Paris Session 2022

OSMOSE WP3: grid forming capability and synchonisation services

SC B4: PS1 & PS3 Grid forming Applications
Question S1

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Need for standard definition of grid forming functionalities

Response time, ramping rate… **Yes** *Details of controls…* **No**

OSMOSE WP 3 propose to limit grid forming capability to be defined as a function of 5 features:

1. **Standalone**: be capable of *participating* in island operation after the loss of the main grid (with or without SM).
2. **Synchronising active power**: be capable of providing immediate[1] active power output following a phase jump.

Specification: time-dependent profile or lower bound on the return time (Tsp), i.e. minimal sustain time of the response (~5 Hz bandwidth limit on the controlled power GC0137). Constraints on active power recovery possible.

3. **Inertial response:** be capable of providing an immediate[1] active power output following a frequency ramp (constant RoCoF) or profile (piece-wise linear RoCoF function).

Specification: a fixed, settable or minimal inertia constant value (H), or the power output profile for predefined values ($\Delta P(t)$ per RoCoF) with minimal sustain time (Tir) in coordination with frequency regulation services.

4. **System strength:** be capable of providing an immediate[1] reactive power output following a grid voltage variation. A frequency-dependent impedance characteristic of the system shall demonstrate low transient and sub-transient impedance in the linear domain. Specification: thresholds for impedance values at specific frequency ranges[2].

5. **Fault current:** expected (voltage source) behavior in current limitation mode. Be capable of providing:
   a) immediate current output within the installation capabilities following voltage dips.
   b) The active/reactive current share during the first instants of the fault shall depend on the system impedance
   c) In asymmetrical voltage dips, prioritisation between positive and negative sequence shall be settable.

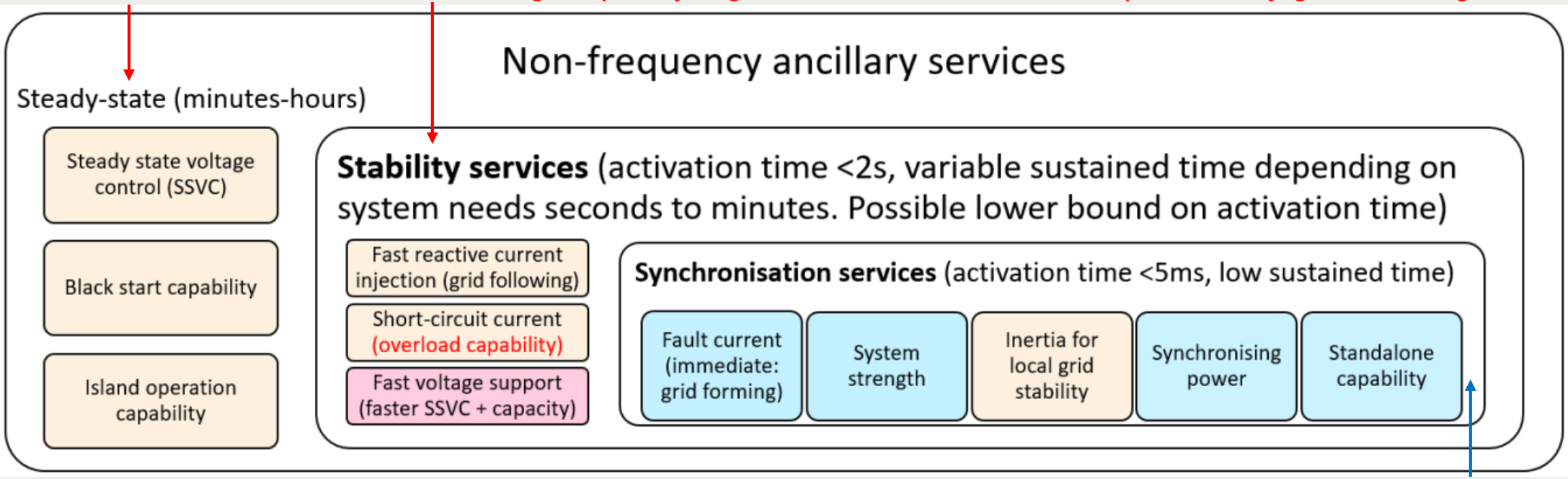
[1] Immediate means subcycle. A 5 ms maximal response time threshold could be adopted as proposed in GC0137

[2] Taking into account physical components between the converter and PCC (filters, valve reactors, transformer…).

Challenges for PE-based ancillary services integration

1. Proper definition and understanding of new ancillary services

Out of SCOPE of GFM with the existing frequency regulation services that can be provided by grid following units[1].

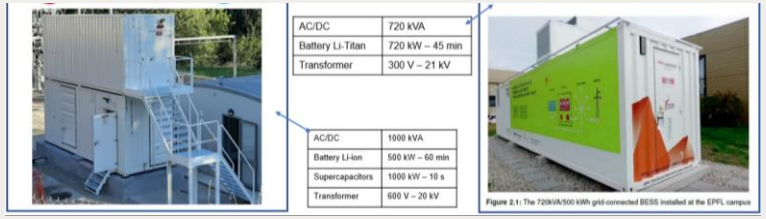


2. Differentiate: technical capabilities vs. service.

GFM is the **capability** to provide (some) synchonisation services

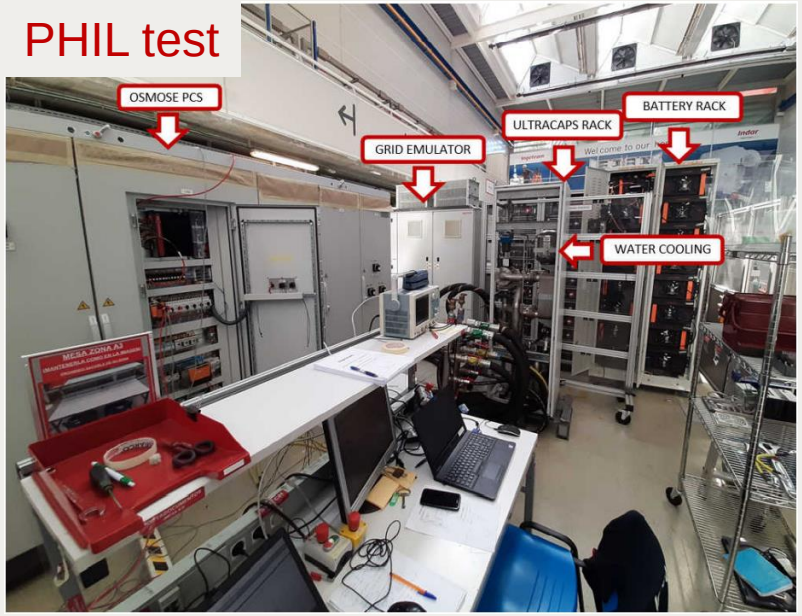
[1] Grid following units (normal operation) may include an island mode or blackstat capability (switch to V-f mode)

Pilots & contributions needed



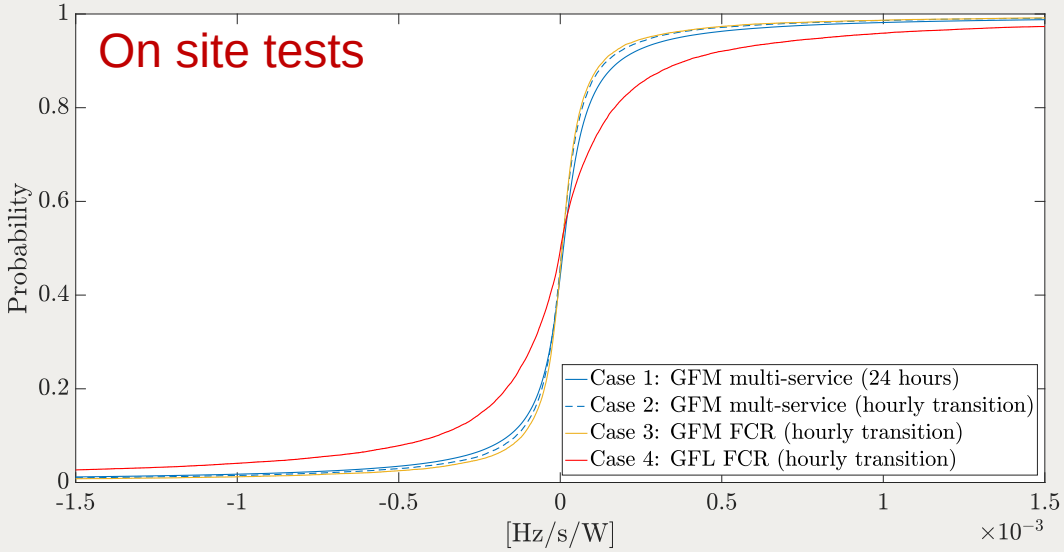
- *OGM*: TRL, technological constraints & capabilities: when does GFM entail costs?
- *@All:* control solutions and performance assessment – more demo? Ex. OSMOSE WP3

PHIL test



- *TSO:* system needs & tech. spec.

On site tests



Case 1: the 24 GFM-controlled BESS providing multiple services.
Case 2: 15-minute window around the hourly transition (i.e., 00:00 CET)
Case 3: dedicated 15-minute experiment around the hourly transition with the GFM-controlled BESS providing only FCR (droop of 1440 kW/Hz).
Case 4: dedicated 15-minute experiment around the hourly transition with the GFL-controlled BESS is providing only FCR (droop of 1440 kW/Hz).