Data Classification: Public

Electricity System Restoration

Assurance Framework
2026/27

Consultation Draft

NESO
National Energy System Operator

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Abbreviations

Abbreviation	Description
BESS	Battery Energy Storage Systems
BMRS	Balancing Mechanism Reporting Service
BSC	Balancing and Settlement Code
CMP	CUSC Modification Proposal
CTU	Control Training Unit
CUSC	Connection and Use of System Code
DER	Distributed Energy Resource
DESNZ	Department for Energy Security and Net Zero
DNO	Distribution Network Operator
DRZ	Distribution Restoration Zone
DRZP	Distribution Restoration Zone Plan used for distribution network restoration
eNAMS	Electricity Network Access Management System
ENCC	Electricity Network Control Centre
ESR	Electricity System Restoration
ESRS	Electricity System Restoration Standard
ETG	Electricity Task Group (ETG)
EU	European Union
GC	Grid Code
ICCP	Inter-Control Centre Protocol
IEMS	Integrated Energy Management System
LJRP	Local Joint Restoration Plan used for transmission network energisation
NCMS	Network Control Management System
NESO	National Energy System Operator
NETS	National Electricity Transmission System
NGET	National Grid Electricity Transmission
NPO	National Power Outage
OFTO	Offshore Transmission Owner
PI	Plant Information

Consultation Questions

The following questions are intended to guide your feedback on this draft consultation document. Your input will help NESO refine and improve the final version and identify any gaps or shortcomings. Please review the questions below and share your comments or suggestions with us at esrsimplementation@neso.energy by 15 February 2026.

Table 1: List of consultation questions

Questions for All Respondents
1. Based on the proposed activities outlined in Chapter 1, do you believe there are any gaps, challenges or factors that could hinder the industry's ability to meet the Electricity System Restoration Standard (ESRS) 2026 target?
2. Given that technology and industry practices continue to evolve, do you believe the foundational modelling assumptions outlined in Chapter 4.4 remain valid and realistic?
3. Mobile phones and landline telephones may only function for a short period following a National Power Outage (NPO) event. Have you implemented automated processes and communication systems to support reliable restoration within a limited timeframe and ensure readiness by December 2026? Please explain what gives you confidence in your approach, or outline any concerns you have about the adequacy of your communication procedures following an NPO.
4. To help NESO understand your organisation's overall readiness for restoration following an NPO event, please provide insights on key aspects of preparedness, resilience and risk mitigation. In particular, consider staff training, logistical and emergency preparedness, lessons learned from past events, system monitoring, single points of failure, regulatory or technical barriers, cybersecurity resilience, and alignment with evolving Grid Code requirements and standards. Based on these considerations, how confident are you in your organisation's ability to support restoration effectively? What gives you confidence, and what concerns or gaps do you see that could hinder readiness? Please share any mitigation measures or recommendations you believe are critical.
5. Considering NESO's approach for ESRS go-live in December 2026 and the planned activities for 2027–2029 and beyond, what additional changes would you like to see that could improve restoration times and overall efficiency? Are there any risks, aside from those outlined in Chapter 5, that could jeopardise the successful implementation of the ESRS?
6. NESO plans to initiate an industry restoration working group and explore additional collaboration with the International Electrotechnical Commission (IEC) and British Standards (BS). Would you be interested in participating in these initiatives, and do you have any recommendations or suggestions for areas of focus?

Transmission Owners (TOs) Only

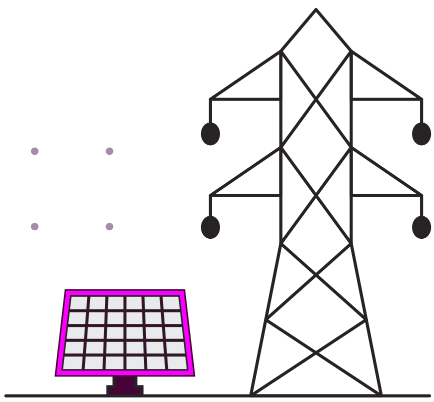
7. As a TO, are you confident in your ability to implement at least two LJRPs per Restoration Region within the first 2.5 hours following an NPO declaration by NESO by December 2026? Please explain what gives you confidence in achieving this or outline any concerns you have about meeting this requirement.

Distribution Network Operators (DNOs) Only

8. Grid Code clause ECC/CC7.11.4 states that DNOs must work with NESO and TOs to switch demand quickly enough to help meet the Electricity System Restoration Standard. Are you confident that this code will drive appropriate action and support effective collaboration through the working group? Please explain what gives you confidence or outline any concerns you may have.

DNOs, TOs and Restoration Contractors Only

9. As a TO, DNO or Restoration Contractor, are you confident in delivering the first demand block within 2.5 hours following an NPO declaration by NESO by December 2026? Please explain what gives you confidence in achieving this or identify any blockers or concerns that could prevent meeting this requirement.



Executive Summary

This document sets out the National Energy System Operator (NESO)'s assurance framework for compliance with the Electricity System Restoration Standard (ESRS), as mandated by the Department for Energy Security and Net Zero (DESNZ) under licence condition C4 of the system operator licence conditions. With the measures set out in this document, NESO, with the cooperation of industry, will meet the licence requirement to restore 60% of national electricity demand within 24 hours across all seven Restoration Regions, and 100% within five days, by 31 December 2026.

The framework details the engineering, operational and regulatory measures underpinning this commitment and future enhancements, including:

- **restoration capability:** NESO has established commercial contracts with Restoration Contractors with self-start capability at strategic sites
- **demand block loading:** a 10-minute block loading interval across all Distribution Network Operator (DNO) regions is being adopted, supported by Grid Code Modifications
- **generation readiness:** Primary and Secondary Generators are subject to periodic capability assessments and targeted training, and 83% of contracted generator capacity has confirmed 72-hour resilience by 31 December 2026
- **Regional Restoration Plans (RRPs):** RRPs are being developed for all seven Restoration Regions to provide a structured approach for system recovery
- **data, tools and innovation:** NESO is deploying new Inter-Control Centre Protocol (ICCP) links, implementing the Restoration Decision Support Tool (RDST), and integrating distributed energy resources and battery reserves to enhance system resilience and support restoration speed
- **monitoring and assurance:** compliance is tracked through structured oversight, including Week 24 submissions, capability assessments and continuous review of Grid Code provisions. The Empirical Restoration Framework[1] supports ongoing validation of restoration assumptions and strategies

NESO's approach is grounded in probabilistic modelling, engineering judgment and lessons learned from international events. This framework ensures that restoration targets will be achieved through coordinated industry action, effective technical solutions and continuous improvement.

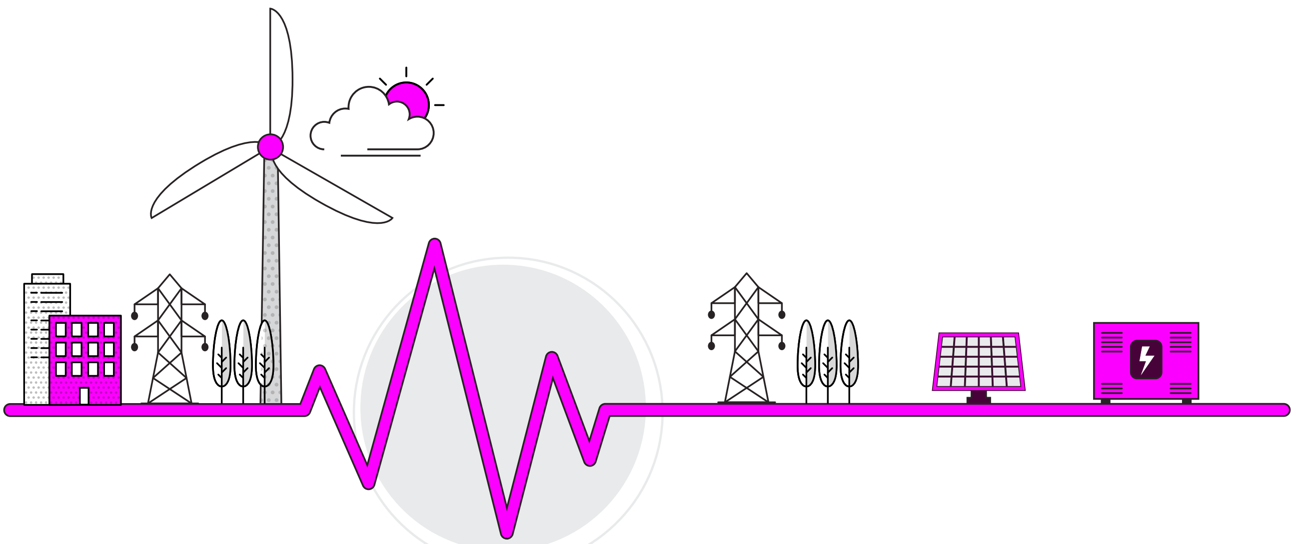
1 A data-driven framework that uses empirical analysis to improve electricity system restoration after major outages.

Vision

NESO's vision is to lead the transformation of system restoration and resilience for Great Britain's electricity network. Building on the foundations set out in the RIIO-2 Business Plan, our priorities for 2026 and beyond are to:

- deliver and sustain compliance with the ESRS, embedding it into business-as-usual operations from 31 December 2026
- develop and expand competitive market services to support evolving operational needs
- maintain and enhance legacy systems while deploying new tools and technologies to future-proof the Electricity Network Control Centre (ENCC)
- advance reform of codes and regulatory frameworks to support restoration and resilience
- improve transparency around assumptions and expectations of critical stakeholders, ensuring all parties have clarity on roles and responsibilities
- be transparent in testing and exercising restoration processes, incorporating international best practice to support Great Britain's ambition to be a world leader in system restoration
- strengthen system insights and improve visibility of Distributed Energy Resources (DERs) through ICCP links to support whole-system coordination
- ensure networks are fit for the future, with improved access and flexibility for all users
- continue to advance restoration strategies and embed sustainability principles, ensuring resilient recovery pathways that minimise environmental impact
- support the integration of future-generation technologies and accelerate the transition to clean, reliable power sources, enabling progress toward a net-zero electricity system
- foster collaboration with government, the Regulator and industry to continuously improve system restoration capability

NESO is committed to sustaining ESRS compliance, improving restoration performance and delivering a more resilient, agile and future-ready electricity system for all.



Introduction to ESRS

NESO is an independent public corporation at the centre of Great Britain's energy system, taking a whole-system view to ensure everyone has access to reliable, clean and affordable energy. To mitigate the high-impact, low-probability risk of a Total System Shutdown, classified in the National Risk Register for its severe economic and societal consequences, DESNZ issued the ESRS in 2021. The ESRS requires the system in Great Britain to have sufficient capability by 31 December 2026 to restore 60% of national demand within 24 hours across all seven Restoration Regions and 100% within five days.

Meeting these targets requires a coordinated and well-prepared response across the industry.

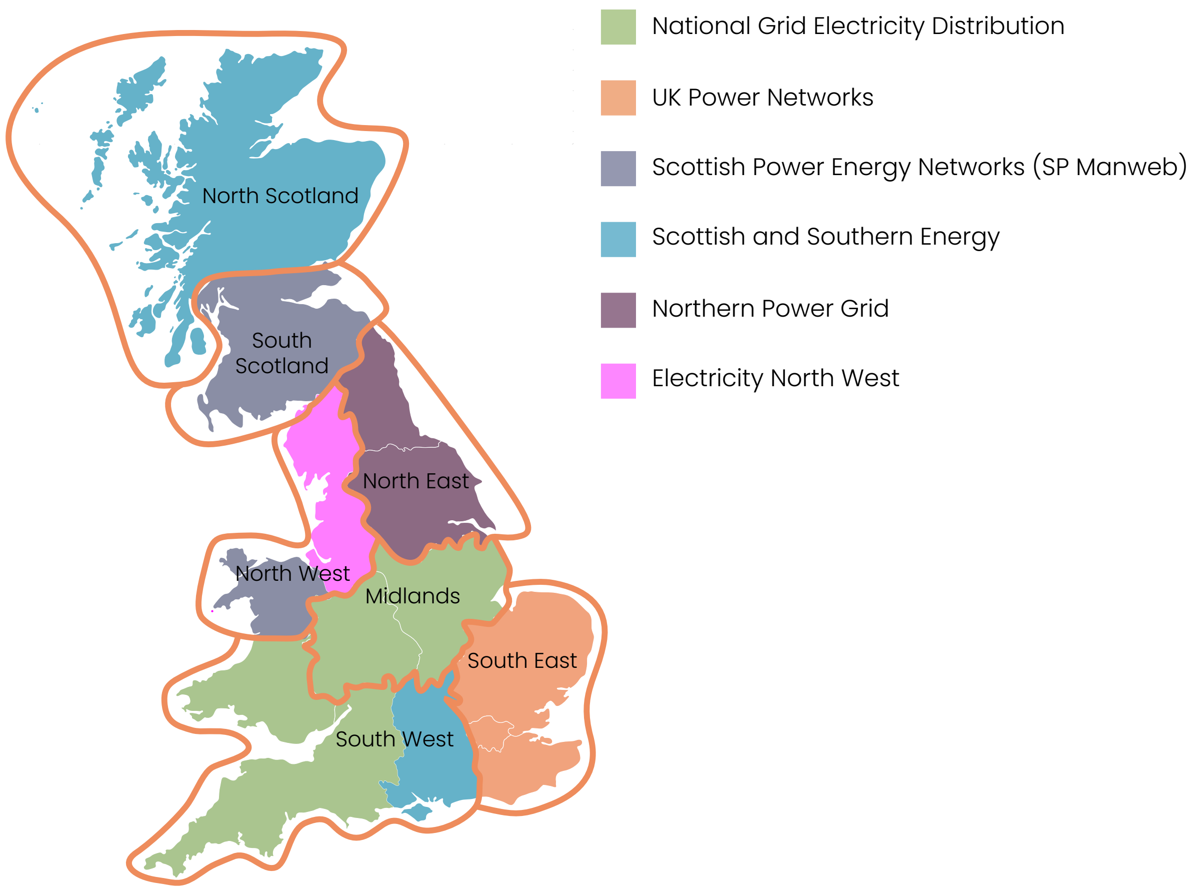


Figure 1: Restoration Regions

NESO plays a central role in planning and coordinating restoration activities across the seven regions, ensuring all parties are prepared to respond effectively. Delivering the ESRS requires full commitment from every stakeholder, as restoration is a shared responsibility involving NESO, Transmission Owners (TOs), DNOs, Generators and other market participants. NESO is specifically responsible for overseeing restoration capability, processes, testing and procurement, supported by a fleet of Restoration Contractors strategically positioned across the network in Great Britain.

These contractors provide two distinct services:

- **Primary Electricity System Restoration (ESR) Contractors**
  Contracted providers with the technical capability to start their generating units independently, without external electrical supplies. Once operational, they re-energise predefined sections of the network to form local Power Islands.
- **Top-Up ESR Contractors**
  Contracted providers that cannot self-start but maintain readiness to synchronise with existing Power Islands once external supplies are restored, supporting the expansion of restored areas.

Following the declaration of an ESR event and the development of an ESR strategy, Restoration Contractors are instructed to activate Local Joint Restoration Plans (LJRPs) or Distribution Restoration Zonal Plans (DRZPs). These pre-agreed plans guide the formation of Power Islands and the initial stages of restoration.

Once a Power Island is established, ESR Contractors begin restoring local demand blocks. As stability is confirmed, NESO coordinates with Network Operators to expand restoration across the wider system, prioritising geographic location and immediate restoration needs.

To support this process, NESO is developing Regional Restoration Plans (RRPs) for each of the seven Restoration Regions. These documents will detail contracted ESR Contractors, non-contracted Secondary Generators, large demand blocks and sensitive or critical sites for restoration (such as gas terminals). RRPs will be used by all Network Operators to guide the transition from isolated Power Islands to larger regional or national transmission islands.

As synchronisation of additional generating units increases total capacity, the size of demand blocks available for restoration grows. RRPs define the size and location of these blocks, which are essential to meeting ESRS restoration targets and ensuring system resilience.

NESO is also responsible for procuring and onboarding restoration services. Competitive regional tenders have been launched to secure Primary Generator and Top-Up Generator services from both transmission and distribution connected assets. These tenders support the transition from project phase to complete delivery of the Distributed ReStart service.

The procurement strategy for ESR is based on a combination of technical and economic considerations. NESO procures regionally to align with the ESRS regional directive. LJRPs are then designed from this regional approach to ensure NESO is aligned from the Expression of Interest stage through to the Contract Start date.

While competitive tenders are the primary route, NESO retains the ability to use bilateral procurement where urgent needs arise. Progress on procurement includes:

- **South West and Midlands – transmission and distribution connected assets**
  Tender launched in 2024/25. Contracts scheduled for award in Q4 [2] 2025, with services operational by August 2027.
- **National – transmission connected assets only**
  Long-term 2029 tender launched in Q1 2025 to procure Stability, Voltage and Restoration services via a bundled approach. Contract award expected in Q2 2026, with services going live in Q3 2029.

2 Q1 covers April–June, Q2 covers July–September, Q3 covers October–December, and Q4 covers January–March.

01

Regulatory Years 2026-2027: Achieving the Standard

By applying probabilistic modelling, engineering judgment, targeted stakeholder engagement and lessons learned from global blackouts, a set of activities required to meet ESRS requirements has been identified. While NESO is leading the implementation, success depends on close collaboration with TOs, DNOs and Generators. Each party plays a critical role in ensuring that the measures are practical, coordinated and aligned with system resilience objectives.

These activities incorporate clear rationale, implementation considerations and expected outcomes, forming a structured pathway toward achieving full ESRS compliance. With only one year remaining before ESRS implementation, we recognise the urgency and are intensifying our approach by rigorously testing key assumptions, asking detailed practical questions of ourselves and our partners, and ensuring stakeholder readiness to deliver on restoration commitments. The roadmap for completing these activities is shown in Figure 2, which demonstrates the current status and timeline.

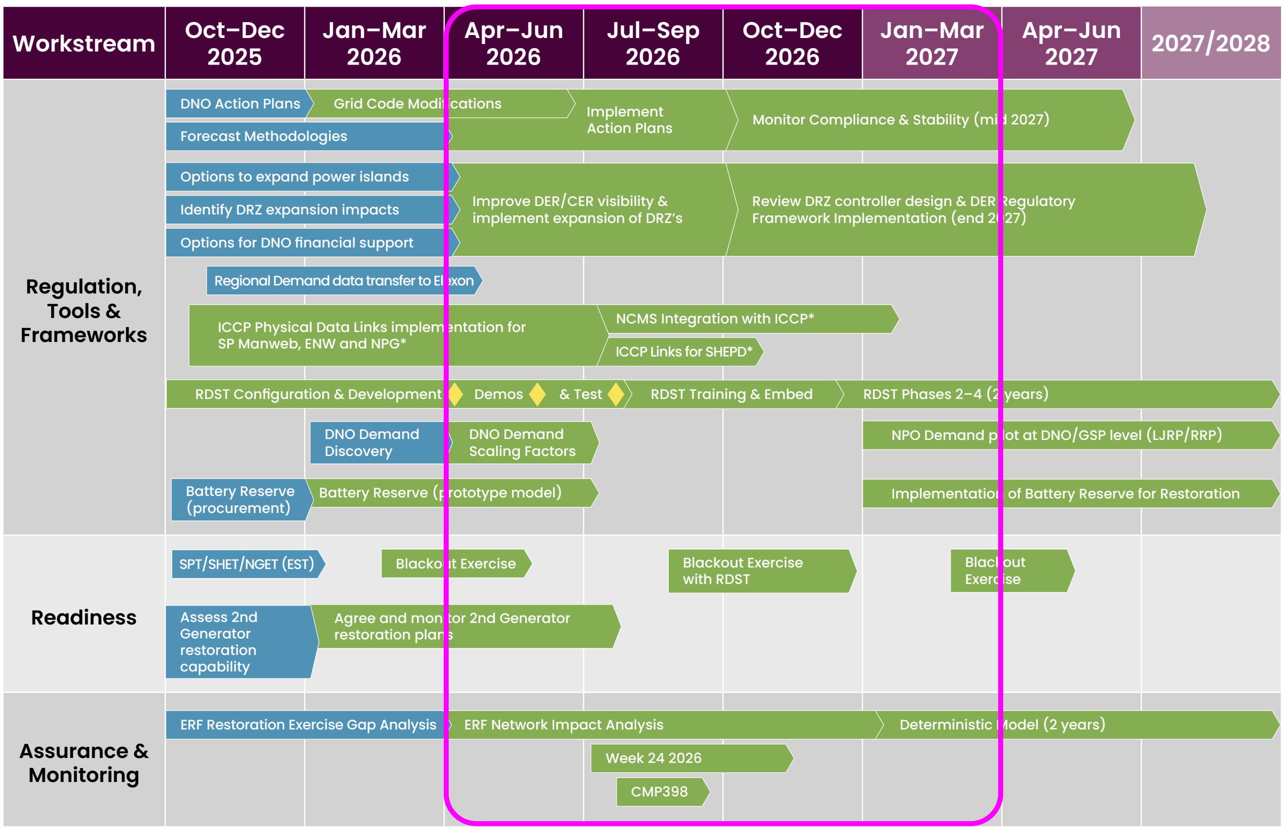


Figure 2: Roadmap for delivering ESRS compliance

1.1 Regulatory framework Modification

Modifications to the Grid Code GC0156 were completed to support ESRS compliance, leading to consequential changes across other industry codes, including:

- System Operator Transmission Code (STC) and System Operator Transmission Code Procedures (STCP)
- Security and Quality of Supply Standard (SQSS)
- Balancing and Settlement Code (BSC)
- Connection and Use of System Code (CUSC)

In addition, several important industry codes and standards were modified to align with these changes, such as:

- System Defence Plan
- System Restoration Plan
- System Test Plan
- Electrical Standards, including Control Telephony, Communication Standard and Distribution Restoration Zone Control System Standard

Ofgem approved all these Modifications.

In accordance with the GC0156 Grid Code Modification, specifically provision OC1.7, daily forecasts of 60% and 100% of peak, day-ahead national demand for each region are required to be published via Elexon's platforms during normal operations, with best endeavours to provide hourly updates on demand restored in each region during system restoration.

To enable compliance with OC1.7, BSC Modification P480 was introduced, mandating the sharing of the required data and its publication on the appropriate platform. As the Balancing Mechanism Reporting Service has been superseded by the Insights Solutions platform; all data is now published there.

Forecasts have been developed to serve as restoration targets and can be generated by Restoration Region. In collaboration with Elexon, a process has been implemented to share updated forecasts through the Insights platform, ensuring timely and accurate information during both normal operations and restoration scenarios.

1.2 Generation readiness

Primary ESR Contractors with self-start capability, which are critical to initiating restoration, continue to be assessed and supported to ensure readiness to deliver contracted services. Periodic ESR Contractor Capability Assessments and testing are carried out, allowing contractors to demonstrate their technical ability to provide ESR services in alignment with designated Local Joint Restoration (LJRPs) or Distribution Restoration Zone Plans (DRZPs).

This ongoing validation process ensures that Primary Contractors can reliably initiate restoration and form the foundation of Power Islands during a national power outage (NPO).

To date, 13 capability assessments have been completed, with a further 4 scheduled. These assessments have been expanded to evaluate a range of restoration service elements across the network, including:

- two Top-Up tests involving synchronisation to the live system and reactive power loading
- one test demonstrating synchronisation to the wider network via a Power System Synchroniser
- one test involving energisation of a 275/132 kV supergrid transformer (SGT)
- one comprehensive test covering energisation of:
  - 2 × 132 kV busbars
  - 1 × 33 kV busbar
  - 1 × 11 kV busbar

- 1 × 132 kV circuit
- 1 × 33 kV circuit
- 1 × 132/11 kV grid transformer (GT)
- 1 × 11/33 kV GT

- restoration of supplies and synchronisation of secondary generation

These tests not only confirm technical readiness but also provide valuable insights into the operational dynamics of restoration, helping NESO refine its strategies and support robust system recovery capability.

In parallel, secondary generation plays an important role in meeting the ESRS as it is required to support the expansion and stabilisation of Power Islands during a restoration event. These Generators, which are CUSC signees, join the restoration process following activation of LJRPs and DRZPs. Their readiness is essential to providing additional capacity as demand increases and restoration progresses.

Secondary generation integrates into Power Islands to strengthen and expand them, helping the system reconnect more areas efficiently. By adding generation capability at the appropriate stages, these units help achieve ESRS targets for timely and effective recovery.

An example of the restoration stages is shown in Figure 3, as set out in the Regional Restoration Plans (RRPs) and described in Section 1.5:

- **Stage 1:** The system is completely de-energised, transmission equipment is in an uncertain condition, Restoration Service Providers are preparing and the restoration strategy is being developed. The first ESR generation is synchronised, marking the enactment of an LJRP.
- **Stages 2–4:** Demand block loads are applied, and the Power Island is progressively expanded to include non-contracted stations.
- **Stage 5:** Regional Power Islands are synchronised to ensure system stability.
- **Subsequently:** Regional Power Islands are synchronised further to form multi-regional Power Islands, progressing towards complete national restoration.

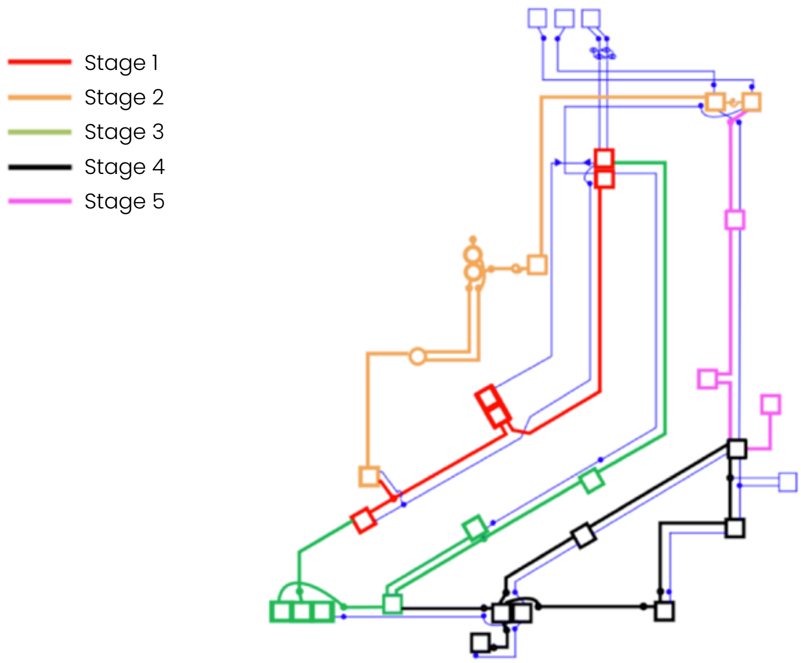


Figure 3: System restoration stages

To support operational readiness, NESO held a Compliance seminar in October 2025, followed by a series of Secondary Generator preparedness webinars in Q3 2025. These webinars were designed to enhance understanding of restoration requirements, guide participants through compliance activities and introduce the development of a Secondary Generator preparedness guidance document.

Focus areas for the webinars include:

- communication during a restoration event
- system checks during a restoration event
- logistics
- data submission during a restoration event
- compliance with Parts 1 and 3 of Schedule 16 of the Data and Registration Code used in system restoration

This guidance helps ensure that all Generators are informed, ready to assist during restoration and able to support consistent network performance while minimising risks arising from delays or incomplete preparation.

1.3 Demand block loading speed

Block loading is a critical component of Electricity System Restoration, enabling DNOs to reconnect demand in a controlled and coordinated manner. Before re-energisation, DNOs segment their networks into predefined demand blocks, which are progressively energised as generation availability increases. This approach supports the stable expansion of Power Islands and helps maintain system integrity during restoration.

The pace at which these blocks are reconnected varies across DNOs and depends on factors such as network configuration, generator ramping capability and switching mechanisms (such as remote versus manual switching). For modelling purposes, NESO currently assumes a conservative interval between block reconnections. However, analysis indicates that reducing this interval can significantly improve restoration timelines. Even modest reductions yield meaningful gains in the speed at which electricity demand is restored across regions.

Securing a consistent 10-minute demand block loading speed across all DNO regions has emerged as a practical pathway to achieving the targets set out in the ESRS. Discussions with DNOs suggest that faster block loading is feasible. While Grid Code clauses ECC/CC 7.11.4 require network companies to support NESO by providing adequate demand reconnection speeds, there is currently no formal standard specifying a target interval. To address this, a Grid Code amendment is being proposed as part of an upcoming Modification, which is expected to be completed ahead of the ESRS implementation date.

Formal requests have been issued to all DNOs to support adjustments to the assumptions underpinning the restoration model, and NESO has been actively engaging with DNOs on this issue. So far, all DNOs have indicated confidence in their ability to achieve the 10-minute block loading target.

Modelling results indicate that implementing the demand block speed change could improve restoration times by approximately 33% compared with existing capability, significantly reducing the time required to restore 60% of demand across all regions and satisfy ESRS requirements.

Table 2: Estimated Modification timelines

Project Activities	Timelines
Formal letters sent to DNOs	July 2025
DNO inclusion in discussion group	September 2025
DNO responses to letters	September 2025
Informal discussions with DNOs and TOs	Q3 2025–Q4 2025
Proposal to raise Grid Code Modification	Q1 2026
Implementation	Q3/Q4 2026

1.4 Demand block loading stability

Unpredictable demand blocks during restoration increase the likelihood of instability within a Power Island and raise the risk of collapse, which can significantly delay the restoration process. This challenge is amplified by the growing presence of Distributed Energy Resources (DERs) and consumer energy resources. Higher DER penetration can introduce voltage stability issues at the transmission level, making the determination and maintenance of block load sizes more complex.

Reducing demand block rejection rates is therefore critical to meeting ESRS targets. In the probabilistic restoration model, a 1-in-20 rejection rate is assumed; however, analysis indicates that lowering this to 1-in-100 could shorten the time required to restore 60% of demand across all regions by 24% compared with existing capability.

To address this, a dedicated workstream has been established to reduce demand rejection rates. Engagement with DNOs has highlighted the need for a clear policy on the role of DERs and guidance on managing these resources during restoration. As part of the Modification, Regional Restoration Plans (RRPs) are being codified to include specific instructions for block loading to minimise rejection risk. The requirement for these plans to specify block loading for stability will be included in the same Grid Code Modification that addresses block loading intervals, ensuring both measures follow a common timeline.

1.5 Regional Restoration Plans (RRPs)

The ESR team within NESO is responsible for drafting the RRPs for each of the seven Restoration Regions, with input from TOs, DNOs and Restoration Contractors to ensure a clear framework for restoration, while orchestration during system recovery is coordinated by the Control Room.

Each plan will include multiple LJRP's, details of contracted ESR contractors, non-contracted Secondary Generators, demand block prioritisation and restoration-critical sites (including renewables). RRPs will be used by NESO to manage the transition from LJRP to larger regional or national Power Islands.

As additional generating units are synchronised, total capacity increases and larger demand blocks can be restored. RRPs define the size and location of these blocks to maintain stability and support efficient restoration. This approach is expected to improve system stability and reduce restoration time, helping meet ESRS targets. All seven RRPs will be completed before December 2026.

02

Regulatory Years 2027–2029:
Beyond Compliance

While the activities outlined in previous sections are sufficient to meet ESRS requirements under the current grid configuration, the network continues to evolve. Restoration must therefore remain a continuous process, supported by ongoing improvements and adaptations to address future system changes.

From 2027 onwards, the focus will shift to embedding ESRS practices as business-as-usual, while introducing measures to enhance restoration performance, system resilience and the continued development of a long-term sustainable restoration strategy.

Business-as-usual activities will include:

- reviewing Grid Code Modifications implemented in prior years and raising further changes where required
- ensuring compliance with updated provisions
- expanding in-field testing to include Distribution Restoration Zone Plan (DRZP) providers, with multiple tests already planned
- conducting industry-wide exercises on restoration scenarios and resilience settings, including testing of post-LJRP restoration procedures in collaboration with TOs and DNOs
- continuing procurement of Restoration Contractors through competitive tendering to expand coverage and capacity
- using the Electricity Network Access Management System (eNAMS) outage reporting for proactive planning and early identification of LJRPs and DRZPs affected by outages
- embedding a framework for network owners and DERs to clarify roles, responsibilities and communication channels
- monitoring obligations through periodic data submission checks to ensure compliance with the Grid Code and operational frameworks

These measures will become part of standard operational practice, maintaining readiness and supporting continuous improvement beyond compliance.

In addition, a series of **forward-looking activities will be developed to strengthen future restoration capability**. These initiatives are expected to improve overall effectiveness, reduce restoration times and enhance system reliability.

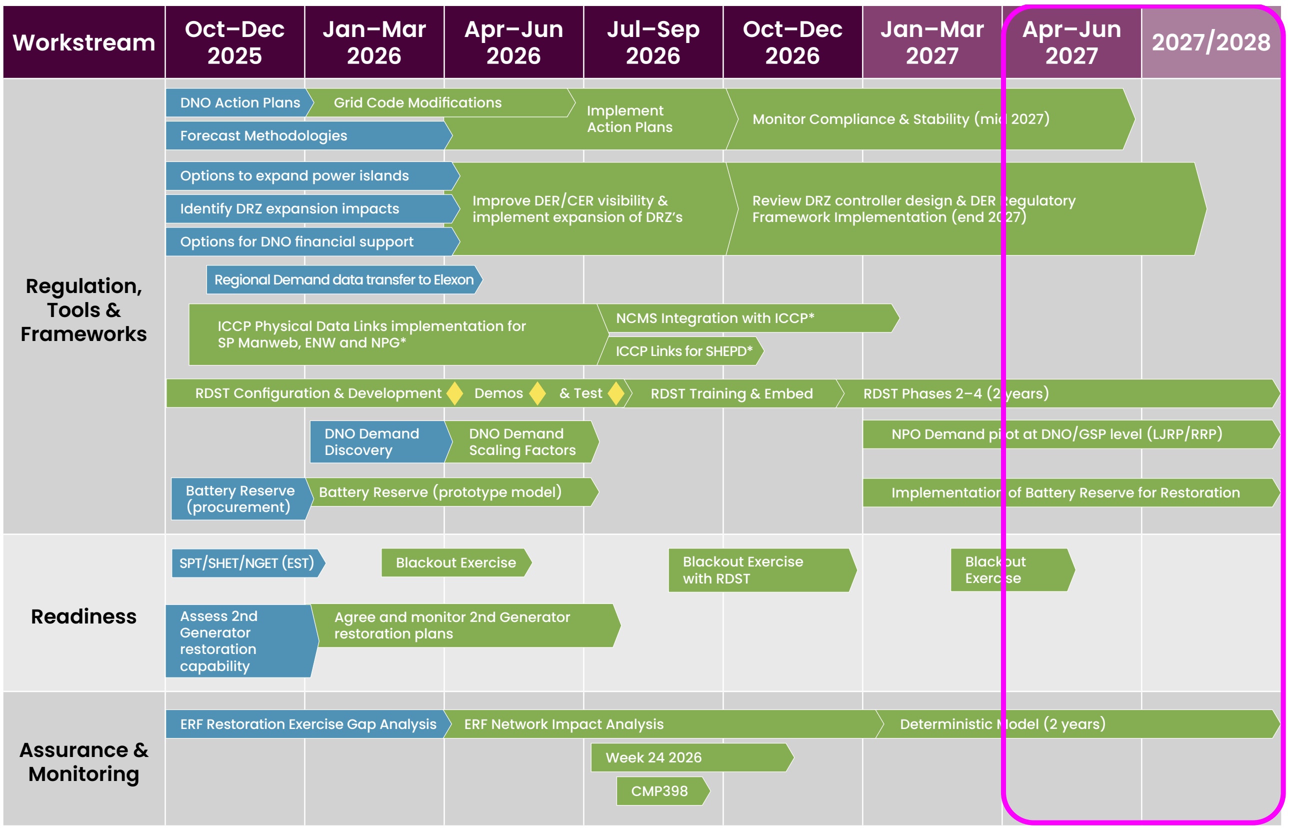


Figure 4: Roadmap for enhancing and sustaining compliance

2.1 Distribution Restoration Zone (DRZ) sizes

In addition to restoration plans developed around transmission-connected generators, the Distributed ReStart project demonstrated the viability of also using distribution-connected generators. NESO has now formulated restoration plans, known as DRZPs, based on generators connected to the distribution network. We have procured distribution restoration providers through recent tenders and DRZPs are currently under development.

Sensitivity analysis indicates that the megawatts delivered by a DRZP in each Restoration Region can influence the time required to achieve 60% of electricity demand across all regions. The analysis suggests that a firm DRZP response of 1 GW in each Restoration Region will reduce the time to the 60% target by **approximately 21%** compared with existing capability, while a firm response of 500 MW will reduce this time by approximately 12%.

It is likely that the Generators within a DRZP are very small (potentially only tens of megawatts), which necessitates strategies to increase the megawatt output from a DRZP beyond the contracted value so that they have more impact on restoration times.

By December 2026, only a few DNOs will have a DRZP within their licence areas, and NESO has already commenced engagement on DRZ expansion. To date, one DNO has proposed expanding DRZs to include non-contracted Generators, which could deliver more than 1 GW during restoration. Regular discussions are ongoing to develop the specifics of this plan; however, completion is not expected before 2028.

In parallel, NESO is engaging with other DNOs to establish additional arrangements that will enable DRZ expansion by 2028. We recognise that significant lead time is required, as DERs are not currently subject to Grid Code requirements and lack shutdown resilience and robust communication capability, unlike CUSC-connected Generators, which must maintain 72-hour resilience. Working with DNOs and Ofgem to address these challenges will be critical to supporting long-term system restoration efforts.

2.2 Inter-Control Centre Protocol links

To support the integration of DRZs into the restoration framework, NESO is delivering new ICCP links between NESO and DNOs that currently lack direct connectivity. This initiative includes the deployment of three new ICCP links, connecting NESO with SP Manweb, Northern Powergrid and Electricity North West, and the upgrade and takeover of an existing Plant Information (PI) link with Scottish Hydro Electric Power Distribution. The physical links are scheduled to be in place by Q1 2026.

Real-time data exchange between NESO and Generators within DRZPs is essential, as NESO does not normally have visibility of the DNO network.

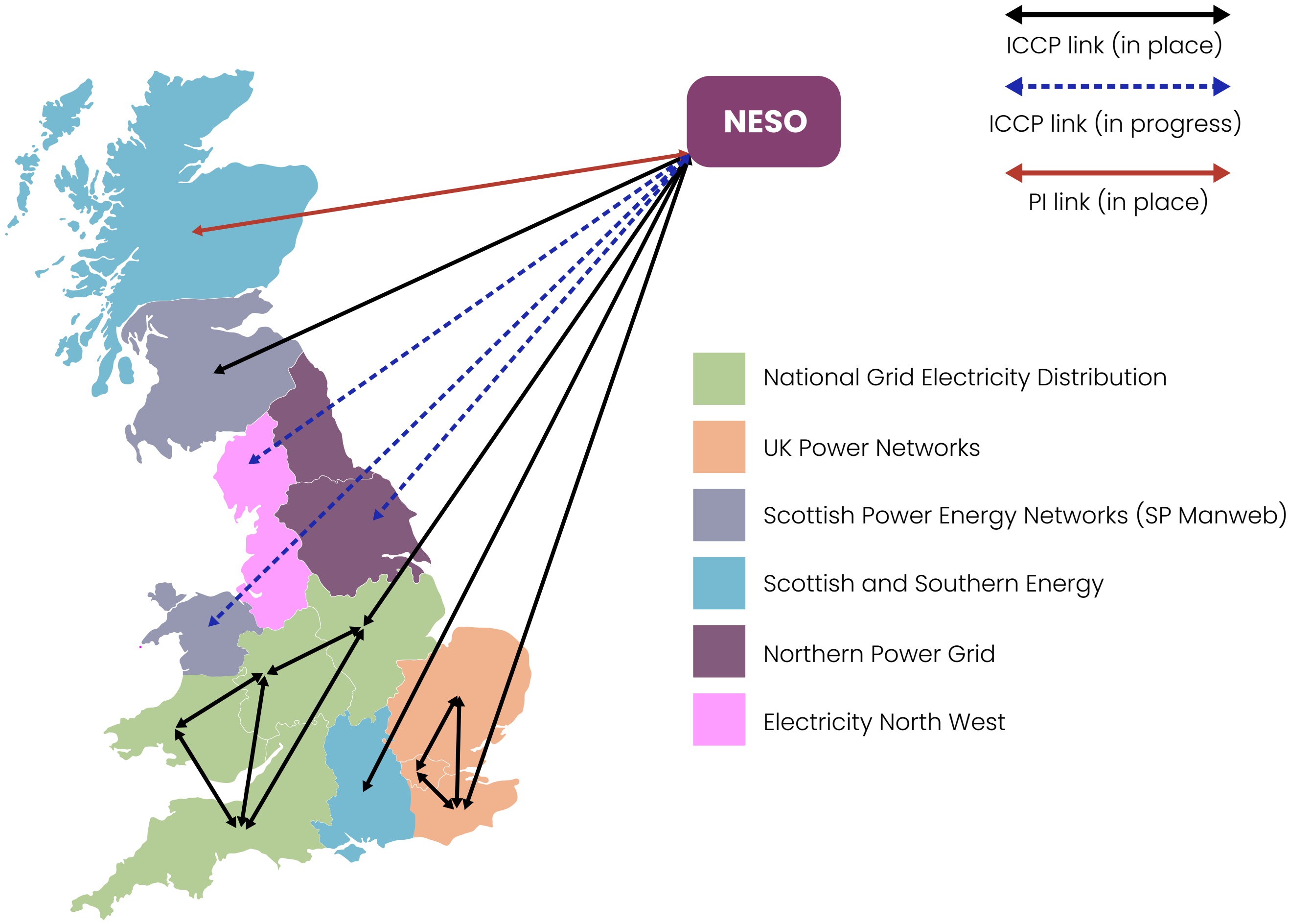


Figure 5: Current and future DNO ICCP links

2.3 Restoration Decision Support Tool

The Restoration Decision Support Tool (RDST) is designed to help control engineers manage cognitive load and identify effective strategies during system restoration. As providers and distributed plans increase in number, the tool is expected to play an expanding role in the restoration process.

The tool will enhance the control room's operational effectiveness during system restoration by providing real-time decision support and situational awareness. It will integrate data from multiple sources, including the Integrated Energy Management System (IEMS), forecasting systems, a NESO system that stores data from IEMS called the data historian and pre-agreed restoration plans, to generate route recommendations and visualise the health of different network zones. By reducing cognitive load on control room engineers, the tool may help reduce fatigue and support restoration stability.

The proposed delivery approach has been agreed with the selected delivery partner; Phase 1 will be delivered in Q1 2026 for testing, with a planned go-live in the control room by Q3 2026. Further phases to provide full functionality of the tool will be implemented over the following two years.

2.4 Battery reserve for restoration

As the electricity system evolves toward decentralised, low-carbon generation, the role of DERs in restoration planning becomes increasingly important. Battery Energy Storage Systems (BESS) and Vehicle-to-Grid (V2G) technologies have the potential to provide flexible, fast-response support during a national power outage. Using these assets could accelerate restoration, enhance system stability and enable more adaptive restoration strategies.

NESO is leading an innovation initiative to examine how distributed battery resources can be integrated into restoration processes to complement existing capabilities and strengthen overall system resilience. The project focuses on how battery installations within the distribution network can contribute to faster block loading, soft energisation, improved system stability and sectional energisation during restoration. It also evaluates the feasibility of autonomous control strategies under degraded grid conditions and considers whether current Grid Code provisions and market arrangements are adequate to support emergency deployment.

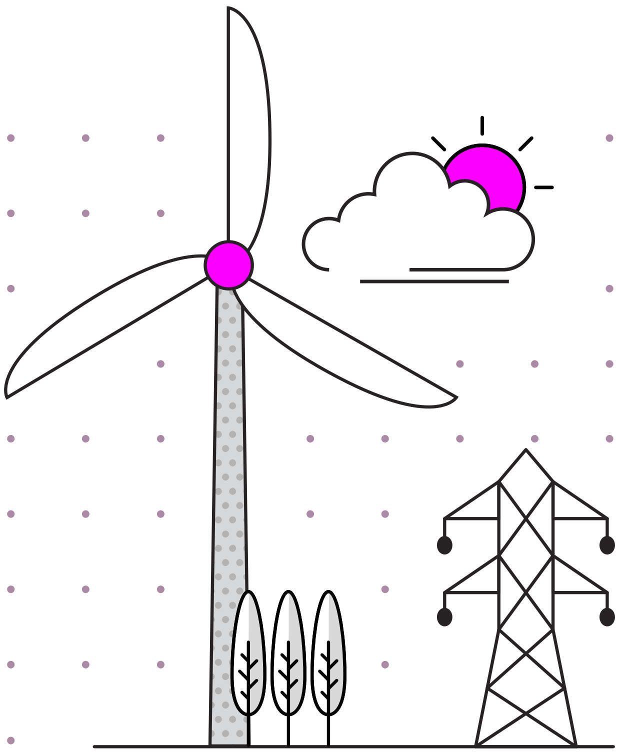
Initial modelling will provide indicative insights into asset coordination, availability and restoration value. The outcomes are expected to inform future restoration strategies by improving restoration speed, enhancing system stability, enabling decentralised restoration zone planning and supporting the development of alternative restoration pathways. Expected benefits include improved stability, reduced restoration time, lower overall costs and accelerated adoption and expansion of DRZPs. The first phase of the project is scheduled to commence in Q3 2025.

2.5 National Power Outage demand calculation

Accurately forecasting electricity demand following a National Power Outage (NPO) is a significant and under-researched challenge. Conventional assumptions based on normal operating conditions do not apply, as post-outage demand is shaped by unpredictable consumer behaviour, variability in embedded generation and regional recovery dynamics. In an NPO context, much of the projected demand may ultimately not materialise, which has led to approval of a dedicated project scheduled to launch in Q4 2025.

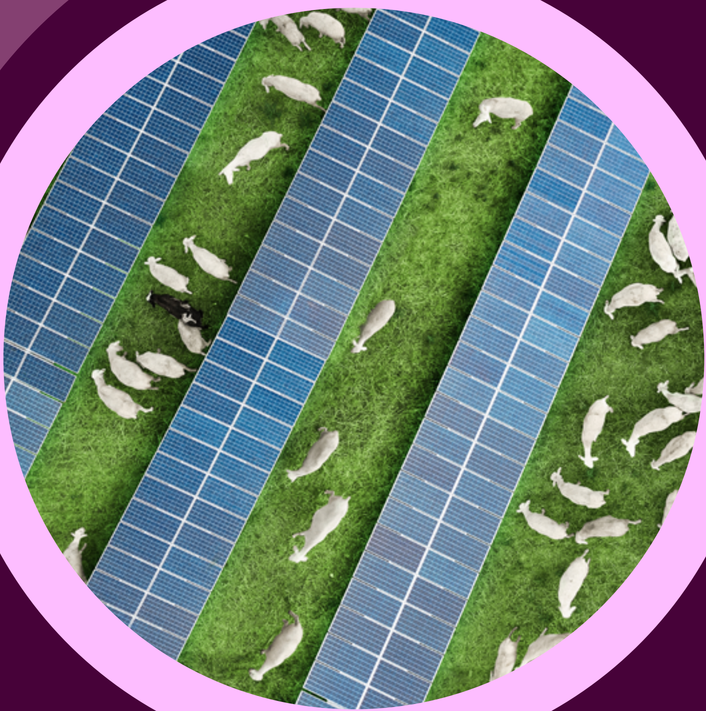
The objective is to create a realistic view of electricity usage across residential, commercial and industrial sectors and to understand how demand varies across the seven Restoration Regions. This includes analysing cold load pickup behaviour, industrial recovery patterns and post-disruption demand rebound to adjust business-as-usual national demand forecasts. Expected outputs include a scaling factor for each demand region and indicative demand profiles to inform generator sizing, block loading strategies and restoration sequencing.

This work will complement ongoing Grid Code Modifications to refine assumptions and calculation methods for national demand during restoration. By reducing uncertainty in demand forecasting, this initiative will strengthen restoration planning, improve coordination between Network Operators and Generators and support faster and more stable restoration performance.



03

Regulatory Years 2029 Onwards: Supporting Clean Power

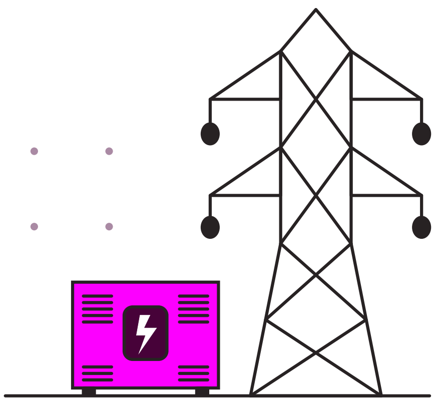


For the subsequent regulatory years, alongside continuing and expanding business-as-usual activities, key strategic initiatives will focus on accelerating the transition to bottom-to-top restoration. This approach enables restoration to begin at distributed levels and scale upward to regional and national networks, using insights gained from earlier innovation projects. To meet the 2030 and 2050 clean energy targets, it is NESO's understanding that conventional fossil fuel generation will be reduced, if not phased out.

A combination of innovative activities will support this objective, including:

- developing an open-source discrete restoration model that allows all restoration parties to contribute data and expertise, creating an accurate, industry-driven monitoring and decision-making tool
- conducting in-field restoration exercises with participation from NESO, TOs, DNOs and Generators, and incorporating route energisation exercises to strengthen coordination and operational readiness
- advancing battery anchor plants to support generation output from the battery reserve project, which is expected to enter Phase 2 during this period, with implementation and testing
- assessing the feasibility of replacing combined-cycle gas turbine generators with clean energy alternatives and preparing for CP30 objectives
- exploring the integration of new nuclear plants into restoration strategies, working closely with manufacturers to define technical requirements
- testing new communication methods for coordination during degraded grid states

Additional initiatives will explore the broader use of renewable resources in restoration and the uncertainties they introduce, as well as challenges associated with reduced thermal generation and increased low-inertia conditions. Maintaining RDST effectiveness through updated training and lessons learned from exercises and live events will remain essential. Increased power system modelling will complement probabilistic modelling.



04

Monitoring Compliance and Assumptions

To ensure compliance with the Electricity System Restoration Standard (ESRS), a structured oversight framework has been implemented, as shown in Figure 6. This framework monitors industry-wide compliance by collecting and assessing assurance activities submitted by relevant parties through Week 24 submissions. These submissions provide evidence of compliance with ESRS requirements and confirm readiness for restoration. The requirement for parties to provide evidence is set out in the Grid Code and associated procedures.

PC.A.5.7.3 required Generators, HVDC System Owners, DC Converter Owners, Non-Embedded Customers and Network Operators to submit evidence of progress toward ESRS compliance in their Week 24 submission from 1 January 2024 until 31 December 2026. TOs were required under STCP 08-3, 3.1.5, to provide evidence to support their work to satisfy these requirements by submitting Part 3 of DRC Schedule 16 of the Grid Code.

NESO intends to introduce on-site compliance checks in the coming years, conducted on a selective basis, to support ongoing readiness and maintain high standards across all parties.

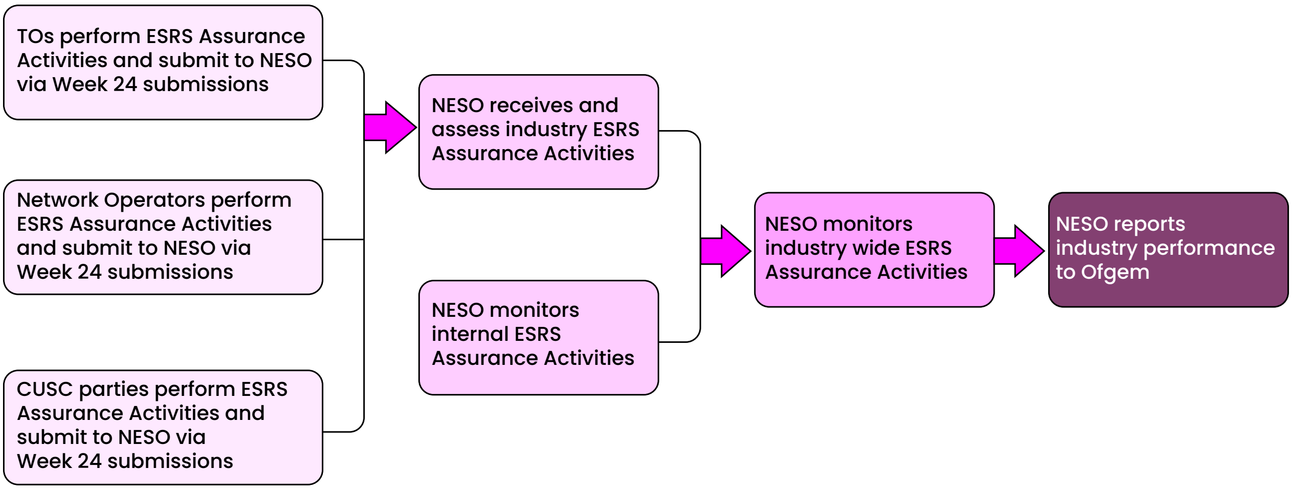


Figure 6: Levels of assurance activities monitoring and reporting

In addition to these checks, an Empirical Restoration Framework has been developed to provide a system-level analytical approach for ongoing monitoring and validation of the foundational assumptions underpinning restoration planning. Its purpose is to ensure that modelling inputs and strategic assumptions remain accurate and relevant as system conditions evolve. This framework supports the assurance process by identifying capability gaps and validating whether restoration strategies perform as expected under real-world conditions.

4.1 Week 24 submissions

Week 24 submissions are the primary mechanism for monitoring Generator compliance with ESRS obligations. The data collected is assessed to provide a detailed view of restoration capability by region and to confirm compliance with DRC Schedule 16.

Secondary Generators bound by the Grid Code but not contracted for system restoration must comply with the GC0156 requirements, specifically Part 1 and Part 3 of DRC Schedule 16.

Part 1 focuses on reasonable restoration cold start times. Generators must indicate, assuming all BM Units were running immediately before a Total or Partial Shutdown and in the event of loss of all external power supplies, how long it would take their first and subsequent BM Units to synchronise back to the system if external power supply were restored after 12, 24, 36 and 72 hours.

Part 3 sets out the assurance activities that each CUSC Party must complete by 31 December 2026 to demonstrate resilience and readiness for restoration. These activities include:

- resilience to Total or Partial Shutdown for 72 hours
- voice systems resilience test or equivalent
- critical tools and facilities control systems resilience demonstration
- cyber-security confirmation
- telephony services test
- restoration procedure review

At the close of Week 24 submissions for 2025, 83% (60 GW of 72 GW) of Generator capacity under NESO agreements confirmed 72-hour resilience for external supply loss by 31 December 2026. Additionally, 78% (56 GW of 72 GW) confirmed full compliance with all assurance activities by 31 December 2026. Currently, the number of fully compliant Generators is sufficient to meet ESRS restoration targets. Offshore generation is not included, as GC0156 72-hour resilience does not apply retrospectively, but all new agreements signed after February 2025 will need to be built with these requirements in place.

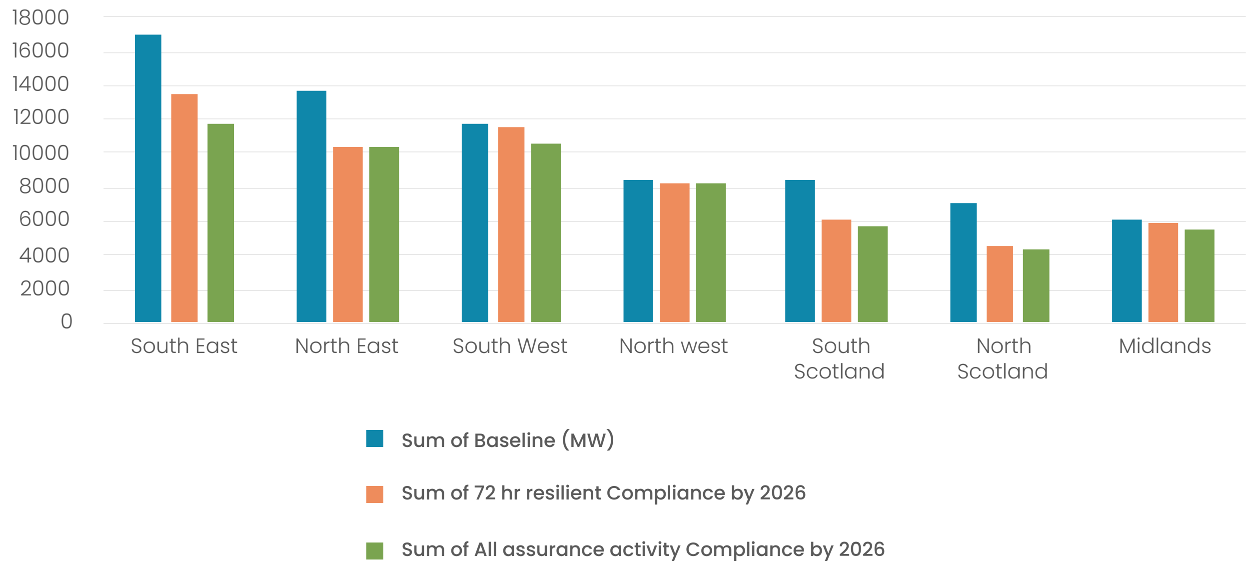


Figure 7: Summary of 72-hour resilience by region

4.2 Cost recovery for CUSC Parties 72-hour resilience

CMP398 (WACM1) is a structured cost recovery mechanism for CUSC Parties to support compliance with GC0156 requirements, including those related to 72-hour resilience and restoration capability. The mechanism distributes the costs of meeting these obligations among CUSC Parties. Funding is provided through CUSC Modifications CMP398 and CMP412, which allow Generators and other stakeholders to recover eligible expenses incurred while complying with updated Grid Code provisions. This process supports industry compliance by promoting fairness and transparency in cost allocation and recovery, contributing to the resilience and reliability of the electricity system.

The following points summarise the key elements and timings of the CMP398 and CMP412 claims process:

- The guidance for claims was consulted on by industry and published in 2024.
- Previous claims periods took place in September 2024 and September 2025, with the final claims window scheduled for December 2026.
- Pre-claim submissions are currently under review. A pre-claim is an informal and optional step in the claims process that allows CUSC Parties to share their proposed plans with NESO before incurring any costs and may be submitted at any point before December 2026.
- December 2026 is the final claims period, and no claims will be accepted after this date.

4.3 Electricity Network Control Centre readiness

Training and preparedness are central to NESO's ability to deliver effective electricity system restoration. To ensure Control Engineers are equipped to respond to a range of restoration scenarios, NESO has developed simulation-based training within the Control Training Unit (CTU), enabling real-time practice in a controlled environment. NESO's approach includes cross-industry collaboration, scenario-based exercises and continuous improvement, with strategic training engagements involving TOs, DNOs and other key stakeholders to build a shared understanding of restoration processes and support ESRS targets.

NESO conducts ongoing training programs to ensure control room personnel maintain the skills and readiness required for effective system restoration. Recent exercises have highlighted areas for improvement, particularly the value of end-to-end exercises involving network owners and other relevant parties. Periodic training and readiness exercises include TOs, DNOs and, where possible, Restoration Contractors, ensuring all stakeholders are prepared and aligned for a restoration event.

ENCC training delivered through the CTU provides significant value by:

- scenario-based practice: simulating NPO conditions to test and enhance readiness. This enables faster restoration through familiarity with LJRPs and RRPs, reducing the time to restore 60% of electricity demand per region and 100% of national demand
- strategic insight: offering foresight into how the ENCC might address future NPO challenges and identifying opportunities to reduce restoration timeframes
- collaborative learning: engaging TOs, DNOs and Generators to share insights and outcomes, making future exercises more realistic and improving stakeholder familiarity with processes, actions and procedures during restoration
- continuous improvement: building on lessons learned from previous exercises and incorporating insights from stakeholders to refine Great Britain's network restoration processes

In addition to continuous ENCC training, Control Engineers from TOs such as NGET, SPT and SHET will participate in simulation training at the CTU. Other key stakeholders, including DNOs, National Gas, Elexon and neighbouring System Operators, are involved in joint workshops and benchmarking sessions. These sessions promote industry-wide understanding of restoration, highlight best practices and support collaboration to address restoration challenges.

Supplementary training and exercise activities include:

- **completed Q1 2025:** ENCC training to evaluate performance against restoration targets
- **completed Q3 2025:** ENCC training to re-evaluate performance against restoration targets
- **completed Q3 2025:** NESO support for NGET internal restoration exercise, focusing on LJRP switching under ENCC instruction
- **planned Q1 2026:** ENCC and TO joint restoration exercise covering all RRPs
- **planned Q2 2026:** ENCC-focused exercise to demonstrate capability to meet the ESRS target of restoring 60% of electricity demand per region within 24 hours

4.4 Modelling assumptions

Foundational restoration modelling assumptions used in probabilistic modelling were historically established through an industry working group that is no longer meeting, and have been complemented by industry experience and engineering judgement. NESO is currently using this probabilistic model as its primary quantitative tool to assess restoration performance. It is essential to verify that these assumptions remain valid as system conditions evolve, and to take appropriate steps to update or reinforce them when they are no longer accurate. This process ensures that oversight activities align with realistic operational scenarios and support accurate evaluation of ESRS readiness. NESO intends to review these assumptions annually with industry and incorporate any new assumptions into the model as required.

Current restoration modelling assumes that the first demand block will be delivered within 2.5 hours of NESO confirming an ESR event. This timeframe includes situational awareness among Generators, TOs, DNOs and other relevant parties, as well as strategy development for restoration and routing LJRPs. During this period, notifications and instructions are issued, and DNOs and TOs prepare their networks for LJRP deployment. Once the network is ready and online, subsequent block loads are assumed to be delivered on average every 10 minutes.

The model assumes that 12 LJRPs (2 per Restoration Region) can be enacted simultaneously: 10 across England and Wales and 2 in Scotland.

To ensure operational resilience, it is assumed that the SCADA system will maintain functionality for at least 72 hours and that strategic remote sites will have equivalent capability. It is also assumed that there is a 2% chance of failure per generation set across the entire generation fleet and a 5% probability of block load rejection, which decreases as the generator takes on more load.

Table 3: Modelling assumptions

Assumption	Value
First demand block delivered after ESR event	2.5 hours
Subsequent block loads delivered	Every 10 minutes
Number of LJRPs that can be enacted simultaneously	12 (10 in England and Wales, 2 in Scotland)
SCADA system functionality duration	At least 72 hours
Chance of failure per generation set	2%
Probability of block load rejection	5%, decreasing as load increases

05

Risks to Implementation

We have identified risks associated with implementing our adopted strategy to meet the ESRS by 31 December 2026. Our mitigation strategy is to continuously analyse and assess all potential risks, identify changes in their severity and propose appropriate mitigation measures. Table 3 outlines some of the identified risks to ESRS implementation and the actions planned to mitigate them.

Table 4: Risks affecting restoration strategy and mitigations

Risk Name	Risk Description	Likelihood	Impact	Mitigation Plan
		1 (lowest) to 5 (highest)		
Time constraints	There is a risk that the industry does not achieve compliance by December 2026 due to the limited time for Generators to achieve 72-hour resilience, which could lead to an inability to restore 60% of demand across all regions within 24 hours and result in a licence breach.	1	5	• OFGEM to explore developing a strategy around Generators that have/can achieve 72-hour resilience ahead of December 2026 • Current confirmed compliance of Generators is sufficient for ESRS targets • Risk is mitigated but will remain open for monitoring
High imple-mentation cost	There is a risk that the industry does not achieve compliance by December 2026 due to the potential uneconomic cost for industry to achieve 72-hour resilience via the CMP398 process and TO price control, which may reduce the ability to restore 60% of demand across all regions within 24 hours and lead to a licence breach.	1	3	• NESO to support industry through the approved guidance for CMP398 cost claims and to provide feedback on concerns raised through this process to Ofgem • NESO to work with Generators on derogations where implementation costs are prohibitive • Pre-claims to be submitted to obtain approval for expenses before they are incurred
Lack of sufficient resources	There is a risk that all parties do not have sufficient resources by December 2026 due to challenges with retention, high attrition and increased workload, which could lead to an inability to restore 60% of demand across all regions within 24 hours and a potential licence breach.	3	4	• Ongoing recruitment • Increase dual authorisation • Former ENCC staff to retain authorisation • DNO recruitment due to increased tasks • TO recruitment

Risk Name	Risk Description	Likelihood	Impact	Mitigation Plan
		1 (lowest) to 5 (highest)		
Delays with Restoration Decision Support Tool	There is a risk that, by December 2026, the ENCC will not have the RDST available to reduce cognitive load during restoration because of delays in the vendor contracting process. This may result in the ENCC relying on manual processes during restoration.	4	1	• A contract has been signed with the provider • An agile delivery plan will be developed • Control room training will be enhanced • The provider has confirmed that the development team has mobilised and is working toward deliverables before contract sign-off
Challeng-es with DRZC imple-mentation	There is a risk that NESO will not be able to implement a bottom-up restoration strategy by December 2026 because DNOs may face challenges implementing DRZCs, which could lead to limited or no contribution from Restoration Contractors on the DNO network.	1	2	• The Electricity Task Group (ETG) Chair will engage with the ENA's Electricity and Networks Futures Group to create a subgroup for DNOs to share best practice on DRZC implementation • The risk is currently mitigated but will remain under monitoring
System access to TO infra-structure	There is a risk that stakeholders may be unable to comply with testing requirements due to challenges with system access, which could delay service delivery.	1	2	• Existing processes to manage and optimise system access will be followed • NESO will collaborate with TOs to identify optimal timing for business-as-usual activities and testing procedures • The risk is currently mitigated but will remain under monitoring

Risk Name	Risk Description	Likelihood	Impact	Mitigation Plan
		1 (lowest) to 5 (highest)		
Supplier capability to install ICCP data links	There is a risk that the ICCP links will not be implemented within the agreed timeline if the provider does not have sufficient resource, which could delay delivery and affect compliance with Ofgem milestones for the three ICCP links.	4	1	• Weekly meetings are held with the provider to discuss and address • Escalations will be made where needed to ensure visibility and progress • ESRS only requires the links to be in place by Q2 2027
Delay in Grid Code Modifica-tions	There is a risk that Grid Code Modifications for DNOs will not be implemented by December 2026 because of the time needed for consultation and approval, which may delay the imposition of obligations on DNOs.	2	2	• Grid Code Modifications will be prepared in a timely manner • Contributing and impacted parties will be prepared ahead of release to allow sufficient time for implementation • Stakeholder support will be secured before raising the Modification • DNOs are supportive of achieving targets even without the Modification
Misaligned modelling assump-tions	There is a risk that modelling assumptions may become misaligned with industry expectations if not reviewed regularly, which could lead to inaccurate reporting of restoration times.	4	4	• Modelling assumptions will be confirmed early through the Assurance Framework consultation • Assumptions will be reviewed and challenged with stakeholders • Contingency will be created by reducing the estimated restoration time through initiatives such as NPO demand analysis and demand block loading

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