Ofgem climate resilience report – fourth round reporting

Publication date:	9th April 2025
Contact:	Alexandra Holder
Team:	Climate Resilience Team
Email:	ClimateResilienceTeam@ofgem.gov.uk

This publication has been prepared in response to Defra's request to report via the fourth round of climate change adaptation reporting (ARP4) of the Climate Change Act 2008. It has been prepared in line with Defra's guidance for regulators. It sets out Ofgem's view of progress on climate resilience in the energy sector and how we support those we regulate to manage risks. The report also outlines our priorities for addressing outstanding challenges. Ofgem's two priority objectives to do this are:

- To work with the sector and government to accelerate setting goals for climate resilience.
- To strengthen climate considerations in upcoming regulatory decisions.

We welcome feedback on our report and our regulatory approach to climate resilience. Please get in contact by emailing ClimateResilienceTeam@ofgem.gov.uk

Any enquiries related to the text of this publication should be sent to Ofgem at:

10 South Colonnade, Canary Wharf, London, E14 4PU.

This publication is available at www.ofgem.gov.uk. Any enquiries regarding the use and re-use of this information resource should be sent to: psi@nationalarchives.gsi.gov.uk

Executive Summary

Climate resilience executive summary

Our energy system is undergoing a rapid transition to a low carbon system and an increasingly electrified economy. The GB energy system is amongst the most reliable in the world, and we must ensure that these high standards are retained even as the risks facing us change. One of these risks is climate change. We are already experiencing the impacts of extreme weather, as highlighted by recent events such as Storm Darragh, affecting around 2.5 million customers. Without further action, disruptions to our service may increase as climate change is increasing the frequency and intensity of extreme weather events and driving changes to ambient conditions.

Ofgem recognises the urgency for ensuring our policy and regulation keep pace to enable sector-wide resilience to climate impacts, today and in the future. Ofgem has important regulatory functions relevant for ensuring resilience in the sector, laid out in chapter 1.

Despite progress across the energy sector, challenges remain that require action by both Ofgem and Government. We set out these challenges and how we plan to address them in chapter five of this report. Government has the lead responsibility for resilience to climate change, both in the energy sector and across society. It is critical that Government sets a climate resilience goal for the energy sector. We will continue to work with government, so that our work can inform this decision, at a pace aligned with regulatory timelines.

Progress from the sector and Ofgem to date

Chapter 3 provides Ofgem's overview of progress within the sector. The network companies we license have improved their assessment and management of climate risk and there is increasing collaboration on these issues across companies. All network companies produce climate resilience strategies and are required by Ofgem to report on their progress. However, there is more to be done. Particularly to improve the join up between longer-term risk assessment and investment decisions within the 5-year price control period. This is not easy and requires agreed approaches for measuring and valuing climate resilience. Ofgem is taking a leading role in addressing these challenges, as outlined in chapter 5.

For other licensees, such as energy generators, Ofgem does not set out specific climate resilience requirements, although many companies are required to disclose their climate risks and strategies via other regulatory requirements. There is engagement in this

space, with Energy UK, Solar UK and Renewable UK reporting that climate risk and adaptation strategies are often embedded into the overall governance of companies. However, individual companies did not report in sufficient detail through the recent adaptation reporting round to properly understand their individual level of climate resilience.

There is also a gap in understanding whole system resilience to future climate impacts. The establishment of NESO with its new resilience functions is a significant step forward to address this. We will continue to work with NESO, DESNZ and the sector on this.

In chapter 4, we highlight how Ofgem has mobilised progress in the sector. This includes:

- Increasing the awareness and capabilities of the network companies, by setting requirements on them to submit climate resilience strategies.
- Increased collaboration and development of expertise in the sector, working with network companies to develop metrics and indicators in advance of the next price control.
- Learning from recent extreme weather events, such as Storm Arwen, to allow for investment in networks to improve resilience.
- Supporting innovation in resilience through funding industry-led innovation projects.

Ofgem has also supported capacity and capability building to improve understanding of climate risk across the energy system and how this might change through the transition.

- We have established a multidisciplinary climate resilience team and strengthened our decision making. We have also established an expert panel to inform our work and have been learning lessons through international engagement with other regulators.
- In collaboration with Ofgem, the Government established licence conditions setting out requirements for the National Energy System Operator (NESO) to take on new, enhanced responsibilities for energy system resilience and security. This includes understanding how extreme weather hazards impact the system now and how impacts may change in the future.
- We have set requirements for NESO to consider resilience, including climate resilience, in their Centralised Strategic Network Plan, that will inform future network and energy system requirements.

Addressing critical challenges through Ofgem's climate resilience programme

In the final part of this report, we highlight what needs to be done to ensure long-term decision making on resilience to climate change and how Ofgem plans to take bold action on this. Our climate programme is set out in figure 1, which is designed to address key challenges to enable further progress in the sector. Section 5 of this report covers this in more detail.

Top level: Our twin track approach sets out the two objectives we are tackling in parallel

1) **Accelerate setting goals for climate resilience**
2) **Strengthen climate considerations through upcoming regulatory decisions**

Second level: <u>Our strategic priorities</u> tackle priority barriers to unlock progress against both of our twin track areas

Roles and responsibilities
Provide strategic direction to government, NESO and Ofgem to drive the step change required.

Valuing and measuring resilience
Develop economic framing, tools and metrics to value and inform/drive investment decisions on climate resilience.

Consistent & impactful stress testing
Ensure decisions at all levels of energy system are informed by consistent consideration of high impact, low probability events.

Standards
Review standards and their role in driving investment decisions on climate resilience for new build.

Bottom level: <u>Our actions</u> are designed to drive progress against one or several strategic priorities

- Working closely with DESNZ, NESO and other key stakeholders to establish goals for climate resilience
- Consider and refine options for climate resilience in upcoming price controls
- Set requirements for stress testing for network companies
- Continue to support and oversee NESO on how it delivers and oversees its capabilities on whole energy system resilience
- Improve monitoring of climate resilience including support to network companies in the development of climate resilience metrics and indicators
- Develop approaches to improve the valuation of resilience
- Build understanding of public acceptability for climate resilience
- Work with DESNZ, NESO, industry and others to review standards which support resilience to future climate
- Continue international engagement with other regulators to identify best practice and lessons learned

Figure 1 Ofgem's climate resilience programme. This is composed of 3 levels: top-level outlines two principle objectives for the programme, second-level outlines four strategic priorities, and the final level outlines actions.

Ofgem cannot deliver these objectives or actions in isolation. It is Government's role to decide whether there should be an overall climate resilience goal for the sector. Ofgem defines a climate resilience goal as the acceptable minimum level of resilience of energy assets and/or the system to climate impacts in order to provide a defined level of service to consumers. It should be balanced to ensure mitigations are proportionate and deliver the right level of protection at the right time. Ofgem is providing advice on this topic and we will also share our learnings with NESO to help inform their work on resilience. Collaboration is imperative to ensure a well aligned, joined up approach across the energy sector.

Conclusion

The GB energy system must be prepared for the future effects of climate change. To do this, we urgently need to better understand the costs, benefits and options for building resilience across the system. Ofgem will be working towards this through our twin-track approach, aiming for greater certainty for the sector through goals on climate resilience, and delivering necessary guidance and regulatory intervention.

Contents

1. Introduction

Context

1.2 The Climate Change Act 2008 sets out statutory requirements for the UK to mitigate and adapt to climate change.[1] This Act provides Government with powers to mandate or request infrastructure operators and bodies of a public nature to report on the steps they are taking to respond to climate change. This report is published in response to Defra's request to report via the fourth round of adaptation reporting (ARP4) and prepared in line with Defra's guidance for regulators.[2]

1.3 This report provides Office for Gas and Energy Markert (Ofgem)'s view on progress on climate resilience in the sector, existing challenges, and our role supporting those we regulate. It highlights our responsibilities in relation to climate resilience, what we have delivered to date and our approach to climate resilience as a regulator.

Your feedback

We believe that feedback is at the heart of good policy development and welcome comments about this report. We are keen to get your answers to the following questions:

1. Are the conclusions drawn in this report accurate?
2. Do you have any comments about Ofgem's approach to climate resilience and the actions we plan to take?
3. Are there any improvements that could be made for future reporting?
4. Any further comments?

Please send any feedback and comments to ClimateResilienceTeam@ofgem.gov.uk.

[1] Climate Change Act 2008
[2] Climate change adaptation reporting power: plans for the fourth round - GOV.UK

2. Ofgem and climate resilience

Section summary

Climate change is increasing the frequency and severity of extreme weather events as well as driving changes in average conditions. Ofgem is taking an increasingly active role through our regulatory work to enable climate resilience in the sector. This section outlines why we are reporting and what our responsibilities are for enabling climate resilience in the sector.

Background

2.1 Ofgem last reported on climate resilience in 2016.[3] A lot has changed since our last report. We have experienced several unprecedented events, imposing wide ranging impacts in Great Britain (GB), including impacts to our energy infrastructure: the Covid-19 pandemic, the energy crisis resulting from Russia's invasion of Ukraine in February 2022, and increasingly extreme weather events. The case for ensuring the resilience of our energy system to future threats and challenges has never been clearer.

2.2 A secure and reliable energy system is a basic societal need. A resilient energy system is one that is able to effectively counter and respond to a broad range of threats and challenges. Ofgem has an important role in supporting this. Ensuring secure and resilient supplies is an objective in our multiyear strategy.[4] Ofgem considers resilience in relation to cyber resilience, supply chain resilience, asset resilience and broader security of supply. This report focuses on climate resilience, which has unique physical risks and interacts with all of these wider aspects of resilience.

2.3 Climate resilience, in the context of energy infrastructure, is the ability of the system to anticipate, absorb, recover and adapt to shocks and stress events which are driven by a changing climate. Climate hazards, including excess or lack of rainfall, extreme and/or prolonged heat spells, extreme and/or prolonged cold spells, and strong winds, are becoming more frequent and intense.[5]

[3] Climate adaptation reporting second round: Ofgem - GOV.UK
[4] Objective 10: Secure and resilient supplies. Ofgem's multi year strategy
[5] State of the UK Climate 2023 - Kendon - 2024 - International Journal of Climatology - Wiley Online Library

2.4 Climate hazards can pose a variety of risks to our energy system. These can be broadly considered in terms of:

- Damage to physical infrastructure at an asset or network level. For example, excess rainfall can lead to flooding which can cause direct damage to assets, as well as limit access or ability to repair and/or operate certain infrastructure.
- Impacts to supply and demand, with implications for security of supply. For example, extreme heat could lead to increased energy demand for cooling, with potential implications for security of supply.
- Interdependent risks. Climate change hazards can have cross-vector and cross-sector (see glossary) impacts, such as power outages causing interruptions to telecoms, exacerbating the overall impact of events.

2.5 Climate change is already impacting our energy system. It is driving changes to average conditions, such as increased temperatures. The most recent decade, 2014-2023, the UK experienced an average of 30 cooling degree days,[6] more than double the 1961-1990 average of 14 days.[7] The frequency and severity of extreme weather events is also increasing.[8] In recent years, storms, including Storm Arwen in 2021 and Storm Darragh in 2024, led to power cuts of several days for thousands of households and businesses.[9] Meanwhile an extreme, record-breaking heatwave in summer 2022 caused system stress on GB energy infrastructure.[10]

2.6 To mitigate emissions which are driving climate change, the energy system is undergoing a significant transition to a decarbonised system.[11] The energy system is likely to be more complex, decentralised and distributed. The design of the future energy system, as well as changes in demand for energy, will influence the system's vulnerability and exposure to climate hazards. For example, increasing reliance on intermittent renewables could increase the energy system's vulnerability to impacts from extreme weather events. However, ensuring a diverse energy mix, policy decisions, as well as innovative

[6] Number of cooling degree days measures how much (in degrees) and for how long (in days) the outside temperature was above a certain level.
[7] State of the Climate for the UK Energy Sector 2023-24 | Royal Meteorological Society
[8] ukclimaterisk.org/wp-content/uploads/2021/06/Technical-Report-The-Third-Climate-Change-Risk-Assessment.pdf
[9] Storm Arwen Report | Ofgem
[10] Record breaking 2022 indicative of future UK climate - Met Office
[11] Future Energy Scenarios (FES) | National Energy System Operator

solutions, such as microgrids,[12] demand flexibility,[13] and storage can all enhance resilience, reducing the impact of climate-driven stress events. Ensuring a secure and stable energy supply throughout the transition will remain imperative.

2.7 To deliver on this energy transition, significant investment will be required. It is important that climate resilience is considered as far as possible within those investment decisions. To enable this, the National Infrastructure Committee (NIC) recommended that Government and Ofgem review current resilience standards to identify gaps and develop approaches for stress testing, underpinned by overall goals for resilience.[14] Government plays a key role in setting these goals, including goals for resilience to climate impacts. Ofgem is working to bring this agenda forwards and this is detailed in Chapter 5 of this report.

2.8 We are already taking important steps to address risk posed by climate change, which is laid out in more detail throughout this report.

Ofgem's responsibility for climate resilience

2.9 Ofgem regulates network companies and plays a critical role in regulating gas and electricity markets in Great Britain. Ofgem operates within the statutory framework set by Government and its duties are set out in the Gas Act 1986[15] and Electricity Act 1989.[16] Ofgem's principle objective is to protect the interests of current and future consumers. Ofgem is required to carry out its functions in a way which it considers best calculated, amongst other aims, to secure a diverse and viable long-term energy supply, sustainable economic growth, net zero targets and address customer vulnerability.

2.10 Ofgem's remit has expanded since our last report to deliver on broader aims set by Government, including to support and enable the delivery of a net zero energy system. Recently, Ofgem was given a net zero duty[17] and a growth duty.[18] We have taken on new functions, such as setting out requirements for strategic planning processes and moved from regulating the Electricity System

[12] Power systems and microgrids resilience enhancement strategies: A review - ScienceDirect
[13] Demand Flexibility Service (DFS) | National Energy System Operator
[14] Developing resilience standards in UK infrastructure - NIC
[15] Gas Act 1986
[16] Electricity Act 1989
[17] Ofgem welcomes Energy Act getting Royal Assent | Ofgem
[18] Growth duty - GOV.UK

Operator to become the regulator for the new National Energy System Operator. We have also become the regulator for heat networks, Smart and Secure Energy Systems, Cyber/Network and Information Systems and AI and more. Government recently launched a Review of Ofgem to ensure that it is set up to be an effective regulator as the energy market transitions to net zero.[19]

2.11 Ensuring resilience and security of supply is a key objective in the Government's Strategic Policy Statement (SPS).[20] Ofgem's Multiyear Strategy, which is aligned to the SPS, outlines three priorities to deliver on its objective to build resilience to extreme climate events and long-term climate change: [21]

- Developing a regulatory framework and new approaches to ensure that the costs and benefits of climate resilience actions are better understood and accounted for in decision making.
- Developing an economic framework and tools/guidance that account for climate change and high-impact, low-probability events and take a consistent approach to stress testing. We will use this in our own decisions, for example in price controls, but also aim to enable improved decision-making across the wider sector.
- Working closely with Government and NESO to ensure consistency in our approaches at system, regional and asset levels and support policy development. This will include providing evidence and thinking to inform acceptable levels of risk resilience within new performance standards.

Ofgem's relevant regulatory mechanisms

2.12 Ofgem has several regulatory mechanisms to support delivery on its objectives and duties. The most relevant for climate resilience include:

- Setting requirements for licenced energy and gas network companies, including performance and reporting requirements and determining funding allowances for investment in network maintenance, resilience and improvement.
- Establishing and enforcing the licensing regime. Ofgem sets specific obligations on the network companies, gas shippers, generators and suppliers

[19] Review of Ofgem: call for evidence - GOV.UK
[20] Strategy and policy statement for energy policy in Great Britain - GOV.UK (www.gov.uk)
[21] Multiyear Strategy sets out Ofgem's vision for delivering clean, affordable and secure energy system | Ofgem

to ensure supply is protected as well as management requirements for the National Energy System Operator (NESO), including requirements for resilience;

- Setting out the regulatory framework for the Future Energy Pathways (FEP) and strategic network planning processes such as the Centralised Strategic Network Plan (CSNP) and the Regional Energy Spatial Plans (RESP);
- Providing advice on security of supply and market insights, and contributing to the deployment of mitigations and interventions to reduce the likelihood and, if necessary, the impact of energy not meeting demand;
- Approval of code modifications. Industry codes underpin the electricity and gas wholesale and retail markets. Certain codes will have implications for resilience and security of supply by setting standards and requirements.

Principles for climate resilience decision making

2.13 Ofgem established principles for climate resilience which we expect to be followed in our own work and across the sector more broadly. These principles were recently published in our RIIO-3 Sector Specific Methodology Decision for electricity transmission and gas network company price controls.[22] This outlines the approach which we expect network companies to take in their climate resilience investment planning. Ofgem's Principles are as follows:

2.14 Climate resilience decisions need to be based on **forward-looking data and information**. This is especially important as climate change is expected to bring unprecedented extreme weather and variability which means information based on the past is not a good indicator for the future.

2.15 **High impact, low probability events**, based on the latest understanding of climate science, need to be considered in light of the more frequent and severe extreme weather expected.

2.16 The **costs and benefits of adaptation actions and their impact on resilience** (i.e. avoided costs) need to be correctly valued. This includes understanding the impact actions will have on improving levels of resilience over the lifetime of the asset and capturing direct and indirect (e.g. impact on other sectors) as well as avoided costs.

[22] https://www.ofgem.gov.uk/sites/default/files/2024-07/RIIO_3_SSMD_Overview.pdf

2.17 Investment decisions need to be **fit for purpose for the decarbonised energy system**, in particular, considering the increased vulnerability of the system to climate risks, whilst we transition to net zero.

3. Climate resilience in the energy sector

Section summary

This section highlights respective roles and responsibilities for climate resilience in the energy sector and progress made by the sector since our last report.

Roles and responsibilities for climate resilience

3.0 The energy sector in Great Britain is made up of a number of different assets and actors. It includes:

- large scale generation such as gas, wind generation, large-scale solar, bioenergy, hydroelectric and nuclear plants;
- distributed generation such as rooftop solar PV;
- interconnectors which provide electricity connection to other countries;
- gas terminals;
- gas shipping;
- gas and electricity transmission and distribution networks;
- and end users.

3.1 Government, regulators like Ofgem, NESO, sector bodies, research and innovation organisations are also key components. Each actor plays a crucial role for maintaining a resilient and reliable energy system. They are also highly interdependent on one another.

3.2 Clarity on respective roles and responsibilities for each actor is a crucial enabler for ensuring resilience to climate impacts. The Climate Change Committee (CCC)[23], National Preparedness Commission (NPC)[24], and National Infrastructure Commission (NIC)[25] each highlight the imperative for clear governance arrangements and responsibilities for climate resilience.

[23] March 2023 Progress in adapting to climate change 2023 Report to Parliament
[24] NPC_RegulatingForResilience.pdf
[25] Anticipate-React-Recover-28-May-2020.pdf

Department for Energy Security and Net Zero (DESNZ)

3.3 DESNZ is responsible for setting policy direction for climate resilience in the energy sector, as the sector's Lead Government Department[26]. The Secretary of State for DESNZ has ultimate accountability for energy security of supply in Great Britain. DESNZ works with industry, regulators, sector bodies and other stakeholders to improve and maintain the resilience of the energy infrastructure, networks and assets, to reduce vulnerabilities and ensure an effective response to actual or potentially disruptive incidents.[27]

3.4 DESNZ also has a role in engaging with other Lead Government Departments of Critical National Infrastructure (CNI) sectors to understand cross-sector dependencies and agree joint work between them, for example through actions in the National Adaptation Programme.[28]

National Energy System Operator

3.5 In Autumn 2024, the National Energy System Operator (NESO) was established. NESO is an independent, expert, impartial body with new roles across electricity and gas. In collaboration with Ofgem, Government established licence conditions which set out specific requirements to take on new and enhanced responsibilities for supporting energy system resilience and security. This includes functions relevant for understanding and planning system resilience, preparation for emergencies, and learning from emergencies. NESO has a specific statutory objective to ensure security of supply of the electricity and gas infrastructure when carrying out its functions. National Gas Transmission (NGT), as the Gas System Operator has a similar responsibility for gas infrastructure. NESO also has a statutory advisory role to Ofgem and Government, providing advice, information or analysis where it has expertise.

3.6 Ofgem regulates and licences NESO. Its licence conditions set specific requirements for energy resilience and resilience reporting, including condition C7 in the Electricity System Operator licence[29] and C6 in the Gas System Planner licence.[30]

[26] Strategy and policy statement for energy policy in Great Britain - GOV.UK
[27] Preparing for and responding to energy emergencies - GOV.UK
[28] Third National Adaptation Programme (NAP3) - GOV.UK
[29] ESO Licensing Direction and Licence Terms and Conditions
[30] GSP Licence Terms and Conditions

Tripartite collaboration

3.7 DESNZ, Ofgem and NESO each have relevant functions for informing acceptable levels of resilience to climate change and requirements for the sector. We are working closely with DESNZ and NESO to build a shared understanding and align our strategic work.

Network companies

3.8 Network companies are responsible for transporting gas and electricity from the point of generation (or gas terminal or storage) to households and businesses. In this report, we refer to Transmission Operators (TOs), Distribution Network Operators (DNOs) and Gas Distribution Networks (GDNs) as "network companies".

3.9 Network companies are regulated monopolies and operate under licences issued by Ofgem. These companies are subject to common statutory requirements overseen by DESNZ, the Health and Safety Executive (HSE), the Environment Agency (EA), the Scottish Environment Protection Agency (SEPA) and Natural Resources Wales (NRW). Network companies are category Two responders under the Civil Contingencies Act.

Energy Emergency Executive (E3) and its Committee (E3C)

3.10 E3 and E3C is a partnership between government, the regulator and industry which coordinates resilience planning across the energy industry. It enables a joined-up approach to emergency response and recovery, identifying risks, processes and lessons to manage the impact of emergencies affecting the supply of gas and/or electricity to consumers in Great Britain.[31]

Progress on climate resilience in the sector

3.11 This section summarises Ofgem's view of progress on climate resilience amongst those we regulate, including awareness and implementation of climate risk management as well as challenges and barriers to further progress. It covers energy network companies regulated through price controls, energy generators, and NESO.

3.12 We recognise that there are other infrastructure operators in the energy sector, nd we will seek to better understand how these actors manage climate resilience.

[31] Energy Emergencies Executive Committee Storm Arwen Review: interim report

Energy network companies

3.13 There is a degree of maturity for climate risk reporting amongst network companies, participating in all four rounds of reporting through the Adaptation Reporting Power. The cross-sector Climate Change Adaptation Reporting Group (CCRAG), chaired by the Energy Networks Association (ENA), was established in 2009 as a forum for network companies to share learnings and support reporting. In addition to individual network company reports, the ENA produce a sector level report for network companies covering a risk assessment and general approaches to risk management for both electricity and gas.

3.14 Ofgem introduced requirements in its network regulation to improve risk assessment and join up identification of risk mitigation measures and justification for investment. Climate resilience was formally introduced as a targeted funding area into Ofgem's RIIO-ED2 price control (2023 -2028). In prior price controls, across all sectors, it was captured within the wider theme of maintaining a safe and resilient network which covers aspects such as asset, workforce, supply chain, physical and cyber resilience. For ED2 and RIIO-3, network companies were required to submit a Climate Resilience Strategy as part of Business Plan submissions and to work together as part of a working group led by the ENA to develop understanding and capabilities. The group was tasked with developing Climate Resilience Metrics and Indicators (CRMI) initially for the start of ED3, followed by wider sector introductions. In addition, network companies are also required to report on their progress on climate resilience, including compliance with the flood resilience standard, ETR138.

3.15 There is proactive engagement from network companies on climate resilience and increased understanding of climate risks to inform climate future policy decisions. We ave seen new approaches for enabling resilience, such as:

- Innovative and collaborative working across network companies as evidenced in the Storm Arwen Reopener,[32] incentivising flexible working and training of staff;
- Improving digital services for accessing compensation post events;
- Asset improvements such as upgrading poles in the electricity sector, and the fitting of plastic piping in the gas sector;
- Improved reporting on compliance with flood resilience standards; and

[32] RIIO-2 Re-opener Applications 2024 Final Determinations – ED Annex

- Cases of collaboration with other sectors to understand interdependent risks.

3.16 Whilst there has been progress in the sector in recent years, challenges remain. Evaluating the cost benefit of climate resilience measures and assigning their value is challenging and there are several approaches which could be taken. Developing a consistent and appropriate approach to valuing resilience measures is instrumental for our role as a regulator to assess options for investment in the networks. Secondly, as highlighted in ENA's fourth round of reporting, climate risks are inherently uncertain. The main factors contributing to these uncertainties are uncertain global warming scenarios; incomplete data availability for individual and compounded climate hazards; and the speed at which the energy system will need change to meet net zero targets.

3.17 Finally, there remains a need for further work by network companies on addressing cascading, compound and interdependent risks between different sectors. However, this is complex and requires co-ordination from Government and relevant regulators, including Ofgem. This is something we will look to progress as part of our work to accelerate goals for overall climate resilience and is set out in more detail in section 5.

Energy generation operators

3.18 Licenced energy generation operators are required to carry out activities in accordance with their licence and code requirements. Unlike network companies, Ofgem does not require these operators to submit climate resilience strategies. Nonetheless, many operators will have obligations to consider and report on climate resilience depending on factors such as the type of assets being operated, as well as their size and location. For example, compliance with the Companies (Strategic Report) (Climate-related Financial Disclosure) Regulations 2022 (TCFD)[33] and/or compliance with environmental permitting requirements.[34]

3.19 For generation technologies, Energy UK, Renewable UK and Solar Energy UK produced a synthesis report.[35] Technologies represented by these trade bodies include solar farms, onshore and offshore wind, and thermal and other power plants. Different generation infrastructure will have different vulnerabilities to certain climate hazards depending on factors such as the type of infrastructure,

[33] The Companies (Strategic Report) (Climate-related Financial Disclosure) Regulations 2022
[34] Climate change: risk assessment and adaptation planning in your management system - GOV.UK
[35] Climate change risks and adaptation responses for UK electricity generation - Energy UK

location and individual design specifications. The report highlights that there is engagement in this space, with many reporting that climate change risks and adaptation strategies are embedded into overall governance. However, individual companies did not report on their risks in detail, therefore it can be difficult to assess progress in full.

3.20 Whilst there has been progress in understanding climate risk amongst some energy generators, there remains a need to understand whether gaps remain, including on cascading impacts and interdependencies. Ofgem will work with the sector, Government, NESO, and others to ensure that regulation keeps pace to ensure generation assets and wider energy infrastructures are resilient to future climate impacts.

National Energy System Operator

3.21 Although only recently established, NESO will provide annual assessments on energy system resilience across the full range of risks facing the sector. Some of these risks include the assessment of extreme weather-related conditions. NESO is also required to provide annual season ahead system readiness assessments, advise on emergency readiness and run post-event reviews, identifying lessons learned for overall energy security. These functions should address important gaps to understanding whole system resilience to climate impacts.

4. What has Ofgem delivered since our last report

Section summary

This section showcases our achievements since our last report, which is also summarised in appendix 1 and 2. It includes measures to support climate resilience through our network regulation. We also highlight how we have built the capacity and capability on climate resilience across the energy system, both internally and within the sector.

4.0 Over the last eight years, we have delivered on all actions outlined in our previous report (see appendix 1). We have introduced new requirements on network companies in relation to climate resilience which has contributed to greater understanding of weather-related impacts and the future challenges imposed by a changing climate across energy infrastructure. This includes improved consideration of climate risk within business planning and supporting investment in measures to bolster resilience to climate impacts. The full list of measures which we have introduced can be found in appendix 2.

Supporting climate resilience through our regulation of network companies

Setting requirements for network companies on climate resilience, through our price control regulation

4.1 Since our last report, Ofgem has introduced measures to enable specific funding to protect network assets from climate change through price controls. For the first time, in the RIIO ED-2 price control, we introduced requirements for network companies to submit climate resilience strategies as part of their business plans. We have also introduced this requirement for RIIO-3 in relation to the electricity and gas transmission and gas distribution sectors.[36]

4.2 RIIO-ED2 required the ENA and network companies to establish the Climate Change Resilience Working Group, providing a forum for network operators to discuss climate resilience planning, investments, monitoring and adaptation reports. The group is tasked with developing a climate resilience metrics and

[36] RIIO-3 Sector Specific Methodology Decision for the Gas Distribution, Gas Transmission and Electricity Transmission Sectors | Ofgem

indicators (CRMI) for ED3. CRMI will enable all parties to monitor and measure climate resilience. Given the complexities involved in this task, the development of a climate resilience team in Ofgem and the evolving scope and direction, we are working closely with the ENA and network companies to develop CRMIs suite. The implementation of these CRMIs is intended at the start of the next ED price control and future price controls.

4.3 Building on RIIO ED-2, we evolved our thinking for RIIO-3 set to start in April 2026. In addition to requiring climate resilience strategies, as part of the SSMD,[37] Ofgem outlined the climate resilience principles (see chapter 2) and proposed requirements for the upcoming price control period. This included the adoption of stress testing, scenario planning and adaptation pathways. To ensure climate resilience is embedded into RIIO-3, Ofgem are engaging with the network companies, ENA, Future Energy Network (FEN) and wider stakeholders to ensure that the sectors are able to build the capabilities allowing them to deliver proportionate and meaningful change to inform investment decisions. To ensure that the companies are able to deliver high quality deliverables, all requested outputs should be completed and submitted to Ofgem by the RIIO-3 second annual reporting period in Summer 2028, rather than at the start of the period in April 2026.

4.4 These measures have contributed to a collective understanding of the need for and challenges of climate resilience in our current and future price controls. We are looking to continue to work with the sector to develop a more robust understanding of climate resilience and how to design the price control in a manner that ensures climate resilience is addressed in a cost effective way for consumers. In November 2024, Ofgem published a framework consultation for the next Electricity Distribution price control which explores how our approach to climate resilience in the electricity distribution sector needs to evolve to enable this and how this might interact with other policy areas.[38]

Reviewing regulatory provisions in light of Storm Arwen

4.5 In November 2021, Storm Arwen brought widespread disruption to the UK and resulted in over one million customers losing power. Approximately 40,000

[37] RIIO-3 Sector Specific Methodology Decision for the Gas Distribution, Gas Transmission and Electricity Transmission Sectors | Ofgem
[38] Framework consultation: electricity distribution price control (ED3) | Ofgem

customers were without supply for more than three days, and nearly 4,000 customers were off supply for over a week. In light of the severity of the event, Ofgem conducted a review of the Distribution Network Operators response to Storm Arwen.

4.6 The final report was published in June 2022 and provided 20 recommendations relevant to all DNOs, across five areas in need of improvement:

- Network resilience;
- Planning and preparation;
- Handling of incidents;
- Communication and support during the incident;
- Ongoing support after the incident.

4.7 The review was distinct, but complementary to the review undertaken by the Energy Emergencies Executive Committee (E3C) which was commissioned by the Department for Energy Security and Net Zero and provided 45 recommendations in December 2021.

4.8 It was recognised that additional funding during the RIIO-ED2 price control period would be required for DNOs to be able to respond to Storm Arwen. The ED2 re-opener relating to Storm Arwen (2021) aimed to provide this in-period funding for storm resilience enabling DNOs to minimise the risk of future asset failures during extreme weather events, as seen in Storm Arwen in 2021. Across the DNOs there were 75 project proposals submitted, totalling £266.75 million. Ofgem accepted 40 of the 75 proposals submitted in its final determinations, totalling £149m, published December 2024. Ofgem will be using the information gained from this process to help shape climate and extreme weather event decisions as part of ED3 and to ensure the appropriate investments are made.

4.9 The Storm Arwen reopener highlighted the need for proactive investment for not only storms but other climate hazards.

Providing innovation funding to support resilience objectives

4.10 In 2021, Ofgem launched the Strategic Innovation Fund (SIF) which aims to help fund work that will speed up the transition to net zero at lowest cost to the

consumer, whilst supporting energy systems to be more resilient and robust.[39] This provides an additional funding mechanism through the RIIO-2 price controls for the system operator, Electricity Transmission, Electricity Distribution, Gas Transmission and Gas Distribution sectors.

4.11 Each round of the SIF focuses on four Innovation Challenges, and climate resilience can be seen across many of them, either as a primary goal, or as a downstream effect. One of these four challenges was embedding resilience. Whilst this innovation challenge looks broadly across resilience, it is recognised that this will become increasingly important as the severity and frequency of extreme weather events increase in the UK due to climate change.

4.12 We list below some of the most specifically relevant projects on climate resilience (totalling £24.2 million of SIF monies spent on across seven projects by Ofgem):

- CREDO+ which involved developing digital twin and data sharing tools to help understand infrastructure interdependencies and cascading risk from extreme weather.
- Nature4Networks which explored the use of nature-based solutions to protect assets from problems such as flood risk and extreme heat.
- Multiresilience project which involved coordinated solutions for cost effective resilient services that maintain customer supply during unplanned grid outages.
- Predict4Resilience which investigates using data from historical faults, land cover, weather and surveys to improve the forecasting of network faults and risks.
- Scenarios for Extreme Events which creates a strategic planning methodology for events which are unlikely but could have severe repercussions on energy networks.
- WELLNESS which develops a standardised approach to embed resilience into decision-making across the whole energy network, as it becomes more complex and varies.

[39] Strategic Innovation Fund (SIF) | Ofgem

- NIMUS which will make meteorological data e.g. rainfall, wind speeds and temperature, available and usable by energy networks to improve the ability to model and predict the impacts of weather and climate change.

Improving capacity and capability on climate resilience across the system

Increasing our capability and collaboration to support our work on climate resilience

4.13 Since our last report in 2016, Ofgem's remit has expanded to deliver on a resilient net zero transition at the lowest cost to the consumer. Over this time, Ofgem has sought to adapt to this challenge, including by establishing a multidisciplined climate resilience team.

4.14 Ofgem has also helped to establish several internal and external forums to enable knowledge sharing and effective governance on our work across the organisation and with key stakeholders. This includes working-level and senior-level forums to guide our work on climate resilience, both internally and externally. Ofgem is also engaging with international regulators and organisations. These learnings are fed into Ofgem's work to deliver best practice on climate resilience.

4.15 In Autumn 2024, Ofgem established a climate resilience expert panel to provide advice on technical aspects of the climate resilience work, including stress testing and climate scenario planning; climate resilience metrics and indicators; and climate resilience standards.

4.16 Ofgem continues to engage with relevant forums such as the Infrastructure Operators Adaptation Forum, UK Regulators Network and the ENA-chaired Climate Change Resilience Working Group and FEN.

Supporting Government to establish the National Energy System Operator

4.17 Government established a new legislative framework, through the Energy Act 2023, which included powers to establish NESO, set its duties and objectives, and define its relationship with Ofgem. NESO launched on 1 October 2024 and is regulated by Ofgem.

4.18 NESO will have an important role in identifying risks and making recommendations to improve resilience to Government and Ofgem, including climate risks to the energy system (see section 3.5). Ofgem is continuing to consider policy development on NESO's future regulatory arrangements.

Considering needs for climate resilience within future energy pathways and strategic planning

4.19 Progressing to net zero requires greater coordinated planning to ensure the right generation, network, and storage technologies are built in the right place at the right time. This is necessary so that consumers interests are maintained, especially in relation to security of supply. This has led to a more anticipatory type of strategic planning which considers energy needs at national and regional levels, across different types of energy such as electricity, gas and hydrogen.

4.20 Key strategic planning initiatives are the: Future Energy Pathways (FEP), Strategic Spatial Energy Plan (SSEP), the Centralised Strategic Network Plan (CSNP) and Regional Energy Strategic Plan (RESP). At a high level, these initiatives aim to map future requirements for energy generation and demand, both national and regional, and strategic onshore and offshore transmission network requirements. NESO has responsibility for delivering these plans and Ofgem is responsible for regulating NESO and making decisions on funding the network plans.

4.21 Ofgem recognises that long-term, whole system planning should safeguard the resilience of the system, which includes consideration of the impacts that climate change may have. We set out in our December 2023 decision on the CSNP that NESO should develop its capability to evaluate climate resilience of the transmission network.[40] This includes building capability to conduct sensitivity analysis. This is likely to include stress testing High Impact, Low Probability (HILP) events, including extreme weather. This will allow for better informed decisions at appropriate stages in the FEP and CSNP. Ofgem sought views on our draft FEP Guidance, including the treatment of HILP events, through a consultation which closed September 2024.[41] Ofgem is also working with NESO to

40 Decision on the framework for the Future System Operator's Centralised Strategic Network Plan
41 Future Energy Pathways Guidance

ensure adequate consideration of climate change in the SSEP and will consider the role of RESP.

Overseeing industry codes modifications

4.22 Industry codes set out the detailed rules which facilitate the operation of gas and electricity markets. The codes are governed by an industry-led process which Ofgem oversees through its approval of modification processes and other approval decisions, although this is currently undergoing reform. Certain codes set out standards and obligations for security of supply and resilience, such as the Security and Quality of Supply Standard (SQSS) and Grid Code for electricity and the Uniform Network Code (UNC) for Gas, and therefore have relevance to climate resilience.

4.23 To note, standards have a variety of governance depending on ownership. Future code modifications may be required to implement changes to modify standards stipulated in codes, such as the SQSS, or possibly introduce new standards. We will continue to engage with industry, code administrators, government, NESO and others to inform future policy and consider whether future code changes may be required. Additionally, any broader changes in standards, including in the SQSS or other relevant code reviews, will necessarily need to be reflected in updating modelling across the strategic planning initiatives.

5. How Ofgem plans to drive a step change and address key challenges

Section summary

This section of this report details our commitment to driving further progress in the sector, outlining our multi-level programme which is structured as follows:

- Top-level: Deliver two parallel objectives: accelerate goals for climate resilience and strengthen climate considerations through upcoming regulatory decisions.
- Seocond-level: Address barriers through four strategic priorities: roles and responsibilities, valuing and measuring resilience, consistent and impactful stress testing, and standards.
- Bottom-level: Deliver on clear actions.

Ofgem will work with others to provide certainty on climate resilience for the sector, whilst integrating consideration of climate resilience into its investment decisions through our existing regulatory functions.

5.1 Ofgem climate resilience programme has 3 levels (see figure 1).

Take a twin track approach to deliver two objectives

5.2 We are taking a **twin-track approach** to deliver two objectives in parallel. We need to meet both to enable sufficient investments by the sector in upcoming price controls.

Figure 1 Ofgem's climate resilience programme. This is composed of 3 levels: top-level outlines two principle objectives for the programme, second-level outlines four strategic priorities, and the final level outlines actions.

Top level: Our twin track approach sets out the two objectives we are tackling in parallel **3) Accelerate setting goals for climate resilience** **4) Strengthen climate considerations through upcoming regulatory decisions**
Second level: <u>Our strategic priorities</u> tackle priority barriers to unlock progress against both of our twin track areas **Roles and responsibilities** Provide strategic direction to government, NESO and Ofgem to drive the step change required. **Valuing and measuring resilience** Develop economic framing, tools and metrics to value and inform/drive investment decisions on climate resilience. **Consistent & impactful stress testing** Ensure decisions at all levels of energy system are informed by consistent consideration of high impact, low probability events. **Standards** Review standards and their role in driving investment decisions on climate resilience for new build.
Bottom level: <u>Our actions</u> are designed to drive progress against one or several strategic priorities • Working closely with DESNZ, NESO and other key stakeholders to establish goals for climate resilience • Consider and refine options for climate resilience in upcoming price controls • Set requirements for stress testing for network companies • Continue to support and oversee NESO on how it delivers and oversees its capabilities on whole energy system resilience • Improve monitoring of climate resilience including support to network companies in the development of climate resilience metrics and indicators • Develop approaches to improve the valuation of resilience • Build understanding of public acceptability for climate resilience • Work with DESNZ, NESO, industry and others to review standards which support resilience to future climate • Continue international engagement with other regulators to identify best practice and lessons learned

Accelerate setting a climate resilience goal

5.3 As the energy system undergoes radical transformation to meet the Clean Power 2030 ambition and deliver on net zero targets, the changing climate is likely to increase disruptions to consumers and increase their costs. To maintain current levels of resilience to climate change, additional investment may be required. To ensure clarity on investment choices, a climate resilience goal is required.

5.4 DESNZ is responsible for setting resilience goals for the sector and considering any cross-sector impacts as part of this. This would include a climate resilience goal. For the purpose of our work, Ofgem defines a climate resilience goal as the acceptable minimum level of resilience of energy assets and/or the system to climate impacts in order to provide a defined level of service to consumers. It should be balanced to ensure mitigations are proportionate and deliver the right level of protection at the right time. The aim of the goal should be to set targets and direction for regulation and policy. Ofgem defines this as distinct from standards, which are part of regulatory tools which set specific requirements and enable consistency, and have various governance arrangements.

5.5 Further, there is also a need to take a whole system, whole society approach. The resilience and security of the energy system is interdependent to the resilience and security of other systems, such as telecoms and water. This requires engagement from a range of stakeholders. From a regulatory perspective, clarity is required on overall resilience across key infrastructure and how regulators work together.

5.6 We recognise that setting resilience goals for the energy sector is complex and would require Ofgem, NESO and Industry to support government in this. If goals are agreed, Ofgem can implement appropriate regulatory interventions which allow them to be achieved.

5.7 To inform investment decisions, a goal should be aligned with our regulatory timelines. The upcoming price control for electricity distribution (ED3) will be a key milestone to work towards and provide greater clarity on what might be expected for a climate resilience goal. We recognise this is challenging and to tackle this, Ofgem's climate resilience programme will produce tools for stress testing and valuation. Greater understanding on acceptable levels of resilience will also be required for other sectors, including gas and electricity transmission and we will consider options for delivering this throughout the on-going price controls.

Strengthen climate considerations into upcoming regulation

5.8 Ofgem recognises that decisions will be made which will have direct and indirect implications for resilience to climate impacts. For example, through our upcoming price controls. There is an urgency to embed climate resilience through tools

within the short term, whilst building capabilities and regulatory approaches for the longer term.

5.9 Without clear regulatory and policy requirements for climate resilience, there is a risk that investment may not be appropriately climate proofed, potentially resulting in decreased levels of service or expensive retrofit solutions. A goal would provide the certainty needed to enable timely investment in climate resilience that is of best value to both current and future consumers. Regardless of the existence of a goal for climate resilience, Ofgem will be required to make implicit decisions on climate resilience through its regulatory functions in the coming years to deliver on our broader duties for net zero. As a result, Ofgem must ensure our regulation can keep pace to ensure climate resilience is embedded into its decisions.

5.10 There is also a need to ensure climate resilience is considered across the whole energy system. This includes considerations across NESO's relevant functions and we will continue to work with NESO and DESNZ to ensure the regulatory requirements we set appropriately enable and support this.

Address challenges through our strategic priorities

5.11 To deliver on these objectives, our programme identifies four strategic priorities.

Roles and responsibilities

5.12 Our objectives cannot be delivered in isolation and require collaboration with multiple actors, including government, NESO and industry. There is a need to ensure alignment and co-ordination of work going forwards. We'll be looking to continue to work with key stakeholders to build on progress to date.

Consistent and impactful stress testing

5.13 Although progress has been made on identifying climate risks, these are not consistent across all organisations. In particular, there is not a consistent approach for considering high impact, low probability events. This could mean that different risk profiles for climate extremes are used within energy infrastructure planning and investment leading to inconsistencies. We will introduce stress testing for network companies in price controls to address these concerns.

5.14 Consistency is also required at the system level. Both climate change and the transition to net zero increase the importance of factoring consideration of extreme events into these decisions. We will work with NESO to ensure consistency with their stress testing approaches.

Measuring and valuing resilience

5.15 Our ability to make decisions or incentivise behaviours on climate resilience will be heavily influenced by how we measure resilience. Currently there is a need for approaches to better measure and monitor climate resilience in the energy sector.

5.16 Building climate resilience metrics and indicators for the energy sector is not straightforward. Resilience is complex, dynamic and multidimensional. Designing metrics requires an agreed definition for resilience and clarity for the end-use of the metric. Current metrics and methodologies for asset and network level resilience, including Network Asset Risk Metric (NARM), do not explicitly capture climate change, although they do take into consideration environmental factors. This can make it challenging to identify if changes to asset health and/or the need for asset replacements are primarily driven by climate change, or whether this is a secondary driver, with the primary driver being age or expected end of life. Other metrics which track disruptions, such as Customer Interruptions and Customer Minutes Lost, are lagging indicators and only give an indication of performance against historic events.

5.17 For security of electricity supply, the reliability standard forms a key component of capacity adequacy. In the past a single metric, such as Loss of Load Expectation (LOLE), was found to be sufficient to set reliability standards which utilised historical weather data modelling to determine the nature of system stress events. These events tended to be more predictable, short in duration and relatively limited in size. In the future, system stress events are expected to become more complex. However, LOLE only captures the average number of hours of stress events over the year. Whilst a recent DESNZ study[42] highlighted limited evidence to move away from LOLE at this stage, reliability metrics may

[42] Exploring reliability standard metrics in a net zero transition

need to change in the system depending on future scenarios and in light of more extreme weather patterns.

5.18 Furthermore, a critical challenge for resilience is the ability to value it. Existing approaches for valuing resilience are not well equipped to deal with the uncertainty of climate change. We are considering valuation approaches to inform setting a climate resilience goal and identifying the most cost-effective approaches for building resilience.

Reviewing standards

5.19 Standards are important mechanisms for driving investment, ensuring consistency in outcomes and creating accountability. The NIC made recommendations to DESNZ and Ofgem to identify whether further standards are required to ensure the energy system is resilient and adequately considers changes to climate related threats.

5.20 Whilst standards, such as ETR138 Resilience of flood defence, have been instrumental to drive improvements for certain climate hazards, not all types of climate hazard are covered. Several standards use historical weather data and may need updating in light of climate change. There are also multiple actors setting standards, including government, regulators, industry and international organisations which has resulted in a fragmented landscape which makes it challenging to identify priorities for action. We plan to work closely with DESNZ and NESO on determining the best approach and clarify our role compared to other actors.

Actions to deliver on our four strategic priorities

5.21 The third level of our programme comprises specific actions which we will deliver and are summarised in this final section.

5.22 We will work closely with NESO and other key stakeholders to support DESNZ with the development of clear climate goals for the electricity and gas sectors in advance of the upcoming ED3 price control. A coordinated approach with DESNZ and the NESO, as well as industry and experts, will be essential.

5.23 We will review options for greater consideration of climate resilience within investment decisions in the next ED price control period. In November 2024 Ofgem consulted on the framework for the next electricity distribution price control period which will come into effect in April 2028. [43] The consultation outlined the context that drives the climate resilience agenda for ED3 and identifies some of the potential options to be considered. This includes, but is not limited to, investing in asset hardening, adapting cost-benefit analysis, and developing approaches to stress testing. We recognised that we must enable proactive investment, appropriately balancing risk and reward. Ofgem will continue to consider, and refine options based on feedback and ensure ongoing engagement with stakeholders. Further details will be provided in the ED3 Framework Decision which is expected to be published in Spring 2025, followed by Ofgem's publication of the ED3 sector specific methodology consultation (SSMC) scheduled in summer 2025.

5.24 We will require stress testing of the energy system's resilience to the current and future effects of climate change. As part of this, we will collaborate with network operators to produce guidance they can use to carry out stress testing at an asset and networks level.

5.25 We will also work closely with NESO to ensure stress testing for the system level. This includes how high impact, low probability events are considered within strategic planning processes, such as in the longer-term CSNP, FEP and SSEP. Ofgem, alongside DESNZ, will continue to support and oversee NESO as it builds up into its capabilities to deliver on responsibilities for strategic whole energy system resilience and coordination, including climate resilience.

5.26 We will look to improve our monitoring work, both internally and with network companies. This includes managing and developing our data on climate resilience and we will work with network companies to progress the development of CRMIs ahead of ED3. This will allow Ofgem to track progress on climate resilience and link stress testing to better understand current and future levels of resilience and enable monitoring over the longer term.

[43] https://www.ofgem.gov.uk/consultation/framework-consultation-electricity-distribution-price-control-ed3

5.27 We will look at approaches to value resilience, including cost benefit analysis. As part of this, we will work with the ENA, DESNZ and wider Ofgem teams to review the Value of Lost Load for electricity, which has not been updated in over 10 years. This will include its interactions within price controls and its role in valuing climate resilience.

5.28 We will build understanding for public acceptability of risk and the consumer view of what a resilient, net zero energy system should look like. This includes the public appetite on levels of service and how resilience should work for consumers and communities, to inform regulatory approaches and goals for the sector.

5.29 We will work with NESO, Government and industry to review the current landscape of standards which have a role in supporting climate resilience to identify priorities and gaps to address. This is important to support our regulatory role of ensuring sufficient funding throughout our price control periods.

5.30 We will continue our engagement with others, including international partners, to further our understanding of climate resilience on our future energy system and possible regulatory implications and solutions.

Appendices

Index

Appendix 1 – update on previous actions

Summary of actions	Timescale	Update
Monitoring and assessing the effectiveness of our regulatory tools and policies in ensuring that energy companies meet their adaptation needs.	On-going	Continual action. ED2 and RIIO 3 set out new requirements for climate resilience.
We will initiate work on the strategy for the next price controls (RIIO-T2 and GD2, followed by ED-2) in the next few years. As part of this, we will review the best available climate risk evidence and adaptation will be a future strategy consideration.	2015-2020	Complete. RIIO-ED2 introduced additional climate resilience provisions. DNOs are required to produce climate resilience strategies as part of their business plans.
We will work with our partner organisations in the UKRN to consider how to respond to the ASC recommendation over a review of reward and penalty regimes	Pending a final decision by UKRN but potentially taken forward in 2016	Ofgem continues to consider the effectiveness of reward and penalty regimes. Ofgem's recent ED3 framework consultation sought views on the current approach to regulating reliability44.
We have also initiated a new Insights for Future Regulation project to help us better understand what is driving system change, the likely impacts on consumers and the implications for regulation. This includes consideration of environmental factors, including impact from climate change. Knowing this will help set our future priorities for the evolution of regulatory arrangements.	Key findings to be reported at the end of 2016.	Complete.
Ongoing monitoring and review of the regulatory framework set out above will determine what further actions might be required	N/A	Continual action. Ofgem continually monitors and reviews the regulatory framework to identify further action. Alongside E3C, we

		published our Storm Arwen Report which made recommendations for further action to Ofgem, E3C and DNOs.

Appendix 2 – Actions delivered to-date

Action	Timing
ED2: Ofgem introduced new requirements on climate resilience for electricity distribution network companies. This included the requirement to submit a dedicated Climate Resilience Strategy as part of their business plans. We requested that strategies included the use of adaptation pathways to be used to inform the programmes of work that the DNO will need to carry out over the price control. RIIO-ED2 required a climate resilience working group to be set up and chaired by the ENA and also set out the ambition that network companies collectively deliver a "climate resilience metric" for implementation at the start of ED3.	Ofgem published its decision on policy in the sector specific methodology in December 2020. Final determinations were published November 2022. The price control period covers the five-year period from 1 April 2023 to 31 March 2028.
RIIO-3: Ofgem required electricity transmission companies and gas network companies to provide climate resilience strategies. This included the requirement to submit a dedicated Climate Resilience Strategy as part of their business plans.	Ofgem published its policy decision in the sector specific methodology in July 2024. Network companies submitted their business plans in December 2024. The price control period covers the fire-year period from 1 April

[44] ED3 Framework Consultation

	2026 to 31 March 2031.
Storm Arwen review: Ofgem conducted a review of electricity distribution companies response to Storm Arwen and made 20 recommendations to DNOs.	Ofgem published this review July 2022.
Storm Arwen re-opener: Ofgem introduced a reopener mechanism to allow additional funding to electricity distribution companies in response to Storm Arwen.	Draft Determinations were published Oct 2024. Final Determinations were published Dec 2024.
ED3 Framework consultation: Ofgem published a framework consultation for the third electricity distribution price control (ED3) to ask for options for addressing existing climate resilience challenges.	Consultation published Nov 2024.
Reporting requirements: Ofgem has continued to improve its reporting on outages through the annual review process. Ofgem's RIIO-3 SSMD stated that we will be increasing the reporting and assurance processes for asset data. This includes expanding the number of assets reported in its Network Asset Risk Metric, introduce more standardisation of reporting and inspection practices and introduce independent auditing One of 99 different direct causes of the faults are attributed, which includes weather related causes.	See ED2 and RIIO3 timings. Reporting is reviewed annually.
Innovation funding: Since 2021, Ofgem's Strategic Innovation Fund has enabled funding to meet a range of innovation challenges, including resilience.	Part of RIIO-2, and will be a part of RIIO-3.
Establish NESO Day 1 licences: In September 2024, DESNZ and Ofgem took the decision to establish set up NESO in September 2024. NESO was operational from 1 October, and holds both Ofgem granted NESO then Electricity System Operator ESO) Licence and Gas System Planner (GSP) Licence, which includes conditions C7 and C6 (respectively) on Energy resilience and resilience reporting.	Licences effective started from 1 October 2024.

Ofgem climate resilience expert panel: November 2024 Ofgem established an expert panel to provide technical advice on climate resilience challenges and implications for regulatory approaches.	Established November 2024 to run through 2025.
Future Energy Pathways guidance: Ofgem consulted on Future Energy Pathways Guidance which includes how high-impact, low-probability events, including climate change and extreme weather, should be treated as part of the methodology to inform decisions on the future system needs.	Consultation ran 13th August – 14th September 2024.
CSNP requirements: CSNP framework decision outlined requirements for NESO to consider resilience and high impact low probability events, including extreme weather.	Decision on CSNP framework was published 13th December 2023.
SSEP: Ofgem will work with NESO and DESNZ to support the approach for the Strategic Spatial Energy Plan, including considerations for security of supply and weather years within the modelling.	NESO published the consultation on SSEP methodology December 2024.
Code modifications: A suite of code modifications were introduced to implement the Electricity System Restoration Standard in 2024 which requires that in the event of a Total or Partial Shutdown of the Great Britain electricity system, the National Electricity System Operator (NESO) must be capable of restoring 60% of Demand on the Transmission System in all regions within 24 hours, and of restoring 100% of Demand nationally within 5 days.	Compliance is required for this licence by Dec 2026.

Glossary

Adaptation

The actions that protect us against the impacts of climate change. This includes reacting to the changes we have seen already, as well as preparing for what will happen in the future. Adaptation actions can either be incremental or transformative.

Adaptive pathways

A decision-making approach, that allows decision-makers to take actions under uncertainty. It enables the identification of what actions can be taken now and in the future.

Capacity adequacy

The ability of generation to match demand in line with security and quality of supply requirements.

Centralised Strategic Network Plan (CSNP)

Plan for the onshore and offshore transmission network to accommodate additional demand and generation, and planning where interconnection should be sited on the system. The CSNP will be delivered by NESO.

Codes

Industry codes underpin the electricity and gas wholesale and retail markets. Licensees are required to maintain, become party to, or comply with the industry codes in accordance with the conditions of their licence.

Climate risk

IPPC definition: Climate risk results from the interaction of hazard, exposure and vulnerability. Hazard refers to the potential occurrence of climate-related physical events or trends that may cause damage and loss. Exposure indicates the presence of assets, services, resources and infrastructure that could be adversely affected. Vulnerability is the propensity or predisposition to be adversely affected.

Climate resilience

Climate resilience is the ability for an individual, group, asset or system to anticipate, prevent, respond to and recover from a climate-driven shocks from extreme weather or longer term chronic stress such as increased average temperatures. These events may include flooding, storms, extreme or increasing average temperatures, wildfires and drought.

Climate resilience goal

Ofgem defines a climate resilience goal as the acceptable minimum level of resilience of energy assets and/or the system to climate impacts in order to provide a defined level of service to consumers. It should be balanced to ensure mitigations are pro-portionate and deliver the right level of protection at the right time. The aim of the goal should be to set targets and direction for regulation and policy.

Climate resilient network

A climate resilient network company is one where the physical network assets and company procedures have the measurable capacity to withstand impacts of current and future foreseeable climate hazards to provide a continuation of the primary service in line with existing standards of performance, or to facilitate a rapid service recovery from a climate hazard.

Cross-sector

Broad set of interdependencies which impact energy system, such as heat networks, transport, water and housing.

Cross-vector

Interdependencies between energy vectors, such as electricity, gas, heat and hydrogen.

Department for energy security and net zero

This is a ministerial department focused on delivering the energy portfolio.

Distribution Network Operator (DNO)

A company that operates the electricity distribution network, which includes all parts of the network from 132kV down to 230V in England and Wales. In Scotland 132kV is a part of transmission rather than distribution so their operation is not included in the DNOs' activities. There are 14 DNO licensees that are subject to RIIO price controls. These are owned by six different groups.

Gas Distribution Network (GDN)

A company that operates the gas distribution network that transports gas from the transmission system to homes and businesses.

Goal

Ofgem defines a climate resilience goal as the acceptable minimum level of resilience of energy assets and/or the system to climate impacts in order to provide a defined level of

service to consumers. It should be balanced to ensure mitigations are proportionate and deliver the right level of protection at the right time. The aim of the goal should be to set targets and direction for regulation and policy.

High Impact Low Probability (HILP) events

Events or occurrences that cannot easily be anticipated, arise randomly and unexpectedly, and have immediate effects and significant impacts.

National Energy System Operator

A new body that will take on the existing roles and responsibilities of National Grid ESO and longer-term whole system planning, forecasting and resilience functions.

Price controls

The regulatory mechanism developed by Ofgem to set targets and allowed revenues for network companies. Its characteristics are developed in the price control review period depending on network company performance over the last control period and predicted expenditure (companies' business plans) in the next.

RIIO – ED2

The price control applied to the electricity distribution network operators. It runs from 1 April 2023 to 31 March 2028.

RIIO – 3

The price control applied to the electricity transmission network operators and gas network operators. It runs from 1 April 2026 to 31 March 2031.

Standard

A document, established by consensus and approved by a recognised body providing rules, guidelines or characteristics for activities or their results. Standards may include technical asset standards and system recovery standards.

Strategic planning

A coordinated whole-system approach to spatial planning that will allow a more holistic understanding of the long-term changes across the whole energy system. Some of these plans include the Strategic Spatial Energy Plan, Centralised Strategic Network Plan and the Regional Energy Spatial Plan.

Stress testing

[Ofgem is using] the National Infrastructure Commission definition for stress testing: 'testing a representation or simulation of a system to reveal its performance under certain conditions or to reveal the conditions that could lead to failure.' It will focus on stress testing the energy system's resilience to current and future climate change.

Transmission network

The system of high voltage electric lines and high-pressure pipelines providing for the bulk transfer of electricity and gas across GB.