JGCRP Meeting

26 March 2026

Agenda

INTRODUCTION: 10 mins

- Welcome Members.
- Minutes and Actions from the Previous Meeting (03 December 2025).

DISCUSSION: 15 mins

- Grid Forming Requirements for HVDC.

UPDATES: 15 mins

- SPID_03_2025/MPID345 – Fault Ride Through, RoCoF and Post Fault Active Power Recovery for Demand Facilities;
- CRU; and
- Utility Regulator.

AOB. 5 mins

1. Introduction: 10 minutes

a. Welcome Members
b. Minutes and Actions from Previous Meeting (03 December 2025)

26/03/2026

Discussion

Non-mandatory Grid Forming Requirements for HVDC SONI & EirGrid

EirGrid SONI

Scope

EirGrid & SONI Approach

- Inserts a new Grid Code framework for HVDC interconnectors that offer grid forming capability
- Non-mandatory and non-retrospective
- Defines expected grid forming behaviour only when capability is offered
- Interim national framework before NC HVDC 2.0 implementation
- Provides early visibility for developers and TSOs
- Supports trials and operational learning

European Legislation

Background and European Context

- The technical capabilities requirements for high voltage direct current systems are defined in Regulation (EU) 2016/1447 (NC HVDC)
- In September 2022, the EC asked ACER to propose amendments to the NC HVDC to reflect the latest developments in the sector
- In December 2024, following public consultation, ACER submitted to the EC its recommendation for amending NC HVDC 2.0. These amendments include non-exhaustive non-mandatory grid forming requirements for HVDC systems
    - The process of finalising the adoption of the updated regulation is now the responsibility of the EC
    - After the publication of the NC HVDC 2.0, ENTSO-E will release an IGD on exhaustive grid forming requirements
- February 2026, EirGrid and SONI released the “All-Island Grid Forming Strategy”, outlining a phased approach for the adoption of grid-forming capability across the All-Island power system

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Grid-Forming Roadmap & Strategy

A staged approach to the introduction of grid forming capabilities in the All-Island power system to enhance security and reliability of supply

1. Introduction of **non-mandatory grid forming requirements** for HVDC and PPMs in grid codes
2. **Technology trial** for HVDC and PPMs
3. Introduction of **mandatory grid forming requirements** in grid codes, informed by trials, stakeholder feedback and detailed system studies, in compliance with European Network Codes

What is Grid-Forming?

Functional behaviour at the Grid Connection Point

Definition:

The expected requirement for a device with Grid-Forming characteristics is for it to appear at the Grid Connection Point as a passive source that injects current, within its current capability limits, in the sub-transient and transient timeframe (sub-cycle up to tens of cycles) opposing Disturbances

In grid forming mode, a converter:

- Behaves like a voltage source
- Controls AC voltage magnitude, frequency and phase
- Responds immediately to disturbances
- Enhances system strength, stability and inertia

Note: The response of the GFM device to a system disturbance (voltage phase, magnitude or frequency) is expected to **flow naturally**, without explicit control actions or delays.

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All-Island Power System Context

Dynamics of the All-Island Power System

Challenges

- Transitioning towards a converter-based power system brings stability and operational challenges
- High shares of renewables challenges conventional stability mechanisms.
- A decrease in the minimum number of online synchronous generators brings reduction in synchronous torque and damping
- Decaying system strength and inertia, driving new oscillatory phenomena
- Reduction in available fault current
- Maintaining adequate power quality

Approach

- Facilitate integration of new technologies capable of providing essential stability services and enhancing the reliability and security of the All-Island system with high levels of renewables
- Grid forming controls allow converter-based technologies (i.e., HVDC, wind, solar PV and batteries) to provide stabilising functions traditionally delivered by synchronous machines
- So, when this capability is provided, it can strengthen the transmission system and support secure power system operation with higher renewable shares

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Structure of the Grid Code Modification Proposal

New Grid Code sections are included for grid forming operation mode

These sections collectively define how HVDC interconnectors are expected to perform when operating in grid forming mode, as well as the information required by the TSO to safely integrate such capabilities

1

Interconnector Data Requirements

- Specifies the additional data that the HVDC interconnector owner must submit to the TSO when grid forming capability is provided

2

"GRID FORMING" technical requirements

- Defines the technical requirements applicable to HVDC interconnectors operating in grid forming mode
- Works in parallel with existing HVDC interconnector clauses and supersedes specific legacy provisions when grid forming functionality is enabled

3

Definitions

- Creates a common interpretation of the new terminology, so that the technical requirements can be read consistently by TSOs, interconnector owners and other stakeholders

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Clause Mapping

Integration of grid forming requirements into the Grid Codes

The new grid forming sections are included in both the EirGrid and SONI Grid Codes, customised to the structure of each code and inserted into the corresponding locations as follows:

	EirGrid	SONI
Interconnector Data Requirements	PC.A6.1.v.h	PC.A2.3.6.r
Grid forming technical requirements	CC.7.5.13	CC.S3.1.11
Grid forming definitions	Definitions	GLOSSARY AND DEFINITION (GD)

Interconnector Data Requirements

Additional data needed by the TSO to safely integrate HVDC interconnectors with grid forming capability

When an HVDC converter operates in grid forming mode, the HVDC Interconnector Owner must provide:

- Effective impedance (positive and negative sequence) – including both physical and virtual impedance
- X/R ratio of the Interconnector Converter Station
- Inertia constant (H_{eq})
- Damping
- Frequency-dependent impedance

These parameters enable the TSO to model the HVDC Interconnector accurately and ensure secure integration of grid forming capability under a wide range of system conditions

Grid Forming technical requirements - Part 1

Outlines the minimum set of technical parameters needed for HVDC interconnector operating in grid forming mode

1. **General applicability rules** – specifies the conditions under which grid forming operation applies

2. **Voltage-source behaviour** – the HVDC interconnector must behave as a controllable voltage source

   - Internal voltage amplitude, phase angle, and frequency must be controllable
   - Following a disturbance, the converter must respond immediately
   - Effective impedance must be within 0.2–0.5 pu, and $X/R \geq 10$
   - The converter must contribute to Synchronising Active Power (to oppose phase-angle jumps) and Voltage Stiffness (reactive power response to magnitude changes)

3. **Synthetic inertia contribution** – the HVDC interconnector must emulate the inertia provided by synchronous machines

   - It defines the active power response of the HVDC interconnector to system ROCOF
   - Must respond with no intentional delay
   - Use a minimum equivalent inertia constant of $H_{eq} \geq 3$ MW·s/MVA and a damping ratio ≥ 0.4

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Grid Forming technical requirements – Part 2

Outlines the minimum set of technical parameters needed for HVDC interconnector operating in grid forming mode

4. **Current limitation** – it defines how the HVDC interconnector must behave when it reaches its current limits during disturbances

- Only current magnitude may be limited; the phase angle must be preserved
- The converter must not change control mode
- The converter must remain stable, connected, and smooth during transitions
- Once system conditions improve, the converter must return to full capability without a bump

5. **Withstand capability** – it defines the ability for the HVDC interconnector to remain stable and connected under severe but credible disturbances

- Withstand ±30° phase-angle jumps at the Grid Connection Point
- Remain stable during sudden network topology changes
- Continue to operate even when system strength falls below the minimum Short Circuit Ratio
- Must not:
  - trip
  - block
  - introduce oscillations

Grid Forming technical requirements - Part 3

Outlines the minimum set of technical parameters needed for HVDC interconnector operating in grid forming mode

6. **Fault ride-through (FRT)** – it defines the required behaviour during voltage dips (both symmetric and asymmetric):

- Provide immediate voltage support based on its effective impedance
- Inject positive and negative sequence currents with no prioritisation
- Respect current limits as defined in the Current Limitation rules
- After the fault is cleared:
  - Restore active power quickly: ≥50% within 500 ms / ≥90% within 1.5 s
  - Avoid causing >5% voltage overshoot

7. **Optional capabilities** – additional advanced grid forming functions that may be provided

- Voltage Balancing: Maintaining balanced three-phase voltages by absorbing negative sequence current
- Islanding Capability: Ability to energise and stabilise an isolated network section
- Re-synchronisation Capability: Ability to smoothly re-connect an islanded section to the live grid
- Black Start Capability: If equipped, the station must be able to start in GFM Mode and energise the network

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Grid Forming definitions

They ensure consistent interpretation of technical terms across TSOs, manufacturers, and Interconnector Owners.

- **Effective Impedance:** Total impedance (physical + virtual) seen at the Grid Connection Point
- **Grid-Forming (GFM):** Capability to act as a voltage source
- **GFM Mode:** Control mode meeting all grid forming technical requirements
- **Interconnector STATCOM State:** DC-isolated state with modified requirements
- **Islanding Capability:** Maintain voltage and loads during islanding
- **Re-synchronisation Capability:** Smooth reconnection of an island to the grid
- **Self-Synchronisation:** Autonomous creation of voltage waveform
- **Synchronising Active Power:** Immediate active power response to angle jumps
- **Synthetic Inertia:** Active-power response to ROCOF
- **Voltage Balancing:** Control of negative-sequence current to balance voltages

4. Updates: 10 minutes

a. SPID_03_2025/MPID345 - FRT, RoCoF and Post Fault Active Power Recovery Demand for Demand Facilities;
b. CRU; and
c. Utility Regulator.

CRU Update

- Recommendation Papers with CRU for decision (3): MPID 320, MPID319, MPID 327

AOB

Meeting Minutes will be issued by COB 13 April 2026