

Environment Report

2019/20



electricity
north west

Bringing energy to your door



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1 Introduction

1.1 Executive summary

We are dedicated to achieving the highest standards of environmental performance, not only by minimising the environmental risks created by our activities, but also through targeted investment in outputs that deliver a positive environmental impact.

We are also determined to play our part in enabling the UK's transition to a net zero carbon future and the environmental benefits this will bring. This desire influences both our asset investment plans and the investments we make in measures to reduce our own carbon footprint.

To reflect our environmental ambitions, we included four environmental commitments in our business plan for the RIIO-ED1 period and have made further progress against achieving these in the fifth year of the RIIO-ED1 period;



Table 1: RIIO-ED1 Environment commitments

Commitment	Measurement	Target	Target date	2019/20
Reduce losses	Annual gigawatt hours (GWh) saved	11	2021	Programme completed
Reduce carbon footprint	Tonnes of Carbon Dioxide Equivalent (tCO2e)	10%	2020	26%
Reduce oil lost from cables	Litres lost	<30,000 per year	2023	21,626l
Undergrounding overhead lines in Designated Areas	km removed	80	2023	7km for a total of 34km

We have continued to connect new low carbon generation, developing innovative solutions to connect **2,427 units** of low carbon technologies with a combined capacity of **213.5MW** along with investing over **£3m** in the smart meter roll-out in 2019/20.

1.2 Our business - who we are

We operate an electricity distribution network delivering power to five million people with 12,500 km of overhead lines, over 44,800 km of underground cables, almost 84,000 items of switchgear and more than 35,000 transformers. We do this through a workforce of 2,000 people; a large contractor workforce; a fleet of over 1,000 commercial vehicles, trailers and items of mobile plant; and 15 depot and office sites. Consequently, our activities create both risks and opportunities in regard to their impact on the environment.

The environmental risks we manage include those associated with holdings of electrical insulating oil (some of which may contain a constituent of polychlorinated biphenyl), waste management, vehicle emissions, holdings of sulphur hexafluoride gas (SF6) and working in environmentally sensitive areas.

We have opportunities to minimise resource use and reduce waste to landfill. As the electricity distribution network operator for the North West of England we also have a key role to play in enabling the transition of our region to zero carbon energy, supporting the UK as a whole and our region in meeting its climate change targets.

Recognition of these obligations is reflected in our environment and energy management policy.

1.2.1 Environment and energy management policy

We are committed to achieving excellence in environmental and energy management performance, minimising any adverse impacts our operations might have and fulfilling our obligation to manage energy and improve the environment that we operate in.

We will:

- Identify the environmental and energy using aspects associated with our activities, minimising those with any adverse impact whilst promoting those with beneficial impact.
- Comply with all applicable environmental and energy management law and other relevant requirements and, where possible, exceed them.
- Integrate environmental performance and energy management considerations into business as usual processes including the setting and reviewing of objectives and targets.
- Operate and maintain systems of work that minimise adverse environmental impacts and seek to minimise energy usage whilst delivering beneficial impacts.
- Fully inform, instruct, train, supervise and equip people to identify and minimise adverse environmental impacts, maximise energy management opportunities and deliver beneficial impacts.
- Make environmental and energy management performance a significant factor in the selection of suppliers of goods and services.
- Implement and maintain a robust environmental management system that is certified to the ISO 14001 standard and an energy management system which is certified to ISO 50001.

- Manage the waste generated by our activities according to the principles of reduction, re-use and recycling.
- Minimise the carbon footprint of our business and actively contribute to the low carbon economy.
- Manage our business operations to prevent pollution and wasteful use of energy.
- Maximise the sustainability of natural resources used in our activities.
- Develop and promote a culture of continuous improvement with regard to environmental and energy management performance.

To deliver this policy commitment we work to an environment strategy that is based on:

- A clear understanding and visibility throughout the business of environmental issues and impacts;
- Targeted investment and expenditure in environmental control measures;
- Strong corporate governance and performance management;
- Continuous learning and improvement; and
- A systematic approach to environmental management.

In line with this policy and to support our drive for excellence in environmental performance our environment and energy management system is certificated to the ISO 14001 Environmental Management and ISO 50001 Energy Management standards. Both these systems have been audited and verified by external auditors during 2019/20.



Photo: Community energy manager Helen Seagrave at a community energy project 'Halton Hydro' recipients of our Powering Our Communities fund.

1 Introduction

1.2.2 Role of stakeholders in environmental management

We have a stakeholder engagement strategy that includes working with a number of advisory panels. These are made up of stakeholders who are subject experts and represent our communities. One of our panels, the Sustainability Advisory Panel (SAP), focuses on sustainability challenges; ensuring our network can adapt to future challenges, such as the transition to zero carbon and Distribution System Operation (DSO), growth and development of community and local energy etc whilst keeping bills affordable.

Working in partnership with our SAP and a range of other stakeholders, including Greater Manchester Combined Authority, we have developed an ambitious new plan called 'Leading the North West to Zero Carbon'. This includes activities to drive down our own operational business carbon emissions, as well as those associated with the distribution network, and support our colleagues, business customers and partners to lower theirs. We propose to invest £63.5million over the remainder of RIIO-ED1 to deliver the plan, working with the SAP and other stakeholders to make it happen and to hold us to account;

<https://www.enwl.co.uk/zero-carbon/leading-the-north-west-to-zero-carbon>

As part of our leading the North West to Zero Carbon plan we have increased engagement with our employees around their opportunities for supporting the transition to Net Zero and are proud to have been the first DNO to be awarded the Bronze Carbon Literacy standard. We are working towards Silver accreditation however these plans have been impacted by the restrictions due to the Coronavirus pandemic.

We also meet regularly with our regional partners in relation to visual amenity in designated areas. Through this process our stakeholders play a key role in shaping our environmental strategy and investment priorities. This is covered further in section 2.2.

Over the last year, stakeholders and colleagues have also been involved in developing our 'Transforming our Communities' responsibility framework. This framework, launched in January 2019, and is part of our Corporate Social Responsibility (CSR) Strategy. The framework articulates our ambition to be a responsible business and creates a framework which captures our environmental, social and community ambitions. We are increasingly also working with our supply chain to raise awareness of our framework. We report our progress annually. It can be found at the following link:

www.enwl.co.uk/about-us/our-purpose-and-principles/transforming-our-communities/

Stakeholder and customer engagement is critical to our existing activities and development of future plans and we were pleased to be one of the first distribution network companies to create an independent Customer Engagement Group (CEG). The role of the CEG is to challenge the company to ensure that we are prioritising our customers' needs in our future plans. This process has included extensive customer and stakeholder research on priorities and willingness to pay.

Details of all our stakeholder engagement and how customers and stakeholders are able to get involved can be found via the following link:

www.enwl.co.uk/about-us/engaging-with-our-stakeholders/

1.3 Purpose of the report

It is important to our business that customers and other stakeholders have a clear understanding of how we endeavour to minimise any adverse impact our activities might have on the environment and how we are taking advantage of opportunities to play our part in moving to a zero carbon economy. The purpose of this report is to provide the detail on the progress we have made in the fifth year of the RIIO-ED1 (2015-2023) period in terms of our overall strategic environmental objectives and meeting the environmental targets we set out in our RIIO-ED1 business plan.



Photo: Transforming our Communities project in Hale

2.1 Introduction

This section provides detail on the progress we have made in 2019/20 in regard to the environmental risks and opportunities we encounter, including those for which we have set targets in our RIIO-ED1 business plan.

2.2 Visual amenity

There are three National Parks and four Areas of Outstanding Natural Beauty (AONB), collectively known as Designated Areas, either wholly or partially within our region. These are:

- Arnside and Silverdale AONB
- Forest of Bowland AONB
- North Pennines AONB
- Solway Coast AONB
- Lake District National Park
- Peak District National Park
- Yorkshire Dales National Park

We have a programme of undergrounding overhead lines for visual amenity benefits in Designated Areas and we have worked closely with regional partners to ensure its success since its inception in 2005. As part of our wider stakeholder engagement plan, we meet annually with representatives from the above Designated Areas to share information on the individual programmes of work in each of

the areas and current topics of interest. Each of the designated area statutory body representatives, together with Friends of the Lake District and Friends of the Peak District, meet with ENWL planners on a regular basis to identify the lines to be undergrounded in their area and to ensure programmes are progressed.

Our investments have also been leveraged by regional partners to deliver greater environmental value and secure additional funding from other sources. This includes £7.9m of National Lottery Funding for a range of landscape improvement programmes in two of the Designated Areas above. In our RIIO-ED1 business plan we planned to invest £9m (12/13 prices) undergrounding overhead lines by 2023. This was equated to 80km in our published Business Plan commitments based on assumption as to the average unit cost of undergrounding.

In 2019-20 we increased our activity inside Designated Areas, removing a further 7.2km of overhead line and installed 8.6km of underground cable. At the end of the fifth year of RIIO-ED1, we have now removed a total of 34.4km of overhead line and invested £5m (at 12/13 prices). We still intend to invest the totality of our entitlement of £9m (12/13 prices) over the RIIO-ED1 period but some of the sites selected by stakeholders, whilst high in amenity value, are costlier than originally anticipated. Hence, it is likely that the total length undergrounded over the period will be around 65km.

Table 2 gives details of the schemes underway or completed in 2019/20 and Table 3 shows the projects planned for 2020/21.

Table 2: Visual amenity activity summary 2019/20

Designated Area	Scheme	Overhead Line Removed (km)	Underground Cable Installed (km)	Expenditure (£m)
Forest of Bowden	UVA Kenibus-Lamb Hill Slaidburn	0.57	0.65	0.01
Forest of Bowden	UVA Fellside-Merrybent Slaidburn	1.76	2.09	0.10
Forest of Bowden	UVA Closes Barn-Beatrix Dunsop Bridge	2.04	2.63	0.26
Forest of Bowden	UVA Brennand Spur Dunsop Bridge	0.90	1.06	0.15
Lake District	UVA St Patricks Church Patterdale	0.12	0.16	0.00
Solway Coast	UVA Rockcliffe Marsh Rockcliffe	0.73	0.70	0.09
Yorkshire Dales	UVA Alpha ABS-Sannat Hall	0	0	0.37
Yorkshire Dales	UVA Alpha ABS-Lower Tren House	1.05	1.32	0.14
Yorkshire Dales	UVA Storrs Common Ingleton	0	0	0.11
TOTAL		7.18	8.61	1.26

Table 3: Visual amenity planned projects 2020/21

Designated Area	Scheme	Overhead Line Removed (km)	Underground Cable Installed (km)	Expenditure (£m)
Forest of Bowland	UVA Closes Barn-Beatrix Dunsop Bridge	0.00	0.00	0.04
Forest of Bowland	UVA Bleasdale Nr Chipping	3.43	4.70	0.57
Forest of Bowland	UVA Holden Clough to Wycongill	2.37	3.50	0.41
Lake District	UVA LV Dacre	0.29	0.44	0.09
Lake District	UVA Dacre Village South	0.15	0.28	0.05
Lake District	UVA A66 to Dacre	1.78	2.18	0.31
Lake District	UVA Welcome Nook-Fell Lane Corney Fell	1.46	1.63	0.29
Lake District	UVA Charlesground-High Corney	0.94	1.08	0.15
Peak District	UVA Reaps Farm-Higher Deep Clough	2.17	3.26	0.40
Yorkshire Dales	UVA Alpha ABS-Sannat Hall	2.77	3.45	0.01
Yorkshire Dales	UVA Storrs Common Ingleton	0.75	0.85	0.09
TOTAL		16.12	21.36	2.41

Details of our strategy for project assessment and delivery, analysis of costs and benefits, stakeholder engagement and support and our approach to the assessment of projects is included in our document Undergrounding for Visual Amenity – Scheme Selection and Design Process 05 May 2016 which can be downloaded from the following link;

<https://www.enwl.co.uk/globalassets/stakeholder-engagement/documents/engagement-publications/undergrounding-for-visual-amenity/2016--underground-for-visual-amenity.pdf>

The data relating to our visual amenity activity can be found in worksheet E1 of the Environment and Innovation Reporting Pack in the appendices.

2.3 Oil leakage from cables

Fluid-filled cables were installed from the late 1950s to the early 1970s as part of the extra high-voltage distribution network at 132,000 and 33,000 volts. The fluid acts as an electrical insulator and will be either mineral naphthenic oil or linear alkyl benzene or a mixture. In all cases the fluids have a low viscosity and colour, not unlike water. Leaks from fluid-filled cables can occur for varying reasons including:

- cable damage by third party excavations;
- cable damage due to installation failure;
- failure of ancillary oil equipment such as pipe work, monitoring gauges and oil tanks; and
- cable joint failure.

Whilst only a very small percentage of cables ever develop leaks, a leak can present a significant environmental risk if it is adjacent to a water course or an aquifer. Our strategy to address leakage from fluid-filled cables is to replace them with alternative modern fluid-free cable. We have also started to dose circuits with perfluorocarbon tracers which enables leaks to be detected more quickly reducing oil lost and time finding leaks.

We have committed in our RIIO-ED1 business plan to maintain a leakage rate of less than 30,000 litres per year by 2023. With the practice of dosing and replacing the circuits which have leaked, we have seen a reduction in leakage to 21,616 litres in 2019/20. During the year, we have removed 16.9km of fluid filled cable, meaning that in the first five years of RIIO-ED1 we have removed 70.6km of 33kV and 7.9km of 132kV fluid-filled cable taking the total removed to 78.5km (16% of the total in service at the start of the period). In the last three years of RIIO-ED1 we plan to remove a further 25km.

When leaks are detected we act in accordance with the requirements of the joint Environment Agency and Electricity Companies Operating Code on the Management of Fluid Filled Cable Systems Issue 3, 2013. The data relating to our oil leakage activity can be found in worksheet E2 of the Environment and Innovation Reporting Pack.

2.4 Carbon impact and climate change

2.4.1 Business carbon footprint

Within our Environment and Energy Management Policy we have committed to minimise the carbon footprint of our business and actively contribute to the transition to a zero carbon economy. The carbon footprint is a measure of the impact of our business on the environment through our emissions of greenhouse gases.

The target set in our RIIO-ED1 business plan was to reduce our 2014/15 business carbon footprint (excluding losses) by 10% by the end of 2019/20. We have exceeded this target, achieving a reduction of 26%, and will target further reductions throughout the final three years of the RIIO-ED1 period. The cumulative benefits of this reduction are the equivalent of 6,364 tonnes of CO₂ emissions saved including a reduction of 1,237,379 kWh of energy used in powering our buildings and substations.

In 2019/20, we continued to realise the benefits from our investment in fuel efficiency including reduced vehicle weights, installation of engine rev limiters and educating our drivers on the most efficient manner in which to use our fleet. Further investment in the refurbishment of our buildings also took place including the installation of more energy efficient equipment. This investment, alongside continued promotion of energy reduction behaviour with our employees, is driving down the electricity used to power our buildings.

The higher CO₂ contribution from generators was mostly off-set by our improved performance for electricity in our buildings, meaning that our business carbon footprint (excluding losses) for 2019/20 was 18,051 tCO₂e, a reduction of 2,366 tCO₂e on the previous year. This means that we have delivered an average saving of over 3,772 tCO₂e per year over the first five years of the plan compared to the baseline.

Table 4: Business carbon footprint 2019/20

Emissions	2019/20 tonne CO ₂ e	2018/19 tonne CO ₂ e	2017/18 tonne CO ₂ e
Scope 1			
Operational transport (direct labour)	3,653	4,020	3,960*
Operational transport (contractors)	3,196	3,850	3,017
Business transport – road	1,343	1,319	1,254
Fugitive emissions - SF ₆	1,772	867	1,237
Fugitive emissions – other	16	87	17
Fuel combustion	2,560	4,435	3,763
TOTAL	12,540	14,578	13,248
Scope 2			
Buildings energy usage	4,845	5,773	7,262
TOTAL	4,845	5,773	7,262
Scope 3			
Business transport – rail	21	22	21
Business transport – air	99	44	68
TOTAL	120	66	89
Business Carbon Footprint (exc. losses)	18,051	20,417	20,599
Losses	293,793	347,010	512,292
Business Carbon Footprint (including losses)	311,844	367,427	532,891

*The figure for 2017/18 Operational transport (direct labour) has been rounded up from 3,959.27 so that the rounded figures add up to the total reported in worksheet E3.

The data relating to our business carbon footprint can be found in worksheet E3 of the Environment and Innovation Reporting Pack in the appendices.

2 Managing our environmental impact

2.4.2 Sulphur hexafluoride emissions (SF6 emitted)

SF6 is a gas with excellent electrical insulation and other properties, which have led to its widespread use in electrical switchgear and in a number of other industrial applications. However, there is concern over any SF6 that escapes into the atmosphere since it is a potent greenhouse gas.

In terms of our strategy to address the level of SF6 emitted, we contribute to the overall UK electricity transmission and distribution industry in supporting Government initiatives to ensure the implementation of sound policies for the control and use of SF6. The European electricity industries have also agreed a set of actions to reduce emissions of the gas to the atmosphere with manufacturers of electrical equipment. Leakage rates are being reduced in cooperation with power equipment manufacturers under a programme of continuous improvement.

On a company level our current policy is to continue to install modern SF6 equipment with lower leakage rates and leakage monitoring. Over the RIIO-ED1 period we plan to reduce our leakage rate by over 20% from a rate of 0.38% (as a proportion of the mass in service) in 2013 to 0.30% by 2023.

In 2019-20 a total of 77.73 kg of SF6 was lost from our system, with a carbon equivalent of 1,772 tCO2e. This loss equates to 0.49% of the total mass in service and was due primarily to ongoing issues at Heysham which will ultimately be resolved through replacement in 2021/22 and a sudden failure at our Natland substation causing a large leak. Here, the unit had to be kept in service due to circuit risk for a few weeks following which it was removed from the system and sent for refurbishment.

The data relating to our SF6 holding, leakage and associated carbon footprint can be found in worksheets E2 and E3 of the Environment and Innovation Reporting Pack in the appendices.

We can proactively target losses reduction and our strategy is to continually review the options for reducing the losses on our network.

2.4.3 Distribution losses

When electricity is generated not all of the electrical energy which flows through the power network reaches the customer. This is because power networks use some of the energy in the process of transporting the electricity to customers. In the broadest sense, distribution network losses are the difference between the electrical energy entering the distribution network, and the electrical energy that leaves it. Some losses are associated with the technical characteristics of the electricity network ('technical' losses), whilst other losses are more to do with measurement and billing ('non-technical' losses).

Losses cost customers money and contribute to carbon emissions. They can be reduced in various ways but these measures also cost money. At Electricity North West we act on behalf of our customers to determine the appropriate balance between spending money on reducing losses, and saving money for customers by lowering the energy lost during transportation.

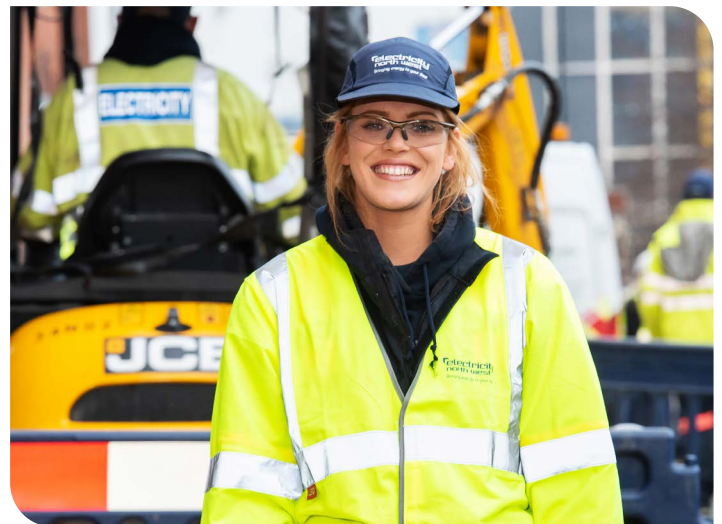
The overall level of losses will be influenced to a greater extent by electricity usage i.e. the more electricity consumed, the more power transmitted and distributed, the more losses and vice versa. This movement in losses is reflected in the total losses associated with our network.

In 2019/20 losses¹ were 1,149,427,577 kWh or the equivalent of 293,794 tCO2e. This was a reduction of 76,453,359 kWh from 2018/19 which, together with a change in the UK government electricity conversion factor, equated to an equivalent reduction of 53,216 tCO2e.

We can proactively target losses reduction and our strategy is to continually review the options for reducing the losses on our network. We have examined the potential for reductions through the application of various alternative investment strategies during the RIIO-ED1 period and are adopting, as policy, only those strategies that deliver clear positive benefits for our customers.

We also plan to maintain and expand our activities to investigate and minimise non-technical losses, such as theft, while continuing to establish a more reliable reporting baseline for losses within RIIO-ED1.

As part of this strategy we have identified a number of priorities for reducing both technical and non-technical losses summarised in Table 5 below.



¹ It should be noted that the reported losses figure is a snapshot of received data as of the date of the 2020 RRP submission and will change as further settlement reconciliation runs are carried out (up to 28 months after each relevant settlement date).

Table 5: Losses strategy summary

Investment	Actions	
Technical losses		
Distribution transformers (ground-mounted)	Replace old (pre-1990) large, ground-mounted, secondary network transformers with capacities of 800kVA and 1000kVA with lower loss EU Eco design	Proactive
Primary transformers	When installation or replacement required, replace with lower loss EU Eco design	Opportunistic
Grid transformers	When installation or replacement required, determine best type to reduce losses with all new transformers lower loss EU Eco design	Opportunistic
Distribution transformers (pole-mounted)	When installation or replacement of larger pole-mounted secondary network transformers required, replace with lower loss EU Eco design	Opportunistic
Cables (high voltage and low voltage)	Install large-cross section cables (300mm ²) at both HV and LV as standard	Opportunistic
Non-technical losses		
Transactional theft	Continue to work alongside suppliers to help reduce transactional theft	Proactive
	Monitor / share best practice with other DNOs	Proactive
Theft in conveyance	Develop our theft in conveyance services	Proactive
	Contribute to the development of the National Revenue Protection Code of Practice	Proactive
	Increase number of investigations undertaken	Proactive
	Monitor / share best practice with other DNOs	Proactive
Unmetered supplies	Undertake regular audits of unmetered supply inventory	Proactive
Network Innovation Strategy		
Ofgem Innovation Funding	Review and analyse the details of the innovation projects	Proactive

Our losses strategy can be found at the following link:

<https://www.enwl.co.uk/zero-carbon/leading-the-north-west-to-zero-carbon/electrical-losses/>



2 Managing our environmental impact

A summary of our activity in reducing losses in 2019/20 is presented in the tables below.

Table 6: Summary of losses costs and benefits from activities in RIIO-ED1²

Programme/ project title	Regulatory Reporting Year 2019/20			RIIO-ED1
	Distribution Losses – Justified Costs	Reduced Losses	Reduced Emissions Associated with Losses	Cumulative reduced losses to date
	£m	GWh	tCO2e	GWh
Standardise use of 300mm ² HV cable	0.72	8.31	2,123	21.51
Standardise use of 300mm ² LV cable	0.73	3.43	876	8.90
Proactive replacement of pre-1990 1000kVA transformers	0.64	4.64	1,187	11.96
Proactive replacement of pre-1990 800kVA transformers	0.80	3.73	954	6.44
Opportunistic primary transformer replacement	0.23	2.02	516	4.18
Opportunistic 200kVA pole-mounted transformer replacement	0.02	0.16	40	0.39
Relevant theft of electricity action	0.14	10.19	2,604	31.03
TOTAL	3.28	32.48	8,300	84.41



² For all technical losses initiatives, it is assumed that there are no losses saving in the year of installation and the full losses saving commences the following year.

Table 7: Summary of losses activity in 2019/20 and estimate for 2020/21

Programme / project title	Description of unit	Volumes in 2019/20	Forecast volumes for 2020/21
Standardise use of 300mm ² HV cable	km of cable	92	80
Standardise use of 300mm ² LV cable	km of cable	42	13
Proactive replacement of pre-1990 1000kVA transformers	Transformers	49	5
Proactive replacement of pre-1990 800kVA transformers	Transformers	67	7
Opportunistic primary transformer replacement	Transformers	5	18
Opportunistic 200kVA pole-mounted transformer replacement	Transformers	37	16
Relevant theft of electricity	Theft cases identified	403	114

The data relating to our loss reduction activities can be found in worksheet E4 of the Environment and Innovation Reporting Pack in the appendices.

The cost and benefit analyses for our innovative solutions are included in the appendices.

To underpin our target of reducing our business carbon footprint, we have implemented an energy management system across the company.

2.5 Other environment related activities

2.5.1 Energy management system

To underpin our target of reducing our business carbon footprint, we have implemented an energy management system across the company. This system has driven us to carry out a full review of our energy use and consumption, identify opportunities for improving energy performance, set energy reduction targets and put procedures in place for managing energy use. The system was audited and verified by an external organisation during 2019/20 and we have maintained certification to the ISO 50001 Energy Management Systems standard.

2.5.2 Hazardous waste

Our oil recycling facility at Blackburn continues to play a significant part in managing our environmental impacts by allowing us to minimise the use of raw materials and disposal of waste oil.

2.5.3 Noise complaints

We received 16 noise-related complaints in 2019/20 compared to 40 in the previous year. All complaints in the year related to substation noise and were dealt with through our customer service processes.

The data relating to noise complaints can be found in worksheet E2 of the Environment and Innovation Reporting Pack in the appendices.

3 Smart grids, innovation and our role in the low carbon transition

3.1 Introduction

As the electricity distribution network operation for the North West of England, we have a key role to play in enabling the transition of our region to net zero and supporting the UK as a whole in meeting its climate change targets.

Innovation is key to the success of our organisation. At the core of our innovation strategy is delivering value to customers through maximising the use of existing assets and offering new services and choice for the future. We are generating value for customers now by deploying proven technology providing innovative solutions to real problems.

This section describes our activity in 2019/20 in regard to smart grids, innovation and how we are fulfilling our commitments in this area.

3.1.1 Key challenges

The long term challenges our business and industry face regarding energy use remain the same;

- Government initiatives on energy efficiency, carbon costs, renewable energy generation and electric vehicles combined with increasing customer awareness of energy issues will drive changes in customer behaviours that will impact significantly on electricity consumption in terms of patterns and levels of demand.
- Increased use of electricity for heating and transport will increase customer demand for electricity, improved reliability of supply and information when the supply is interrupted.
- Our assets are ageing with many now approaching their previously assumed end of life at a time when we are asking them to perform new functions.

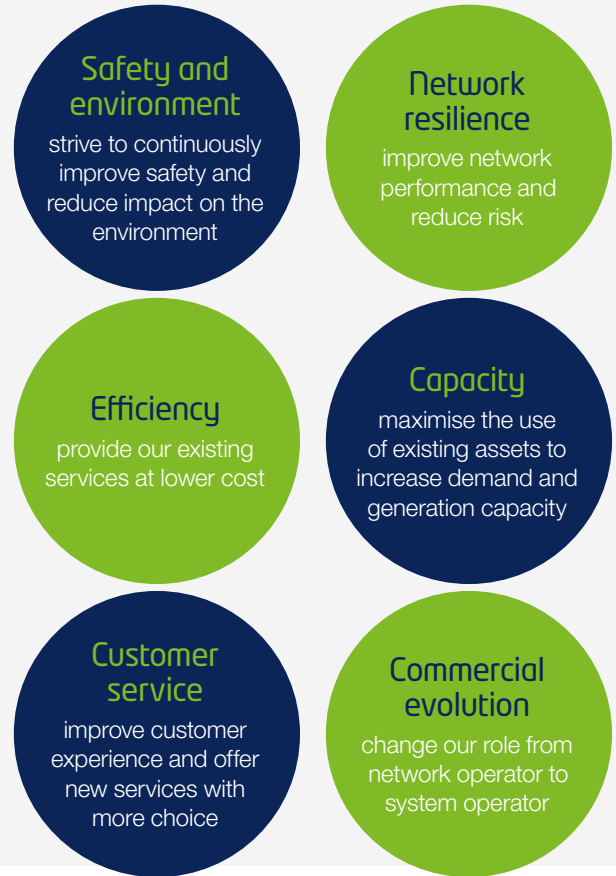
Equally the opportunities these challenges present and the new technologies that are emerging to tackle them are broadly consistent;

- New technology itself has the overall ability to add value to our business by enabling improvements in customer service and reducing costs.
- Energy storage can help us manage demand uncertainty and help customers and communities improve energy efficiency.
- Smart meters will allow us to monitor how much power our customers are using or producing in near real time and allow us to positively influence usage and operate the network more responsively.
- New markets are emerging through which customers can earn value while helping solve network constraints.
- Regulatory models can be developed that support changes needed.
- The Distribution System Operation (DSO) will have a central role in determining where innovation is required.

Our innovation strategy is built to resolve these new challenges and to realise the opportunities. It is made up of five objectives with the aim of delivering value to our customers.

- Maximise the use of existing assets
- Apply innovative solutions to real problems
- Deploy proven technology today
- Generate value for customers now
- Offer new services and choice for the future

In line with this strategy we have developed a range of projects, some of which have been completed and a number of which are currently in flight. All projects are designed to support one or more key innovation themes:



Full details of our innovation work can be found on our dedicated innovation web pages through the following link:

<https://www.enwl.co.uk/innovation>

Our innovation strategy can be found at the following link:

<https://www.enwl.co.uk/globalassets/innovation/innovation-strategy/innovation-strategy-august-2019.pdf>

The data relating to the benefits of using innovative solutions to respond to the challenges set out above can be found in worksheet E6 of the Environment and Innovation Reporting Pack in the appendices.

The cost and benefit analyses for our deployed innovative solutions are included in the appendices.

3.1.2 Low carbon technologies connected

In 2019/20 we connected 2,427 low carbon technologies (LCTs) with a total capacity of 213.5 megawatts (MW). 2,417 of these were connected onto our secondary³ network, with near equal values for photovoltaic installations and electric vehicle chargers. On our primary⁴ network we connected 10 low carbon technology, non-G83 distributed generation units.

Overall, the volume of LCTs installed has been decreasing over the last few years. However, the data relies on installers accurately reporting installations to Electricity North West and therefore may not reflect actual installations.

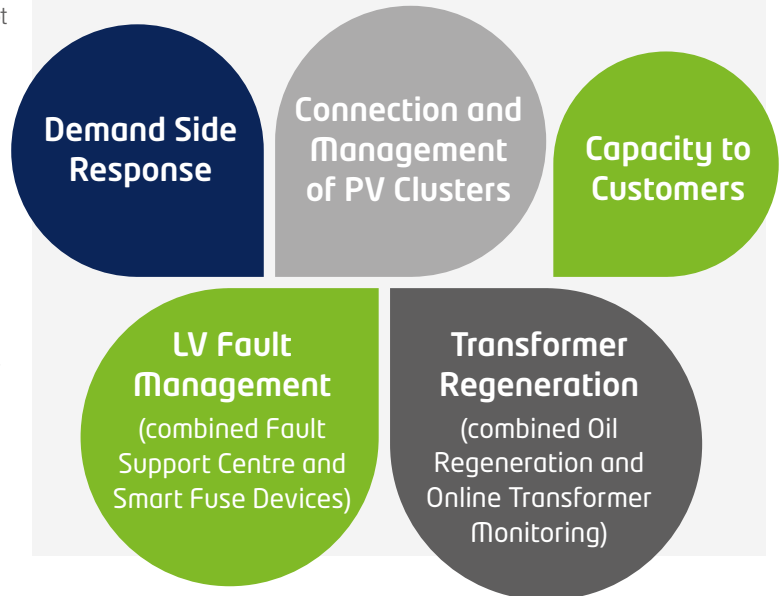
The volume of small photovoltaic installations has decreased in 2019/20 compared to 2018/19. This is assumed to be associated with the deadline for the removal of the feed-in-tariff support. However, the number of heat pumps and electric vehicles has increased significantly compared to 2018/19 by 302% and 1,358% respectively.

In our RIIO-ED1 Business Plan we concluded that the DECC Low scenario was the most probable estimate for our region over the period. The uptake during the RIIO-ED1 period so far is indicating that overall uptake during the period is likely to be significantly below the forecast.

The data relating to deployed Low Carbon Technologies can be found in worksheet E7 of the Environment and Innovation Reporting Pack in the appendices.

3.2 Progress of the innovation strategy

There are five Innovative Solutions which formed part of our business as usual activities during 2019/20. Some of these solutions consist of separate projects, however they are brought together in combination to form a new and innovative solution. Owing to this combination of several projects into combined solutions and to avoid double counting of the associated costs and benefits, a cost benefit analysis has only been prepared for the combined solution. The Innovative Solutions are:



³ 11kV and below ⁴ 33kV to 132kV

3 Smart grids, innovation and our role in the low carbon transition

3.2.1 Summary of innovative solutions deployed

Demand Side Response (DSR)

What the solution is

Catterall Waterworks Primary Substation has a single 7.5 MVA transformer and a firm capacity of 5 MVA, limited by High Voltage transfer capacity. The peak demand at the substation is 7.41 MVA, which exceeds the firm capacity by 2.41 MVA causing a compliance issue with ENA Engineering Recommendation (EREC) P2/6. The non-compliance issue only exists when the system is operating abnormally due to the loss of the transformer or the circuit supplying the transformer (ie under a fault situation), as the demand exceeds the transfer capacity.

By entering into a commercial agreement for the purchasing of DSR services, ENWL is able to defer the reinforcement of this primary substation and maintain compliance with EREC P2/6 as it ensures that the demand does not exceed the capacity when the system is abnormal.

How the solution is being used

Under system abnormal conditions, ENWL will switch out a circuit at Catterall Waterworks primary to reduce the demand at the customer's site, to enable the restoration of supplies connected to Catterall primary so the transfer capacity of 5 MVA is not exceeded. The customer has agreed to have their demand reduced by 3 MVA for up to eight hours to allow time for ENWL to identify and resolve the issue.

How the solution is delivering benefits

Demand Side Response limits the demand on Catterall Waterworks primary which is constrained by the transfer capacity for the loss of the transformer. With continuous monitoring this provides the opportunity to defer or mitigate the need for reinforcement in the future if demand increases or arrangements change.

Connection and Management of PV Clusters

What the solution is

As a result of the learning outcomes of the LCN Fund Tier 1 Project – Low Voltage Network Solutions (LVNS), we have been able to successfully implement a streamlined approach to the connection of domestic scale PV systems to the LV network. These systems are often connected in clusters and can give rise to associated network voltage and thermal issues.

Traditionally, a network operator would undertake detailed and time-consuming network assessments to be performed in advance of allowing the connection to proceed. These assessments are aimed at understanding if the connection could give rise to any of the aforementioned problems. However, as a result of the research that was undertaken as part of the LVNS project and the sophisticated network modelling that underpinned it we have adopted the alternative approach of connecting PV and monitoring the LV network.

We have successfully shown that up to a certain threshold (ie percentage of customers with PV systems) it is acceptable to allow the connections to proceed. Once the threshold is met however we will install network monitors to assess, using actual recorded data, if the network requires a further intervention.

How the solution is being used

The solution is being actively used across our network. We use this to avoid the often costly and time-consuming network assessments that can accompany generation connections. We have established a business process supported by internal policy that provides for continued monitoring of the PV volumes. Specific actions are triggered when these volumes exceed pre-determined limits and follow up actions are performed as appropriate.

How the solution is delivering benefits

The solution delivers benefits to customers in the form of avoided waiting times associated with the connection of PV systems to the LV network. We have also been able to avoid expensive and resource intensive network connection studies, thus reducing internal costs and freeing up resources to concentrate on other parts of our connection services.



Transformer regeneration

Oil regeneration

What the solution is

The condition of the oil in the transformer main tank is a good proxy of the general condition of the transformer as a whole. It has been shown from recent research that unique application of transformer oil regeneration (a process whereby transformer oil is cleaned through an on-site process) can result in an improvement in overall condition of the transformer. When this is used in conjunction with enhanced transformer monitoring, this can improve the Health Index and extend the expected life of the transformer.

How the solution is being used

Transformer regeneration is being used as an alternative to traditional asset replacement. The regeneration activities are being undertaken on those assets which are categorised as 'end of life' due to their Health Index and/or criticality level. Regeneration activities are also being undertaken on those transformers categorised as 'mid-life' in order to determine the optimum point in a transformer's life cycle to implement oil regeneration activities to further extend the life of the asset.

How the solution is delivering benefits

The financial benefits from this innovative solution are derived from transformer life extension and hence deferment of asset replacement costs. Other benefits include quality of supply benefits which relate to improved understanding of the risk of failure of older transformers and a better insight into the oil ageing process. The environmental benefits result from extending the life of an existing transformer and its oil therefore reducing the requirement for disposal of and/or recycling of used oil and scrapping the transformer. However additional losses are incurred due to the delayed implementation of modern equivalent transformers.

This is used in conjunction with the Online Transformer Monitoring.

Online transformer monitoring

What the solution is

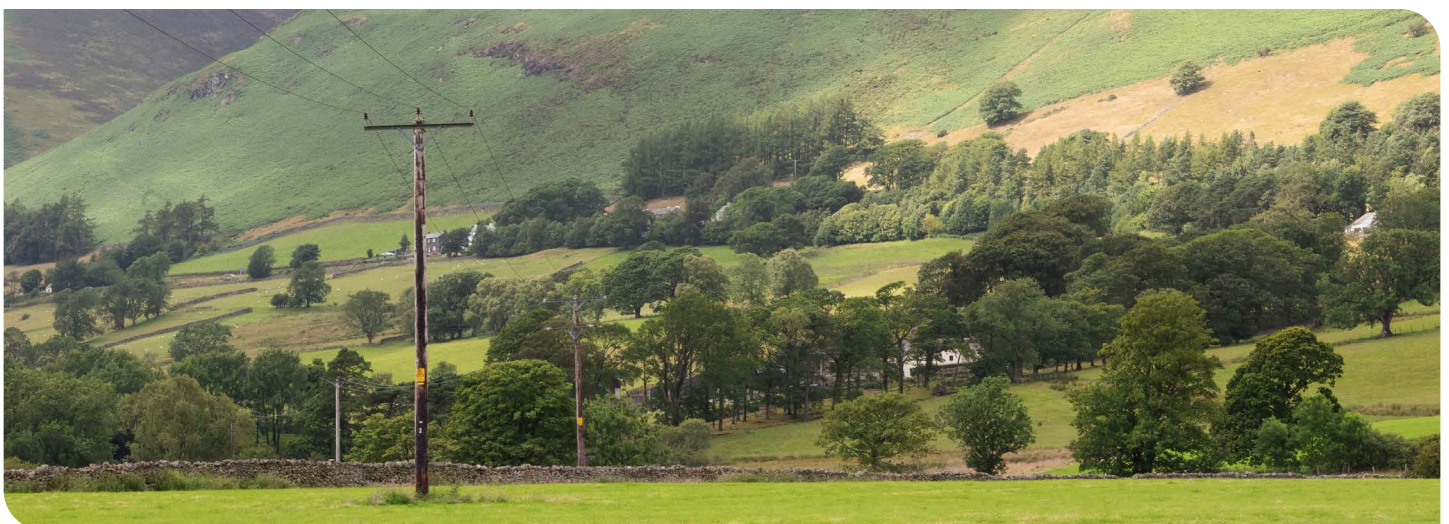
As transformer life is extended through the use of techniques such as transformer oil regeneration, network operators must be certain that the refurbished units will continue to operate both safely and reliably. To support this, a real-time condition monitoring system has been developed which provides us with enhanced information on each refurbished transformer via an on-line information dashboard.

How the solution is being used

Transformer monitoring is being fitted to all transformers which have had their oil regenerated in R110-ED1 for a period of time to confirm (via observable data) that both the initial condition of the transformer is improved and that this improved condition is maintained thereafter. The solution is being used as part of our intervention plan to extend the life of a large number of 132kV and 33kV transformers. The technology is fitted to targeted transformers for a short period prior to the commencement of the oil regeneration process and continues for a defined period thereafter.

How the solution is delivering benefits

The condition monitoring provides us with confirmation that the transformer regeneration process has been successful in improving the condition of the transformer oil and thus the main tank. The combined online transformer monitoring is a key enabling technology for the refurbishment of large volumes of 132kV and 33kV transformers under the transformer regeneration innovative solution.



LV Fault Management

Fault Support Centre

What the solution is

The Fault Support Centre (FSC) is an enhanced Low Voltage network fault management solution which makes use of the increased penetration of intelligent devices such as the Bidoyng coupled with an innovative commercial partnership with a third party provider (Kelvatek). The FSC provides a real-time operational management of low voltage networks to allow for the proactive management of faults. The data obtained can be further used to target areas of the network which would benefit from asset replacement.

How the solution is being used

This solution is being used as the business-as-usual approach for how all transient faults are managed. In the event that a transient fault is detected, a smart fuse device such as the Bidoyng or Weezap is fitted to the suspect LV network. Kelvatek is informed of the installation event and data recorded by the Bidoyng/Weezap in real-time to monitor the suspect network.

Kelvatek will continue to monitor the affected networks until they have determined the potential location of the fault causing the transient supply interruption and issued an instruction to our field teams to investigate with the aim of locating and removing the fault or proving that the transient fault is no longer active. In both cases, the equipment will be recovered and redeployed elsewhere.

How the solution is delivering benefits

The Fault Support Centre allows for the proactive management of LV transient faults. Our customer engagement activities have shown that these types of fault are one of the biggest causes of customer dissatisfaction. The ability to repair these faults before they have chance to progress into a permanent fault will significantly reduce the number of associated faults and reduce customer disruption accordingly.

Further benefits flow from the reduction in customer interruptions and customer minutes lost and associated fault costs that the proactive management of faults delivers.

Smart fuse devices

What the solution is

The smart fuse devices produced by Kelvatek such as the Bidoyng and the Weezap act as an innovative replacement for the standard low voltage fuse. They provide a multi-shot re-close feature as opposed to the single operation offered by the standard fuse. This means that customer supplies can be automatically restored in the event of a transient fault, reducing the number of customer interruptions and customer minutes lost and the costs associated with managing our response to a loss of supply. This enhanced approach to LV faults also improves customer satisfaction.

In addition, this equipment provides increased network visibility via its ability to measure and transmit to our Network Management System key network parameters and make this available in near real-time.

How the solution is being used

These smart fuse devices are used to reduce the customer impacts of faults, facilitate increased understanding of the impact of the connection of low carbon technologies and improve the management of network faults.

These devices are acting as enablers for a number of innovation solutions and applications. In particular, they are a key tool in the management of low voltage transient faults. These faults are intermittent in nature and are often difficult to find and repair. The Bidoyng is used to both minimise the customer disruption associated with a fault (ie by automatic restoration of supplies) and to help engineers to locate the fault (using travelling wave technology built into the smart device) thus allowing proactive repair of the fault.

How the solution is delivering benefits

The Bidoyng smart fuse is a key enabling technology. It is being used as the main technology deployed on faulty parts of the LV network as part of the Fault Support Centre. In addition, it is providing information on the performance of the network to facilitate the application of the Connect & Manage approach to domestic PV clusters connected to the LV network.

Over the last three years there has been a further roll out of Weezap smart fuses. These devices have the capacity for five auto-recloses, whereas the Bidoyng has the capacity for only two. The further recloses offered by the Weezap saves additional subsequent customer interruptions while providing us with further information regarding the fault location enabled through the monitoring service managed by the FSC.

Capacity to Customers

What the solution is

Managed connections provide customers wishing to connect to the network with a lower cost connection and reduced waiting times versus traditional network reinforcement-based connection arrangements. It utilises advances in network automation and communications alongside innovative commercial terms. It is a form of Active Network Management (ANM) which may seek to disconnect managed customers from the network for agreed periods when the network is running abnormally.

How the solution is being used

Managed connections are now the standard connection offer provided to all generation customers connecting to the HV and EHV network. Managed connections afford customers a lower cost connection and as such have become the default connection offer provided to all Distributed Generation (DG) customers.

To support decision making by customers, information on the potential 'curtailment factor' (ie the typical period of time that a customer could expect to be at risk of disconnection) is provided alongside the connection offer.

Customers may choose to reject the managed connection offer and instead opt for a more traditional connection arrangement without the managed elements.

How the solution is delivering benefits

Managed connections are providing a number of benefits. Economic benefits flow to connection customers from lower reinforcement costs and reduced time to connect. Benefits also flow to all customers from lower reinforcement costs recovered through lower distribution use of system (DUoS) charges. Environmental benefits also accrue because of removing barriers to support the connection of low carbon generation such as solar/wind farms.

Economic benefits flow to connection customers from lower reinforcement costs and reduced time to connect.

Further details of our strategy can be found in our Network Innovation Allowance annual summary report which can be found on the following link:

<https://www.enwl.co.uk/globalassets/innovation/nia/nia-reports-and-literature/nia-annual-summary-report-2020.pdf>



3.3 Roll out of smart grids and innovation into business as usual

All our innovative solutions are designed, implemented and monitored through a set process.

Figure 1: Innovation lifecycle



The cost and benefit analyses for our innovative solutions are included in the appendices.

3.3.1 Transfer to business as usual (BAU)

Managing the transition of an innovative solution, device, technology or new operating arrangement into BAU is perhaps the most important stage in delivering benefits to customers. This phase generally represents the final stage of a project's time line and is the culmination of its successful outcome.

The ability to transition the innovation to BAU is an important consideration when innovation investment opportunities are assessed. We recognise that some projects are aimed at informing

our understanding and learning and in such instances BAU transition normally involves updates to business processes, procedures and specifications. The BAU assessment also considers the technology risk, the development time line and our ability to support the developers in a meaningful manner before embarking on a project.

To ensure the successful transition to BAU, we select innovation investments that are assessed as having a good chance of delivering value for customers. We focus on challenges that have been identified in our business plan and use innovation to address these issues. We use a cost benefit analysis approach to ensure that best value projects are taken forward.

We have developed a five-stage initiative tracking process which enables us to take innovation and other business initiatives into BAU.

Figure 2: Innovative solutions transfer to business as usual



3.3.2 Benefits and impacts

With the continued roll-out of the above innovative solutions in 2019/20, the following benefits have been realised.

Table 8: Innovative solutions benefits and impacts

Innovative Solution	Additions	Estimated Gross Avoided Costs (£m)	Benefits	
			CI Impact (Interruptions)	CML Impact (Minutes)
Demand Side response	0	0.00	N/A	N/A
Transformer Regeneration	3 sites	1.08	N/A	N/A
Fault Support Centre and LV Reclosing Device Installations	1,014 installations	1.26	51,004	4,590,390
Connect and Manage PV Clusters on LV Networks	942 new PV installed	0.05	1,030	61,800
Capacity to Customers	18 new connections	27.03	N/A	N/A

In 2019/20, we successfully applied for funding under the Innovation Roll-out Mechanism for a roll-out of our Smart Street initiative which will commence in 2020/21. Next year's report will therefore detail this solution, corresponding to worksheet E8 of the Environment and Innovation Reporting Pack for the reporting of costs, in addition to table E6 where the expected benefits of the roll-out will be documented.

3.3.3 Smart metering

Although energy supply companies (suppliers) are responsible for the roll-out of smart meters, we are preparing to maximise the benefits from the data they will provide in the future and are actively participating in various industry groups aimed at making the transition as smooth as possible.

Our strategy is to help customers and work in collaboration with suppliers, for example by upgrading our service positions where necessary to accommodate a smart meter.

There is now a total of 1,367,050 smart electricity meters installed in our distribution service area. The majority of these are an early version of smart meter referred to as SMETS1. These are being brought on-line by electricity suppliers in phases. We can currently communicate with approximately 5,000 of this type. The latest type of smart meter is referred to as SMETS2 and we can communicate with approximately 115,000 of these.

There is the potential for approximately 2.3 million smart meters to be installed within our area. Having established a communications gateway to access smart meter data, we will identify ways in which it can deliver benefits and incorporate these into our business processes.

In 2019/20 we incurred:

- £2.5m in Smart Meter Communication Licensee Costs. Each DNO must contribute towards the Smart Meter costs of the Data and Communications Company (DCC) which delivers communications from electricity meters to industry stakeholders who need it. They are payable by us to the DCC, as required by the Smart Energy Code and defined by DCC's published charging methodology statement. The costs have increased by £0.5m compared to last year as a result of the DCC increasing the monthly fixed charges for Electricity Distributors.
- £1.4m in IT costs. This covered the continued support and maintenance of the gateway infrastructure connecting our IT systems to the DCC central systems as part of the Smart Meter Implementation Programme (SMIP) and required by the Smart Energy Code, additional design work required for the uplift of systems to be compatible with the DCC User Interface Specification (DUIS) to v2.0 and v3.0 specifications and continuing with a data cleanse. The costs have decreased since last year by £0.4m as there has not been the same requirement for infrastructure build activities as the previous period.

3 Smart grids, innovation and our role in the low carbon transition

Connection to DCC's central systems facilitates access to smart meter data. This is generally in the form of proactive alerts such as power outage notifications received directly from the meter and service requests made by us to ascertain the status of a meter or details of consumption, for example the maximum demand in the previous month.

In the longer term, we expect benefits from the use of this non-elective data, procured as part of the Smart Meter Communication Licensee Costs, to enable us to manage our network more effectively and cost efficiently for customers. Distribution companies have previously assessed the benefits of half hour consumption data as being attained once a smart meter installation level approaching 70% penetration is reached (noting that there may be some geographic clustering which in some cases may allow us to begin achieving benefits earlier).

As per our Licence, we will not access any household electricity consumption data from smart meters which relates to a period of less than one month before approval of our Data Privacy Plan. We have submitted our Data Privacy Plan to Ofgem.

A SMETS2 meter provides us with notification of a power outage within minutes of a customer losing their electricity supply. This functionality is not currently working as it should because the national communications hub covering the north of England is not fully functional. There are no plans at present for existing SMETS1 meters to be upgraded or replaced to provide power outage notification.

As can be seen from the volume of installed smart meters above, the Smart Meter programme has not yet rolled out to the extent that benefits are identifiable. Solutions for a number of common issues relating to both smart meter device and DCC functionality are being investigated but have a high potential to negatively impact medium term benefits realisation.

Current issues cover several areas including significant volumes of false positive alert notifications, extremely high volumes of nuisance alerts and incorrect/inconsistent meter functionality. In conjunction with other DNOs we are liaising with industry parties to attempt to resolve these in order to be able to move forward with systems integration and business transformation plans.

Throughout the year, we have continued to play an active role at industry level through the Energy Networks Association Smart Metering Operations Group and its sub-group looking specifically at the safety aspects of the roll-out.

The data relating to smart meter readiness expenditure can be found in worksheet E5 of the Environment and Innovation Reporting Pack and in section E5 of the Environment and Innovation Commentary in the appendices.



These documents can be found on the following link:

<https://www.enwl.co.uk/about-us/regulatory-information/environment-report/>

Cost Benefit Analyses (Losses):

- 2020 Install 300sqmm HV Cable versus 185sqmm HV
- 2020 Install 300sqmm LV Cable Versus 185sqmm LV
- 2020 Proactive 1000kVA GMT Replacement CV21
- 2020 Programme 23MVA Replacement
- 2020 CBA for E4 Theft of Electricity

Cost Benefit Analyses (Innovation):

- C2C CBA FY20 RIIO ED1 CBA V1.0
- Demand Side Response FY20 RIIO ED1 CBA v2.0
- LV fault management FY20 RIIO ED1 CBA v1.0
- PV Connect & Manage FY20 RIIO ED1 CBA V1.0
- TX Regen CBA FY20 RIIO ED1_v0.1



SHK1318

Electricity North West

Borron Street
Portwood
Stockport
SK1 2JD

www.enwl.co.uk