

Environment Report

2017/18

Contents

1	Introduction	2
1.1	Executive summary	2
1.2	Our business / who we are	3
1.3	Purpose of the report	3
2	Managing our environmental impact	4
2.1	Introduction	4
2.2	Visual amenity	4
2.3	Oil leakage from cables	5
2.4	Carbon impact and climate change	6
2.5	Other environment related activities	10
3	Smart grids, innovation and our role in the low carbon transition	11
3.1	Introduction	11
3.2	Progress of the innovation strategy	12
3.3	Roll out of smart grids and innovation into business as usual	16
4	Appendices	18

1.1 Executive summary

We are dedicated to achieving the highest standards of environmental performance, not only by minimising the 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 low carbon future and the environmental benefits this will bring. This 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.



Table 1: RIIO-ED1 Environment commitments

Commitment	Measurement	Target	Target date
Reduce losses	Annual gigawatt hours (GWh) saved	11	2021
Reduce carbon footprint	Tonnes of Carbon Dioxide Equivalent (tCO2e)	10%	2020
Reduce oil lost from cables	Litres lost	<30,000 per year	2023
Undergrounding overhead lines in Designated Areas	km removed	80	2023

In the third year of the RIIO-ED1 period we made further progress against our commitments, achieving:

- 5 km of overhead line removed to enhance visual amenity
- Reduced losses of 12.3 GWh
- 2% reduction in our business carbon footprint

An exceptional event resulted in an increase in oil lost from cables in 2017/18.

We have also continued to connect new low carbon generation, develop new innovation to accommodate smart grids and prepare for the roll out of smart metering by:

- Connecting over 1,500 units of low carbon technologies with a combined capacity of 123 MW
- £3m invested in enabling smart meter roll-out

1.2 Our business / who we are

As a company with a workforce of over 1800 people; a large contractor workforce; an electricity distribution network delivering power to 5m people with 13,000 km of overhead lines, over 44,000 km of underground cables, almost 86,000 items of switchgear and more than 37,000 transformers; a fleet of over 1000 commercial vehicles, trailers and items of mobile plant; and 15 depot and office sites, our activities create both risks and opportunities in regard to the environment.

The environmental risks we encounter 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 work 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 low carbon energy, supporting the UK as a whole 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.

1.2.2 Role of stakeholders in environmental management

We have a stakeholder engagement strategy that includes advisory panels composed of stakeholders who are subject experts. One such panel focuses on sustainability, ensuring our network can adapt to future challenges such as a low carbon economy and climate change, whilst keeping bills affordable. 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.

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 low carbon economy. The purpose of this report is to provide the detail on the progress we have made in the third year of the RIIO-ED1 (2015-2023) period in terms of our overall strategic environmental objectives and meeting the environment targets we set out in our RIIO-ED1 business plan.

2.1 Introduction

This section provides detail on the progress we have made in 2017-18 in regard to the environmental risks and opportunities we encounter including those for which we have set targets in our RIIO-ED1 business plan. These are visual amenity, oil leakage, business carbon footprint, sulphur hexafluoride (SF6) emissions and distribution losses.

2.2 Visual amenity

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

- Arnside and Silverdale (Cumbria)
- Forest of Bowland (Lancashire)
- North Pennines (Cumbria)
- Solway Coast (Cumbria)
- Lake District
- Peak District
- Yorkshire Dales



We have a programme for undergrounding overhead lines for visual amenity and since its inception we have worked with regional partners to ensure its success. 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 our planners to identify the lines to be undergrounded in their area on a regular basis to ensure programmes are progressed.

In our RIIO-ED1 business plan we planned to invest £9m (12/13 prices) in undergrounding 80km of existing overhead lines by 2023 (although the exact length will depend on the nature of the sites proposed by our regional partners). In 2017-18 we removed a further 4.9km of overhead line and installed 4.5km of underground cable inside Designated Areas.

At the end of the third year of RIIO-ED1, we have now removed a total of 19.9km (25%) of the 80km we have committed to remove in the regulatory period.

Table 2: Visual amenity activity summary 2017-18

	Designated Area	O/head Line Removed (km)	U/ground Cable Installed (km)	Expenditure (£m)
Lake District	High Rough Mill-Scalegate 11kV Spur NWW Cawdale-Stanegarth 11kV Spur Rawdale Mardale ABS-Goodcroft PMT Abbots Reading nr Haverthwaite Spark Bridge-Broad Haws 11kV spur Docke Nook-Kilnstone Hydro Toms Howe-Hill House Longsleddale Bushby House Caldbeck LDNPA Surveys Phases 1, 2 & 3	0.88	1.06	0.69
Forest of Bowland	Deep Clough-Winder Roeburndale Thornbush-Bracksbottom Roeburndale Middle Lees-Cow Ark Crimpton-Ing Bar Wolfen Hall-Fell Foot Chipping Greenbank Spur Farleton Priory Farm Hornby Farleton Crossing	2.69	3.40	0.28
North Pennines	Coatley Hill-Sunnyside Alston The Loaning Alston Raise Bank Alston	0.00	0.00	0.01
Peak District	The Wash Chapel En Le Frith Derbyshire Level Glossop	1.32	0.00	0.10
	TOTAL	4.88*	4.46	1.08

*This value does not summate to the sum of the individual programme costs owing to rounding in the RRP report.

2 Managing our environmental impact

In 2018-19 we have the following projects planned:

Table 3: Planned visual amenity activity 2018-19

	Designated Area	O/head Line Removed (km)	U/ground Cable Installed (km)	Expenditure (£m)
Lake District	Docker Nook-Kilnestone Hydro	0.68	0.73	0.13
	Toms Howe-Hill House Longsleddale	0.62	0.74	0.02
	Redsike-Lobbs Troutbeck	2.48	3.10	0.05
	St Patricks Church Patterdale	0.13	0.16	0.02
	Elmhowe 11kV Spur Grisedale	0.23	0.28	0.08
	Matterdale-Swineside 11kV Spur	0.90	1.15	0.11
	Goosegreen 11kV Spur Matterdale	0.82	0.99	0.02
Forest of Bowland	Closes Barn-Beatrix Dunsop Bridge	2.04	2.5	0.32
	Fellside-Merrybent Slaidburn	1.77	2.13	0.29
	Kenibus-Lamb Hill Slaidburn	0.57	0.70	0.07
	Brennand Spur Donsop Bridge	0.90	1.10	0.12
Peak District	Pob Green Uppermill	0.98	1.50	0.10
Yorkshire Dales	Sannat Hall Spur	0.50	0.68	0.08
TOTAL		12.62	15.76	1.41

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 found at the following link:

<http://www.enwl.co.uk/sustainability/reports-and-assurance>

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

We have used fluid-filled cables since the 1960s as part of our extra high-voltage distribution network at 132,000 volts down to 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 will 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 cabling and to respond quickly to leaks on legacy circuits.

We have committed in our RIIO-ED1 business plan to maintain a leakage rate of less than 30,000 litres per year by 2023. To achieve this, we have increased the length of fluid-filled cable we aim to replace from 57km to 107km which will reduce our overall fluid in service by approximately 290,000 litres. In the first three years of RIIO ED1 we have removed 44km of 33kV and 5km of 132kV fluid-filled cable taking the total removed to 49km. In 2018-19 we plan to remove a further 24km.

When leaks are detected we respond in accordance with requirements, including response times, of the joint Environment Agency and Electricity Companies Operating Code on the Management of Fluid Filled Cable Systems Issue 3, 2013.

In 2017-18 a total of 67,398 litres of oil was lost representing 6.09% of the total oil in service. We had a leak on a strategically critical 132kV circuit needed to maintain supplies to the City of Lancaster. We were not able to take the cable out of service to locate and repair the leak as quickly as usual because other work was taking place to repair severe flood damage caused by storm Desmond in 2015. We worked closely with the Environment Agency to monitor the situation and, in the event, there was no discernible environmental impact.

The data relating to our oil leakage activity can be found in worksheet E2 of the Environment and Innovation Reporting Pack in the appendices.

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 low 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 is to reduce our 2014-15 business carbon footprint (excluding losses) by 10% by the end of 2019-20. The cumulative benefits of this reduction will be the equivalent of 2,440 tonnes of CO₂ emissions saved including a reduction of 1,237,379 kWh of energy used in powering our buildings and substations and a reduction of 804,727 litres of diesel used to power the operational fleet, plant and equipment.

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.

When customers go off supply, portable generation is sometimes installed temporarily to maintain supplies. The fuel used by these generators contributes to the fuel combustion component of our business carbon footprint. This increased in 2017-18. Our carbon emissions are sensitive to severe weather events and such fluctuations are to be expected going forwards. In addition, to meet customer satisfaction expectations and better support our Priority Services customers, policy on the provision of generation has been updated to allow their wider use. This has the potential to have a negative impact on our carbon footprint and the contribution from this component is expected to further increase during 2018-19.

Our business carbon footprint (excluding losses) for 2017-18 was 20,599 tCO₂e, a reduction of 413 tCO₂e (2%) on the previous year.

This means that we have delivered an average saving of over 2,800 tonnes of CO₂ emissions per year over the first three years of the plan.

Table 4: Business carbon footprint 2017-18

Emissions	2017/18 tonne CO ₂ e	2016/17 tonne CO ₂ e
Scope 1		
Operational transport (direct labour)	3,960*	3,541
Operational transport (contractors)	3,017	3,610
Business transport – road	1,254	1,231
Fugitive emissions - SF ₆	1,237	1,259
Fugitive emissions – other	17	17
Fuel combustion	3,763	2,657
TOTAL	13,248	12,315
Scope 2		
Buildings energy usage	7,262	8,595
TOTAL	7,262	8,595
Scope 3		
Business transport – rail	21	19
Business transport – air	68	83
TOTAL	89	102
Business Carbon Footprint (exc. losses)	20,599	21,012
Losses	512,292	580,352
Business Carbon Footprint (inc. losses)	532,891	601,364

*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.



2.4.2 Sulphur hexafluoride emissions (SF6 Emitted)

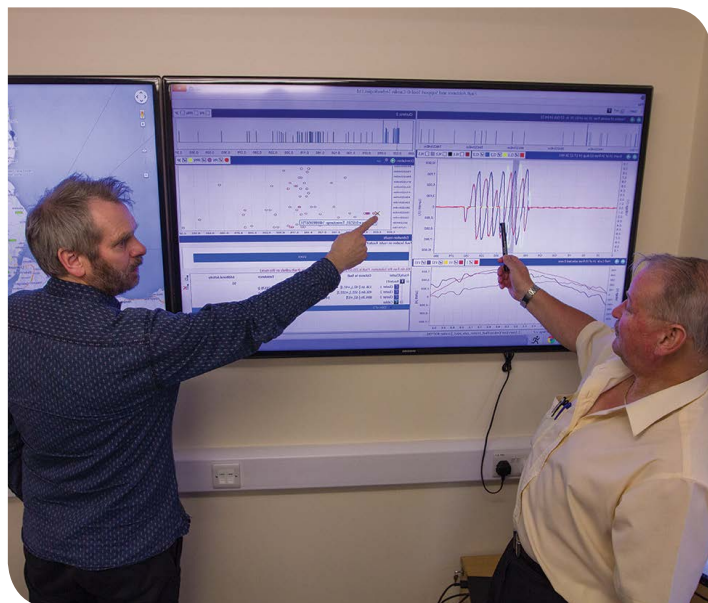
SF6 is a gas with excellent electrical insulation and other properties, which have led to its widespread use in electrical switchgear and in a number of other industrial applications. However, there is concern over any SF6 that escapes into the atmosphere since it is a potent greenhouse gas.

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 2017-18 a total of 54.27 kg of SF6 was lost from our system, with a carbon equivalent of 1,237 tCO2e. This loss equates to 0.37% of the total mass in service.

The data relating to our SF6 holding, leakage and associated carbon footprint can be found in worksheets E2 and E3 of the RIIO-ED1 Environment Report – Environment and Innovation Reporting Pack in the appendices.



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 up 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 2017-18 losses¹ were 1,457,195,550 kWh or the equivalent of 512,292 tCO2e. This was an increase of 48,745,954 kWh from 2016-17 which, together with a change in the UK government electricity conversion factor, equated to an equivalent reduction of 68,060 tCO2e.

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

¹ It should be noted that the reported losses figure is a snapshot of received data as of the date of the 2018 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	Primary transformers	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 DNO's	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 DNO's	Proactive
Unmetered supplies	Undertake regular audits of unmetered supply inventory	Proactive
Low Carbon Networks (LCN) Fund Strategy		
LCN Fund	Review and analyse the details of the LCN Fund innovation projects	Proactive

Our losses strategy can be found at the following link:

<https://www.enwl.co.uk/about-us/regulatory-information/electrical-losses/>

2 Managing our environmental impact

A summary of our activity in this area is contained in the tables below.

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

Programme/ project title	Regulatory Reporting Year			RIIO-ED1
	Distribution Losses – Justified Costs	Reduced Losses	Reduced Emissions Associated with Losses	Cumulative reduced losses to date
	£m	GWh	CO2e	GWh
Standardise use of 300mm ² HV cable	0.91	4.51	1584.17	6.92
Standardise use of 300mm ² LV cable	0.5	1.93	678.11	2.87
Proactive replacement of pre-1990 1000kVA transformers	0.96	2.42	852.17	3.39
Proactive replacement of pre-1990 800kVA transformers	1.13	0.53	185.07	0.71
Opportunistic primary transformer replacement	0.75	0.64	224.92	0.74
Opportunistic pole-mounted transformer replacement	0.01	0.08	29.11	0.13
Relevant theft of electricity action	(0.03)	2.19	769.60	6.23
TOTAL	4.23	12.3	4323.15	20.99



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 amount of losses activity in Regulatory Reporting Year and estimate for 2018-19

Programme / project title	Description of unit	Volumes in Regulatory Reporting Year	Forecast volumes for Following Regulatory Year
Standardise use of 300mm ² HV cable	km of cable	117	119
Standardise use of 300mm ² LV cable	km of cable	29	9
Proactive replacement of pre-1990 1000kVA transformers	Transformers	73	83
Proactive replacement of pre-1990 800kVA transformers	Transformers	95	109
Opportunistic primary transformer replacement	Transformers	16	17
Opportunistic pole-mounted transformer replacement	Transformers	26	16
Relevant theft of electricity	Theft cases identified	432	624

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 by 10% by 2020 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 by 10% by 2020 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 is certificated 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 19 noise-related complaints in 2017-18 compared to 30 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 operator for the north west of England we have a key role to play in enabling the transition of our region to low carbon energy and, through this, in 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 2017-18 in regard to smart grids, innovation and generally how we are fulfilling our commitment in this area.

3.1.1 Key challenges

The long term challenges our business and industry face in regard to 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 have not changed.

- 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.

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

³ 11kV and below ⁴ 33kV to 132kV

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:

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

Our innovation strategy can be found at the following link:

<https://www.enwl.co.uk/innovation/our-approach/our-innovation-strategy/>

The data relating to the benefits of using innovative solutions as a component in the strategy to accommodate expected load growth can be found in worksheet E6 of the Environment and Innovation Reporting Pack in the appendices.

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

3.1.2 Low carbon technologies connected

In 2017-18 we connected 1,539 low carbon technologies with a total capacity of 123 megawatts (MW). 1,535 of these were connected onto our secondary³ network, the majority of which were electric vehicle fast chargers. On our primary⁴ network we connected 4 low carbon technologies all of which were non-G83 distributed generation units.

The volumes of LCTs installed increased in 2015-16 and 2016-17 and was expected to continue to rise. However, reported volumes do not indicate this.

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 in the first three years of the RIIO-ED1 period is indicating an overall uptake at the end of the period that is likely to be significantly below this forecast. A challenge remains with data visibility for equipment connected beyond the meter as it relies on the end user notifying us of the installation. It can therefore be assumed that the actual number of units installed will be higher than those notified to us.

The data relating to low carbon technologies deployed can be found in worksheet E7 of the Environment and Innovation Reporting Pack in the appendices.

3.2 Progress of the innovation strategy

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.

We seek to innovate continuously across our business activities to ensure that we not only meet our obligations to our customers but also respond to their evolving needs and expectations. The world is changing as are our customers' needs and we need to innovate to meet these needs.



The world is changing as are our customers' needs and we need to innovate to meet these needs

Our approach to innovation is underpinned by the following three guiding principles:

We seek collaboration with partner organisations to work together to find innovative solutions to common problems

We aim to understand and respond to the changing needs of customers

We involve customers in our innovation work, ensuring that potential innovative solutions deliver customer benefits

Several innovative solutions have now become business as usual and are being used to reduce costs and improve quality of service.

Innovative Solutions

There are four Innovative Solutions which formed part of our business as usual activities during 2017/18:

- Transformer regeneration (combined Online Transformer Monitoring)
- LV Fault Management (Fault Support Centre and Smart Fuse Devices)
- Connection and Management of PV Clusters (LV Smart Joint)
- Demand Side Response (Catterall).

Several of these solutions are presented as separate projects. However, they are eventually 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 CBA has only been prepared for the combined solution.

3.2.1 Summary of innovative solutions deployed

Transformer regeneration and online monitoring

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 application of transformer oil regeneration (a process whereby transformer oil is cleaned through an on-site process) can result in an improvement in the overall condition of the transformer. When this is used in conjunction with enhanced transformer monitoring, this can 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 risk. It is assumed that the year in which the oil regeneration is completed is the year that the transformer would have been replaced, based their HI categorisation. 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 lifetime 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 Combined Online Transformer Monitoring in the next section.

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 transient fault management. In the event that a transient fault is detected, a smart fuse device such as a 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 it can be reasonably shown 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 reduced CI and CML 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 fault management improves customer satisfaction.

In addition, the Bidoyng 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 an enabler 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.

Within 2017/18 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. While 516 uses were made of this technology in 2017/18 compared to 807 in 2016/17, the additional reclose capability offered by the Weezap means that the number of customer interruptions saved has increased from 17,114 in 2016/17 to 40,570 in 2017/18. They also continue to provide us with further information regarding the fault location, enabled through the monitoring service managed by FSC.

Connection and Management of PV Clusters

What the solution is

As a result of the learning outcomes of the LCNF 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 and undertake further assessments.

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 a continued monitoring of the PV volumes. Specific actions are triggered when these volumes are exceeded 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.

Demand Side Response

What the solution is

Catterall Primary Substation has a single 7.5MVA transformer and a firm capacity of 5 MVA, limited by High Voltage transfer capability. The peak demand at Catterall Primary is 7.41 MVA, which exceeds the firm capacity by 2.41 MVA. It primarily supplies a water treatment works.

Catterall primary is compliant with ENA Engineering Recommendation ER P2/6. The non-compliance issue only exists when the system is operating abnormally due to the loss of the circuit supplying the transformer or the transformer itself (ie under a fault situation), as the demand exceeds the transfer capacity. Deferring the reinforcement and entering into a commercial contract with the operator of the treatment works to reduce their demand allows us to control Catterall's primary demand patterns, enabling us to remain compliant with ER P2/6 when the above scenario occurs. Purchasing Demand Side Response ensures that the demand does not exceed the capacity when the system is abnormal.

How the solution is being used

Under system abnormal conditions, we will switch out a circuit at Catterall primary to reduce the demand at the water treatment works to enable the restoration of supplies connected to Catterall primary so the transfer capacity of 5 MVA is not exceeded. The treatment works operator has agreed to have their demand reduced by 3 MVA for up to eight hours to allow time for us to identify and resolve the issue. This is a contract agreed for three years, with a per MVA payment per year, with a maximum of six events over the three year period. After three years the parties have the right to extend the arrangement on a one year rolling basis.

How the solution is delivering benefits

Demand Side Response limits the demand on Catterall primary to the transfer capacity for the loss of the transformer and with continuous monitoring provides the opportunity to defer or carry out reinforcement in the future if demand increases or arrangements change.

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/innovation/smaller-projects/network-innovation-allowance/>

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

3.3.2 Benefits and impacts

With the roll-out of the above innovative solutions in 2017-18, the following benefits have been realised:

Table 8: Innovative solutions benefits and impacts

Innovative Solution	Additions	Benefits		
		Estimated Gross Avoided Costs (£m)	CI Impact (Interruptions)	CML Impact (Minutes)
Demand Side response	0	N/A	N/A	N/A
Transformer Regeneration	7 sites	3.81	N/A	N/A
Fault Support Centre and LV Reclosing Device Installations	516 Installations	0.968	40,570	3,651,300
Connect and Manage PV Clusters on LV Networks	1,067 new PV installed	0.04	40	2400

We have not applied for any funding under the Incentives Rollout Mechanism and so there is no data in worksheet E8 of the Environment and Innovation Reporting Pack in the appendices.

3.3.3 Smart metering

Although the energy supply companies are responsible for the rollout of smart meters, we are preparing to maximise the benefits from the data they will provide in the future.

Our strategy is to help customers and suppliers with the transition to the new meters, for example by upgrading our service positions where necessary to accommodate a smart meter.

At the same time, we will train our employees and upgrade our IT systems so we can use smart meter data for the benefit of our customers. We are also working with suppliers to ensure customers are properly informed about smart meters.

There is now a total of 832,709 smart electricity meters installed in our distribution service area.



In 2017-18 we incurred £1.80m in IT costs covering the procurement, implementation and commissioning of the gateway infrastructure connecting our IT systems to the Data and Communications Company's (DCC) central systems as part of the Smart Meter Implementation Programme and required by the Smart Energy Code. Connection to DCC's central systems allows access to smart meter data generated from alerts and service requests which, in the longer term, will enable us to manage our network more effectively and cost effectively for our customers.

We also paid £1.35m in communication licensee costs to the DCC, as required by the Smart Energy Code and defined by DCC's published charging methodology statement.

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 smart meter programme has not yet rolled out to the extent that benefits are identifiable. However, in 2018-19 we are hopeful that the roll-out will have progressed to the point where we will be in a position to quantify realised benefits.

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 RIIO-ED1 RIGs 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/>

Regulatory Reporting Pack and Commentary:

- Environment and Innovation Reporting Pack_v4.0 2018 _FINAL_19.07.18 REVIEWED
- 2017-18 Environment and Innovation Commentary – FINAL 19.07.18 REVIEWED

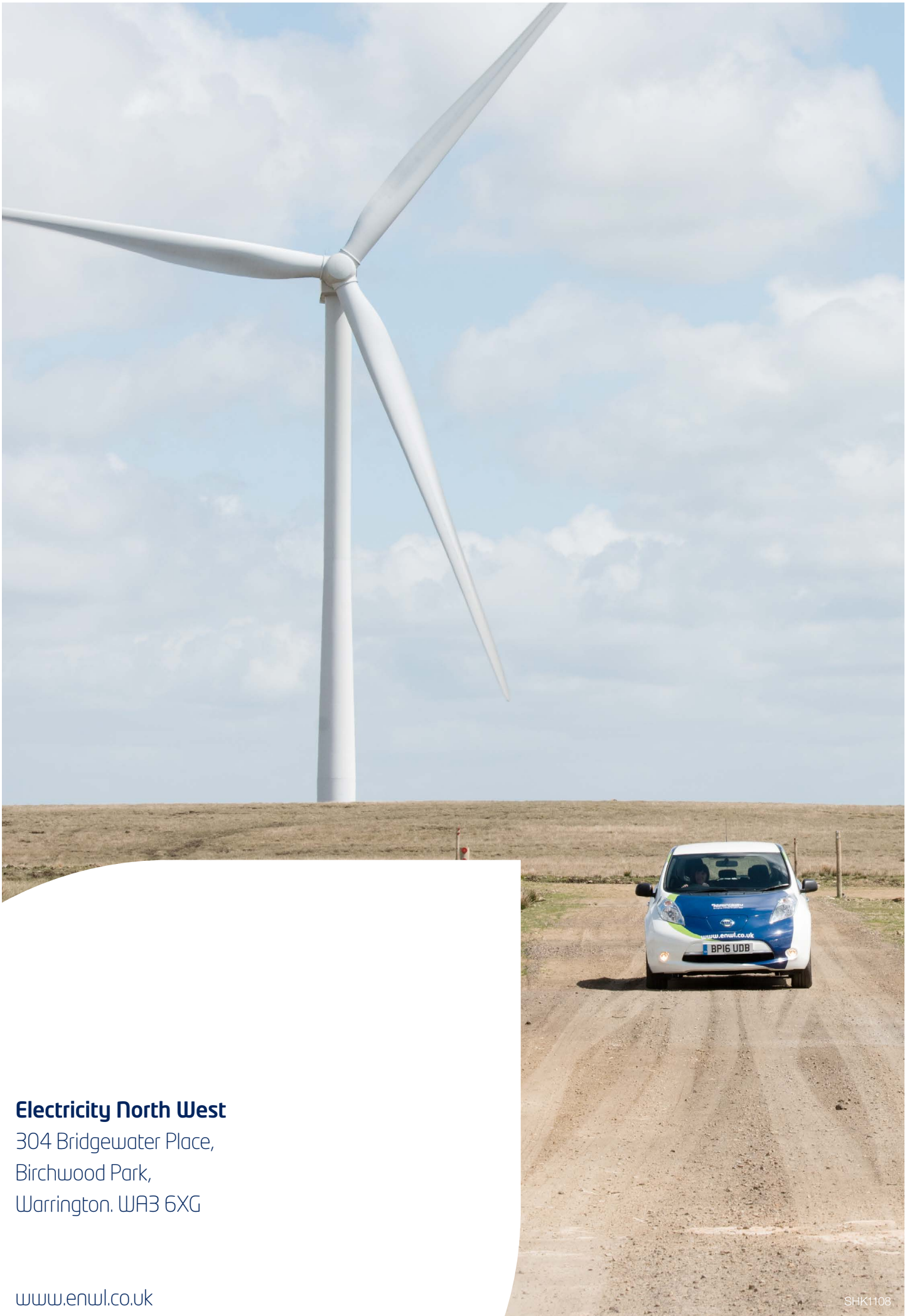
Cost Benefit Analyses (Losses):

- 2018 Install 300sqmm HV Cable versus 185sqmm HV
- 2018 Install 300sqmm LV Cable Versus 185sqmm LV
- 2018 Opportunistic 200kVA PMT Replacement CV1 CV2
- 2018 Opportunistic 200kVA PMT Replacement CV7
- 2018 Opportunistic 200kVA PMT Replacement Other
- 2018 Proactive 800kVA GMT Replacement CV21
- 2018 Proactive 1000kVA GMT Replacement CV21
- 2018 Programme 23MVA Replacement
- 2018 CBA for E4 Theft of Electricity

Cost Benefit Analyses (Innovation):

- Demand Side Response FY18 RIIO ED1 CBA FY18_v1.0
- LV fault management FY18 RIIO ED1 CBA v1.0
- PV Connect & Manage FY18 RIIO ED1 CBA v1.0
- TX Regen CBA FY18 RIIO ED1_v0.1





Electricity North West

304 Bridgewater Place,
Birchwood Park,
Warrington. WA3 6XG

www.enwl.co.uk