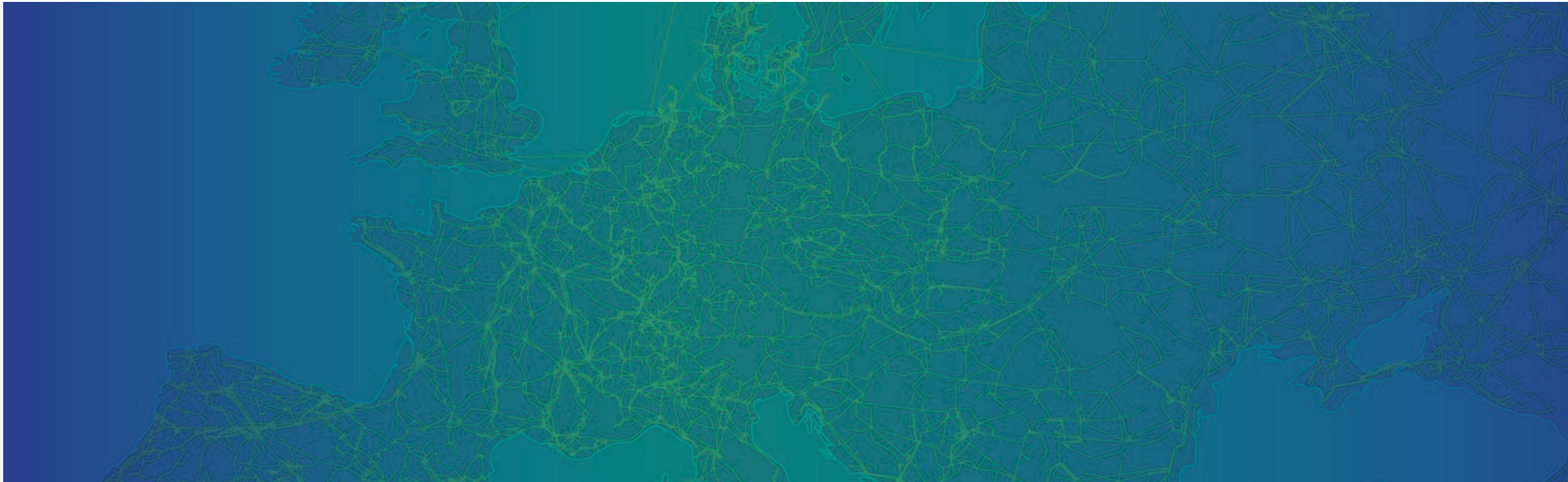


TOP 4.1 – Technical Group on Grid Forming Capability

19th March 2025 – 37th GC ESC Meeting in Brussels



Mario Ndreko (ENTSO-E) – StG CNC convenor

Background

- **ACER's recommendations on the amendments for the NC RfG** (published in December 2023) include non-exhaustive Grid-Forming (GF) requirements for Power Park Modules (PPM)
- To facilitate its application and address stakeholders' concerns about harmonization, ENTSO-E will release an Implementation Guidance Document (IGD) proposing exhaustive GF requirements after the publication of the updated regulation
- To advance the work on this IGD, **ENTSO-E** published in May 2024 a **technical report** ([link](#)) providing first interim recommendations on the exhaustive definition of GF connection requirements for PPMs
- In order to address the stakeholders' comments on this technical report, ENTSO-E established a Technical Group on Grid Forming Capability (**TG GFC**)
- The goal of this TG is to publish a **second consolidated version of the report** considering the stakeholders' feedback (CENELEC, EASE, EU DSO entity, HTW-Berlin, SolarPower Europe and Wind Europe)
- After the publication of the NC RfG 2.0, ENTSO-E will release an **IGD on exhaustive GF requirements** based on this second version of the report

Discussion topics

7 topics for discussion were defined and prioritized in the ToR of the TG

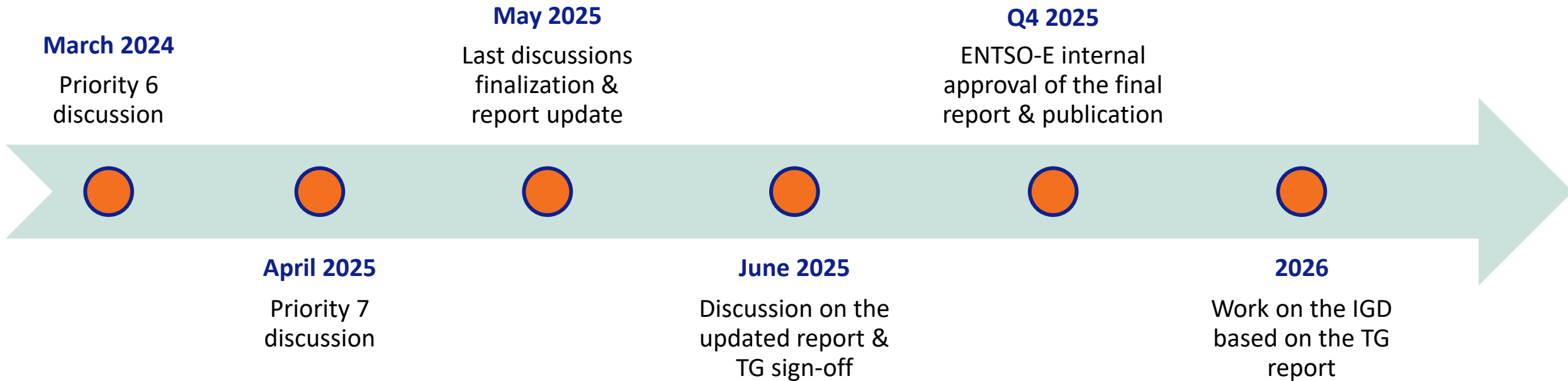
1. Power Generating Unit (**PGU**) level requirements
2. **Inherent energy storage** of the PGU for both PPMs and Electricity Storage Modules (ESM)
3. **Current limiting requirements and effective impedance** of the PGU for cases of voltage drop and angle jumps
4. **Synthetic inertia** requirement and **sub-cycle measurable quantities** of the PPM
5. **Dynamic response** expected to RoCoF and **time domain requirements**
6. **Compliance verification and certification** recommendations
7. Impact of existing **anti-islanding protections** in islanded grids

Priorities 1-5
already addressed

Priority 6
discussion ongoing

Priority 7 not yet
started

Timeline



Main decisions (1/2)

Requirements on unit vs PPM levels

- All requirements in NC RfG 2.0 are defined at PPM level and specified at the connection point
- However, for the purpose of NC RfG 2.0 Article Y(7), the Thevenin equivalent is specified at the PGU terminals of the PPM
- Compliance of GFM requirements based on Article Y(7) shall be shown at unit terminals. Requirements according to all the other articles in NC RfG 2.0 need to be evaluated at the connection point

Inherent energy

- Where only a very small inherent energy is available, showing a single-sided response (i.e., reducing power output) should be sufficient proof for the equivalent voltage source behind an impedance behaviour of a unit
- In case of phase angle jump where the GFM response of a PPM (except ESM) results in a swing into the negative power flow, curtailment of the active power response to zero is acceptable
- For the case of ESM, the GFM behaviour is expected to change the direction of load flow

Main decisions (2/2)

Limit for effective impedance

- In the Phase 1 report, both minimum and maximum limits are required for the effective impedance
- It has been decided to change the requirement to only define a maximum limit
- The change increases the freedom in control implementations while maintains the minimum system needs for PPM's contributions in power/current during disturbances

Synthetic inertia

- If the compliance with the PPM requirement for synthetic inertia is realized by additional equipment in addition to the PGU, this equipment is not required to provide synthetic inertia during periods where PGU is disconnected
- The required synthetic inertia at PPM level shall correspond to the maximum capacity of the PGUs in operation

Dynamic response

- If IEC 61400-21-1 Annex C aggregation method is used, an extra 20ms is added resulting in a response time requirement of 30ms

Main ongoing discussions

Passivity requirement

- The stakeholders argue that this requirement is not backed up by the NC RfG 2.0 and must be written as a non-mandatory requirement
- ENTSO-E would like to see justification on why this requirement cannot be met

Voltage source behaviour

- The criteria to identify the voltage source behaviour of a GFM PGU are being discussed
- One opinion is that both islanding and phase jump tests need to be conducted
 - **Islanding test** is the method of which we are most confident to identify voltage source nature
 - **Phase jump test** gives some temporal quantitative evaluations to supplement and make us more convinced of the voltage source behaviour
- However, there are also opinions supporting that either of them is sufficient to identify the voltage source behaviour and it would reduce the workload in compliance testing as well

Compliance testing

- CENELEC suggested a different approach and will provide recommendations for stakeholders' review