Annex 4.10
Investment in High Voltage Automation

Northern Powergrid: our business plan for 2023-28

Overview

We have performed well against our reliability targets in the 2015-23 period; we have reduced the number of power cuts (customer interruptions) by 27 per cent and their length (customer minutes lost) by 37 per cent relative to our 2015-23 starting point[1]. That means we have exceeded our customer interruptions (CI) and customer minutes lost (CML) commitments for 2015-23 by eight per cent and 20 per cent respectively. During 2015-23 we have invested to meet customer priorities in this area, in line with the overall cap on interruptions and incentive scheme (IIS) incentives revenue imposed by our regulator, Ofgem.

2023-28, however, presents new challenges. Ofgem's target-setting methodology for IIS means we will be required to deliver a step-change improvement, in particular Yorkshire's CI and CML, relative to performance as of today. While Northeast's recent performance has been strong, we will need to continue investing in order to manage risk and meet the new 2023-28 targets. Our stakeholder engagement has shown that stakeholders continue to value reliable services highly and there has been broad stakeholder support for us delivering an incremental step-up in performance through 2023-28.

In this annex, we set out the challenges facing our business in the coming price control period in relation to new IIS targets for 2023-28. Given the support of stakeholders for a step change in our reliability, we aim to meet these challenges with a plan of efficient investment. This paper's focus is on our proposals for a long-term programme of investment in high voltage (HV) automation, which we have established is the optimal way to achieve these CI and CML targets. The other elements of our plan to deliver improvements in our IIS performance (such as improving restoration times at HV and low voltage (LV) to 45 minutes and 155 minutes respectively; improvements from deploying LV technology on our network; and improved fault rates from asset replacement) are set out in our reliability and availability improvement plan and associated electrical justification papers (EJPs).[2]

Our investment in HV automation will need to ramp-up in 2023-28 in order to meet the new expectations, and we expect the investment programme would need to continue into 2028-33. During 2023-28, we propose £64.8m of investment on HV network automation. Approximately 80 per cent of this new 2023-28 investment would be made in Yorkshire, where the most stretching new target will be set relative to today.[3] This investment programme will ensure we can meet Ofgem's targets for 2023-28, and deliver long-term net benefits that our customers have told us they want, both now and in the future, as reliance on electricity increases.

The £64.8m investment programme should be included in our baseline totex allowances for 2023-28. To give Ofgem the confidence that we will only be funded for what is actually rolled out; we propose our investment programme is captured under a bespoke price control deliverable (PCD).

In this annex:

- we set out the key elements of the IIS target setting methodology proposed for 2023-28 and which drive the need for additional investment in automation, particularly in Yorkshire;
- we describe our performance against reliability targets to-date, explaining how we have invested efficiently to deliver service improvements in line with Ofgem's 2015-23 caps;
- we describe the proposed HV automation investment programme in more detail; and
- we discuss our proposed price control arrangements in terms of our proposal for a bespoke PCD.

[1] i.e. our IIS performance as of 2012-13
[2] See EJP-10.1 HV remote control and automation; EJP-10.2 LV Technology; EJP-10.3 Worst served customers
[3] Ofgem targets are indicative based on 2019-20 data. We understand Ofgem will update and determine these targets using latest data available in its Draft and Final Determinations.

2023-28 IIS targets for unplanned CI and CML

Ofgem's target-setting methodology for 2023-28

The tables below show the components included in the 2023-28 IIS target-setting method for unplanned interruptions.

	LV	HV	EHV & 132kV	Other Categories
Customer Interruptions	4 year licensee average	**Granular Benchmarking Approach:** • 23 Types of circuit • 4 years of data • Sector benchmarks controls for company circuit characteristics	10 year licensee average	4 year licensee average

Notes

1. Modelled targets are the sum of the voltage components
2. Performance improvement of 1.5 per cent per annum is applied, further reduced by 0.5 per cent if the company is ahead of the modelled target

	LV	HV	EHV & 132kV	Other Categories
Customer Minutes Lost	**4 year sector average benchmark** of CML per CI with licensee specific dampening: • DNO is beating benchmark: CML = CI target x industry duration • DNO is missing benchmark: CML = CI target x ((25% industry duration) + (75% 4-year DNO Average))	**Granular Benchmarking Approach:** • 23 Types of circuit • Industry upper quartile CML per CI • Target = CI target x CML per CI benchmark	**10 year benchmark**, with a ratchet to licensee, CML Target = CI target x lower of CML per CI from: • 10 year licensee average • 10 year industry average	4 year licensee average

Notes

1. A distribution network operator's (DNO) first pass CML target is equal to the smaller of the two: (i) the sum of CML targets by voltage level and (ii) 75 per cent of the sum of CML targets by voltage level plus 25 per cent of the current performance
2. Performance improvement of 2.0 per cent per annum is applied to all voltage levels
3. Averages will be calculated using data up to and including the 2021-22 reporting year
4. 23 types of circuit on the HV network with 22 of these used in the target setting calculation

Table 1: 2023-28 Target-setting methodology by network component

Ofgem measures system wide reliability performance by the number of power cuts (CI, which measures the number of supply interruptions in a year per 100 connected customers) and the average power cut duration (CML, which measures the number of minutes lost per connected customer).

As highlighted in Table 1, a number of the targets (highlighted green) are based solely on trends in the licensees' own historical performance, with improvement factors applied. Some categories (highlighted amber) involve a blend of industry benchmarking and company-specific historical performance, to varying degrees.

The CML target at the HV level (highlighted red) is set entirely based on a sector benchmark (adjusting for some DNO-specific factors), based on the industry upper quartile performance. While this method was employed in 2015-23, the resulting targets for 2023-28 are particularly stretching as there has been a divergence in performance – based on the

latest available information; the four licensees who primarily determine the upper quartile benchmark have CML levels that are distinct from the rest of the sector.

The resulting targets for HV CI and CML that would be set for 2023-28 based on Ofgem's current methodology and up-to-date data are shown in the figure below.

Figure 1: HV CML 2023-28 targets[3] against average current performance[4]

As shown in the figure, the resulting HV CML targets are particularly challenging for us to meet in 2023-28, particularly in the Yorkshire license area. Our assessment of how we could meet these new targets has shown that we need to deliver a step-change in network capability and this has been supported by stakeholders throughout our engagement on our business plan.

It is important to note that although Ofgem sets targets for CI and CML separately, improvements in CI will drive performance in CML. Our planned investment in automation to improve our reliability performance will have an impact on both CI and CML performance; as such, we have taken a holistic view towards our reliability goals and investment plan at 2023-28.

We have formulated our reliability investment plan based on existing benchmarking information and the resulting projection of expected IIS targets. We acknowledge that Ofgem will calibrate the specific targets in its final determinations based on extra data available at that point in time, however we do not anticipate this is likely to result in a material shift in our targets or the required investment.

[4] Current performance is the 4 year average of performance for Northern Powergrid based on 2017-18 to 2020-21.

Our 2023-28 objectives for reducing unplanned customer interruptions

Figure 2 below shows the performance improvements we have made in our CI to date, and the trajectory of improvement required to meet 2023-28 CI targets.

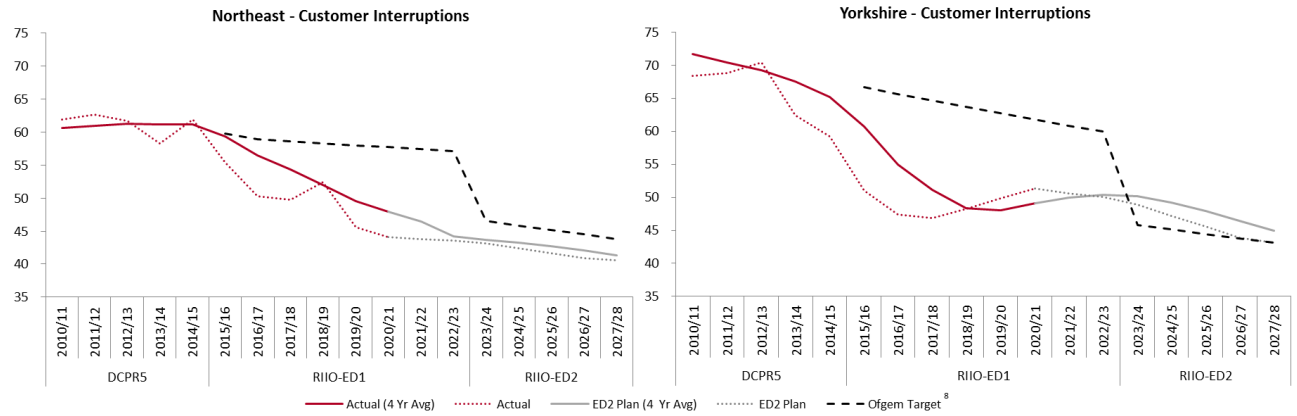

Figure 2: Projected performance improvement required on CI

Based on our current performance,[5] our customers experience CI of 48 and 49 on our Northeast and Yorkshire networks respectively; a 27 per cent reduction on our baseline for 2015-23.

To meet our 2023-28 reliability targets, by the end of 2023-28 we plan to reduce the number of unplanned customer interruptions on both our networks by 12 per cent, relative to our current performance.[5] This means that by 2028, our customers in the Northeast will experience CI of 41, and our customers in Yorkshire will experience CI of 43.

Our 2023-28 objectives for reducing unplanned customer minutes lost

In line with our overall objective to enhance our network reliability, we also aim to meet Ofgem's 2023-28 targets in terms of CML. Based on the 2023-28 target setting methodology, this means we have to reduce CML on the HV network to a level which is on par with the best performing networks in the sector, controlling for a number of local factors.

Based on our current performance[5], our customers experience an average 40 minutes and 37 minutes off supply a year in the Northeast and Yorkshire, respectively. Based on the latest available data, our CML target in year one of 2023-28 is expected to be 34 minutes per customer for the Northeast, and 32 minutes per customer for Yorkshire, a significant change in performance of circa 14 per cent in the next two years.

This is largely driven by the HV target setting model, based on industry benchmarking. Whilst our current HV CML performance is 21 minutes per customer and 19 minutes per customer in the Northeast and Yorkshire respectively, the HV target in year one of 2023-28 expected to be 16 minutes per customer for the Northeast, and 15 minutes per customer for Yorkshire. We will need to deliver a step change improvement in performance of over 20 per cent over the next two years of 2015-23 in order to meet new targets at the start of 2023-28. Thereafter, the HV CML target will impose a two per cent[6] improvement per year, so that by the end of 2023-28 the HV target will be 15 minutes for the Northeast and 14 minutes for Yorkshire.

We have already begun investment in improved automation capability during 2015-23 and we will have delivered £35.1m of investment by the end of the period. During 2015-23, over half a million customers have been restored within three minutes as a result of our automated power restoration system (APRS), which also enables further restoration within 15 minutes from our control centre using remote control. Our 2023-28 proposed investment programme builds on this strong starting point.

[5] Current performance is a 4 year average from 2017-18 to 2020-21
[6] 2023-28 sector specific methodology decision: Annex 1 - Delivering value for money services for customers, pg. 72

In the final years of 2015-23 we will continue to invest in increasing the amount of automation on our network in order to close the gap to our targets and to create a solid foundation for our proposed 2023-28 investment programme. Even with the investment in 2015-23 (which is factored into our starting point for our plan) we will still require substantial investment in 2023-28 in order to reach the proposed targets.

Figure 3 below summarises the ambitious targets set for 2023-28 for CML, which drive the need to realise a step-change in capability, particularly on our Yorkshire network.

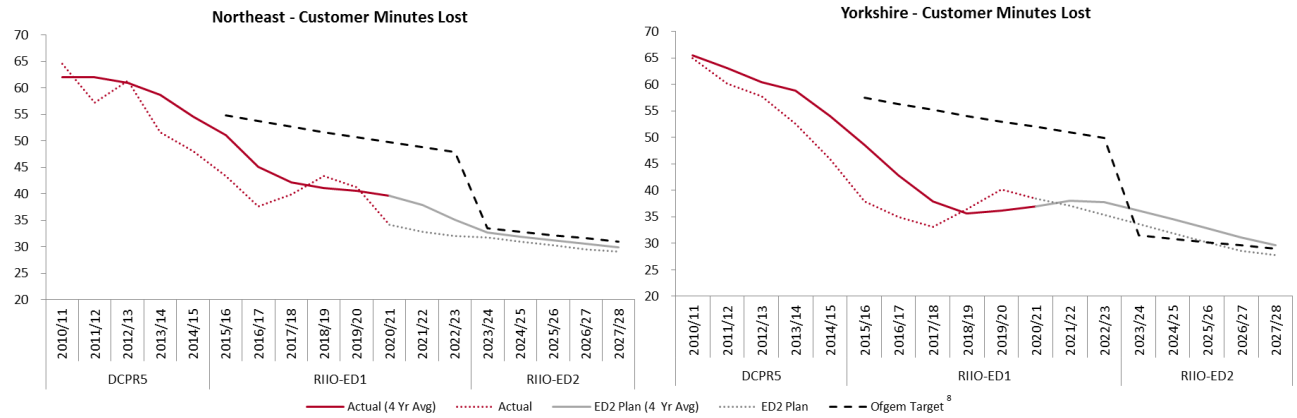

Figure 3: Projected performance improvement required on CML

Our performance against 2015-23 reliability targets

We have performed well against reliability targets and consistently delivered performance improvements

We have consistently improved our reliability performance since the start of the previous price control in 2010. Our reliability and availability performance has improved significantly over a long period of time; we have reduced CI by approximately three per cent per annum and CML by four per cent per annum on our networks since then.

As a result, our supplies are available 99.99 per cent of the time and the majority of our customers experience no supply interruptions in a given year. In 2020-21, more than 65 per cent of our customers did not experience an interruption to their electricity supply. We have also reduced the number of customers experiencing power cuts lasting more than 12 hours by over a third.

We have been able to deliver these consistent incremental performance improvements through an optimised programme of ongoing asset maintenance, operational improvements, and initial investment in automation. Our overall performance against our 2015-23 targets is shown in figure 4 below.

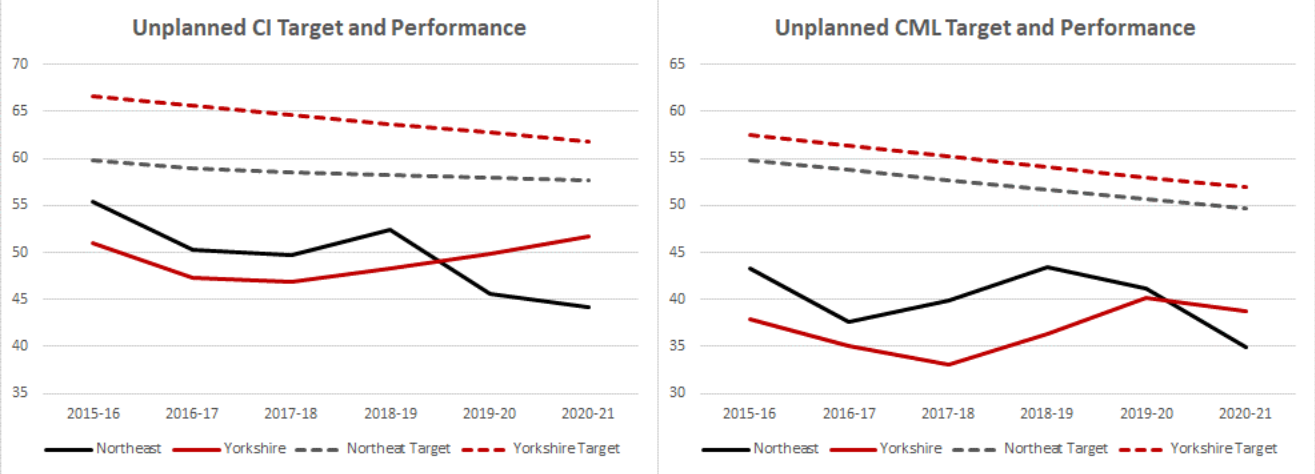

Figure 4: 2015-23 CI and CML performance against targets

2015-23 financial performance for Northern Powergrid

For 2015-23, Ofgem imposed caps on the total level of financial reward available through the IIS incentive. This was implemented in 2015-23 to protect customers from DNOs earning excessive returns under the IIS incentive.[7] In theory, the cap on IIS rewards defines the upper limit that customers want from performance improvements. If a DNO is achieving IIS rewards at or above the reward cap, this implies there is limited scope for DNOs to better meet customer needs.[8]

We have performed beyond Ofgem's IIS reward cap in Yorkshire during 2015-23 and delivered additional benefit for customers. We have similarly performed well in Northeast earning towards the upper end of rewards available. In total, we have achieved 90 per cent of the total IIS reward available so far in 2015-23.

[7] https://www.ofgem.gov.uk/system/files/docs/2017/01/guide_to_riioed1.pdf para 11.15
[8] Ofgem, Jan 2020, RIIO-ED2 Framework Decision - para 5, pg. 65. https://www.ofgem.gov.uk/system/files/docs/2020/01/riio-ed2_framework_decision_jan_2020.pdf

The resulting total performance across both Northeast and Yorkshire in all years is shown in Figure 5 below.

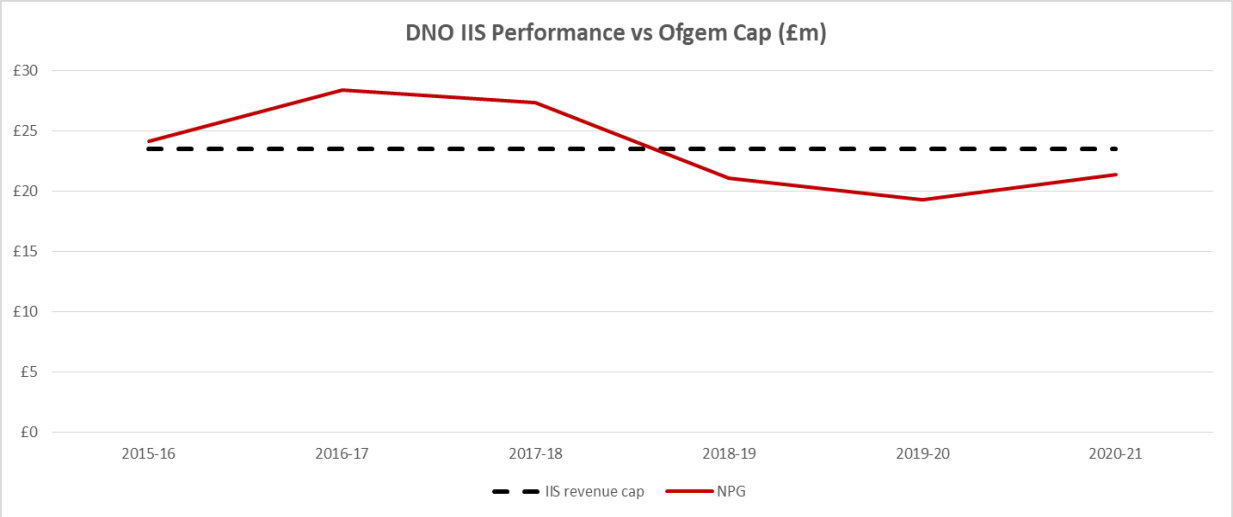

Figure 5: Northern Powergrid's total IIS rewards against the cap, 2015-23 (£m 12-13)[9]

This has all been delivered while making efficient investments to keep bills low.

Ultimately our strategy during 2015-23 has been to focus on incremental performance as dictated by IIS targets and the overall cap, while making sure our investment plan is balanced against customers' willingness to pay.

[9] Source: Ofgem, Regulatory financial performance data file - Annex to RIIO-1 Annual Reports, 2019-20 for performance up to 2019-20. 2020-21 regulatory year estimate based on 2021 RRP submission.

We are proposing a £64.8m programme of investment in HV automation to meet the 2023-28 reliability challenge

Overview of required investment

The table below shows our entire cost programme for 2023-28 in support of delivery of our reliability and availability plan. In this annex we discuss the £64.8m proposed for HV automation. The other elements of our plan to deliver improvements in our IIS performance (such as improving restoration times at HV and LV to 45 minutes and 155 minutes respectively; improvements from deploying LV technology on our network; and improved fault rates from asset replacement) are set out in our reliability strategy and associated EJPs.

Our reliability plan results in an estimated average bill impact of £0.70 for domestic customers.

This annex is focused on establishing the requirement for the £64.8m investment in HV automation. It is a specific, measurable, and separate deliverable with a clear mandate from stakeholders and, given the automation schemes already rolled out across our network and others in the industry, has a benefits case that can be aligned to our 2023-28 targets.

	2023-28 Total	2023-28 Annual Average	2015-23 Annual Average	Variance	
				£m	%
Non-load capex - HV Automation	**64.8**	**13.0**	**4.8**	**8.2**	**170.2%**
Non-load capex - LV Technology	*21.9*	*4.4*	*2.9*	*1.5*	*51.0%*
Non-load capex - Worst Served Customers	*4.3*	*0.9*	*-*	*0.9*	*-*
Non-op capex	*16.6*	*3.3*	*-*	*3.3*	*-*
Network operating costs	*435.5*	*87.1*	*90.0*	*(2.9)*	*(3.2)%*
Closely associated Indirects	*141.1*	*28.2*	*26.4*	*1.9*	*7.0%*
Business Support Costs	*84.8*	*17.0*	*16.2*	*0.7*	*7%*
Total Proposed Cost	**769.0**	**153.8**	**140.3**	**13.5**	**9.6%**

Table 2: Reliability & availability plan costs

Our customers' priorities have evolved and Ofgem's target-setting methodology for IIS has driven significantly tougher targets for 2023-28; now is the right time to make this investment to create a more capable network. We have considered whether alternative options (such as operational improvements similar to those we have delivered in the past) and increasing our asset replacement programme can achieve these objectives. However, we have found that our proposed automation investment programme is the best overall value for money, and delivers long-term benefits for our customers[10] – for example, the use of HV cable overlays would triple the cost of the investment and only achieve a quarter of the performance needed. Indeed, investing in automation in 2023-28 would be both timely and appropriate as this would allow us to meet Ofgem's designated targets, while delivering long-lasting benefits for our customers, as automation assets typically have a useful economic life of circa 20 years.

Our ambition is to meet the changing expectations of customers and deliver on Ofgem's targets while ensuring that we are keeping bills low for customers.

[10] See EJP: 10.1 HV remote control and automation

Technical specification of the 2023-28 investment programme

In order to deliver this, the investment package will add a further 8,600 units to the population of automated switches across Northeast and Yorkshire.

The HV automation investment is based on a unit cost blended from a combination of deployment at both ground mounted (GM) and pole mounted (PM) locations. At GM sites, the works are associated with fitting of actuators to the switchgear and associated communications equipment to facilitate the remote operation. To ensure an efficient unit cost, actuators are applied to modern automation-ready switchgear. This avoids additional costs associated with retro-fitting actuators required to control legacy switchgear. With PM equipment, the communications equipment is added to either PM switches or circuit breakers. As a result the overall unit cost (through the inclusion of new plant) is greater at PM locations; however a detailed procurement process will ensure the most cost effective plant is deployed in line with the technical specifications of each.

Our volumes are derived from our detailed modelling and balance the delivery of a 12 per cent reduction in the number of interruptions and 25 per cent reduction in the duration of interruptions to best meet stakeholder needs. This has led to our volumes as defined in our HV remote control and automation EJP, setting the appropriate level of investment for this investment.

Unit Costs	Northeast (£k)	Yorkshire (£k)
HV Automation Point – GM	5	5
HV Automation Point – PM	13	13
Overall Unit Cost	**7**	**7**

Table 3: Unit cost build up

The 8,600 units proposed will be dispersed across the various network locations as shown in Table 3.

Category	Northeast Total ED2	Yorkshire Total ED2	Total Northeast (£m)	Total Yorkshire (£m)
HV Automation Point - GM	803	5,217	4.2	27.7
HV Automation Point – PM	344	2,236	4.4	28.5
HV Automation Point – Total	**1,147**	**7,453**	**8.6**	**56.2**

Table 4: Automation point volumes by licence area and location

The investment plan is in line with our customers' priorities

Reliability is high on the list of our customers' priorities, as shown by the evidence from our August 2020 'willingness to pay' survey below.[11]

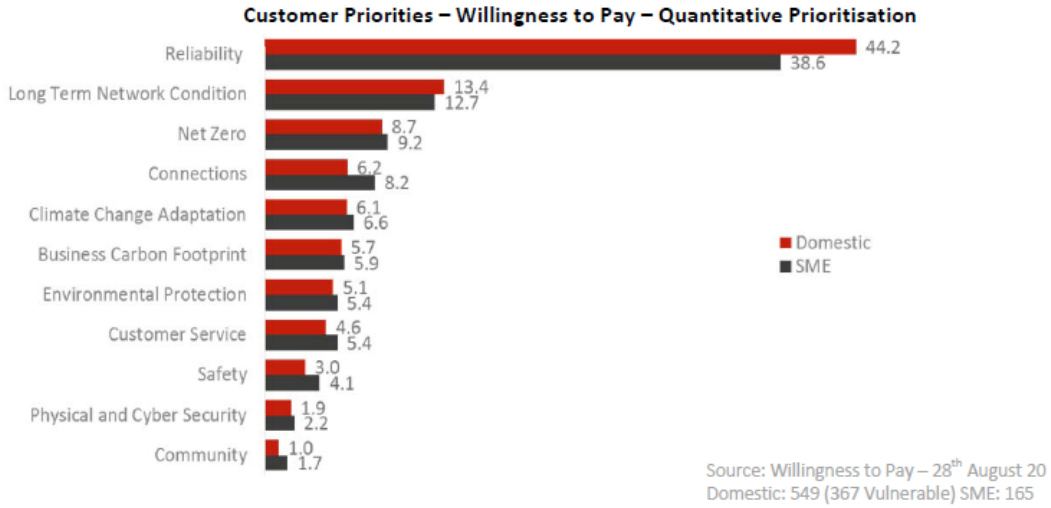

Figure 6: Customer priorities for 2023-28

In our September 2020 'emerging thinking' document, we set out five options for improving our reliability in 2023-28. We then asked stakeholders to indicate the extent of network reliability improvement they would prefer. We provided five options to stakeholders during the engagement process (options A to E) each corresponding to an increasing level of reliability, and which we explained would accordingly be associated with an increased cost.

In their responses our stakeholders confirmed they were not dissatisfied with the level of service they receive currently. However the majority of stakeholders, over 65 per cent in all stakeholder groups, wanted to see at least a "major upgrade" to our network reliability (at least option C).[12] In addition, they also told us that they want to see a stronger focus on reducing CML, and restoration time improvements.

Stakeholders were keen to see investment in upgrading technology across our network; in particular they valued deployment of automation. In our focus group research, customers valued reducing power cuts of one and a half to three hours in length to less than three minutes, at eight out of 10 in terms of importance and those in the focus group were willing to pay more than £5 for this improvement.

Our stakeholder engagement suggests a customer willingness to pay between £0.20 - £1.23 for enhanced reliability and modernisation of the network. This is in line with customer feedback that states they will likely place an increasing reliance on electricity, in particular for transport and heating, as we decarbonise towards net zero in 2050. The bill impact of our total reliability and availability plan is £0.70 and is therefore in line with business plan acceptance testing (BPAT).

[11] We conducted further analysis in December 2020 which suggests that reliability was lower priority. However, that was inconsistent with the stakeholder feedback we've consistently received throughout 2015-23.
[12] See our detailed engagement findings – reliability section

A bespoke PCD is the appropriate mechanism for delivering this investment in 2023-28

Price control deliverables (PCDs) are a new type of uncertainty mechanism introduced in 2023-28. PCDs are specific project or work programme deliverables that have an identified level of funding attached to them. If the PCD specification is not delivered, the relevant proportion of the associated allowances can be clawed back by Ofgem at the end of the period. This mechanism means we commit to delivering the programme set out in our plan during 2023-28 for the allowances provided. If we don't deliver the work, the allowance is not transferable to a different project.

We consider that the proposed solution to meet customer needs under our reliability strategy meets the requirements of a mechanistic PCD. The plan is underpinned by a specific commitment to volumes of workload and underpinned by clear unit costs that have been competitively benchmarked. The volumes and unit costs – and the efficiency of these – is set out in detail in our reliability and availability improvement plan and the associated EJPs. Furthermore, it is possible to clearly measure and audit the impact of the project and the delivery of the workload during 2023-28. The level of work is also specific to Northern Powergrid and separable from the broader cost base.

This investment therefore meets the requirements of a PCD. By committing this programme to a 2023-28 PCD we would provide the guarantee to our customers that their priorities will be met at the level of cost that is efficient and affordable. We also expect that since the programme of work would be specific to Northern Powergrid, it would be subject to separate technical assessment as part of Ofgem's 2023-28 cost assessment, rather than pooled with the broader cost base for the purposes of benchmarking analysis.

Appendix 1: Key measures

Key Measures	ED1 To date[19]	ED2				
		2023-24	2024-25	2025-26	2026-27	2027-28
Ofgem Targets *(indicative based on 2019-20 data)*						
Ofgem CI Target - Northeast	*47.9*	46.5	45.8	45.2	44.5	43.8
Ofgem CI Target - Yorkshire	*49.1*	45.8	45.1	44.4	43.8	43.1
Ofgem CML Target - Northeast	*39.8*	33.6	32.9	32.2	31.6	31.0
Ofgem CML Target - Yorkshire	*37.1*	31.5	30.8	30.2	29.6	29.0
Modelled Northern Powergrid performance *(based on deployment of reliability plan investments)*						
CI - Northeast	*47.9*	43.1	42.4	41.6	40.9	40.5
CI - Yorkshire	*49.1*	48.9	47.2	45.6	43.9	43.1
CML - Northeast	*39.8*	31.8	31.0	30.2	29.5	29.1
CML - Yorkshire	*37.1*	33.6	31.9	30.2	28.6	27.7
Variance – *modelled performance vs. target (Positives are favourable to target)*						
CI - Northeast	-	3.4	3.4	3.6	3.6	3.3
CI - Yorkshire	-	(3.1)	(2.1)	(1.1)	(0.1)	-
CML - Northeast	-	1.8	1.9	2.0	2.1	1.9
CML - Yorkshire	-	(2.1)	(1.1)	-	1.0	1.3
Proposed HV automation investment						
HV automation investment – Northeast	*£18.9m*	£2.2m	£2.2m	£1.7m	£1.7m	£0.8m
HV automation investment - Yorkshire	*£8.5m*	£14.0m	£14.0m	£10.2m	£10.2m	£7.8m
HV automation investment - Total	*£27.4m*	£16.2m	£16.2m	£11.9m	£11.9m	£8.7m
Deployment of automated switches - Northeast	*3,201*	287	287	231	230	112
Deployment of automated switches – Yorkshire	*1,541*	1,863	1,863	1,350	1,350	1,027
Deployment of automated switches – Total	***4,742***	*2,150*	*2,150*	*1,581*	*1,580*	*1,139*

[19] Current performance is the 4 year average of performance for Northern Powergrid based on 2017-18 to 2020-21.

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