energy to reach 100,000 customers – Over 10,000 customers with energy affordability concerns supported – Six-fold increase in school pupils educated on energy careers and STEM skills (3,000) – 30% of investment schemes with bespoke social programmes for local communities	– Wider social benefits form part of decisions about how and where we make investments – New local innovation and training hubs that support regional decarbonisation and facilitate local enhancement of STEM skills – Dedicated advisors working to promote and support uptake of community energy – Expansion of our other social programmes to benefit more people in our region	– Leadership that drives high levels of collaboration between local government, business and communities on decarbonisation and regional growth initiatives – Champion for all customers benefiting from changes to the energy system with 'just transition' to net zero and flexible energy – Social mobility in our regions improves through enhanced training programmes and innovation activity – Significant growth in the scale and reach of our social programmes

Key performance measures

Affordability: customers supported				
4,000	5,000 (+25%)	10,000 (+150%)	25,000 (+525%)	100,000 (+2,400%)
Decarbonisation: customers supported				
0	0	100,000	150,000	250,000
Investment: schemes with bespoke social programmes				
8%	15%	30%	50%	100%
Community energy projects supported				
0	5	10	20	40

What will it cost?

Total annual cost				
£13.6m (-4%)	£14.2m	£14.7m (+4%)	£18.5m (+30%)	£21.8m (+54%)
Annual bill impact				
-£0.03	£0.00	+£0.02	+£0.19	+£0.34

Responding to stakeholder feedback…

	Increase diversity in the workforce	Build relationships with local organisations and partners	Tailor social programmes to meet local needs Support the net zero transition	Affordability and accessibility are key enablers for an inclusive transition to net zero

12.Openness & transparency

As an essential service provider, the regulatory framework in which we operate ensures that we do a lot more than a typical private business to foster and demonstrate openness & transparency.

Northern Powergrid, along with the other network operators, is regulated by Ofgem. It's therefore built into the way that we work to share a large amount of information on our business with our stakeholders as part of our responsibility to meet our regulatory requirements. In addition to normal statutory accounts, which all businesses have to publish, we routinely make a wealth of information about our business publicly available.

Operating in our regulatory framework also requires us to meet other requirements that most businesses do not have to:

- Enabling healthy competition: we encourage competition in connections with Independent Connections Providers (ICPs) and Independent Distribution Network Operators (IDNOs), with a separate team providing services to these market participants.
- Reporting: we publish numerous reports, including regulated accounts, a detailed business plan, a report on delivery against our business plan commitments, an annual stakeholder report, and vulnerability incentive and environment reports.
- Independent board members: as mandated by Ofgem[1] we are required to have two Sufficiently Independent non-executive Directors (SIDs) on our board who scrutinise and challenge management decisions.
- Customer Engagement Group (CEG): our business plans are scrutinised and challenged by our independent CEG, a group of experts who view our plans through a consumer lens to ensure that we are undertaking appropriate engagement with our stakeholders and that their views are taken into account in our business planning. The CEG will then provide a report to our regulator on their findings.

Also, because we understand the need to stimulate trust in our business amongst our stakeholders, we go significantly beyond the formal requirements set by our regulator. That includes:

- Transparent system operation: our internal structures and decision-making processes ensure that there are no conflicts of interest in how we design and maintain our network.
- Sustainable and transparent procurement: we have a dynamic and transparent procurement approach and pay contractors quickly.
- Open data: we have shared data about our distribution future energy scenarios assumptions and modelling results through an open data platform.
- Collaboration: we work with external parties across many parts of our business, helping them navigate a complex market structure and working in partnerships on regional issues. We focus our effort on initiatives around innovation, supporting vulnerable customers and decarbonisation.

We want to understand what further changes we can make to build trust with stakeholders who may question our position in the market for energy.

Despite the significant regulatory and administrative mechanisms of reporting and enhanced transparency that have developed over time, we cannot say that all of the concerns of our stakeholders have been allayed. Yet the evidence suggests that this wealth of available information is not used a great deal by many of our stakeholders. For that reason, we do not believe that simply publishing more reports about our business will develop trust or change the minds of those who have concerns about our position in the market for energy. Therefore, we want to explore with stakeholders what substantive mechanisms could make a difference to building that trust.

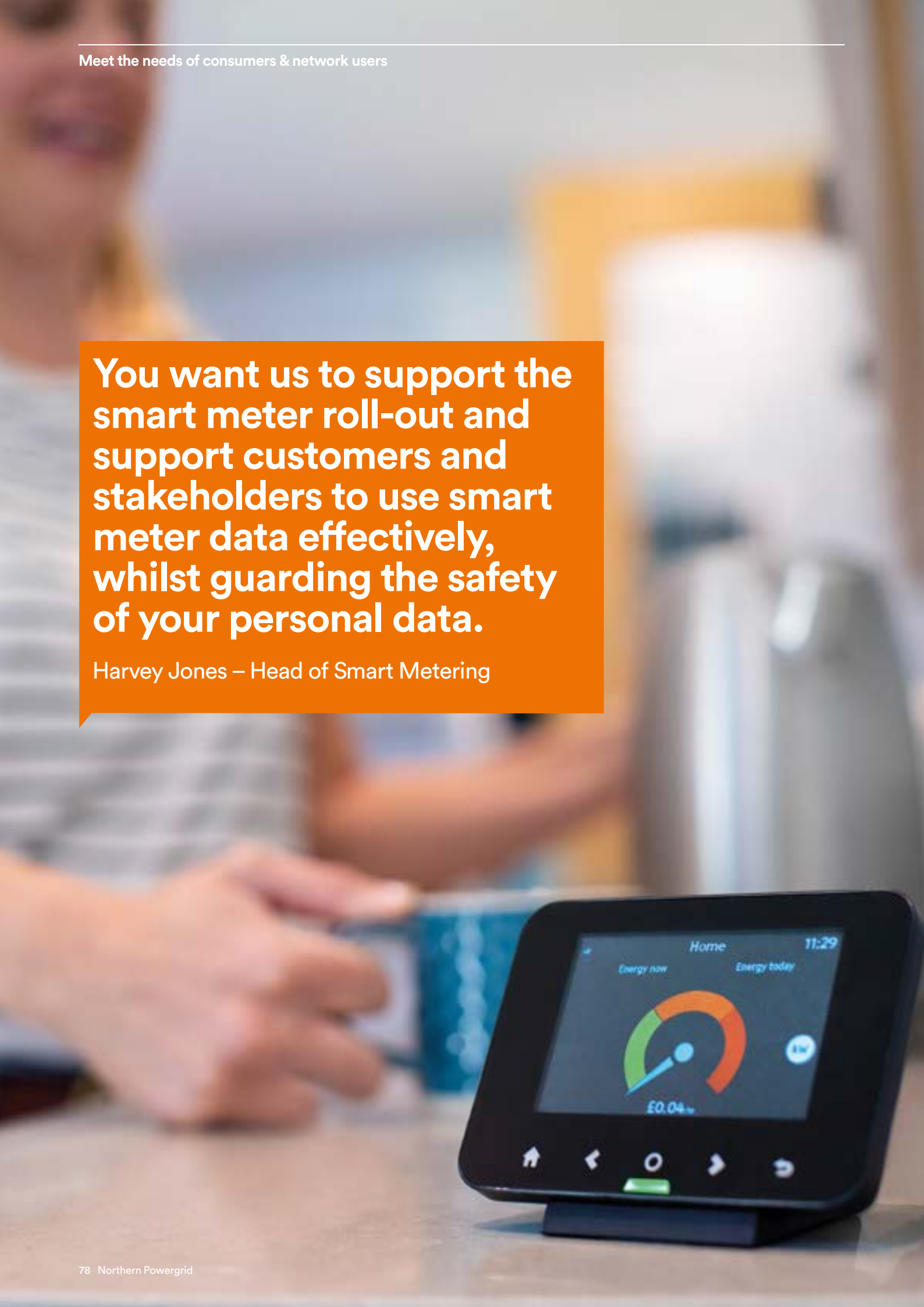
Openness & transparency are essential for achieving our vision of being a force for good in our communities.

We are proud to serve the communities we live and work in and believe that earning and maintaining the trust of our customers and stakeholders is critical for the long-term sustainability of our business. Our engagement principles set out how we ensure our customers and stakeholders are influencing and having a material impact on our plans (see the "Engaging with you" section on page 06).

As we move to a DSO role and seek to facilitate the pathway to net zero, it is critical that we adopt a collaborative approach to open data and the procurement of flexibility services.

Across all our stakeholder engagement, openness & transparency have emerged as common themes. In particular, we have heard that our approaches to flexibility services and open data will be paramount when it comes to building trust in the future, with this becoming increasingly important on the net zero transition.

[1]https://www.ofgem.gov.uk/ofgem-publications/76231/ring-fence-changes-pdf



You want us to support the smart meter roll-out and support customers and stakeholders to use smart meter data effectively, whilst guarding the safety of your personal data.

Harvey Jones – Head of Smart Metering

As a utility company, our procurement is governed by the Utilities Contracts Regulations 2016. These rules, combined with our own internal standards, mean we have always bought traditional goods and services in a transparent and equitable way, driving value for our customers and wider stakeholders. This provides us with a helpful blueprint as we build the foundations for our **flexibility first** approach to network solutions in the future.

A number of stakeholders have, however, challenged us on our procurement practices, where they are concerned that we may be focusing on getting the lowest costs rather than the best value. Furthermore, we have been challenged around whether we can use procurement to drive higher safety and environmental performances and higher ethical standards in our contractors and suppliers.

Open data sharing is key to driving decarbonisation and efficiency in the energy system. You want us to make rapid progress in opening up all network data where there is no good reason not to, and allow open data by default as we develop our processes and products. You want us to support the smart meter roll-out and support customers and stakeholders to use smart meter data effectively, whilst guarding the safety of your personal data. We are committed to make all our data presumed open securely unless there is a good reason not to make it open.

These two areas, alongside a significant focus on whole-system solutions to decarbonisation, mean that **collaboration** will be more important than ever. We will have to develop close and open working arrangements with other network operators, suppliers, generators and new market participants. Our plans will not be deliverable if they aren't supported by our workforce, so collaboration with our trade unions is a prerequisite.

Developing our plans: continuing to be open and transparent with you.

We are confident that we have a strong foundation in openness & transparency, but the transition to DSO and the need to lay the foundations for the pathways to net zero mean that this will become even more important as our role in the market changes. We want to make progress whilst avoiding unnecessary bureaucracy and cost, and explore with you where the focus areas should be.

We are asking you to give us your views on the choices we can make for the next price control period. Some of the areas to consider include:

Transparent system operation:

- We want to maximise visibility of our investment appraisals to show how we reach investment decisions. We'd like your views on how far should we go in doing this.
- We could restructure our business so that we have a separate function and reporting framework.

Enabling competition:

- We could investigate working with other utilities to create a "one stop shop" for customers connecting to regional utility networks.
- We believe that network charges should be equitable and transparent. But IDNOs' charges aren't cost reflective and they are able to make undisclosed adoption payments to developers. This distorts the market to the detriment of the majority of network users. We believe that there should be a level playing field.
- Through our trade body, Energy Networks Association, we are working in collaboration with other network operators to help develop the 'single' market approach across all networks for flexibility services to reduce costs and to stimulate the market.

Sustainable and transparent procurement:

- We are exploring changes to our procurement process to improve the sustainability and ethical credentials of our supply chain.
- We could commit to faster payment terms with our suppliers.

Open data:

- We have heard that many stakeholders put particular weight on open data and we have set out a range of service levels that essentially explore how far and how fast we make our data open.
- We are interested in stakeholders' views about how we have calibrated these options, where they would like us to pitch our ambition and, importantly, what we might have missed.
- We need to navigate the following important areas:
  - Protecting personal and network data
  - Determining what data should be prioritised
  - Further digitising our systems to enable data access.
- Open data underpins our digitalisation and DSO strategies: as we design new products and processes, we will make data "open by default".

Accountability:

- There is an option to increase external independent scrutiny by making the CEG a standing body and widening its remit, for example to include scrutinising our annual stakeholder report.

Collaboration:

- We want to explore the potential to expand our work with regional partners on community energy, decarbonisation and green recovery plans. We think these deeper partnerships are vital to delivering decarbonisation and supporting our customers and stakeholders in navigating a complex market structure in the energy sector.

Exploring choices with you...

In order to explore the options and find what really works, we have developed five levels of service for you to consider that differ in the extent we push the boundary on openness & transparency in RIIO-ED2.

Level A represents the open and transparent approach we already take today as a regulated business, but at a lower cost. Levels B sees incremental changes to our approach to procurement and collaboration, and the provision of outline asset data, but costs more than Level A. Levels C and D represent a fundamental shift in our approach, including making more significant changes in how we structure parts of our business, rapidly opening up our data, and would mark an active shift to an ethically proactive procurement. At Level E, we accelerate all of these significant changes, setting us on a course that would allow for regional decarbonisation before 2050 and put sustainable development at the heart of all of our decision making, in effect making it a primary objective. This would also see us taking on a regional leadership mantle going beyond decarbonisation and linking in economic growth and social objectives.

Key questions for you

1
How useful are the current reporting arrangements and which reports in particular do you use?

2
What steps do you think we need to take to demonstrate that our operation of the electricity distribution system is transparent?

3
What further steps could we take to increase confidence that our 'flexibility first' approach really does drive investment decisions?

4
Should there be a level playing field in charges so that there is real competition between DNOs and IDNOs for new connections?

5
Should we introduce enhanced ethical/ sustainability standards from our supply chain for goods and services, even if doing it has a cost?

6
How quickly should we deliver on the open data agenda (including data quality)? Should we be keeping up or trail blazing, even if doing so adds costs without immediate obvious benefits?

7
Who do we need to collaborate with and how should we go about it to be more effective?

Openness & transparency
Exploring the choices…

Service level A Your current package – but at a lower cost	Service level B Enhanced performance – for the same spend	Service level C Major upgrade	Service level D Breaking new ground	Service level E A new world
Leaders in regulatory integrity – always doing the right thing.	**A modest acceleration of DSO and Digitalisation plans and increasing access to network open data.**	**Actively facilitating regional decarbonisation in our role as DSO and through our supply chain.**	**A regional leader on the path to decarbonisation, collaboratively working with local authorities and other stakeholders.**	**Sustainable development is at the heart of our organisation and its decision making.**
– Separate procurement and asset management functions to avoid conflicts of interest with investment decisions – Connections input services (for ICPs and IDNOs) separated from our core DNO operations – Audits completed on 5% of connections delivered by NPg to ensure adherence to standards – Reducing costs by adopting network "flexibility first" instead of reinforcement, wherever possible, and publishing our decisions – All major works, services and goods contracts tendered to suppliers – Paying invoices promptly and providing guaranteed work volumes to sub-contractors – Encouraging our suppliers to adopt ISO standard ISO14001, to reduce their environmental impact – Publishing annual regulatory reports and independently audited accounts	– Modest acceleration of work to implement DSO plans and our digitalisation strategy – Increase guaranteed work volumes to suppliers – funded by efficiency savings – Increase bids for new work from ISO14001 accredited suppliers only – Provide open access for accredited third parties to an outline of our asset database (including key characteristics and ratings) – Increase our collaboration with local authorities by 50% to work together on local energy projects – Invite trade unions to consult on major asset investment decisions, with representation at our Asset Risk Management Group	– Accountability for asset investment decisions in a separate function, for enhanced transparency – Explore the feasibility of engineering, procurement and construction (EPC) contracts to increase our capacity for delivering asset projects – Our top 50 suppliers are ISO14001 accredited – Provide open access to our detailed asset database and a sub-set of historical network utilisation data – Our Customer Engagement Group (CEG) becomes a standing body within ED2 to scrutinise stakeholder engagement activities and reporting – Develop deeper partnerships with all main local authorities to actively facilitate decarbonisation – Targeted support for community energy across our region to encourage 'clean energy' growth	– A transparent system of 'checks and balances' across our operations, and reinforcement and connections decisions – A new dedicated, executive-led DSO function that, in part, seeks synergies and efficiencies across the whole energy system – An enhanced reporting framework, developed with local Citizens Advice, to increase transparency of our company operations including; an annual DSO report and an independent report from our CEG on our performance – The remit of the CEG is widened to scrutinise the work of both our Risk and Innovation committees – Assess the feasibility of a regional utility alliance to provide a "one-stop shop" for utility connections services – Free online visualisation tools for accessing comprehensive asset data – Trade unions invited to join a Board sub-committee – Lead regional decarboni-sation in partnership with local authorities and other local bodies	– An expanded DSO directorate, accountable for all system operation, network control and investment decisions – Removal of IDNOs' ability to pay adoption payments so Northern Powergrid can compete fairly – Driving carbon reduction throughout our supply chain – 95% of procurement spend will be with ISO14001 accredited suppliers only – Development of a comprehensive open data offering that includes access to all non-personal network and utilisation data and a suite of analysis tools – Expanding our partnerships with local authorities, heat and transport suppliers and to others to also lead on regional growth/prosperity and the regional inequality agendas – Establish regular trade union meetings with our Boards

Key performance measures

Invoices paid on "net monthly basis"				
90%	>92%	>95%	>95%	>95%
Tier 2/3 suppliers invited to tender				
–	+2.5%	+5%	+7.5%	+10%

What will it cost?

Total annual cost				
£0.48m (-4%)	£0.50m	£1.6m (+220%)	£2.2m (+340%)	£5.5m (+1,000%)
Annual bill impact				
Negligible	£0.00	+£0.05	+£0.08	+£0.23

Responding to stakeholder feedback…

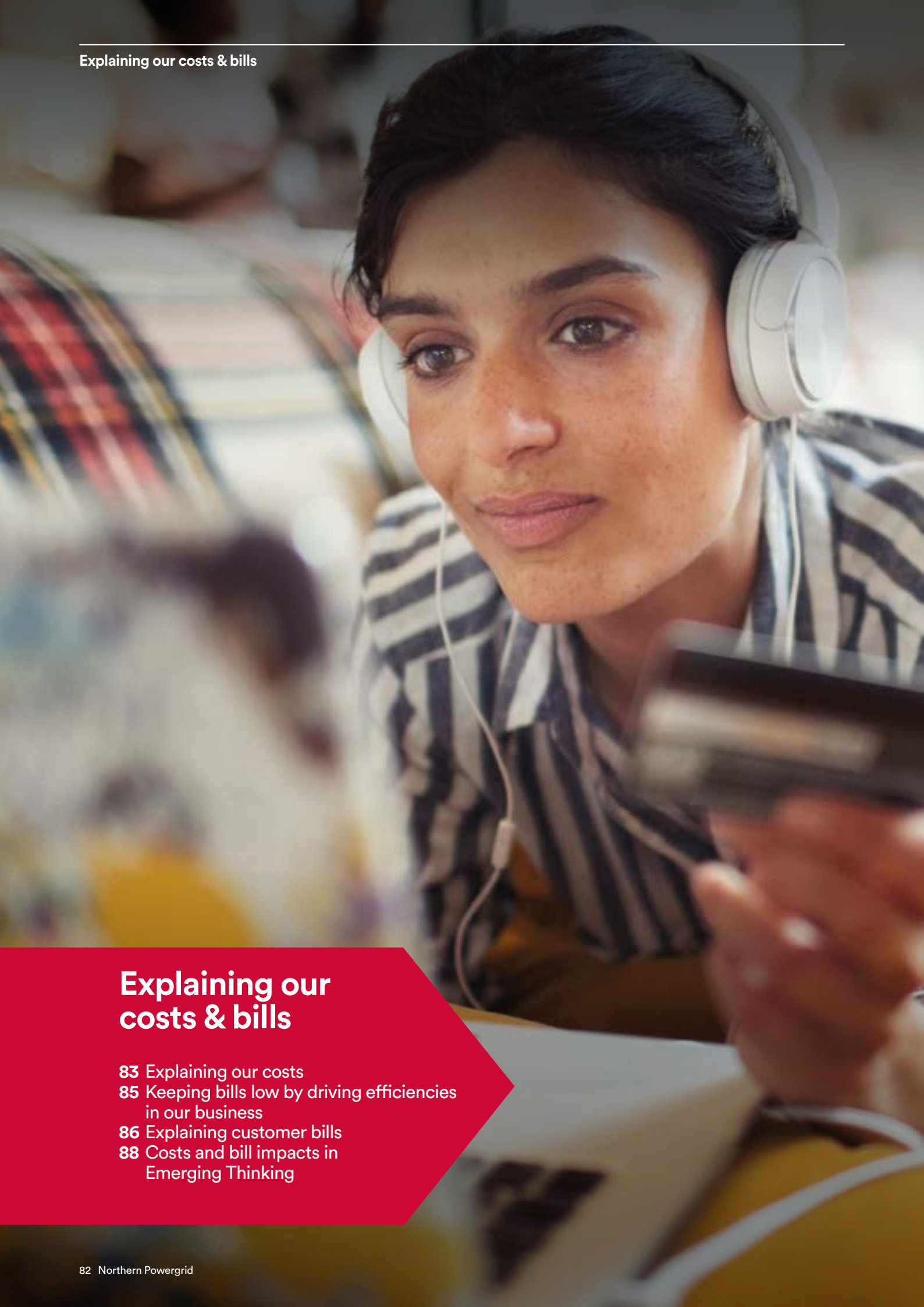
Protect our personal data

Be transparent in how we make key decisions

Access to network data is increasingly important

Play a key role facilitating decarbonisation

Use partnerships and collaboration to deliver on key goals



Explaining our costs & bills

Explaining our costs

The cost of our business plan will be informed by your priorities and choices.

The work we are doing to engage with you on our business plan is gathering valuable stakeholder feedback into your needs, priorities and attitudes to changes in the cost of the service you receive from us. We will use this to develop a well-justified and efficient business plan for RIIO-ED2 that represents value for money for you.

To help you weigh up the key choices, it is important that we explain to you what we spend your money on to deliver the services we provide.

To do this we have calculated an example view of average annual costs for RIIO-ED2 at £496m[1] assuming a package of current or enhanced performance in the five-year period and decarbonisation investment that would support the national goal of net zero carbon emissions by 2050.

This combination of costs would represent an increase of £31m or 7% compared to RIIO-ED1 annual costs attributable to incremental investment to facilitate the transition to net zero. This transition is likely to be the most significant driver of change in our costs in the move from RIIO-ED1 to RIIO-ED2.

[1] Indicative annual figure. For illustrative purposes costs allocated using package 1, details of which can be found on page 92.

Network investment

Investment in our network accounts for 47% of our total costs and can be broken into two parts: costs of installing additional capacity on the network and costs of replacing assets on the network.

New capacity connects new businesses and homes to the network, as well as supporting the low-carbon transition by increasing capacity to prepare for expected load growth on our network. This is where we are seeing increased costs in RIIO-ED2 to facilitate 'on track' (or accelerated) net zero scenarios.

Asset replacement costs relate to replacing equipment that is at the end of its useful life or has failed and no longer operates properly, such as replacing cable and transformers.

Key to our RIIO-ED2 plan is the need to balance network reliability with the drive towards decarbonisation, while at the same time keeping customer bills low. We must maintain the current condition and performance of the network to ensure our service remains reliable and in doing so ensure our investment is efficient in the long term by installing assets that will be fit for the needs of future generations.

In practice, this means we will look to ensure assets are suitably sized so that they are net zero-ready, delivering synergies between our programmes of work and reducing costs in future periods.

Total costs[1]

£111m
Network operating costs (22%)

£73m
Business Support and Non-operational investment (15%)

£233m
Network investment (47%)

£79m
Closely-associated Costs (16%)

Network operating costs

Network operating costs account for 22% of our cost base and are driven by day-to-day repair and maintenance required on the network. We have established programmes that determine the optimum point to proactively undergo maintenance on each part of our network but from time-to-time equipment fails or gets damaged and needs to be repaired.

In our plan for RIIO-ED2, we assume that network operating costs will remain at a relatively stable level; however, options in our plan explore the use of innovative new technology such as Foresight low voltage monitoring to reduce these costs in the longer term. Roll-out of this monitoring technology could encourage a move from a fix-on-fail model to a proactive condition-driven replacement model, reducing outages for our customers. We will target reductions in fault repair costs within RIIO-ED2 driven by technology that allows us to pinpoint fault locations, and forecast further benefits into RIIO-ED3 from full scale roll-out.

Closely-associated costs

We have a number of functions that provide essential support in operating the network, such as our network design team who are our network 'architects' and our customer contact centre. The costs of running these functions are known as closely-associated costs as they are specifically needed because of the services they provide to front-line delivery. Closely associated costs account for 16% of our total costs.

Your choices around our customer service improvement and the transition to Distribution System Operator in support of decarbonisation are likely to impact our long-term cost profile in this area. This will not necessarily increase overall costs, but may lead to a different approach to how we direct our spending.

Business support and non-operational investment

Our business support functions are similar to those in many other businesses, and those functions are supported by non-operational investment. Together, business support and non-operational costs account for 15% of our cost base. These functions include human resources, finance and IT. A significant portion of these costs are for salaries but they also include some capital investment such as IT equipment and systems.

Our digitalisation plans in RIIO-ED2 will carry costs and benefits, including the use of new technologies such as robotic process automation to generate efficiencies. Increased investment in data platforms will likely be required to support commitments around information provision in support of decarbonisation.

Keeping bills low by driving efficiencies in our business

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 our RIIO-ED1 business plan we committed to deliver 'more for less' and we are on track to do that – delivering substantially improved outputs for lower like-for-like costs and living within the challenging cost allowances that were set by our regulator. These allowances were £210m lower than our submitted business plan for the 8-year RIIO-ED1 period and we have so far generated an additional £46m of efficiencies (£256m in total, 8%) within the price control. These efficiencies have enabled us to absorb unforeseen requirements within our total cost allowances for the period, such as protecting our IT systems in response to evolving cyber threats (£25.6m forecast spend in RIIO-ED1), avoiding increasing costs for our customers.

To deliver these savings, we have a well-developed ongoing cost efficiency programme across our business covering our all aspects of our cost base. Key features include:

- **A strategic approach to identifying cost efficiencies:** Our RIIO-ED1 initiatives included a review of technical design specifications to build in efficiency, such as identifying opportunities to refurbish rather than replace overhead lines (saving over £25m) and a review of asset standards, such as enhancing site drainage and new coatings to protect against flood damage (saving over £10m). We undertake careful measurement of unit costs to identify process efficiencies whether they are from our own labour costs, that of our contactors or the materials we use.
- **Continuous improvement in core processes such as procurement and our supply chain:** We review and adapt our procurement approaches to drive incremental value. For example, we took time to re-negotiate our key service contracts at the start of the RIIO-ED1 period. We have also introduced e-auctions and aggregated purchasing with our affiliate companies to drive further cost savings.
- **Exploiting emerging technologies and making better use of existing technologies for our operational activities:** For example, use of innovative technologies has enabled us to improve our fault repair efficiency by over £10m in the RIIO-ED1 period.
- **Exploiting emerging technologies and making better use of existing technologies for our support activities:** For example, we are rolling out robotic process automation to drive further efficiencies in our support costs.

The efficiencies we have realised in RIIO-ED1 (and in earlier price controls) are carried forward into lower cost plans for RIIO-ED2 where we will be targeting further efficiencies and synergies depending on the ultimate package of outputs you want us to deliver.

We know you will want reassurances around the efficiency tests that have been applied to our plan in RIIO-ED2. Ofgem will benchmark our costs alongside other DNOs as part of the RIIO-ED2 price control review, but our business plan will itself set out the benchmarks we have used to measure the efficiency of our proposals, including comparisons to other networks and, where relevant, businesses in other sectors. For example, at the RIIO-ED1 price control review our support costs benchmarked as the best value in the sector.

Benchmarking is a continual process. It allows us to determine where we have opportunities for further efficiencies relative to other organisations and what we can do to make our business better for customers.

In our RIIO-ED1 business plan we committed to deliver 'more for less' and we are on track to do that.

Explaining customer bills

A range of customers pay us for the service we provide.

Most customers pay for the services provided by the electricity distribution network as part of the electricity bill that they get from their electricity supplier. That electricity bill includes our charges for the electricity distribution network but also charges for the generation of the electricity used by customers, transmission costs and the costs of the electricity supplier. Our charges represent approximately 15% of that total bill.

Most of our customers fall into one of three broad categories:
- **3.9 million domestic customers** e.g. homes across our region;
- **Approximately 250,000 commercial customers** e.g. shops, bars, restaurants and other small and medium sized businesses; or
- **Approximately 30,000 industrial customers** e.g. large factories

We also have approximately 2,000 generation and unmetered customers, predominantly local authorities for street lighting.

Approximately 45% of our charges are paid by domestic customers who consume 35% of the electricity we distribute. On average, a domestic customer uses approximately 2,900kWh of electricity every year and our charges are approximately £85[1] per year.

Around 40% of our charges are paid by industrial customers who consume 50% of the electricity we distribute and 15% by other customers who consume 15% of the electricity we distribute.

Customers pay for some of our costs immediately, but a large portion will be paid for over a 45-year period.

Not all of our costs are paid immediately by customers. About 70% of what we spend relates to investment in equipment that will last for several decades. Because of that, those costs are recovered in your bills over a long period, currently 45 years (determined by 'asset lives'). The other 30% is paid immediately.

It is worth noting that asset lives have been increasing over the RIIO-ED1 period, from 20 years to 45 years under Ofgem's RIIO-ED1 asset lives policy. We believe Ofgem should reduce asset lives to support intergenerational fairness. With a shorter asset life, customers would finish paying for that investment sooner. This would avoid future generations funding significant growth in our asset base that will benefit the current generation of consumers disproportionately. If asset lives for RIIO-ED2 expenditure were halved, the illustrative bill impacts shown would increase by approximately 10% but result in lower costs to be paid for by future generations.

What else does the customer bill include?

A customer bill also comprises tax, a return for investors (those equity and debt investors who are funding the 70% of cost that is not recovered for 45 years) and the impact of various incentive or uncertainty mechanisms determined by Ofgem.

Incentive mechanisms are put in place by Ofgem to reward better performance and penalise poorer performance on certain key regulatory measures. Uncertainty mechanisms help to ensure customers do not pay too much when levels of activity in a particular area are unknown. We believe the right answer for customers would be for Ofgem to implement an uncertainty mechanism in RIIO-ED2 that would adjust cost allowances for the rate of low-carbon technologies uptake experienced in the period.

The table opposite shows the assumptions made in calculating the customer bill impacts and compares the assumption to RIIO-ED1. The illustrative cost of equity is based on the financial assumptions in Ofgem's Transmission and Gas Distribution Methodology Decisions. Each of these assumptions remains illustrative as they must be decided afresh by Ofgem specifically for electricity distribution as part of the RIIO-ED2 price control process.

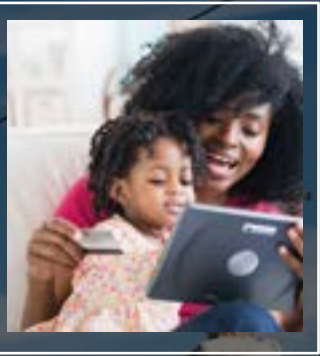
[1] Average domestic customer bill.

Assumption	RIIO-ED1	Emerging Thinking bill impact
Asset lives (recovery period)	45 years	45 years
Cost of equity	6.0%	4.3%[2]
Cost of debt (average)	5.3%	4.4%[3]
Debt ratio	65%	60%
Inflation (OBR 2023 forecast)	3.1%	2.0%
Nominal weighted average of capital	6.7%	5.2%

The cost of equity encourages equity investment in the network. So at a time when the regulatory regime must ensure that there is a significant investment in electricity distribution networks to facilitate the pathways to net zero, there is a delicate balance to strike, and it is more important than ever that the cost of equity isn't set too low.

The cost of capital has come down. Even if Ofgem used a cost of equity at the top of its initial range (5.6%), we estimate that the overall cost to consumers will come down by at least £200m as a result of the lower returns that will be paid to investors in RIIO-ED2. Using this cost of equity would increase the bills set out to illustrate our Emerging Thinking by less than 4%.

Approximately 45% of our charges are paid by domestic customers who consume 35% of the electricity we distribute.



[2] To calculate the Emerging Thinking bill impact we assumed a 65% debt ratio, resulting in a cost of equity of 4.8%.
[3] We have combined the real cost of debt assumption with a long-term forecast for inflation from the Government's independent fiscal watchdog, the Office for Budget Responsibility.

Costs and bill impacts in Emerging Thinking

The cost impact of choices varies significantly across the performance areas in our plan

The chart below shows the range of annual costs for service levels A to E in each performance area in our plan[1].

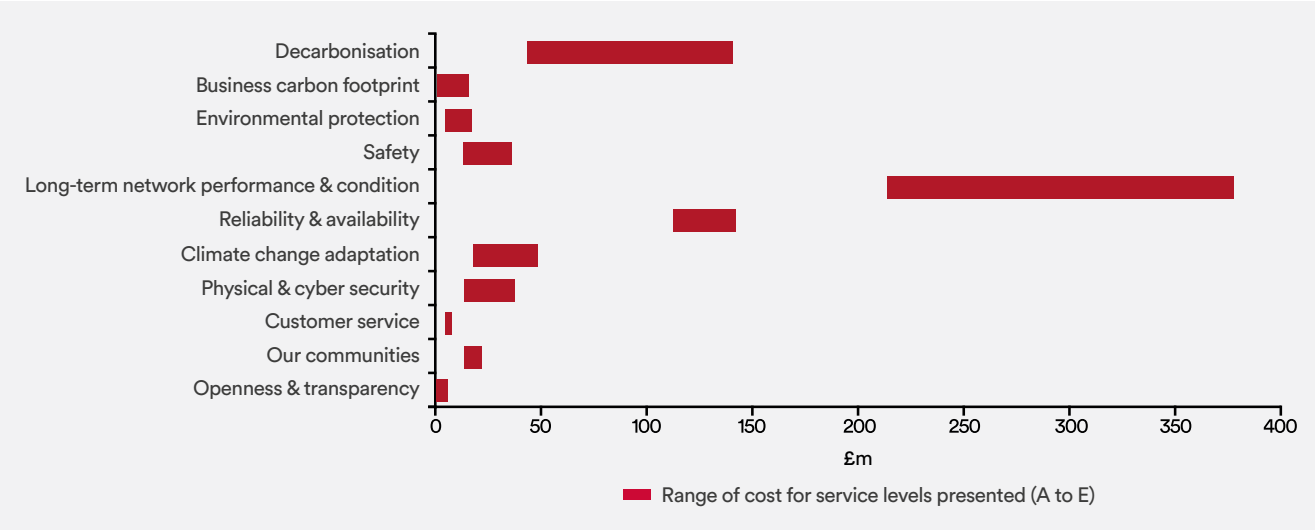
Since around 70% of our costs relate to maintaining and upgrading the network, those performance areas in our plan account for the highest levels of expenditure – **long-term network performance & condition, reliability & availability and decarbonisation.**

It is important to consider the lifetime impact on customer bills

Throughout our Emerging Thinking material, we show indicative costs and bill impacts for each of the levels of service in the 12 business performance areas in our plan. These are provided to give you an indication of the cost impact of your choices both annually as a whole for Northern Powergrid (compared to average costs in RIIO-ED1) and what they equate to for a domestic customers' average bill.

For simplicity, bill impacts shown throughout Emerging Thinking are for domestic customers only. Average bill impacts for commercial and industrial customers are shown in the Annex 1.

In calculating customer bill impacts, we have assumed that the 45-year recovery period remains unchanged in RIIO-ED2 and beyond in line with Ofgem's current policy. This means when you see the bill impacts throughout this document they show the annual impact of choices made for the next 45 years, assuming all other things remain equal.



[1] Excluding connections.

Next steps

Building your plan

Different stakeholder perspectives would balance the priorities differently

We realise that building an understanding of the impact of differing priorities on the overall business plan is complicated. To make this easier for you we have sought to present how different plan priorities may be considered from three example viewpoints (introduced in the summary to Emerging Thinking).

These viewpoints are intended to offer a lens through which to view the different aspects of our business and to help you formulate your views on where you think our priorities should lie.

The viewpoints are applicable to domestic and non-domestic customers, and have been developed based on our stakeholder engagement. They by no means represent all points of view, but provide reference points for you to form your own views.

I am worried about my energy bills and I'm happy with the service I receive today.

— Concerned about affordability of energy bills

— Unlikely to make radical changes to the way they use energy over the next five years

— Rarely notices any issues with the current level of service, so unconvinced that any substantial changes are required to the way the network is run day-to-day and the level of service that is provided

— Understands that climate change is important, and wants to do the right thing for the environment and future generations, but doesn't see a need to speed up the change to get to net zero any earlier than 2050

— Unconvinced that an energy network is the right organisation to be driving radical change in terms of support provided to communities and vulnerable customers – considers that to be a job for the Government, local authorities and charities instead

I want fewer power cuts and improved service.

— Potentially very dependent on the reliability of the electricity supply – could be medically dependent, have small children or be elderly and would struggle much more in a power cut. Could also be a business that is dependent on electricity to keep the doors open. Likes the sound of more reliability

— Understands that climate change is important but is much more focused on the here and now, and the level of service that they receive today

— Given that they are very busy and face many challenges day-to-day, unlikely to adapt the way they use energy over the next five years, and can't see much point in bringing forward the pathway to net zero

— Thinks that the job of a network is to deliver electricity to homes and businesses, and it should focus on that and not necessarily focus on doing other things for the wider community

This is a climate emergency – we must act now and do more in our communities.

— Views the current situation as a climate emergency for now and future generations, and wants to see radical change as quickly as possible

— Is happy to spend more on investments to get there faster, and prepared to be flexible in the way they use their energy

— Keen to drive forward better outcomes for society more generally. Likes the idea of energy networks expanding their remits and being more ambitious in the way they support communities.

— Wants to see more support for vulnerable customers

— Is less bothered about the service that they receive today – less dependent on electricity in their home or business and considers the service is already more than good enough

To help get you started we have developed some ready-made example packages

We have shown three example business plans which illustrate the sorts of choices that might be made if you view our plan from these three viewpoints.

You don't have to pick any of them, as none of them may be right for you, but they might inspire you to come up with a plan that is similar to one of them, or a blend of more than one of them – or something completely different. You can use the interactive tool on our website[2] to provide us with feedback on the right combination for you.

Viewpoint/Example 1

Example viewpoint 1:
"I am worried about my energy bills and I'm happy with the service I receive today"

Example package 1: Enable the pathway to net zero, while making use of efficiency savings elsewhere in the business to improve performance in targeted areas

	Decarbonisation	Business carbon footprint	Environmental protection	Safety	LT network performance & condition	Reliability & availability	Climate change adaptation	Physical & cyber security	Customer service	Connections	Our communities	Openness & transparency	Total
Service level	C	B	A	A	A	A	B	B	A	B	A	A	
Cost (£m) per annum	85.3	1.7	4.6	12.8	214.3	112.7	20.7	14.1	4.5	11.4	13.6	0.5	**496.2**
Cost (% Δ) per annum	89.6%	0.0%	-4.0%	-4.0%	-2.5%	-2.2%	0.0%	0.0%	-4.0%	0.0%	-4.0%	-4.0%	**6.6%**
Bill impact per annum (£)	1.81	0.00	-0.01	-0.02	-0.25	-0.12	0.00	0.00	-0.01	0.00	-0.03	0.00	**1.37**

Customer outcomes

— "On track" for society's transition to net zero and net zero operations by 2050

— Industry leading in safety, maintain a network that is available 99.98% of the time, invest to maintain long-term network performance and hold >9/10 customer satisfaction levels

— Enhanced cross-sector collaboration and investment to build resilience against climate change, advanced security protection at our very highest risk sites and a more personal connections service with more online self-service tools

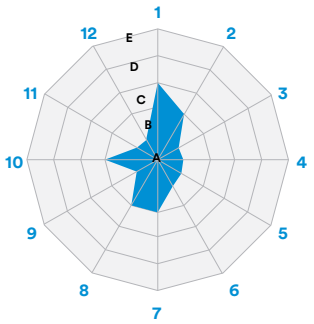
Key considerations

— Does not rely on customers to become flexible with energy use now

— Risks higher costs on the pathway to net zero in the 2030s and may take longer to respond to some future low-carbon scenarios

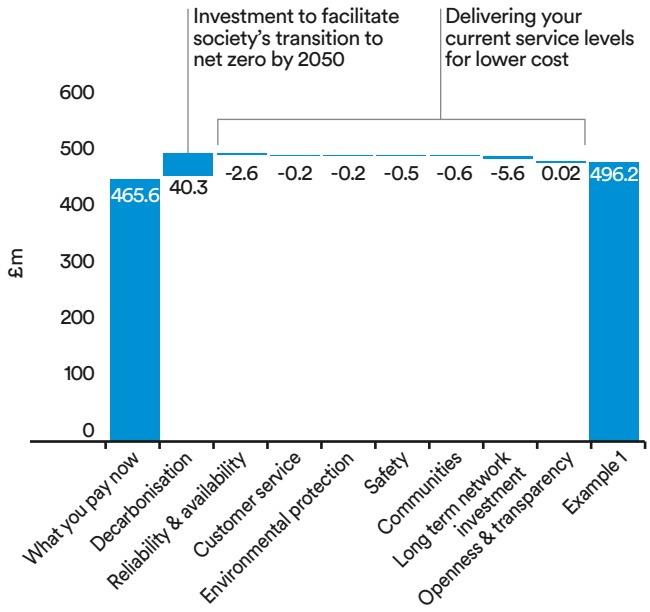
[2] http://engage.northernpowergrid.com/planning-for-2023-28

Example 1



Key

1 Decarbonisation
2 Business carbon footprint
3 Environmental protection
4 Safety
5 Long-term network performance & condition
6 Reliability & availability
7 Climate change adaptation
8 Physical & cyber security
9 Customer service
10 Connections
11 Our communities
12 Openness & transparency



Viewpoint/Example 2

Decarbonisation	Business carbon footprint	Environmental protection	Safety	LT network performance & condition	Reliability & availability	Climate change adaptation	Physical & cyber security	Customer service	Connections	Our communities	Openness & transparency

Example viewpoint 2:
"I want fewer power cuts and improved services"

Example package 2: enable the pathway to net zero by 2050, but don't stop pursuing improvements in reliability and customer service

Service level	C	B	B	B	D	B	B	C	D	D	B	C	Total
Cost (£m) per annum	85.3	1.7	4.8	13.3	219.9	129.3	20.7	24.1	7.0	12.8	14.2	1.6	**534.6**
Cost (% Δ) per annum	89.6%	0.0%	0.0%	0.0%	0.0%	12.2%	0.0%	70.4%	48.2%	11.8%	0.0%	220.0%	**14.8%**
Bill impact per annum (£)	1.81	0.00	0.00	0.00	0.00	0.63	0.00	0.45	0.10	0.06	0.00	0.05	**3.09**

Customer outcomes

— "On track" for society's transition to net zero by 2050 and net zero operations by 2045

— Further reduction in safety risk, improved long-term network performance and reduction in major sites at risk of 1/1,000 flood events

— Reduction in the number of power cuts and duration of power cuts by 25% and 20% respectively, 75% reduction in the number of >12 hour customer interruptions and advanced security protection at our highest risk sites

— Tailored and personalised service for customers including a range of flexible appointments available 7 days a week for planned works, 90% of calls answered by a human and more tailored support for our most vulnerable customers

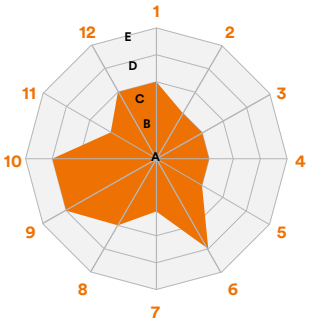
— New measures to encourage low-carbon technology (LCT) uptake and flexible connections

Key considerations

— Does not rely on customers to become flexible with energy use now

— Risks higher costs on the pathway to net zero in the 2030s and may take longer to respond to some future low-carbon scenarios

Example 2



Key

1 Decarbonisation
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10 Connections
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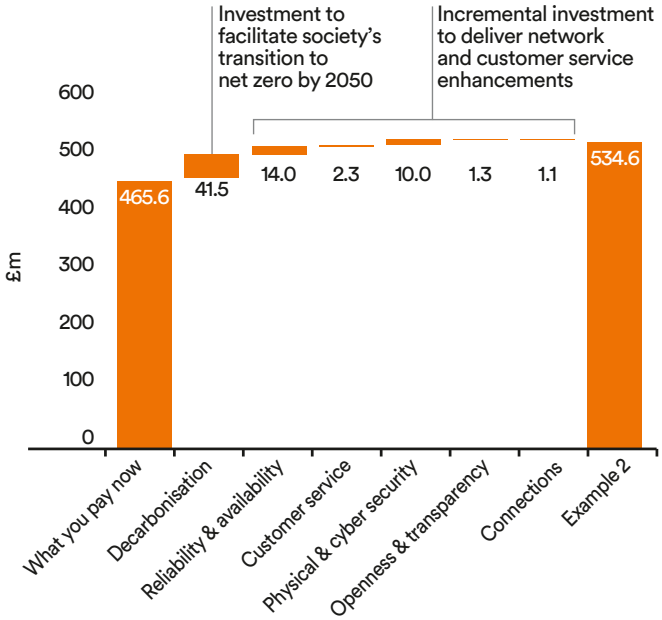


Viewpoint/Example 3

Decarbonisation	Business carbon footprint	Environmental protection	Safety	LT network performance & condition	Reliability & availability	Climate change adaptation	Physical & cyber security	Customer service	Connections	Our communities	Openness & transparency

Example viewpoint 3: "This is a climate emergency – we must act now and do more in our communities"

Example package 3: all out focus on climate change and community support

Service level	E	E	D	B	B	B	C	C	C	E	E	E	Total
Cost (£m) per annum	140.5	16.1	9.5	13.3	219.9	115.2	24.4	24.1	5.8	13.5	21.8	5.5	**609.7**
Cost (% Δ) per annum	212.5%	840.5%	95.7%	0.0%	0.0%	0.0%	17.9%	70.4%	23.6%	18.5%	54.2%	1005.6%	**31.0%**
Bill impact per annum (£)	4.29	0.64	0.21	0.00	0.00	0.00	0.17	0.45	0.05	0.09	0.34	0.23	**6.47**

Customer outcomes

— Accelerated pathways enabled for society's transition to net zero (earlier than 2050) and net zero operations for Northern Powergrid by 2035

— Further reduction in safety risk, number and duration of power cuts reduced by 10%, advanced security protection at our highest risk sites.

— Enhanced range of digital and personal customer services including 7 day service for planned work (am/pm/evening slots), 80% of calls answered by agent and increased face-to-face affordability advice for vulnerable customers

— High levels of network flexibility and connectivity to drive, enable and support the low-carbon transition – up to 950k electric vehicles and 200k heat pumps connected.

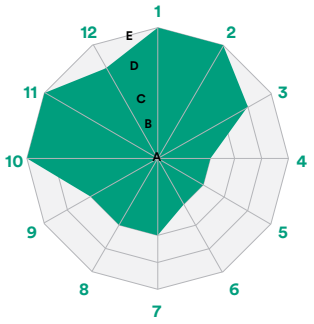
— Regional leadership driving sustainable development

Key considerations

— Requires significant behavioural changes from all customers and policy changes to deliver maximum customer flexibility and reduce the need for investments to accommodate low-carbon uptake

— Reliant on significant increases in output from our supply chain

Example 3



Key

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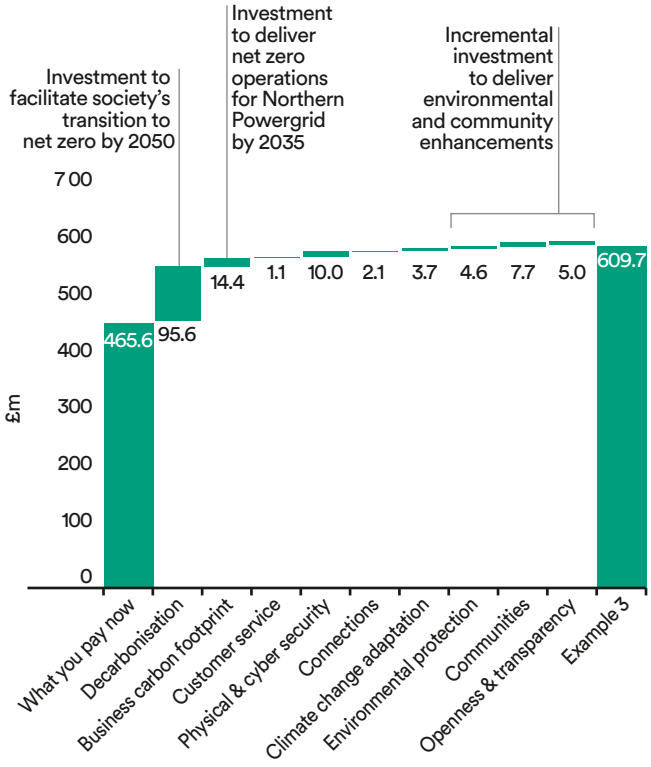


Enabling success in RIIO-ED2

Four key cross-cutting enablers underpin the successful delivery of our plan.

Innovation

— Our ambition is to use innovation to reduce costs and improve the services we deliver to you

— Given that goal, we look for innovative solutions that develop and build on our current operations, that are realistic for us to implement and that will deliver greatest value for you

— In the current regulatory period we have concentrated on building a smarter powergrid, introducing web services, setting ourselves up to use smart meter data and addressing issues of affordability

Focus for RIIO-ED2:

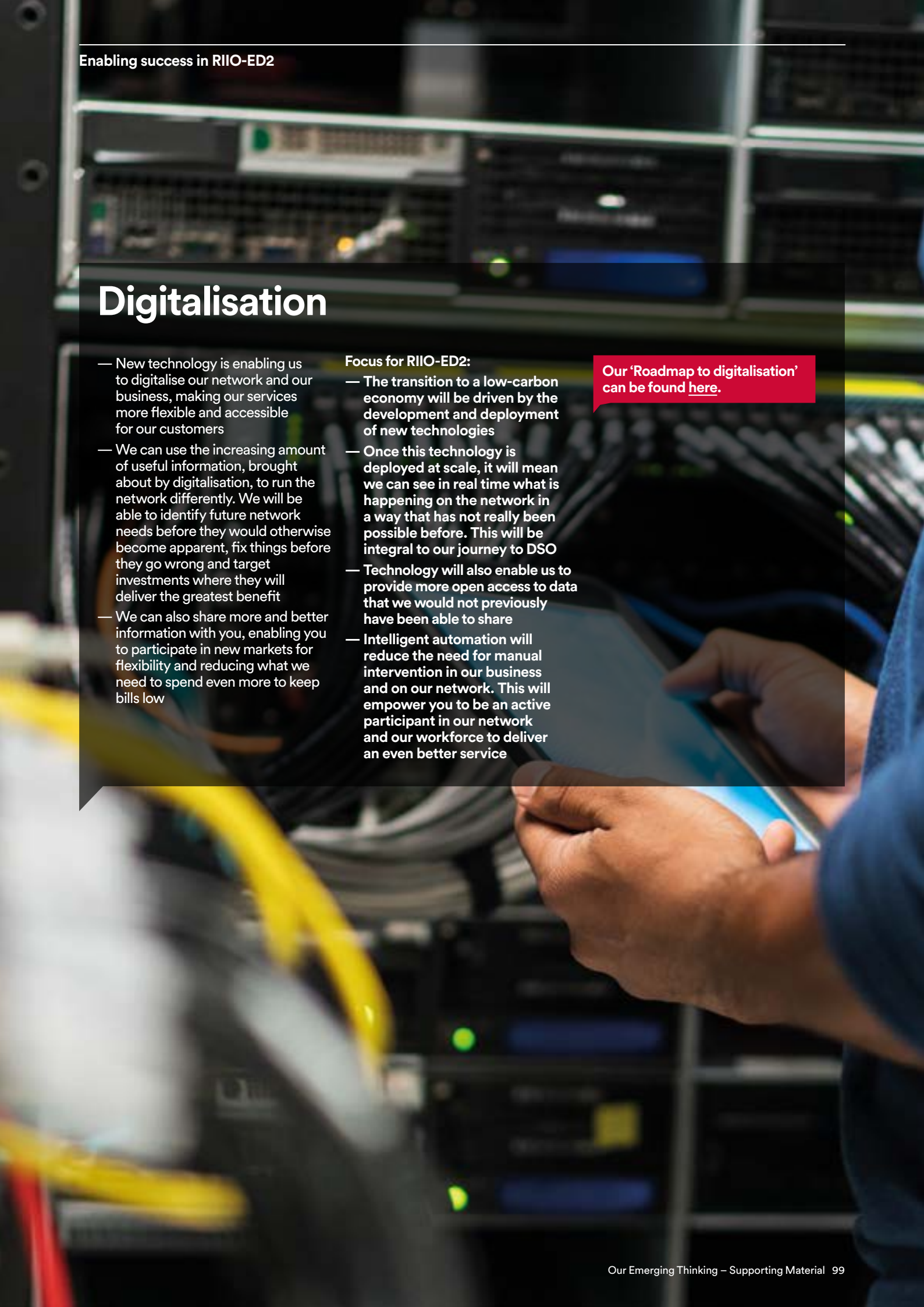
— **We know that protecting the environment is high on everyone's agenda and, in particular, we need to actively support the pathway to net zero. So these areas will play a significant part in our innovation activity in RIIO-ED2**

— **A successful transition to low-carbon energy will require a highly reliable electricity network and we will continue the push for ever higher performance in this area**

— **Our innovation work is central to our effective transition to DSO, and we are using it to inform our thinking on what a DSO is, how it will benefit you and how to ensure the transition to net zero is socially inclusive**

— **We also expect to see an increased focus on harnessing data to deliver cost savings and improve and broaden the services we deliver to you**

We intend to publish our updated innovation strategy to engage with you on your areas of interest and where you think our activity should be focused in RIIO-ED2.



Digitalisation

- New technology is enabling us to digitalise our network and our business, making our services more flexible and accessible for our customers
- We can use the increasing amount of useful information, brought about by digitalisation, to run the network differently. We will be able to identify future network needs before they would otherwise become apparent, fix things before they go wrong and target investments where they will deliver the greatest benefit
- We can also share more and better information with you, enabling you to participate in new markets for flexibility and reducing what we need to spend even more to keep bills low

Focus for RIIO-ED2:

- **The transition to a low-carbon economy will be driven by the development and deployment of new technologies**
- **Once this technology is deployed at scale, it will mean we can see in real time what is happening on the network in a way that has not really been possible before. This will be integral to our journey to DSO**
- **Technology will also enable us to provide more open access to data that we would not previously have been able to share**
- **Intelligent automation will reduce the need for manual intervention in our business and on our network. This will empower you to be an active participant in our network and our workforce to deliver an even better service**

Our 'Roadmap to digitalisation' can be found here.

Our people

- Our workforce of around 2,450 people is central to delivering our vision – to delight our customers with outstanding service
- By the end of RIIO-ED1 we will have delivered on our commitment to create 1,000 new job opportunities in our region
- Our successful Workforce Renewal programme has so far seen 323 new recruits join us to complete comprehensive industrial and technical training
- We have expanded our trainee programme to include roles in Finance, IT, Procurement and Cyber Security, taking it beyond traditional technical and engineering roles
- We have designed an overarching framework to support our colleagues in the way we recruit, communicate, provide training and remunerate – our goal is to develop a workforce that mirrors the diversity of the communities we serve
- Like many organisations in the industry, Northern Powergrid is proud to grow and develop talented colleagues who often move from grass roots through to managerial positions

Focus for RIIO-ED2:

- **Diversity and inclusion within our workforce will be a key feature of our plans**
- **We will also continue to collaborate with our industry and academic partners to promote STEM (Science, Technology, Engineering and Mathematics) subjects in schools, to help to attract more people to our sector**
- **The increasing digitalisation and smarter nature of our business and the energy system more generally means that our more traditional engineering roles are adapting, and our roles are becoming more diverse and include a growing element of technology. Given this, our training programmes will need to evolve to provide our colleagues with the skills they need to manage the energy systems of the future**

We will publish our people strategy to engage with you and gain input on our plans for RIIO-ED2.

Collaboration

— Collaboration has become increasingly central to the way we work as a business

— This is because we are building a smart, local and cost-effective network around your needs, in collaboration with you, the wider industry, Ofgem and Government

— We have always collaborated with the Transmission Owner (and also the Electricity System Operator) to ensure that the needs of both distribution and transmission systems are taken into account when we connect new generation, and also when we adopt new solutions in relation to demand management and customer flexibility

— We also have experience in working with a wide range of industries: a good example of this is InTEGReL, a whole energy system demonstrator built as a collaboration between Northern Gas Networks, Northern Powergrid and Newcastle University. The goal of this project was to explore and test new energy technologies, strategies and processes and to join together views from transport, electricity and gas

Focus for RIIO-ED2:

— Working towards net zero will be a huge undertaking for the energy industry and for society as a whole. It will require political, cultural, behavioural and technological changes. Collaboration will be key

— Enabling whole-systems thinking will continue to be a theme in RIIO-ED2, including in Local Area Energy Plans (LAEPs) where we are working with a range of local stakeholders to agree on the long-term energy solutions in our region

— As we have already delivered substantial improvements in areas such as safety, reliability and customer service in RIIO-ED1, further improvements will become harder to achieve. Collaboration, and learning from other network companies and the wider industry, is essential to drive forward more change

You can read more about collaboration in our Openness & Transparency section (page 77)

Building reassurances around our plan

We know you will want reassurances around our plans to give you the confidence that what we propose is robust and feasible. We are developing reassurances in seven areas:

Reassurances	What we're going to show you	Outcome
Prove we're the right people for the job	— How we're doing against our RIIO-ED1 targets — Service improvements we have delivered in RIIO-ED1 — How we have tested and benchmarked our plans to ensure they are robust and ambitious	**You will clearly be able to see our track record**
Develop this plan with you and continue to engage	— Our programme of engagement with you — What we have heard from you and how it has influenced our plans — Ongoing work with our CEG and the challenge group	**You will see comprehensive, evidenced and robust engagement**
Deliver for the regions & different customer groups we serve	— How our plan reflects our geographic regions and network users — Outline our local goals such as supporting the low-carbon transition	**You will see how our plan reflects the regions we serve**
Make sure this plan is deliverable	— Show that we can deliver our plan and that we have sufficient resources both internally and in our supply chain	**You will know we can deliver our plan**
Demonstrate our plan is financeable	— Ensure financeability on both a notional and actual capital structure basis	**You will know we can finance our plan**
Set out our costs and outputs clearly and prove they are efficient	— Set out the associated costs of our plans and evidence of efficiency — Test costs for ambition and accuracy	**You will clearly see our costs and have confidence that they are efficient**
Make sure this plan is resilient to uncertainty and risk	— Outline our understanding of the key strategic uncertainties and risks facing our business — Outline our proposed uncertainty mechanisms	**You will feel comfortable that our plan is resilient to uncertainty and risk**

Managing uncertainty and risk in our plan...

Right now, the biggest uncertainty we can see is the speed of uptake of new technologies like heat pumps or electric vehicles. We have proposed that our regulator should include a new mechanism that adjusts our cost allowances upwards (or downwards) based on a "£ per device" measure. This way our customers would never have to pay too far ahead of using the devices, different regions of the country would be able to progress their roll-outs at rates that suit them, and we would have a strong incentive to invest early where the investment case is strong. Beyond this, we think our regulator's current mechanisms to handle uncertainty are broadly still the right set for 2023-28.

What next?

We will be developing and refining our detailed business plan in the second half of 2020 and first half of 2021, based on the feedback we receive from you and a comprehensive 'Willingness to Pay' exercise which will continue for the rest of this year.

This consultation gives you the chance to have your say and to make a real difference to our future plans.

We will be submitting a draft plan in July 2021 ahead of a final plan in December 2021.

Whilst our engagement plans have had to be adapted due to the COVID-19 pandemic, there are a variety of online engagement activities planned where you can get involved…

To get involved please:

Visit: engage.northernpowergrid.com

Follow us on Twitter: @powergridnews

Follow us on Facebook: @northernpowergrid

Email us at: yourpowergrid@northernpowergrid.com

Write to us at: Stakeholder Relations, Northern Powergrid, 98 Aketon Road, Castleford WF10 5DS

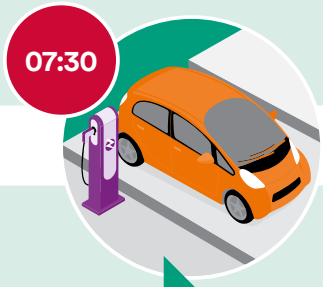
Annexes

A day in the life of an energy customer in the future (Young couple)

We have used three example domestic customer profiles to illustrate what a day in the life might look like in the future in each case, alongside the role that Northern Powergrid (NPg) could play in the future. This illustration shows Sarah and James (a young couple), and some of the ways they may interact with the energy system by the end of RIIO-ED2.

The examples include interactions with industrial and commercial customers – shown with a blue symbol.

Sarah and James (couple)



Sarah drives to work in an electric car
The car is from a shared ownership scheme and is parked in a reserved bay a short walk away from their house where it charges

Sarah logs into the energy retailer's new portal to analyse the café's energy performance

Sarah can look at half-hourly data around energy consumption, generation, and choose to export to and import from the battery

Sarah drives back home, leaving the EV to charge overnight

Annex 1: A day in the life

The local energy company is coming to install a piece of kit that will connect her business to a new large nearby community battery. The battery enhances the energy company's service by balancing as much as possible the demand and generation of local customers, and by taking part in the flexibility market.

Sarah's café has solar panels (PV cells) that enable it to be self-sufficient for its power supply during the day

08:30

09:30

James works from home while Sarah runs a local café

Any surplus electricity from the cells is exported to the community battery to be used during the evening peak

13:30

Network reinforcement/ investment planning allows for domestic PV cells and EV chargers to be connected to the network

Before going to bed, the couple set up the washing machine and dishwasher to run. The appliances will automatically start overnight when the energy supplier signals that the energy price is cheapest or even negative where they may be paid if there is a surplus of renewable power.

2030

Sarah reviews her default vehicle charging option. Her energy supplier will ensure that the vehicle is fully charged by 6am at the optimum price during the overnight period.

19:00

22:00

A day in the life of an energy customer in the future (Family)

This illustration shows Bob and his family, and some of the ways they may interact with the energy system by the end of RIIO-ED2.

The examples include interactions with industrial and commercial customers – shown with a blue symbol.

Bob (and family)

07:30

Bob (father) leaves for work in his car

08:00

His daughter takes public transport, a fuel cell bus, to school

The bus is run on hydrogen that comes from an electrolysis plant connected to the distribution network that uses excess renewable power to produce hydrogen when available.

14:30

The household is delivered a SilentPower mobile battery vehicle by NPg for the duration of the power cut to ensure the power is maintained for the medically dependent resident who has a ventilator

Whilst there, the NPg colleague identifies a need and appetite for advice around energy bills and makes an appointment to come back to discuss further

17:00

17:30

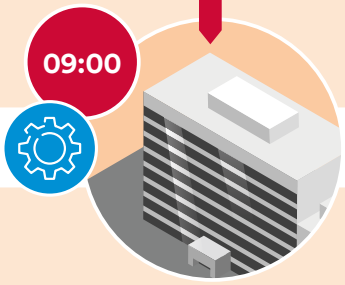
The family gathers around a tablet to watch a video from the council telling them about a new local heat district scheme to which the house will be connected next year

Annex 1: A day in the life

Bob works at a factory which provides flexibility to the network operator earning income and with little interruption to Bob and his colleagues' work pattern

Flexible connections
NPg has agreed with the energy company flexible terms of connections as a solution that is affordable and that caters for a constraint on the local network

Mitigating impact (using customer flexibility)
NPg checks the availability of flexibility against its database of agreements and against the transmission network's own need (to avoid conflict) and dispatches a call out for flexibility



The family receives a phone call from a customer agent to discuss their potential needs during the power cut

Power cut

Caring for the most vulnerable
NPg identifies those who may need additional assistance thanks to a shared database

Bob's household has two registered Priority Services Register (PSR) records in it – age related and medically dependent

The scheme is offering apprenticeships and the daughter is thinking of applying

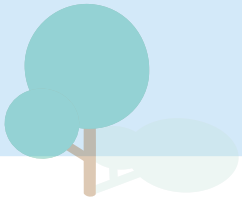
A day in the life of an energy customer in the future (Vulnerable customer)

This illustration shows Les, a vulnerable customer, and some of the ways he may interact with the energy system by the end of RIIO-ED2.

Les (vulnerable customer)

07:30

As Les is conscious of his energy bills he doesn't like to have the heating on overnight. The house has stayed warm as it has high thermal efficiency thanks to the council's retrofit scheme



Les has to pay his home energy bill. As he needs to be careful with his money, it's a relief that the smart meter allows for accurate billing instead of being based on an estimate

19:00

Annex 1: A day in the life

Power cut

13:00

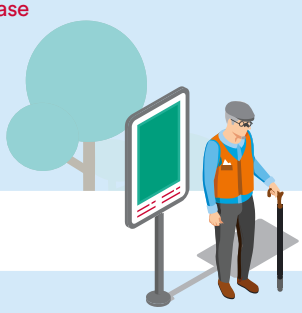
The home's smart meter detects a power cut and automatically sends a signal to NPg

Fixing the fault
NPg sends out field engineers to investigate the fault at the local substation

As Les is on the PSR, he receives a phone call from a customer agent to discuss his potential needs during the outage and to let him know when the power will be back on
Les is reconnected quickly as the fault was identified by NPg using sensor technology

14:00

Mitigating impact (by caring for the most vulnerable)
NPg identifies those who may need additional assistance thanks to a shared database



2030

Les can sleep easy at night because he knows that if he has any problems that lead to changes in his energy usage patterns, his energy supplier will recognise the changes and notify his care provider who can check in on him.

Glossary

Artificial Intelligence (AI):
The ability of a digital computer or computer controlled robot to safely perform tasks commonly associated with intelligent beings[1]

BREEAM:
Sustainability certification and assessment method for master planning projects, infrastructure and buildings

COVID-19:
An infectious disease caused by newly discovered coronavirus[2]

Customer relationship management system:
A fully integrated service across all communication channels with a single record of customer information

Decarbonisation:
The reduction, and ultimately elimination, of greenhouse gas (GHG) emissions. In relation to electricity this means the reduction of emission caused by the generation, transmission and distribution of electricity and the provision of entirely carbon-free electricity for homes and businesses. Decarbonisation of the whole energy system includes removing emissions from transport and heat which will be powered by alternative low-carbon methods

Decentralised energy system:
A system where small-scale energy generation units connected to the distribution network deliver energy to local customers

Digitalisation:
Focused digital and technology agenda that supports the integration of digital technologies to improve Northern Powergrid's everyday business activities

Distributed generation:
Embedded generation and distribution connected generation; these are generators connected to the distribution system, rather than the transmission system[3]

Distribution Network Operator (DNO):
DNOs own, operate and maintain the electricity distribution networks. They do not sell electricity to consumers; this is done by the electricity suppliers. There are 14 licensed DNOs in Britain, and each is responsible for a regional distribution services area[3]

Distribution System Operator (DSO):
A Distribution System Operator (DSO) securely operates and develops an active distribution system comprising networks, demand, generation and other flexible distributed energy resources (DER). As a neutral facilitator of an open and accessible market it will enable competitive access to markets and the optimal use of DER on distribution networks to deliver security, sustainability and affordability in the support of whole-system optimisation. A DSO enables customers to be both producers and consumers; enabling customer access to networks and markets, customer choice and great customer service

Flashover:
A continuous electric discharge of high current which flows through an air gap between conductors. This generates a very bright light as well as intensive heat. An arc flash is typically caused by a short circuit

FES – Future Energy Scenarios:
The ESO scenarios outline four different credible pathways for the future of energy for the next 30 years and beyond, considering energy demand and supply on a whole-system basis. The scenarios consider how much energy we might need, where it could come from and what the changes might mean for the industry, customers and consumers

Flexible energy market:
Modifying generation and/or consumption patterns in reaction to an external signal (such as a change in price) to provide a service within the energy system[4]

Flexibility:
The ability to increase or reduce the production or consumption of energy at a given or requested time in order to support the wider electricity network and optimise capacity available for customers

Fuel poverty:
A household is considered to be fuel poor if they have required fuel costs that are above average and, if they were to spend that amount, they would be left with a residual income below the official poverty line

Local Resilience Forums (LRFs):
Established under the Civil Contingencies Act (2004), LRFs are multi-agency partnerships made up of representatives from Category 1 responders, local public services, including the emergency services, local authorities, the NHS, the Environment Agency and others

[1] https://www.britannica.com/technology/artificial-intelligence
[2] https://www.who.int/health-topics/coronavirus#tab=tab_1
[3] https://www.ofgem.gov.uk/system/files/docs/2019/09/000_-_working_paper_-_summer_2019_-_glossary_final.pdf
[4] https://www.ofgem.gov.uk/electricity/retail-market/market-review-and-reform/smarter-markets-programme/electricity-system-flexibility

Low-carbon energy system:

An energy system which uses energy sources that do not produce carbon dioxide emissions, such as solar and wind

Low-carbon technologies (LCTs):

Technologies that have the ability to reduce carbon dioxide emissions traditionally associated with energy consumption (e.g. electric vehicles, electric heat pumps, solar panels)

LV network:

Low voltage network less than 1,000 volts

Net zero:

Legally binding greenhouse gas emissions target which requires UK to reduce nearly all of its emissions by 2050 (compared to 1990 levels), introduced on 27 June 2019 as result of amendment to the Climate Change Act 2008

Priority Services Register:

A free service operated by network operators and suppliers which provides extra advice and support to customers who may be more vulnerable in power cuts due to their medical or personal circumstances (e.g. medically dependent on electricity, of pensionable age, have a disability, long-term ill health, are blind or visually impaired or have difficulty communicating)

RIIO-ED2 or ED2:

The next price control period which will run from 1 April 2023 to 31 March 2028 – Regulatory period set by Ofgem, 2023–2028

SF_6:

Sulphur hexafluoride – greenhouse gas emission

Smart grid:

An electricity network based on digital technology that is used to supply electricity to customers through a two-way digital communication. This system enables monitoring, analysis, control and communication within the supply chain to help improve efficiency, reduce energy consumption and cost, and maximise the transparency and reliability of the energy supply chain

Smart meter:

An electronic device that records consumption of electric energy and communicates the information for the purpose of system monitoring and billing[1]

ULEV:

Ultra-low emission vehicle – low emission vehicle that emits 75g/km CO_2 or less

Vulnerable customers:

Customers who need extra support when accessing and receiving our services or as a result of a power cut or planned interruption, customers experiencing vulnerabilities which Northern Powergrid has a legitimate role in addressing, reducing or supporting and customers who are less able to represent themselves or their interests in energy matters

Workforce Renewal programme:

With an ageing workforce in the energy sector, Northern Powergrid's Workforce Renewal programme seeks to attract, train and retain new colleagues and upskill existing colleagues to replace vacancies and create a workforce that can work on current and future energy systems

Worst-served customers:

Customers who had three or more power cuts caused by a fault on the high voltage (HV) network in a rolling 12 month period

Industrial and commercial bill impacts in Emerging Thinking

Commercial customers

Output area	Effective rate impact	Levels of service				
		A	B	C	D	E
Decarbonisation	Pence/MWh	-1.6	0.0	48.1	60.0	114.1
Business carbon footprint	Pence/MWh	-0.9	0.0	3.3	9.3	17.2
Environmental protection	Pence/MWh	-0.2	0.0	2.8	5.5	14.6
Safety	Pence/MWh	-0.6	0.0	2.1	25.0	27.2
Reliability & availability	Pence/MWh	-3.1	0.0	5.4	16.8	32.8
LT network performance	Pence/MWh	-6.7	0.0	76.8	165.1	189.6
Climate change adaptation	Pence/MWh	-3.5	0.0	4.4	20.9	32.6
Cyber & physical security	Pence/MWh	-0.7	0.0	11.9	15.9	27.7
Customer service	Pence/MWh	-0.2	0.0	1.3	2.7	3.5
Connections	Pence/MWh	-0.5	0.0	0.5	1.6	2.5
Communities	Pence/MWh	-0.7	0.0	0.7	5.1	9.2
Openness & transparency	Pence/MWh	-0.0	0.0	1.3	2.0	6.0

Industrial (LV) customers

Output area	Effective rate impact	Levels of service				
		A	B	C	D	E
Decarbonisation	Pence/MWh	-1.4	0.0	44.2	55.1	104.9
Business carbon footprint	Pence/MWh	-0.8	0.0	3.0	8.6	15.8
Environmental protection	Pence/MWh	-0.2	0.0	2.5	5.1	13.4
Safety	Pence/MWh	-0.6	0.0	1.9	22.9	25.0
Reliability & availability	Pence/MWh	-2.8	0.0	5.0	15.4	30.2
LT network performance	Pence/MWh	-6.1	0.0	70.5	151.7	174.2
Climate change adaptation	Pence/MWh	-3.3	0.0	4.1	19.2	29.9
Cyber & physical security	Pence/MWh	-0.6	0.0	10.9	14.6	25.5
Customer service	Pence/MWh	-0.2	0.0	1.2	2.5	3.2
Connections	Pence/MWh	-0.5	0.0	0.5	1.5	2.3
Communities	Pence/MWh	-0.6	0.0	0.6	4.7	8.4
Openness & transparency	Pence/MWh	-0.0	0.0	1.2	1.9	5.5

[1] https://www.ofgem.gov.uk/system/files/docs/2019/09/000_-_working_paper_-_summer_2019_-_glossary_final.pdf

Industrial (HV) customers

Output area	Effective rate impact	Levels of service				
		A	B	C	D	E
Decarbonisation	Pence/MWh	-1.1	0.0	35.3	44.0	83.8
Business carbon footprint	Pence/MWh	-0.7	0.0	2.4	6.9	12.6
Environmental protection	Pence/MWh	-0.2	0.0	2.0	4.1	10.7
Safety	Pence/MWh	-0.5	0.0	1.5	18.3	20.0
Reliability & availability	Pence/MWh	-2.2	0.0	4.0	12.3	24.1
LT network performance	Pence/MWh	-4.9	0.0	56.4	121.2	139.2
Climate change adaptation	Pence/MWh	-2.6	0.0	3.3	15.3	23.9
Cyber & physical security	Pence/MWh	-0.5	0.0	8.7	11.7	20.4
Customer service	Pence/MWh	-0.2	0.0	1.0	2.0	2.6
Connections	Pence/MWh	-0.4	0.0	0.4	1.2	1.8
Communities	Pence/MWh	-0.5	0.0	0.5	3.8	6.7
Openness & transparency	Pence/MWh	-0.0	0.0	1.0	1.5	4.4

Industrial (EHV) customers

Output area	Effective rate impact	Levels of service				
		A	B	C	D	E
Decarbonisation	Pence/MWh	-0.3	0.0	8.3	10.4	19.8
Business carbon footprint	Pence/MWh	-0.2	0.0	0.6	1.6	3.0
Environmental protection	Pence/MWh	-0.0	0.0	0.5	1.0	2.5
Safety	Pence/MWh	-0.1	0.0	0.4	4.3	4.7
Reliability & availability	Pence/MWh	-0.5	0.0	0.9	2.9	5.7
LT network performance	Pence/MWh	-1.2	0.0	13.3	28.6	32.8
Climate change adaptation	Pence/MWh	-0.6	0.0	0.8	3.6	5.6
Cyber & physical security	Pence/MWh	-0.1	0.0	2.1	2.8	4.8
Customer service	Pence/MWh	-0.0	0.0	0.2	0.5	0.6
Connections	Pence/MWh	-0.1	0.0	0.1	0.3	0.4
Communities	Pence/MWh	-0.1	0.0	0.1	0.9	1.6
Openness & transparency	Pence/MWh	-0.0	0.0	0.2	0.4	1.0

Connections costs

The table below lays out the illustrative impact on the average cost of a connection for each of the five service levels, split by four types of connection.

Connection type	Service levels				
	A	B	C	D	E
Single domestic connection	£1,248	£1,300	£1,371	£1,405	£1,460
Small business connection	£11,520	£12,000	£12,652	£12,971	£13,477
Large business connection	£91,200	£95,000	£100,160	£102,687	£106,691
Large generator connection	£384,000	£400,000	£421,725	£432,368	£449,225
% change	-4%	-	+5%	+8%	+12%

Illustrative average prices

We offer multiple different types of connections services to our customers, which start from around £500. Each connection job is unique and is priced individually to reflect the cost to us of providing the connection.

We think it's important to provide you with an indication of the cost impacts of the five levels of service. So we have calculated an illustrative 'average' price for four types of connection for each service level.

It is important to remember that the actual cost of any connection would depend on the specific project.

Further information on our service levels

Our service level C proposition includes a major upgrade that will allow our small works customers to self-select the date and time they want us to attend their premises to commence the work. The first available start dates will be subject to our standard lead times but thereafter the customer will be able to select the working date when they want us on site without any further programming restrictions.

Service level D and E include a premium next day and same day service upgrade for short duration site works. These improvements would allow us to attend and commence our site delivery services in the respective same or next working day windows where services are booked prior to 11am.

For all of the service levels, the point when work on site can begin will be subject to having all necessary approvals and consents in place before a delivery date can be selected.