electricity north west

Bringing energy to your door

Fourth Round of Climate Change Adaptation Reporting

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Electricity North West Summary

1. Introduction

This report has been prepared in response to the request from the Minister for Nature in December 2023 asking us to report on the risks that we face due to the changing climate and the actions we are taking to mitigate those risks. This Climate Change Adaptation Report will help inform the government's assessment of future risks across all sectors.

Electricity North West have previously submitted reports in 2011, 2015 and 2021 meeting the requirements of the Climate Change Adaptation Reporting Power within the Climate Change Act 2008.

In order to co-ordinate with the production of the Climate Change Risk Assessment (CCRA4) this fourth round report is being published only three years since our last report. Consequently, this report focuses on the actions that we have taken since the last report, rather than a full review of all potential risks, but we do look at some of the learning since our last report, particularly that related to Storm Arwen.

Our report is supported by the ENA Engineering Report – "4th Round Climate Change Adaptation Report" published in December 2024 which is attached as an appendix to this document. Electricity North West were a leading member of the ENA working group which produced this cross-sector engineering report.

Whilst the ENA report gives an overall view of the national picture for energy network companies, this document is designed to provide a summary of the activities we are undertaking within Electricity North West to adapt to the consequences of climate change.

Contents

2. The role of Electricity North West and the potential impact of Climate Change

Electricity North West is the electricity distribution company for the North West of England. We own and operate the network that transports electricity from the National Grid and local generators to our customers' homes and businesses.

As an electricity distribution company, we have two main functions:

- Ensuring that our network has sufficient capacity so that all our demand and generation customers can connect to the network at a reasonable cost; and
- Ensuring that we have a reliable network so that our customers are able to utilise that capacity, with the minimum number of interruptions.

We recognise that it is not economically viable to prevent all faults and interruptions to supply, but we work to minimise the number of failures and when we do have a fault we aim to restore the supply to customers as quickly as possible.

As these two measures are so important to us and our customers, we report on our performance to our regulator each year and we are incentivised to minimise the frequency and duration of power cuts.

When looking at how we adapt to the impact that Climate Change could have on our business we are primarily looking at how the changes in climatic conditions will affect the provision of capacity and the number and length of interruptions. This report necessarily focuses on the adaptation measures required to maintain this provision.

Our role as a distribution company means we also have a responsibility to ensure that we have the infrastructure in place to facilitate the move to a Net Zero society, both for ourselves and our customers. This is not covered directly in this report, but details of our work can be found on our website[1].

As an electricity distribution company we do not own any generation capacity, other than that used for fault restoration. We do not receive payment directly from customers to use our network; customers will pay their electricity supply company who will pay us a Distribution Use of System charge to "transport" their electricity through our network.

As a monopoly company, the amount that we are allowed to recover from customers is set at periodical Price Reviews. The current price review period is known as RIIO-ED2[2] and runs from 2023 to 2028. Previously DPCR5[3] ran from 2010 to 2015 and RIIO-ED1, ran from 2015 to 2023. You will see references to these periods throughout this document. Most data and graphs will be presented for the fourteen years from the start of DPCR5 to the first year of RIIO-ED2.

Unless otherwise stated all monetary values in this report will be presented in today's money.

[1] https://www.enwl.co.uk/future-energy/facilitating-net-zero/

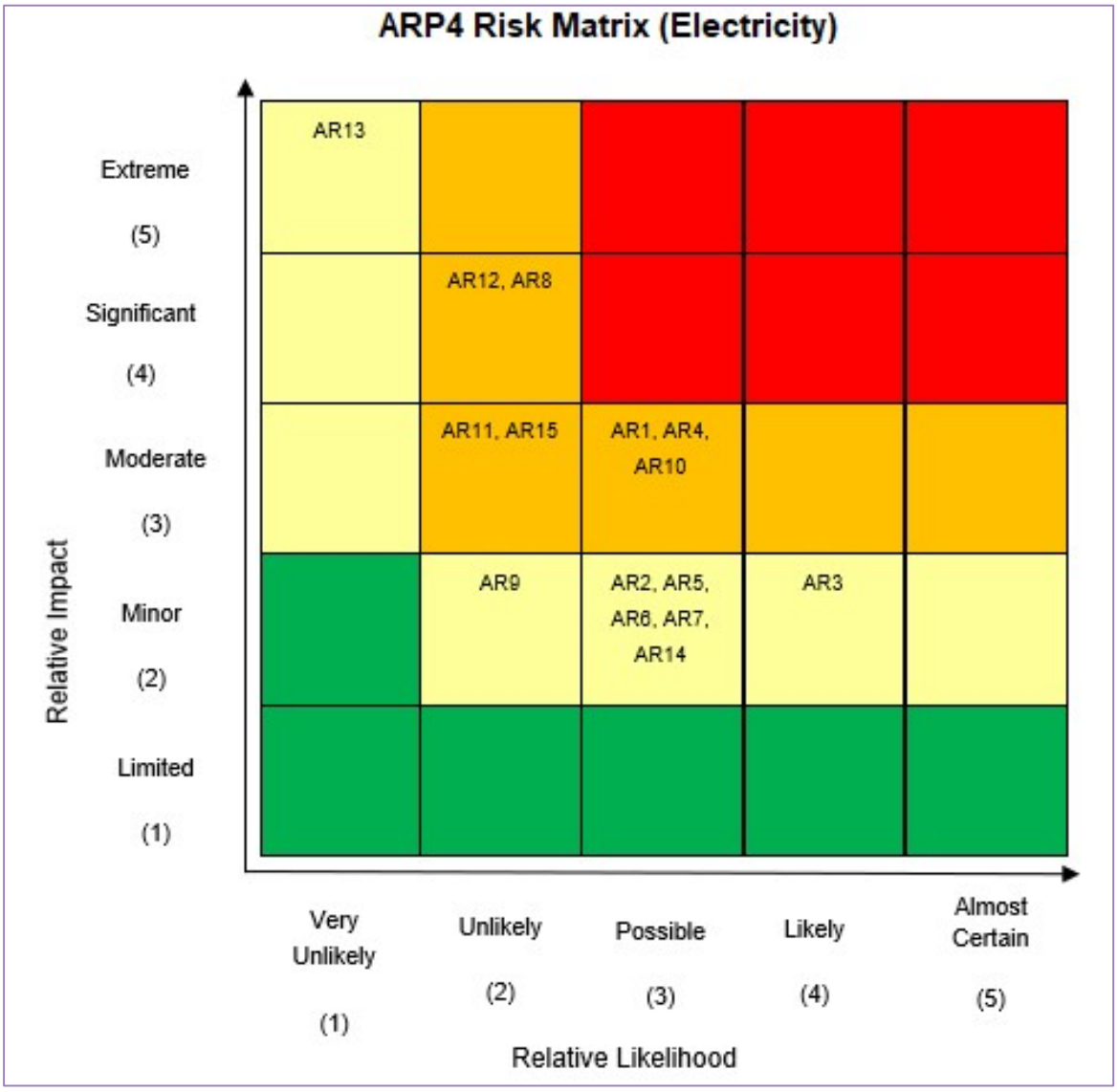
[2] The second Electricity Distribution (ED) price review under the RIIO framework, where RIIO stands for setting Revenue using Incentives and Innovation to deliver Outputs.

[3] The fifth Distribution Price Control Review

In December 2021 we published our Climate Resilience Strategy[4] for the first time as part of our RIIO-ED2 Price Review submission. Our adaptation plans play an important part in that strategy.

3. Industry assessment of risk

Through the ENA CCARWG we have re-assessed the risks identified in our first three industry reports to give the following national risk assessment.



[4] https://www.enwl.co.uk/globalassets/about-us/regulatory-information/riio2/december-final-submission/annexes-final/annex-11-climate-resilience-strategy.pdf

The key to the matrix is:

Code	Description	Relative Likelihood	Relative Impact
AR1	Overhead line conductors affected by temperature rise	Possible	Moderate
AR2	Overhead line structures affected by Summer drought and consequent ground movement	Possible	Minor
AR3	Overhead lines affected by interference from vegetation due to prolonged growing season	Likely	Minor
AR4	Underground cable systems affected by increase in ground temperature	Possible	Moderate
AR5	Underground cable systems affected by Summer drought and consequential ground movement	Possible	Minor
AR6	Substation and network earthing systems adversely affected by summer drought conditions	Possible	Minor
AR7	Transformers affected by temperature rise	Possible	Minor
AR8	Transformers affected by urban heat islands and coincident air conditioning demand	Unlikely	Significant
AR9	Switchgear affected by temperature rise	Unlikely	Minor
AR10	Substations affected by river (fluvial) flooding due to increased winter rainfall.	Possible	Moderate
AR11	Precipitation - Substations affected by pluvial (flash) flooding due to increased rainstorms in Summer and Winter	Unlikely	Moderate
AR12	Precipitation - Substations affected by sea flooding due to increased rainstorms and/or tidal surges	Unlikely	Significant
AR13	Precipitation - Substations affected by water flood wave from dam burst	Very Unlikely	Extreme
AR14	Overhead lines and transformers affected by increasing lightning activity	Possible	Minor
AR15	Overhead lines and underground cables affected by extreme heat and fire smoke damage	Unlikely	Moderate

So nationally we have assessed that there are no ‘Significant’ or ‘Extreme’ impacts which are likely to occur and the only risk that is likely to occur is being managed so the impact is classified as minor.

This national assessment has informed our assessment and strategy at Electricity North West.

4. Conclusions from our first three rounds of reporting

Since the publication of our previous reports we have continued to work with colleagues in industry and academia to identify potential risks from climate change. The publication of the updated UK Climate Projections in 2018 (UKCP18), to replace UKCP09, gave us an opportunity to review our previous analysis. Whilst UKCP18 provides greater granularity of forecasts over a range of scenarios, there have been no significant changes in the risks presented by the changing climate since 2011, so the challenges we face today are largely the same as those we faced thirteen years ago. These were summarised in our 2011 report as follows:

Extract from the covering letter to our Climate Change Adaptation Report - June 2011

At Electricity North West we are aware that climate change will have an impact on the infrastructure that we are responsible for. We are undertaking work to meet current challenges and we are taking part in a number of research projects to quantify the impact in the future.

However, the impact of climate change will be just one of the drivers for change on our network over the next forty years. The move to the low carbon economy with the introduction of smart grid technology, the connection of new generation and the growth in use of electric vehicles will lead to major changes. This will take place at the same time as we are replacing aging assets.

Consequently, we expect that much of the work to adapt to climate change will be built into our ongoing business-as-usual procedures.

The main potential impacts identified for Electricity North West can be summarised as follows:

- **Flooding** – we expect that the number of flooding incidents will increase, and we are currently taking action to protect vulnerable substations from floods.
- **Increase in temperature** – as temperatures increase the performance of our equipment will change. Typically, we expect this to reduce the capacity of the equipment by less than 0.2% per year. We expect demand on our network to increase by up to 2% a year in the long term, so the climate change adaptation activity will be built into our programme to meet increased load.
- **Increased vegetation growth** – change in climate is expected to lead to an acceleration in the rate that trees grow, so we will need to modify our inspection and cutting programmes to minimise the interference from trees on our overhead lines.
- **Resilience to extreme events** – whilst all electricity networks can be vulnerable to lightning and high winds there is currently no evidence to suggest that the intensity of these events will increase in the future. We will continue to work with industry experts to monitor research in this area.

With the exception of flooding we expect that the impacts on our business from climate change will be gradual, largely indistinguishable from other factors, and that we will be able to deal with them with a long-term approach. We will continue to work with our colleagues in the industry and other expert bodies to regularly assess our vulnerability to climate change, and we will adapt our policies and procedures accordingly when required.

Putting this assessment into practice meant that our major focus in adapting to climate change over the last thirteen years has been the development of defences against flooding.

As can be seen from the 2011 extract, our expectation was that storms would become more frequent, but it wasn't forecast that their intensity would increase. Consequently, we did not focus on the impact of storms, as we expected the standards in place to be sufficient. Following Storm Arwen and subsequent reviews we have re-assessed whether those standards are appropriate in a world where we are increasingly reliant on a reliable and resilient electricity supply.

We have always been active in protecting our network from trees that may fall during high winds and strengthening our overhead line networks, both through the ENA committee which reviews the guidance on vegetation management and through the delivery of our tree cutting programme. Following the publication of reports into Storm Arwen and our application for funding under the Storm Arwen Re-opener provision in our RIIO-ED2 licence, we are now actively developing models to identify priority areas for strengthening our overhead network and providing more resilient supplies to our rural customers.

Climate change, climate change adaptation and flooding are all included as risks in our corporate risk register. The register is reviewed regularly at the highest levels within the company. As flooding is one of our highest scoring risks, updates are provided to the Chief Executive and his leadership team on a quarterly basis.

Also, since the initial reports were published we have become increasingly aware of the danger from wildfires and the increasing dependence on telecommunications to manage a more active network. We will examine those briefly in this update.

5. Working with others

Our sector already has well-established co-ordination arrangements to respond to major events. This includes liaison through the Energy Networks Association (ENA), collaborative work on co-ordination with other sectors and mutual aid and support arrangements. Where specific risks are identified, we work together to develop and implement the appropriate response through new or revised technical approaches or specifications. We are seeking to strengthen these co-ordinating actions and to reach out further to other sectors and infrastructure operators who are affected by the same impacts to ensure we have included whole systems thinking into our adaptation actions.

The Climate Change Adaptation Reporting Working Group (CCARWG) was formed in 2010 as an ENA group to develop the industry wide Climate Change Adaptation Report. This group was superseded by the Climate Change Resilience Group (CCRG), established in 2021 under the auspices of the ENA, "to develop an energy industry strategy to assess, manage and mitigate the impact of climate change on electricity network assets and operation".

Whilst the Climate Change Adaptation Reporting Working Group (CCARWG) met for the sole purpose of developing the industry adaptation report, the CCRG builds on this work to develop strategies, review scientific evidence, engage with stakeholders, produce guidance and investigate the introduction of metrics for resilience. Currently there are no nationally agreed metrics for the resilience of a network. A major focus of the CCRG is to understand what a meaningful measure would be and how it would be applied.

The CCARWG was reconvened in December 2023 to produce the ENA report which is an annex to this document.

More locally, we have worked closely with regional partners and stakeholders in supporting their development of resilience plans and also collaborating through our Local Resilience Forums (LRFs). We will encourage the further development of this multi-agency working to ensure not only that our emergency planning is aligned, but also that the steps we take to assess and respond to adaptation risks are co-ordinated and aligned for best societal impact.

6. Providing capacity

Monitoring capacity

As noted in the introduction, one of our primary functions is to ensure that there is sufficient capacity on the network to meet the needs of our customers.

We measure the utilisation of each of our major substations using Load Indices (LI) based on the ratio of peak demand to firm substation capacity and the amount of time any substation exceeds its firm capacity. An overloaded substation will still function effectively, but persistent overloading may shorten the life of the asset.

Using the percentage loading and the hours over capacity we allocate substations to different Load Index Bands using the following criteria:

Ranking	Loading (percentage)		Duration Factor (hours)	
	Lower bound	Upper bound	Lower bound	Upper bound
LI1	0%	<80%	n/a	n/a
LI2	80%	<95%	n/a	n/a
LI3	95%	<99%	n/a	n/a
LI4	99%	n/a	0	<9
LI5	99%	n/a	9	n/a

Using these measures, we can prioritise the substations that we will need to reinforce immediately as they are overloaded and plan ahead so we know which substations will require reinforcement in the next few years.

Each year we report the number of substations in each band and the number of customers that they serve to our regulator Ofgem. In our 2024 return we reported the following figures:

	Substation Count			Number of Customers		
Substation primary voltage	132kV	132kV	EHV	132kV	132kV	EHV
Secondary voltage	EHV	HV	HV	EHV	HV	HV
LI1	54	6	331	2,092,295	67,798	2,272,564
LI2	5	-	27	286,998	-	204,028
LI3	-	-	-	-	-	-
LI4	-	-	-	-	-	-
LI5	-	-	5	-	-	11,084
	59	**6**	**363**	**2,379,293**	**67,798**	**2,487,676**

So, we can see that less than 0.5% of our customers are served by major substations where the peak loading is currently above 95%. We plan to reinforce these five substations during this price review period and will continue to monitor the loading at all substations.

We expect that demand will grow significantly over the next decades, associated with economic growth, but also due to the uptake of low carbon technologies such as electric vehicles and heat pumps as we move towards Net Zero. These forecasts are published on our website[5] in our Distribution Future Electricity Scenarios (DFES) and Network Development Plan (NDP).

Combining the knowledge of current loading with forecasts of demand for each substation we can develop a programme of interventions including network and non-network (eg flexibility) solutions so that we always provide sufficient capacity.

The impact of climate change on capacity

The provision of capacity relates directly to the following three risks from the national risk matrix:

- AR7 - Transformers affected by temperature rise
- AR8 - Transformers affected by urban heat islands and coincident air conditioning demand
- AR9 - Switchgear affected by temperature rise

As the climate changes and temperatures increase the performance of our equipment will change. Typically, we expect this to reduce the capacity of the equipment by around 0.2% per year.

The consequence of this is that we will have to reinforce our substations at a slightly quicker rate, which we will build into our long-term assessment processes, but this impact is far outweighed by the pressure to provide new capacity as we transition to Net Zero.

7. Monitoring and evaluation of network reliability

Recording Faults

As an electricity distribution company, we have a comprehensive system of recording and reporting the occurrence of faults and their causes. Each year we provide a report to our regulator, Ofgem, giving details of each fault which causes a customer interruption of over three minutes, showing the location, numbers of customers interrupted, their time off supply and the cause of the fault.

Using our fault data, we can monitor how weather and climate is affecting the reliability of our network, which enables us to identify trends and respond accordingly. We have been recording data in this format since 1984 so have a significant dataset to interrogate. We are aware that the quality of this data has improved significantly since 2001 so place more reliance on data for the last twenty years. As noted earlier, data in this document will be presented for the last fourteen years since April 2010.

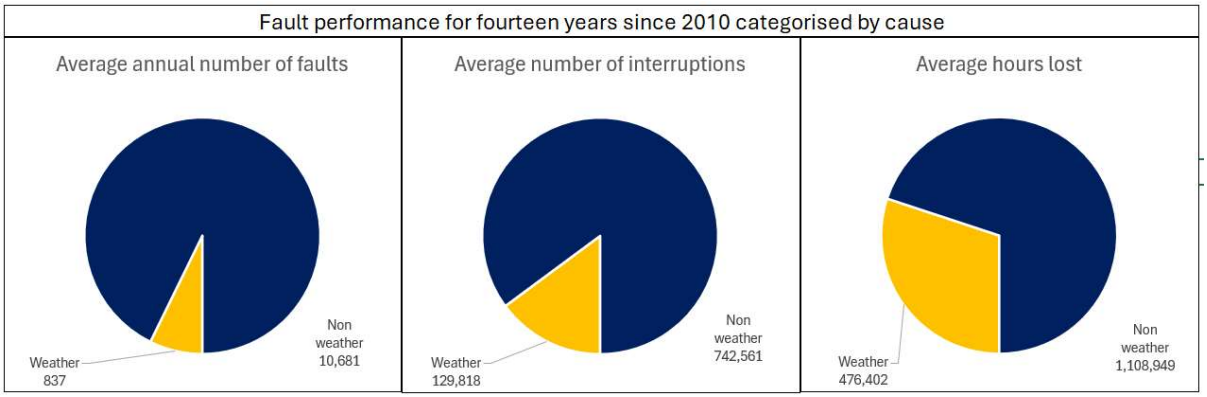
[5] https://www.enwl.co.uk/get-connected/network-information/dfes/

We allocate faults to 76 different cause categories, eleven of which relate specifically to the impact of weather and trees.

For some faults there may be more than one reason for the outage. We will record a Direct Cause and a Contributory Cause for each fault, but it may be a matter of judgement for the individual engineer of what is judged to be the main cause. All fault analysis in this report is based on the Direct Cause only.

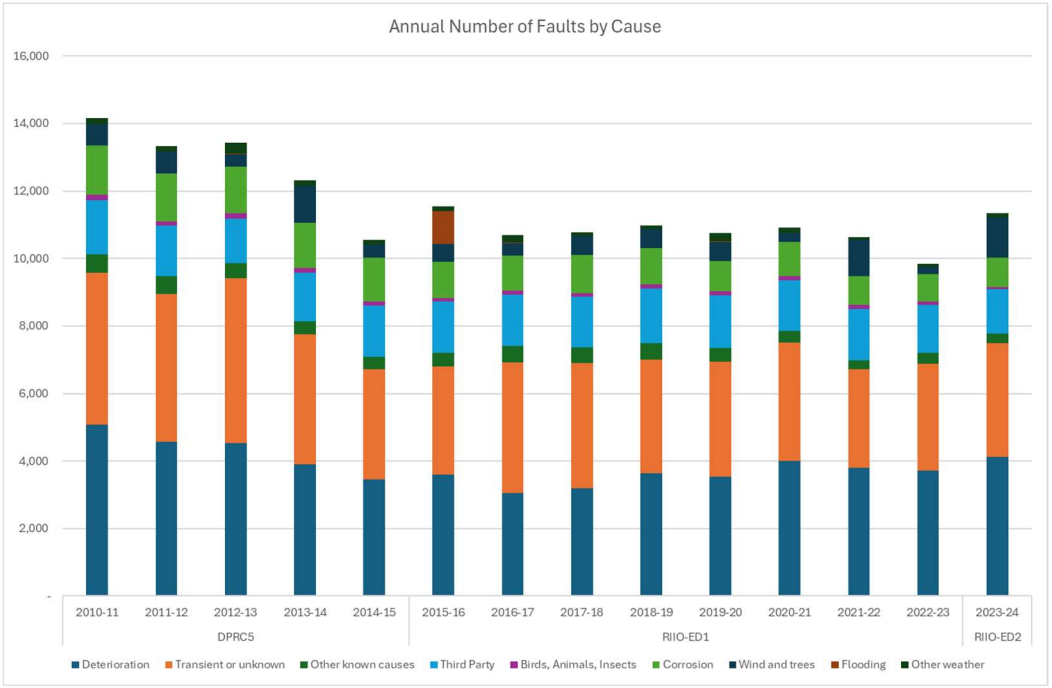
For the purpose of this analysis we have classified corrosion as an environmental cause rather than a weather impact.

On average we have around 11,500 faults each year. The following charts groups those faults into those caused by weather and those resulting from other causes:



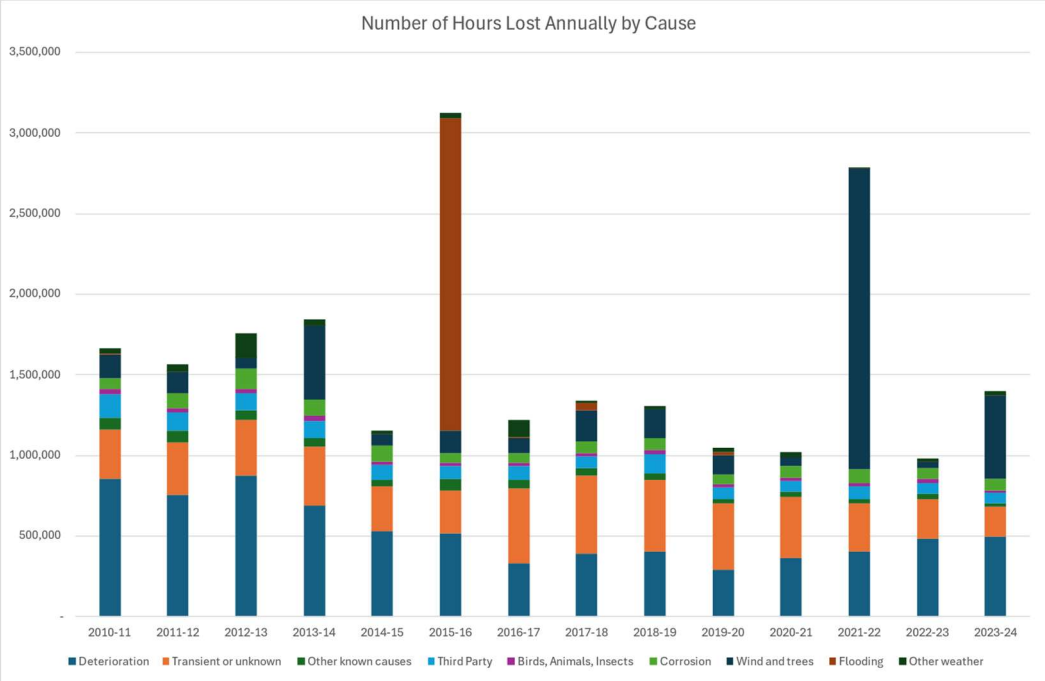
The first chart shows that 7% of our faults since 2010 have weather related causes, but they result in 15% of our customer interruptions and 30% of the customer hours lost.

So the charts show that although the incidence of faults related to weather is relatively low, the impact on our customers can be very high, but this is not a consistent picture across the fourteen years. If we look at the figures on an annual basis we get the following charts:



Generally speaking our performance on faults is improving, but we can see a significant number of faults due to flooding in 2015-16 and due to wind and trees in 2013-14, 2021-22 and 2023-24.

These faults are likely to lead to a greater number of individual interruptions and often have much longer outages. The chart below shows the total hours that customers were without power and clearly illustrates the impact of Storms Desmond, Eva and Frank in 2015-16, Storm Arwen in 2021-22 and Storms Debi and Isha in 2023-24.



It is important to note that despite the relatively high number of hours lost, the availability of our network never fell below 99.994%

Because of the potential impact of flooding and winds and trees on our network, these are the two issues that we are currently prioritising.

8. Managing the risk from flooding

The risks posed by flooding

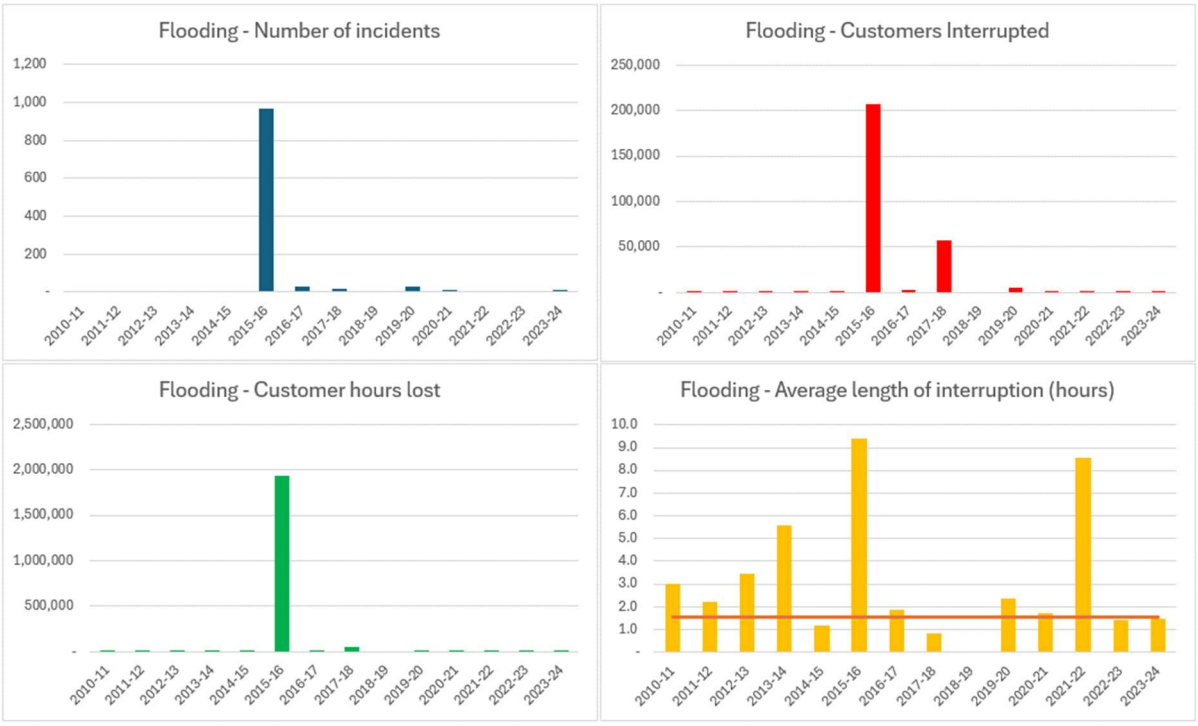
In the national risk assessment we identify four risks related to flooding:

- AR10 - Substations affected by river (fluvial) flooding due to increased winter rainfall.
- AR11 - Precipitation - Substations affected by pluvial (flash) flooding due to increased rainstorms in Summer and Winter
- AR12 - Precipitation - Substations affected by sea flooding due to increased rainstorms and/or tidal surges
- AR13 - Precipitation - Substations affected by water flood wave from dam burst

This recognises the impact that flooding is already having on our network and the increasing future risk.

In the last fourteen years there have been over 1,100 faults caused by flooding in our area. The impact of these faults will range widely, from those that affect a handful of customers for a short time to the flood during Storm Desmond in December 2015 which left around 60,000 of our customers without electricity for up to 48 hours. The variation in annual impact is shown in the following sets of charts.

The charts show that interruptions due to flooding are relatively rare, but their impact can be high:



In 2015/16, the serious flooding caused by Storms Desmond, Eva and others led to nearly 1,000 faults resulting in 200,000 customer interruptions, and on average those customers were off for over nine hours. The average interruption length for a 'non-weather' event (shown as an orange line in the fourth chart) is 1.5 hours, but as the yellow bars show, when we have a flooding event the interruptions are generally longer.

Consequently, we recognise flooding as the first tangible impact of Climate Change to affect our network, so it is the main focus of our adaptation programme.

Our approach to flood risk

Our approach to managing the risk of flooding has been guided by the Energy Networks Association's (ENA) *Engineering Technical Report ETR 138 - Electricity Substation Resilience to Flooding*. This sets out industry guidance on:

- standards of resilience
- how to take account of increasing risk due to climate change
- methods of assessing the likelihood and impact of flooding
- measures to reduce flood risk
- cost-benefit analysis of measures.

Electricity North West was an integral part of the ENA group which developed ETR 138, working with representatives from other network companies, Ofgem, DECC (prior to introduction of BEIS and DESNZ), the Environment Agency (EA), Scottish Environment Protection Agency and the Met Office.

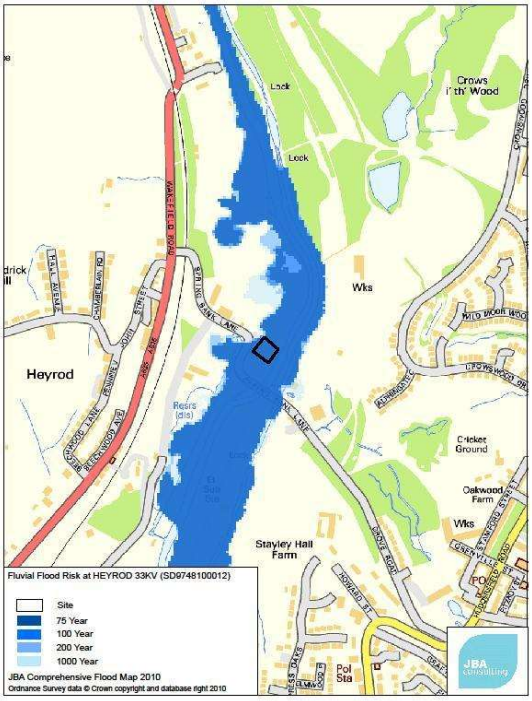
Following ETR 138 guidance we use the Environment Agency Flood Maps and other supporting data to identify major substations that are at risk of flooding. The EA maps show areas that would be affected by flooding, if there were no defences, categorised as follows:

- flooding from a river by a flood that has a 1 per cent (1 in 100) or greater chance of happening each year.
- flooding from the sea by a flood that has a 0.5 per cent (1 in 200) or greater chance of happening each year;
- a major flood, with up to a 0.1 per cent (1 in 1000) chance of occurring each year.
- areas where flooding from rivers and the sea is very unlikely. There is less than a 0.1 per cent (1 in 1000) chance of flooding occurring each year.

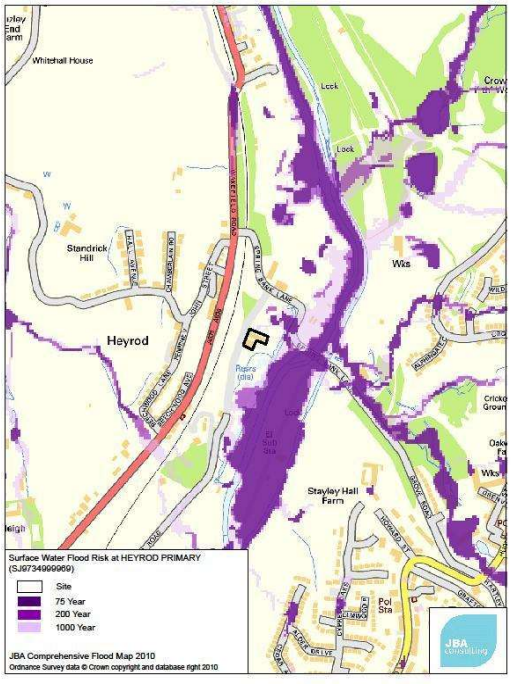
We will then plan our work programme to prioritise those substations where the largest number of customers are at the greatest risk of interruptions to supply due to flooding.

The diagrams below show examples of flood risk maps for a substation in Stalybridge, illustrating both the fluvial risk from streams and rivers and the pluvial risk due to surface water in periods of heavy rain.

Fluvial flood risk at Heyrod Primary



Pluvial flood risk at Heyrod Primary



Defence against flooding

The type of flood defence to be deployed will depend on the flooding risk and the layout of the substation to be protected. It may take the form of a waterproof membrane, such as the one protecting the switchgear house in the following illustration:

or we may increase the height of a bund wall as in the picture below. The bund wall will originally have been built to protect against oil escaping into the environment if a leak occurs. By increasing the height of the wall, it will also protect against flood water entering the substation and affecting the equipment inside the wall.

Following the Lancaster flooding incident in 2015 we decided to remove the risk by raising the substation by 3.6m to 11m above sea level as shown in the following image.

We may also choose to improve the interconnectivity between sites, so that if a substation is flooded the customers in that area can be supplied from another substation.

Our approach for many years was to only employ permanent flood defences at our major substations, connected at 132kV and 33kV. If flooding occurs at lower voltages it will usually be the case that the communities that those substations serve will also be flooded, so for safety reasons we will disconnect those properties from the electricity supply. Once the flooding has subsided we will then check that every property is safe before re-energising the supply. This will involve an engineer entering each property individually.

Our experience in flooding incidents in Carlisle in 2005 and Cockermouth in 2009 was that for the lower voltage substations we are generally able to repair or replace any damaged equipment before customers' premises have been dried out sufficiently to be re-connected to the network. However, during subsequent floods in 2015 we identified a number of HV substations that were vulnerable to highly localised flooding so we are proactively protecting these substations.

We do have the ability to deploy temporary flood defences when we receive a warning from the Environment Agency of a flood that may affect one of our substations. This is illustrated in the picture below showing a HV substation in Burnside, Carlisle, being protected from flooding in January 2015.

In addition to the basic level of protection provided by sand bags, we have temporary flood protection equipment located at seven of our major sites which can be relocated as required. Additional support from our contractors is also available through our civil framework contracts during periods of heightened risk identified though weather warnings and flood alerts.

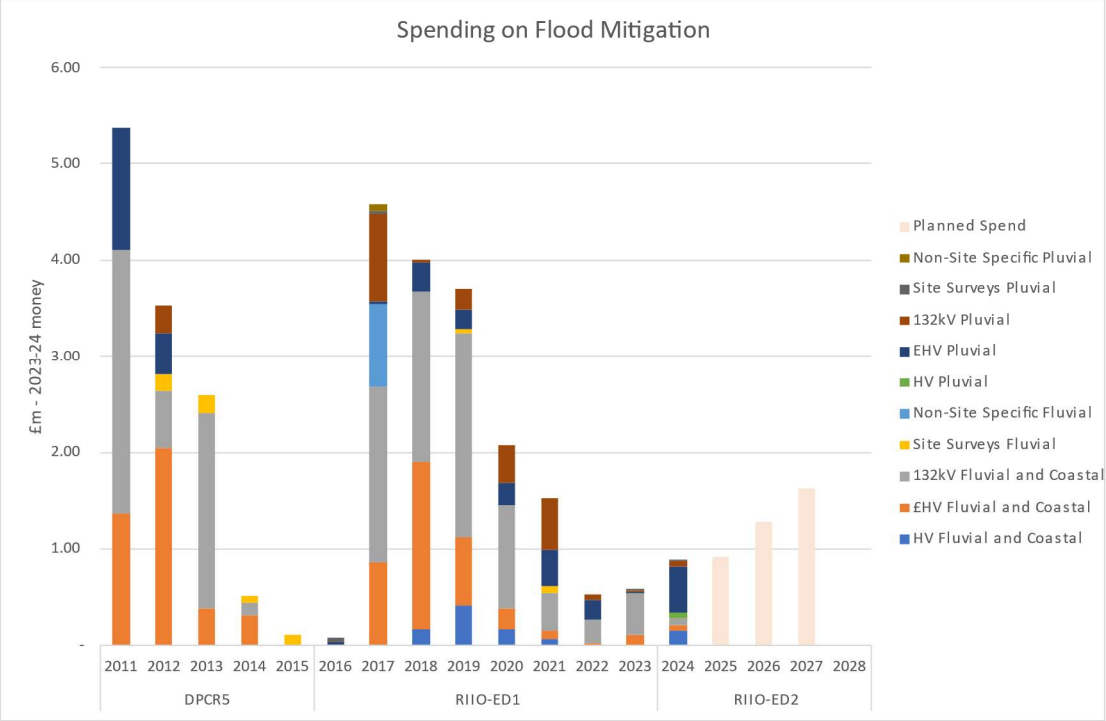
Financing our programme of work

As a monopoly network company our income is regulated. Our allowed revenue is agreed at periodic price reviews, based on our planned programme of works. Because our economic regulator, Ofgem, was involved in the development of ETR 138, they are fully aware of the issues that we are facing from flooding and the processes that we are following to mitigate the risks.

Consequently, in the last three price reviews, the regulator agreed that our submission for flooding expenditure was appropriate and made no adjustments in calculating our allowances.

Since 2010 we have spent £30m mitigating flooding risk at 67 major and 15 HV substations protecting all major substations to at least a 1 in 100-year flooding risk in line with ETR 138. This will include provision for the forecast impact of future climate.

Our expenditure profile for flooding schemes over the last fourteen years and the forecast for the next four years is shown in the following chart.



In preparation for our RIIO-ED2 submission, we engaged a consultant to carry out flood risk assessments for our portfolio of 524 grid and primary substations in line with ETR138. This assessment incorporated the revised and updated flood data from the Environment Agency, the National Flood Resilience Review[6] recommendations for assessing primary substations supplying more than 10,000 customers to a higher 1 in 1,000 year flood risk, and the remedial and mitigation works we have already completed at some of our sites.

The first stage of the assessment was a desktop exercise which identified 300 substations with a potential flood risk. More detailed flood mapping of these and comparing with existing levels of protection, followed by some site visits resulted in the production of 44 detailed flood risk assessments. From these we have identified 36 sites that will require flood mitigation in RIIO-ED2.

Electricity North West Business Plan Output commitments

In our price review submission for RIIO-ED1, the Well Justified Business Plan[7], we made forty commitments to our customers which we delivered in RIIO-ED1, known as Business Plan Outputs. They were developed following stakeholder consultation and reflect the obligations placed on us as a distribution business.

Our Business Plan Output for flood risk mitigation read as follows:

> **Flooding risk** – we will continue our programme of protecting substations against the risk of flooding. All our major substations identified as being at risk will be protected against a once in 100-year flooding risk (in line with the national specification ETR 138) by the end of RIIO-ED1.

[6] National Flood Resilience Review (publishing.service.gov.uk)
[7] http://www.enwl.co.uk/about-us/regulatory-information/business-plan

For the current RIIO-ED2 price review period we included a series of Benefits in our Business Plan[8], including a successor proposition on flooding which commits to:

> **Protect 36 sites from risk of flooding in a 1 in 100-year storm event**
>
> This programme will increase flood protection to 15 existing substation defences and install defences at 21 newly identified as at risk serving 345,000 customers at a forecast cost of £3.6m. Its completion means that all of our major substations will be protected to at least 1 in 100-year flood risk, including assumptions on future climate change impacts.

The work on the fifteen existing sets of defences will improve those defences to protect against 1 in 200 and 1 in 1,000-year storm events.

We published our progress against this target each year as part of our obligation to report on all our output commitments[9].

Future flooding plans

Climate change projections indicate that the risk of flooding will continue to rise throughout the coming century. Whilst we are satisfied that our current programme will protect our assets to recommended levels, we will continue to review the risks from flooding as new climate projections are published and the Environment Agency updates its flood maps.

9. Vegetation management

Vegetation management is an important area of work because falling trees and branches interfering with overhead lines can be a major cause of faults, particularly in stormy weather. We currently spend around £8m annually on cutting and felling trees, but still experience around 130 tree-related faults each year under normal weather conditions.

We have two programmes of vegetation management, which are referred to by the names of the technical guidance documents we follow: ENATS 43-8, which focuses on safety compliance, and ETR 132, which focuses on network reliability.

- ENATS 43-8 is the Energy Networks Association Technical Specification for Overhead Line Clearances, published in 2004. Under this programme we cut back vegetation to meet legal requirements for the clearance from overhead lines, with the intention that we would normally return every five years to ensure safety compliance.

- ETR 132, *"Improving Network Performance Under Abnormal Weather Conditions by Use Of A Risk Based Approach To Vegetation Management Near Electric Overhead Lines",* deals specifically with the risk of disruption due to falling or uprooted trees in storms. This will generally require a higher level of cutting or complete removal of the tree.

[8] https://www.enwl.co.uk/globalassets/about-us/regulatory-information/riio2/december-final-submission/our-plan-to-lead-the-north-west-to-net-zero-2023-28.pdf

[9] Our latest report can be found here (Flooding is commitment #30) - https://www.enwl.co.uk/globalassets/about-us/regulatory-information/documents/business-plan-committments-report/business-plan-commitment-report-2024.pdf

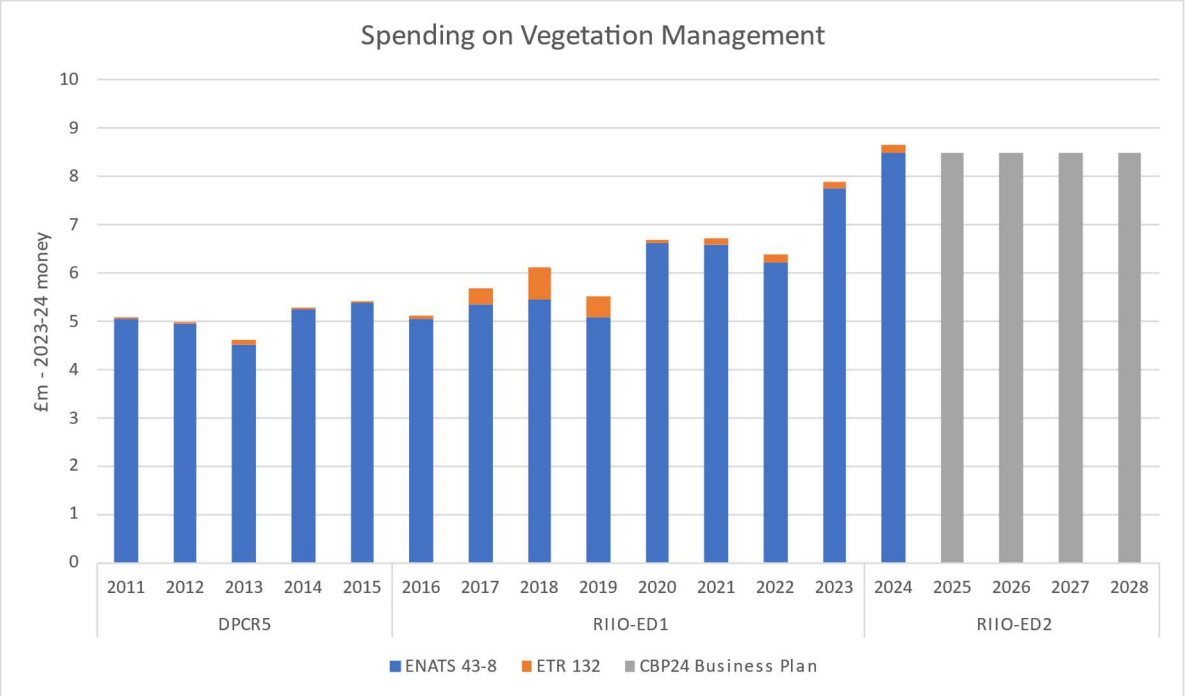
ENATs 43-8 is our 'routine' programme of cutting back trees to avoid contact with overhead lines. In our initial Climate Change Adaptation Report we observed that climate change could cause an acceleration in vegetation growth, which would lead us to modify our inspections and tree cutting programme. Current observations are that we are beginning to see evidence of sustained increase in vegetation growth, so we have started to increase the frequency of cuts.

ETR 132 is a specific programme to reduce the risk of trees falling into lines in stormy conditions. Since the programme started in 2009 we aim to make 0.8% or 86km of our overhead network resilient to the risk of falling trees each year, in line with industry recommendations. Our initial focus has been on our EHV network because this is where the greatest numbers of customers are at risk.

ETR 132 is being reviewed following the reviews into Storm Arwen and we will apply any revised recommendations to our tree cutting programme.

All vegetation management activity is also covered by ENA Engineering Recommendation (EREC) G136 – Vegetation Management near Electricity Equipment – Principles of Good Practice which sets out the industry standard good practice principles for conducting site works, discussions with landowners etc. to ensure that we are able to conduct the required works (which are often heavily reliant on securing permission from landowners).

Our annual expenditure on these three programmes for the last fourteen years and the plan for the next four years is shown in the chart below.



For both ENATS 43-8 and ETR132 tree cutting programmes we are meeting our targets for delivery. Whilst we are only beginning to see the impact of climate change in this area, ensuring that we have been meeting or beating our targets means that we are in a good position to move forward as an acceleration to our regular programme may be required.

10. Resilience to storms

The risks of trees interfering or damaging overhead lines significantly increases during wind storms. The wind may also cause damage directly to our network, sometimes in conjunction with other weather variables such as snow and ice.

A snapped pole can be seen underneath this fallen tree during Storm Darragh – December 2024.

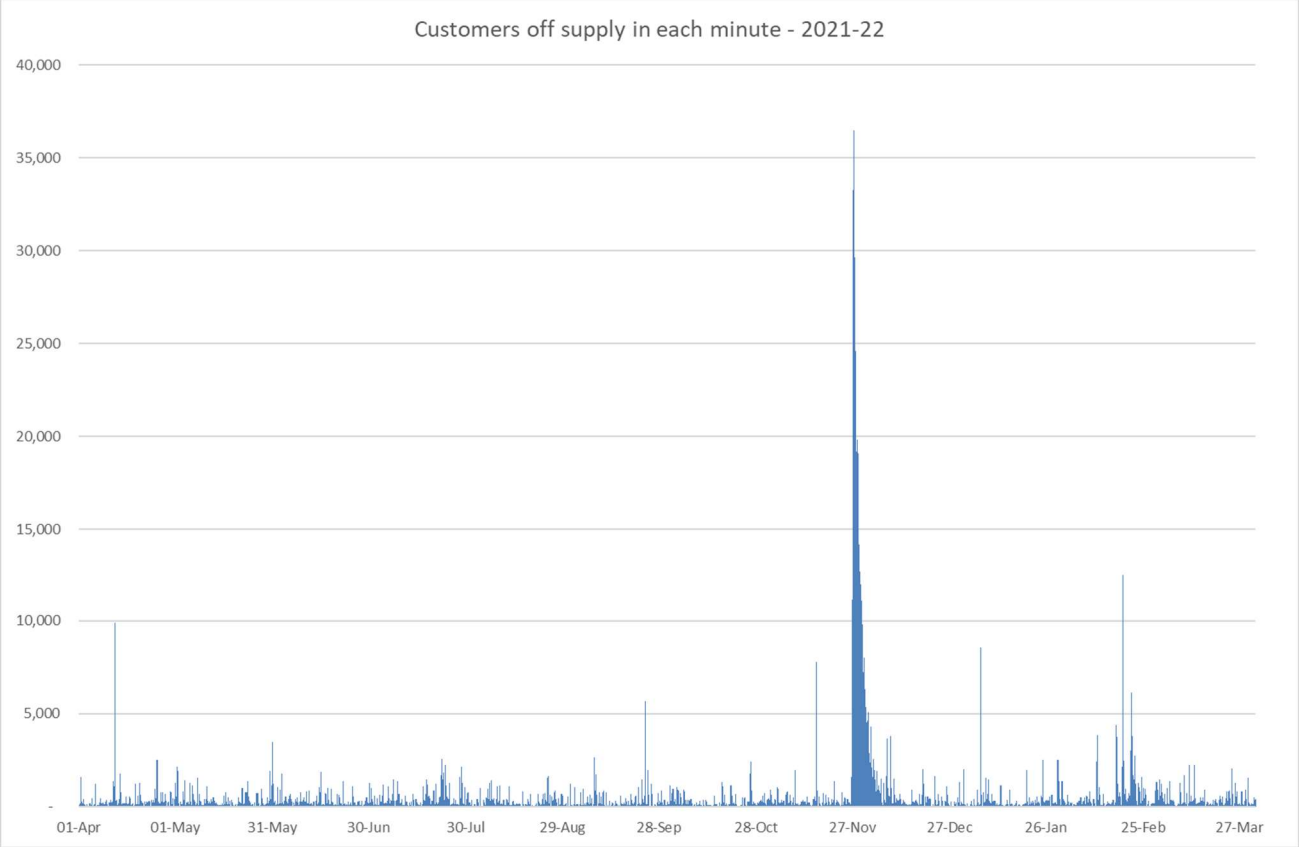
The impact of all faults due to wind and trees is summarised in the set of charts below:

The charts show that the unnamed storms of 2013-14, Storm Arwen in 2021-22 and Storms Debi and Isha in 2023-24 all had similar numbers of faults and similar number of customers off supply, but that the average length of interruptions due to Storm Arwen were significantly longer.

Storm Arwen

Storm Arwen had a significant influence on how we think about resilience, both within Electricity North West and nationally, so we will provide some detail on how it affected us and our thinking on future resilience.

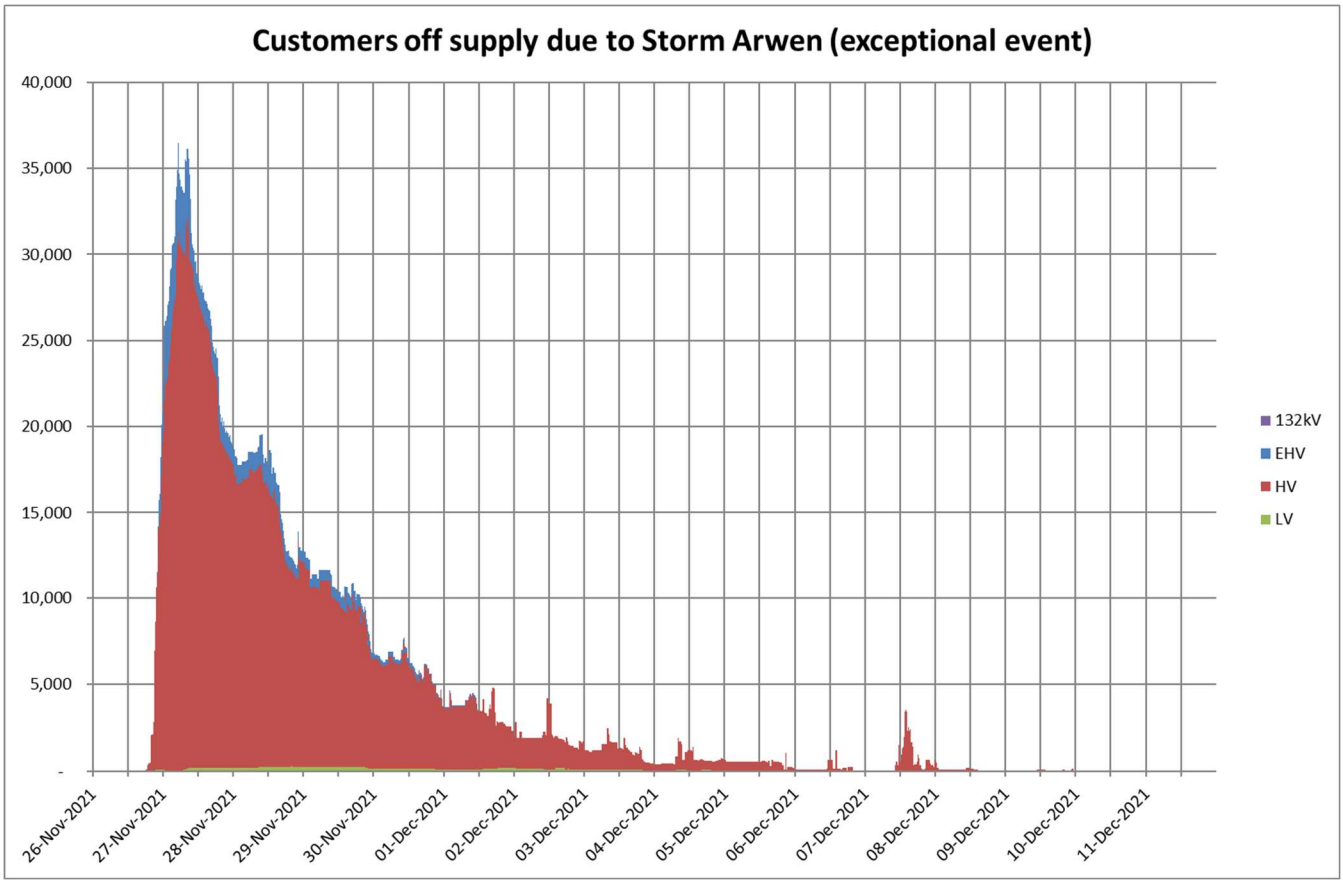
The following chart shows the number of customers off supply in each minute of the year and clearly illustrates the impact that Arwen had compared to our normal level of interruptions:



Storm Arwen hit in November 2021 and had a major impact across the north of the UK. It entered our region from the North East, counter to the prevailing wind direction on the afternoon of Friday 26 November 2021, with gusts of up to 74mph and sustained wind speeds of over 60 mph. The wind was accompanied by drifting snow and freezing temperatures across the region.

It is estimated that tens of thousands of trees fell under the sustained high wind speeds exacerbated by saturated ground conditions and ice loading. In addition to structural damage to power lines, the trees damaged many buildings, closing roads and railways across the region. Wind speeds stayed above safe climbing limits until midday on Sunday 28 November, hampering restoration efforts.

In total 600 faults caused 98,990 customer interruptions, with the impact being felt by some customers for up to a fortnight. At its peak we had over 35,000 customers off supply.



Storm Arwen had such a severe impact on our network because of the wind direction, sustained length of the wind storm and because of the interaction with other weather variables, particularly snow and ice in the Peak District.

Given the significance of the Storm Arwen event, both Ofgem and BEIS (now DESNZ), commissioned reviews into the storms and network companies' response. These produced a total of 67 recommendations, many of which we were able to adopt into our business-as-usual procedures.

In response to these recommendations Ofgem made provision in the RIIO-ED2 Price Control for companies to apply for further funding to implement resilience measures through the Storm Arwen Reopener mechanism. We developed a portfolio of seven measures which will improve resilience for those customers, predominantly in rural areas, who suffer the worst impacts of storms.

Details of these proposals can be found on our website[10], with a brief summary in the table below:

	Proposal	Description
1	HV network strengthening predictive modelling	Develop a risk based predictive model which will identify where to prioritise investment in our network, combining knowledge of our assets with an assessment of the future risks from different weather scenarios.
2	Targeted HV undergrounding /strengthening	Apply the output from the predictive modelling to either: • underground overhead lines; • strengthen the supporting poles; or • shorten the span length.
3	Pennine and Borders Interconnection	Some of our customers on the edges of our network are closer to other DNOs' networks. We are working with surrounding DNOs to identify sites where we can interconnect with the neighbouring network to provide an alternative supply during an outage.
4	LV automation enhancements	Review and extend the rollout of LV reclosing facilities to automatically restore LV transient faults which will reduce the demand on field staff in storm conditions.
5	Coniston – HV interconnector	Construct interconnection to the Coniston substation to provide an alternative supply route in case of faults.
6	Alston – HV interconnector	Construct interconnection to the Alston substation to provide an alternative supply route in case of faults.
7	Review of ETR 132 standard	ETR 132 deals specifically with the risk of disruption due to falling or uprooted trees in storms. It is currently being reviewed to ensure that it is still fit for purpose. This is likely to lead to changes in our tree cutting programme.

These initiatives, which will cost around £36m, are different from our business-as-usual activities because they do not all meet the typical investment criteria based on traditional cost benefit analysis. For example, the project at Alston will provide more resilient supplies to 1,300 customers at a cost of £5.1m, so we will be spending approximately £4,000 for each customer, compared to the amount we receive each year from each domestic customer, which is about £90.

To justify these types of investments we have had to develop new forms of cost benefit analysis which value the societal impacts of improved resilience in extreme events.

[10] https://www.enwl.co.uk/globalassets/about-us/regulatory-information/documents/public-information/enwl-storm-arwen-re-opener-submission-2024.zip

In their Draft Determination published in September 2024[11], Ofgem recommended that we receive all the funding that we requested for these initiatives. We are awaiting final confirmation of this.

Future for storm resilience projects

We believe that the Storm Arwen Reopener mechanism and our response to it provides a template for future investment in resilience projects. In future price control reviews we will make the case for further strategic investment to improve resilience for our rural customers.

11. Future issues to address

We continue to identify new risks to our network and work with partners to identify solutions.

The dry summer of 2018 led to wildfires on Saddleworth Moor and Winter Hill. This was not a risk that had been identified in our earlier adaptation reports but was added to our national list of risks in the third round report as "AR15 - Overhead lines and underground cables affected by extreme heat and fire smoke damage".

We will work to understand which of our assets are at risk from wildfires and how we can predict when and where they may take place.

The fire on Winter Hill burnt for over three weeks, and whilst we do not have any major electrical equipment at that site, we do use communications masts on the hill which were put at risk.

[11] https://www.ofgem.gov.uk/consultation/draft-determinations-riio-2-re-opener-applications-2024-electricity-transmission-electricity-distribution-and-gas-distribution

This focussed our thoughts on the increased dependence on telecommunications. Our networks were originally developed as ‘dumb’ networks. Electricity flowed through them and if we wanted to work on any part of the network an engineer would have to physically visit a substation to operate a switch. Over the years automation has been introduced to the network through telecontrol and SCADA systems (Supervisory Control and Data Acquisition) and this has accelerated with the move to a Net Zero economy and ‘smart’ networks.

Now most of our major equipment will contain a SIM card connected to a mobile phone network which is used for data acquisition and control. We rely on the telecoms network to operate the modern network, which means that we are dependent on their resilience to continue to provide our service.

As with most other aspects of modern life, the telecoms network is in turn dependent on us to continue to deliver power to provide its services.

This major interdependency has been recognised by government as one that needs to be addressed so we are working with government and industry partners to develop resilient solutions.

We will continue this work and also work with other infrastructure providers to understand the interdependencies and agree the best course of actions to deliver resilience across all infrastructure.

12. Summary

We believe that we are at the forefront in preparing for changes to the climate with:

- Well established risk assessment procedures;
- Well developed programmes of resilience measures, both through our flooding programme and our tree cutting programmes; and
- Detailed progress reporting through our annual regulatory reporting cycle.

Our flooding programme remains our main area of adaptation work because of the immediate risk it poses to our customers and we plan to complete our current programme of work by 2028. We will continue to assess the changing risks from flooding and will develop further programmes if required.

Whilst we have not experienced a sustained increase in the rates of tree growth yet, the fact that we are successfully meeting all our targets for vegetation management means that when the expected acceleration occurs, we are well positioned to meet the challenge.

The impact of Storm Arwen has caused us to review our approach to storm resilience, both now and as the climate changes. Following agreement on the Storm Arwen Reopener funding, we will accelerate work to deliver a network more resilient to storm impacts for our customers.

We will continue to monitor other potential impacts, particularly interdependencies, and work with our partners to investigate solutions if required, but as noted in our original submission, the scale of these impacts is likely to be dwarfed by the other work which we will be undertaking on our network to facilitate the move to Net Zero and the increased demand for electricity, so our climate change work will be largely incremental to our business-as-usual practices.

13. Appendix - Glossary

Acronyms used in this document:

132kV	Equipment operating at 132kV – the highest voltage on our network.
BEIS	Department for Business, Energy & Industrial Strategy – government department responsible for energy from 2016 to 2023
CCARWG	ENA Climate Change Adaptation Reporting Working Group
CCAR	Climate Change Adaptation Report
CCC	Climate Change Committee
CCRA	Climate Change Risk Assessment
CCRG	ENA Climate Change Resilience Group
DECC	The Department of Energy and Climate Change – government department responsible for energy from 2008 to 2016
DESNZ	The Department for Energy Security and Net Zero – government department responsible for energy since 2023
DPCR5	Distribution Price Control Review 5 for the period from 2010 to 2015
EA	Environment Agency
EHV	Extra High Voltage – on our network this relates to equipment operating at 33kV
ENA	Energy Networks Association
ENATS	Energy Networks Association Technical Specification
ETR	Engineering Technical Report – an ENA published document
HV	High Voltage – on our network this refers to equipment running at 6.6kV and 11kV.
IIS	Interruptions Incentive Scheme
kV	Kilo-Volts
LI	Load Index
NGC	National Grid Company – owners of the transmission network in our area
NIC	National Infrastructure Commission
RIIO	Framework for energy network price reviews (“Revenue = Incentives + Innovation + Outputs” or “setting Revenues using Incentives and Innovation to deliver Outputs”)
RIIO-ED1	First electricity distribution price review under the RIIO framework for the period from 2015 to 2023
RIIO-ED2	Second electricity distribution price review under the RIIO framework for the period from 2023 to 2028
UKCP09	United Kingdom Climate Projections published in 2009
UKCP18	United Kingdom Climate Projections published in 2018