SECONDARY GENERATOR RESTORATION GUIDANCE DOCUMENT CONSULTATION

NESO
National Energy System Operator

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List of Acronyms

Acronym	**Meaning**
BEGA	Bilateral Embedded Generation Agreement
BELLA	Bilateral Exemptible Large Licence Exempt Generator Agreement
CUSC	Connection and Use of System Code
DESNZ	Department for Energy Security and Net Zero
DNO	Distribution Network Operator
ENCC	Electricity National Control Centre
ESRS	Electricity System Restoration Standard
MEL	Maximum Export Limit
NESO	National Energy System Operator
NDZ	Notice to Deviate from Zero
SEL	Stable Export Limit
TO	Transmission Owner

1. Introduction

NESO is an independent public organization at the very heart of Great Britain's energy system. It's dedicated to making sure everyone has access to energy that's not only reliable and clean, but also affordable.

In 2021, the Department for Energy Security and Net Zero (DESNZ), formerly known as the Department of Business, Energy and Industrial Strategy (BEIS) recognized the potential risk of a total system shutdown, a low probability but high-risk event listed in the national risk register because of its significant economic and social impact and responded by introducing the ESRS (Electricity System Restoration Standard).

This standard establishes a legal requirement for the restoration of electricity supplies in the event of an outage on the national electricity system. Under the ESRS, NESO is required, in the event of a total or partial shutdown, to restore 60% of national demand within 24 hours across each of the seven restoration regions, and to restore the 100% total demand within five days, with an implementation date of 31 December 2026.

Successful delivery of the ESRS necessitates the commitment of all stakeholders, as system restoration is a collective responsibility shared among NESO, Transmission Owners (TOs), Distribution Network Operators (DNOs), Generators, and other market participants.

This document sets out detailed guidance for preparing secondary generators (i.e. a generator which has signed the CUSC and therefore is required to meet the obligations of the Grid Code but does not have a restoration contract in respect of its site) for system restoration following a major power outage. It draws on current regulatory requirements, technical standards, and operational experience, with the aim of ensuring that all generators are ready to restore supply safely, economically and efficiently.

In a total or partial shutdown of the GB electricity system, restoration is executed under emergency operating conditions, coordinated centrally by NESO through the electricity national control centre (ENCC).

Delays, incorrect assumptions, or unrealistic declarations from secondary generators can prolong restoration, destabilise power islands, or lead to re-trips during synchronisation. In response, the ESRS and associated Grid Code modifications now require all relevant CUSC Parties to demonstrate restoration readiness through data submitted through Schedule 16 of the Data Registration Code which is achieved through the compliance process and Week 24 process.

1.1 Definitions

Secondary Generator: A Generator which has signed the connection and use of system code (CUSC) which is bound by the requirements of the Grid Code, but that generator has no Restoration Contract.

Restoration Event: An incident involving a total or partial system shutdown, necessitating coordinated system restoration processes.

Restoration Contractor: Parties such as generators, with specific self-start capabilities and obligations as defined within a local joint restoration plan (LJRP) or distribution restoration zone plan (DRZP).

Bilateral Connection Agreement (BCA): A CUSC contract which applies between NESO and any directly connected party irrespective of being demand or generation.

Bilateral Embedded Generation Agreement (BEGA): A CUSC contract which applies between NESO and any embedded generator who has applied for transmission entry capacity (TEC). Large embedded power stations greater than 100MW must have a BEGA.

Bilateral Exemptible Large Licence Exempt Generator Agreement (BELLA): apply only in Scotland and applicable to large embedded power stations under 100MW. BELLA's do not have TEC, and they must meet the requirements of the Grid Code applicable to large generators

Distribution Restoration Zone Plan (DRZP): A plan produced and agreed by a network operator, the company, restoration contractors and in certain situations transmission licensees under OC9.4.7.7, detailing the agreed method and procedure by which a network operator will instruct a restoration contractor with an anchor plant to energise, part of a network operator's system within 8 hours of that instruction, and subsequently meet complementary blocks of local demand so as to form a power island. A distribution restoration zone plan may require the use of top up restoration plant.

Local Joint Restoration Plan (LJRP): A plan produced and agreed by the company, transmission licensee, restoration contractors and a network operator under OC9.4.7.7, detailing the agreed method and procedure by which the Company or transmission licensee in Scotland will instruct a restoration contractor with an anchor plant to energise, part of the total system within 2 hours of that instruction and subsequently meet complementary blocks of local demand so as to form a power island. A local joint restoration plan may require the use of Top Up Restoration Plant.

Restoration Cold start time: the expected time for the first and subsequent BM units to be synchronised at 12h, 24h, 36h, 48h and 72h after restoration of external supplies.

Total Shutdown : A total shutdown is the situation existing when all generation has ceased and there is no electricity supply from external Interconnections and, therefore, the total system (i.e. Transmission, Distribution and Interconnector infeed into the GB System) has shutdown with the result that it is not possible for the total system to begin to function again without the Company's directions relating to system restoration.

Partial Shutdown: The same as a total shutdown except that all generation has ceased in a separate part of the total system and there is no electricity supply from external Interconnections or other parts of the total system to that part of total system and, therefore, that part of the total system is shutdown, with the result that it is not possible for that part of the total system to begin to function again without the company's directions relating to system restoration.

1.2 When a Generator has Grid Code obligation and is Deemed a Secondary Generator.

A generator is classified as a secondary generator and therefore subject to the requirements of the Grid Code if any of the following criteria apply:

- The generator owns and/or operates a power station which is directly connected to transmission system (irrespective of being small, medium or large)
- The generator owns and/or operates a large power station (even if embedded)
- The generator owns and /or operates an embedded medium power station and has a BEGA.
- The generator owns and operates plant or aggregated plant (for example a Virtual Lead Party) and is registered as a BM participant

Generators who own and operate Small Embedded Power Stations who are BM Participants will be caught by the requirements of CC/ECC 6.5, 7.9, 7.10 and 7.11 which includes Critical Tools and Facilities.

1.3 Power Station Size

Power station size depends on the Power Station's registered capacity and the transmission area in which it is connected.

Large:

- Large power stations in NGET's transmission area are those with a registered capacity of 100MW and above (irrespective of being Directly Connected or Embedded).
- Large power stations in SPT's transmission area are those with a registered capacity of 30MW and above (irrespective of being Directly Connected or Embedded).
- Large power stations in SHET's transmission area are those with a registered capacity of 10MW and above (irrespective of being Directly Connected or Embedded).

Medium:

Medium Power Stations only exist in NGET's transmission area 50 MW or greater but less than 100MW (irrespective of being Directly Connected or Embedded).

Small:

- Small power stations in NGET's transmission area are those with a registered capacity less than 50MW (irrespective of being Directly Connected or Embedded).
- Small power stations in SPT's transmission area are those with a registered capacity less than 30MW (irrespective of being Directly Connected or Embedded)
- Small power stations in SHET's transmission area are those with a registered capacity less than 10MW (irrespective of being Directly Connected or Embedded).

1.4 What this Guidance does and does not cover

This Guidance:

- Explains existing obligations in practical and operational terms
- Highlights common misunderstandings and noncompliance risks
- Sets out NESO's expectations from secondary generators.

This guidance does not:

- Introduce new Grid Code obligations or introduce any mandatory requirements to Grid Code Users beyond those of the Grid Code.
- Require secondary generators to have a self-start or ESR capability.
- Replace the need to refer to the Grid Code. In case of ambiguity, the Grid Code takes precedence over this guidance document.

2 Regulatory and Compliance Framework

Secondary generators are required to comply with all relevant Grid Code provisions for system restoration, including but not limited to, the obligations set out in OC9 (Operational Code 9), which addresses system operation during restoration, and OC5.7, which covers testing and monitoring of performance for restoration purposes. In addition, compliance with ECC/CC7.10 and ECC/CC7.11 is required, ensuring adherence to specific procedures and technical requirements associated with system restoration and coordination during emergency conditions.

These references collectively ensure that secondary generators contribute effectively to the safe and efficient restoration of the electricity system following a total or partial shutdown. Secondary generators are required to be compliant with the applicable parts of DRC schedule 16 and as detailed in PCA.5.7.3, they are required to submit evidence of compliance in their week 24 submissions.

DRC Schedule 16 Part I focuses on generators reasonable restoration cold start times which is different from normal cold start times.

DRC Schedule 16 Part II applies only to restoration contractors operating under a distribution restoration zone plan (DRZP). If you do not hold a restoration contract, this section does not apply to you.

DRC Schedule 16 Part III sets out the assurance activities that each CUSC Party must be compliant with by 31 December 2026 to demonstrate resilience and readiness for restoration.

The following is captured under Schedule 16, Part I and III of the data and registration code and should be submitted to NESO yearly through the Week 24 process.

2.1 DRC Schedule 16 part 1

Reasonable restoration cold start time assuming the generator was running immediately prior to a total or partial shutdown, the expected time for the first and subsequent BM Units to be Synchronised after site supplies have been restored at time intervals of 12 hours, 24 hours, 36 hours, 48 hours and 72 hours. Supplying this data enables the ENCC to devise an efficient and effective restoration plan by identifying which generating units can be brought online promptly.

For instance, if Plant X can restart within 5 hours, while Plant Y requires 10 hours, the ENCC may opt to prioritise Plant X to accelerate overall system recovery. Given the substantial number of generation assets connected across various network sections, this process is inherently complex. Accurate and timely reporting of cold start times is therefore critical, as it allows the ENCC to coordinate and sequence generator restarts in a manner that maximises network stability and minimises downtime for consumers.

It is however important to note that the time declared in this section of the data registration code (DRC) is not to be confused or the same as that declared in DRC Schedule 2 which refers to the time a plant would be required to synchronise and run up to full load following a prolonged outage or following return from maintenance / repair.

Describe any likely issues that would have a significant impact on the time the plant can be synchronised following the loss of site supplies arising as a direct consequence of the inherent design or operational practice of the power station and/or BM Unit, e.g. limited barring facilities, time from a total shutdown or partial shutdown at which batteries would be discharged or the availability of primary fuel supplies.

Block loading capability from 0 MW to registered capacity: This describes a generating unit's ability to pick up load in steps or blocks without tripping.

Governor setting information required: During ESR conditions, the company requires information to understand how each generator's governor will behave during the early-stage conditions of system restoration. Generators and HVDC system owners must inform The Company of the capability of operating their generating units or power generating modules such that the frequency control device (or turbine speed governor) and unit load controller can be switched to frequency control only during the early stages of system restoration while in island operation.

The purpose of this requirement is to confirm that when the plant is reconnected to the system as part of a restoration event, the power island to which it is connected, could be quite small and the Company need some assurance that under this condition the governor system does not have unintended consequences on the operation of the plant for example plant tripping.

2.2 DRC Schedule 16 part 3

Part 3 assurance activities ensure system resilience and efficient recovery from national power outages, minimising downtime. CUSC parties are required to confirm compliance with the following assurance activities by 31 December 2026.

- **Resilience to a Total or Partial Shutdown for up to 72 hours**: The requirement here is that in an event of a total or partial shutdown, generators plant and equipment must be able to safely shut down without risk to plant or personnel and must be able to remain in a safe state without external power supplies for up to 72hrs. Once site supplies are restored, the generator should be capable of restarting within the reasonable restoration cold start times as detailed in ECC/CC7.11 (see above).

- **Voice Systems Resilience test for minimum 72 hours**: (Minimum 72 hours resilience is required under a Restoration event. Demonstrated by fulfilling the Restoration Auxiliary Power Source Test). Generator's voice communication system must remain fully operational for a minimum of 72 hours, even during a complete loss of external power supplies. Most of the generator's control points will have control telephony. This facility is provided by NESO in coordination with the relevant transmission licensees and has a 72-resilience capability.
- **Critical Tools and Facilities Control Systems Resilience Demonstration:** The requirement specifies a minimum of 72 hours of resilience during a restoration event. This includes having the necessary tools and facilities to monitor, control and protect plant and apparatus, as detailed in ECC/CC7.10. and maintaining control telephony in line with relevant Grid Code provisions as provided for in ECC/CC.6.5.1 to ECC/CC.6.5.5
- **Cyber-Security:** Generators must comply with the applicable Network and Information Systems (NIS) Regulations by using the cyber assessment framework (CAF) to regularly assess and enhance their cyber security and resilience.

  It is essential to put in place suitable and proportionate controls to protect the network and information systems supporting generation activities. Key NIS requirements for generators include:
  - Identifying and managing cyber risks
  - Protecting systems against cyber-attacks.
  - Maintaining effective detection capabilities.
  - Being able to respond to and recover from incidents that may affect electricity supply.
  - Reporting any incidents that significantly impact essential services promptly.

There are two categories of CAF Profiles, Basic and Enhanced. The Basic Profile establishes the standard level of protection expected across all sectors when dealing with adversaries possessing only basic attack capabilities, such as those using common cyber-attack methods.

The Enhanced Profile is tailored to individual sectors and extends beyond the basic profile. It sets a higher standard of cyber security and resilience, suitable for scenarios where organisations are likely to encounter more advanced, well-equipped attackers capable of carrying out sophisticated cyber threats.

Generators should have achieved the NCSC Basic Profile in 2020, which ensures resilience against basic cyber threats. By 2027, they must transition to the enhanced profile, which applies stricter controls such as robust identity and access management, improved system security, and enhanced security monitoring.

- **Telephony services test:** To ensure that communication infrastructure and applications are maintained to a high standard, an end-to-end confirmation of the voice route should be confirmed by a live test. For the purposes of restoration this test is required at least once per year.
- **Restoration Procedure review:** For generators, loss of network procedures. Parties should have internal operational procedures in place so their staff are trained and aware of the actions they need to take should there be a total loss of supplies at site. Parties should review of all relevant restoration related procedures to ensure these are up to date and available should a total or partial shutdown occur.
- **Training:** Actively participate in exercises and training coordinated by NESO.

These assurance activities ensure that generators are well-prepared for a restoration event by strengthening resilience, safeguarding critical systems, and guaranteeing secure, reliable communications. The 72-hour resilience requirement ensures that generators can maintain a safe, operational state without external power for an extended period. This resilience directly supports the restoration process because the ENCC knows, with certainty, that each generator can be contacted and will be ready to respond as soon as external power is restored.

The reasonable restoration cold start times submitted annually under DRC Schedule 16 provides ENCC with accurate expectations for how quickly each BM Unit can synchronize and begin energizing the network after a total or partial shutdown. As a result, recovery plans can be executed efficiently, minimizing delays and uncertainties. With respect to critical tools and facilities, the requirements set out in ECC/CC.7.10.1 to ECC/CC.7.10.3 fall under Grid Code modification GC0148 which required compliance by the 4 September 2024.

The remaining parts of CC/ECC.7.10 and CC/ECC.7.11, come under GC0156 and must be complied with no later than 31 December 2026. With these activities in place, NESO can confidently coordinate and manage the restoration of the electricity system, knowing that essential infrastructure and communication channels will remain robust and effective throughout the recovery process.

3 Restoration Process Overview

In the event of a total or partial shutdown, the ENCC control room assumes responsibility for emergency system operation. During such incidents, the ENCC acts as the central coordinating authority in accordance with GB Grid Code and established emergency protocols, coordinating the overall response and prioritising the protection of both personnel and assets. Their immediate focus is on stabilising the network to reconnect customers whilst ensuring that safety protocols are rigorously followed throughout all affected sites.

All parties are required to adhere to established shutdown procedures, ensuring that plant and equipment are safely brought offline. This coordinated approach helps to prevent damage, maintain integrity of essential infrastructure, and position each site for an orderly and timely transition into the restoration phase.

From the generator's perspective, the restoration process is structured into several distinct stages, which may overlap or occur in parallel depending on regional circumstances. These stages provide a clear framework for organised recovery and are designed to align generator actions with ENCC directives, ensuring effective system-wide coordination:

Stage 1: System Shutdown and Stabilisation

When a National Power Outage (NPO) occurs, generators experience a loss of all external supplies. In response, they trip in accordance with their protection and safety systems. The primary goal in this stage is to ensure plant integrity and safety, as detailed in CC/ECC7.11, and to maintain readiness for subsequent restoration steps.

Stage 2: LJRP and DRZP enactments

Restoration Contractors, pre-selected for their self-start capabilities, are instructed by ENCC to energise isolated sections of the network. These initial islands which are formed through the establishment of Local Joint Restoration Plans (LJRPs) or Distribution Restoration Zone Plans (DRZPs) operate under tight frequency and voltage control, with only essential plant connected to manage risks. Generators within these islands play a key role in maintaining grid stability and supporting the phased energisation of network sections.

Stage 3: Communications with secondary generators

Once power islands are formed, the balance between load and generation within each island is carefully managed. Generator control rooms confirm visibility and communications, while ENCC assesses the readiness to accept further generation. This stage is critical for ensuring that the system can safely scale up restoration efforts. Effective communication between NESO (via the ENCC) and generators is fundamental to safe and timely system restoration.

During a Total or partial shutdown, public communication arrangements cannot be assumed to be available or reliable. Generators must therefore ensure that their control, monitoring, and protection systems remain functional under a restoration event for up to 72 hours as detailed in ECC/CC7.10.

Control Telephony (green phone) is the primary resilience voice communication channel between ENCC and generators during restoration events. NESO in coordination with the relevant transmission licensees provide and maintain a resilient control telephony system up to the generator's control point.

The responsibility for communication resilience does not end at the control point. Each generator is required to ensure that all internal communications infrastructure from the NESO provided control point to the relevant operational areas within the site remains robust and functional for at least 72 hours during a total or partial shutdown.

This includes maintaining internal site wiring, backup power supplies, and any cross-site communication links necessary to relay ENCC instructions to all critical assets. Generators whose control points are situated remotely from their plants must establish and maintain resilient communications extending beyond the control point to the plant location.

During restoration reviews, CUSC parties should document and demonstrate their internal communication arrangements, ensuring that all staff are trained in alternative communication protocols and that contingency plans are in place for degraded or failed systems.

Stage 4: Synchronisation of Secondary Generators

Secondary generators are contacted and instructed to prepare for synchronisation, which only proceeds when system conditions permit. Accurate start-up times and declared capabilities are essential at this point as generators need to connect within their reasonable restoration cold start times, as confirmed in their DRC Schedule 16-part one submission. Generators must not synchronise back to the network during a restoration event unless expressly instructed or requested by the ENCC, or, in the case of Scottish generators, by the appropriate transmission licensee.

Stage 5: Expansion and Reintegration

Islands are gradually expanded and interconnected, with demand systematically restored in phases. Secondary generators may be required to operate flexibly, adapting to evolving system needs. The involvement and preparedness of secondary generators can affect both the timing and resilience of reintegration activities.

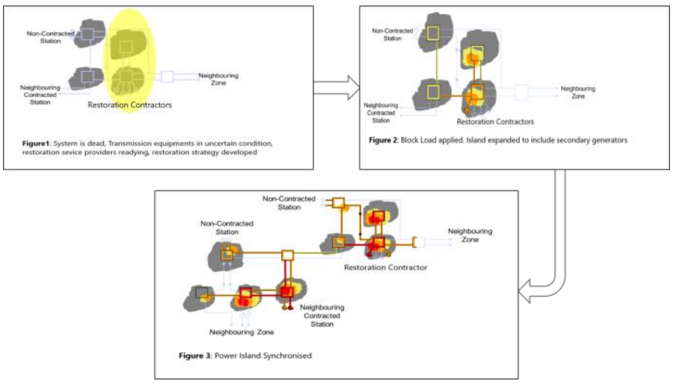

Fig 1: Restoration procedure

By following this staged approach, generators contribute to a robust and well-aligned restoration process, facilitating efficient coordination with the ENCC and ensuring that the electricity system can be safely and reliably brought back online following a total or partial shutdown.

4 Secondary Generator Duties and Expected Actions Before, During and After Restoration Event

The responsibilities of Secondary generators span the entire restoration lifecycle, encompassing preparation prior to an event, operational actions during a total or partial shutdown, and compliance throughout the recovery process.

4.1 Duties in preparation for Restoration Event

Generators are expected to prepare for restoration before any unlikely event of a total or partial shutdown occurs. This preparation underpins all subsequent actions. At a minimum, generators should ensure that:

1. A comprehensive restoration plan is in place. This plan should set out the necessary procedures and arrangements for responding to a restoration event, ensuring site readiness, clear operational roles, and robust procedures for managing restoration activities in line with ENCC instructions.
2. The Control Point is clearly defined and capable of operating during prolonged outages with 72-hour resilience.
3. Communications systems, including control telephony, are installed, accessible, and tested at least once a year. As NESO progresses toward market restoration, generators must ensure they have the necessary staffing and technical resources in place to resume EDT and EDL updates as soon as these systems are fully operational. This includes maintaining up-to-date operational data and being ready to submit required updates promptly.
4. The minimum staff required during the restoration event with the appropriate authority and competence are identified and available to support restoration activities.

4.2 Duties and Expected Actions During a Restoration Event

Following a total or partial shutdown, generators should assume the following conditions until confirmed otherwise:

- External electrical supplies may be unavailable for an extended period.
- Telecommunications and other utilities/services may be degraded.
- Access to site may be restricted.

Generators must therefore allow plant to shut down safely without posing risk to equipment and personnel and they are required to preserve plant integrity, avoiding damage that would delay restart, maintain essential control, monitoring, and communication functions using on-site resilience measures and avoid unauthorised restart attempts or configuration changes. At this stage, generators should not attempt to synchronise unless explicitly instructed by ENCC as stated earlier.

It is important to emphasise that reliance on dispatching staff to site as a solution to meeting the Grid Code requirements is not recommended. During a total or partial shutdown, the feasibility of such actions is significantly hampered, given that essential infrastructure services such as roads, railways, water supply, communications, and sewage etc are likely to be non-operational. Consequently, this may lead to extended restoration times and increased operational challenges.

For those reliant on diesel or alternative fuels for auxiliary power, it is particularly important to adopt a realistic approach to fuel management. This includes having a comprehensive grasp of actual consumption rates under restoration conditions and ensuring sufficient onsite fuel storage for at least 72 hours, as reliance on daily deliveries cannot be guaranteed during a national outage.

When contacted by ENCC, secondary generators may be instructed to:

- Confirm current plant status, NDZ, MEL, SEL, Ramp rate, run up and run-down rate etc.
- Begin preparatory checks for synchronisation
- Startup units once supplies are restored
- Synchronise to an existing power island.

On receipt of instruction, generators should follow their internal restoration procedures, carry out checks that are necessary to confirm readiness, avoid unnecessary delays or additional internal approvals and communicate any constraints or issues immediately to ENCC.

When instructed to prepare for synchronisation, secondary generators must:

- Ensure protection systems are correctly set and active.
- Verify governor and control modes appropriate for restoration.
- Confirm block loading capability and initial loading plan.
- Communicate any constraints or concerns immediately to ENCC.

Generators should avoid introducing last-minute configuration changes unless explicitly agreed with ENCC.

During synchronisation, System conditions may be outside normal operating ranges. ENCC may specify timing, loading, or operating constraints. Block loading and governor behaviour must align with declared capabilities. Generators must Load in accordance with ENCC direction and monitor plant behaviour closely during initial operation.

Once synchronised, Generators remain under ENCC direction until restoration is complete. During this period, generators may be required to hold output steady, vary output to support system stability, remain frequency-responsive or remain available for further instruction as restoration progresses.

4.3 Post Event Review

After the GB network is restored and the market reinstated, it is essential for secondary generators to undertake a thorough evaluation of plant performance. This process should involve a detailed review of any operational challenges or issues that were encountered during the restoration event.

Based on the findings, generators should use the restoration procedures, updating them where necessary along with this guidance document, to ensure that future practices are consistent, effective, and incorporate lessons learned. Additionally, generators must retain all relevant documentation and evidence to support assurance activities required under Schedule 16.

By taking these steps, secondary generators contribute to continuous improvement, supporting future readiness and capability for future restoration events and ensuring that restoration readiness is consistently maintained at a high standard.

5 Conclusion

The successful restoration of the GB network relies on a structured approach, meticulous adherence to operational protocols, and steadfast collaboration, it is essential that generators remain attentive and responsive to ENCC instructions, ensuring that protection systems, control systems, monitoring, and block loading capabilities are maintained in accordance with the Grid Code.

Avoiding unplanned configuration changes and maintaining clear communication channels not only safeguard system stability but also lay the groundwork for a controlled and orderly synchronisation process. By adhering to the requirements and recommendations set out in this guidance, secondary generators can approach their responsibilities with confidence and assurance. Continuous engagement, constructive communication, and a commitment to learning from each restoration event will empower generators to adapt and improve, safeguarding the resilience and reliability of the GB electricity grid.

6 Appendix

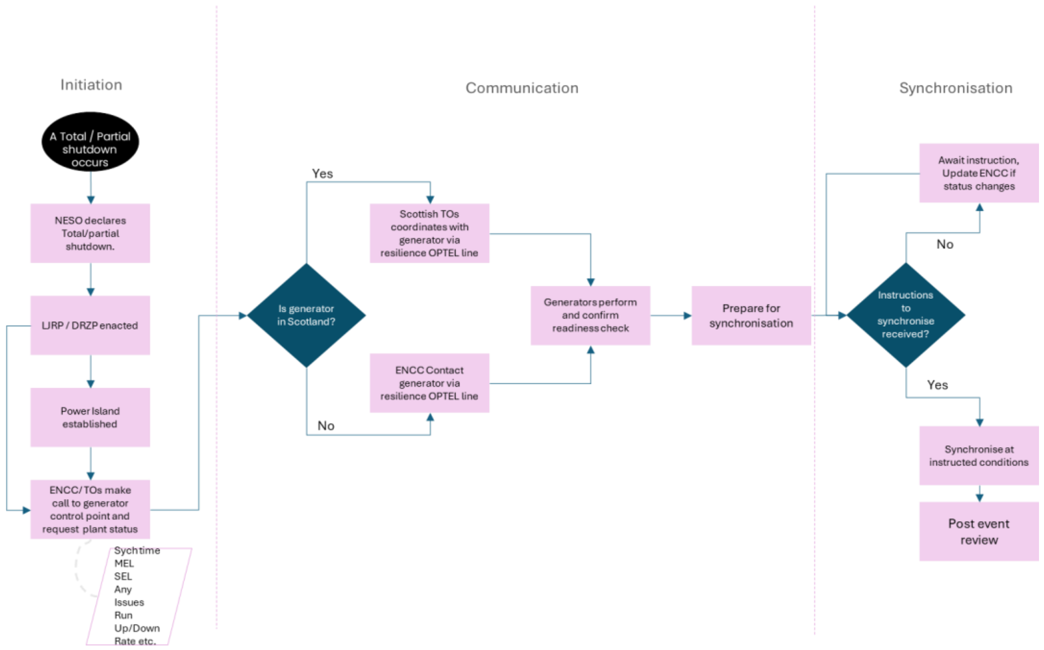

Fig 2: Restoration Flow Chart

7 Consultation Questions

1. Does the guidance clearly explain your obligations as a Secondary Generator in preparation for an unlikely event of a total or partial shutdown.

2. Is the guidance on declaring reasonable restoration cold start times, including identification of start-up constraints, sufficiently clear and practical for your plant? What additional detail or examples would help?

3. Are the expectations for 72-hour resilience of plant, communications, and critical tools achievable with your current setup? What challenges or constraints do you foresee?

4. Are the expectations during a restoration event such as preparing for synchronisation, reporting NDZ/MEL/SEL, and confirming governor settings practical and well defined-? Are there any steps that may be operationally challenging during real outage conditions?

5. What additional support, clarifications, or tools from NESO would help you fully comply with Schedule 16 Parts I & III and the wider restoration readiness framework?