

ENTSO-E views on electricity storage related amendments of the Connection Network Codes

11 May 2023, presented by Manuel Froschauer and Adrian Gonzalez



Context on electricity storage

- ✓ The **penetration of energy storage** devices at EU level is continuously **rising**.
 - ✓ **Electricity storage is a mature technology**.
 - ✓ In **some member states** already have **national requirements** for storage.
 - ✓ Storage devices need to **fulfil certain harmonized technical requirements with cross-border relevance**.
 - ✓ **Currently**, the three European Connection Network **Codes** (RfG, HVDC and DCC) **explicitly exclude storage** (other than PSH).
- >> A contribution to the security of supply and sustainability on EU-level is required.

Recommendations for electricity storage in the CNC

1. Electricity Storage Modules (ESM) are **to be considered as PGMs**.
Therefore, they are either a SPGM or PPM.
 2. Consequently, ESMs have to fulfill the relevant requirements, which **simplifies the introduction** into the CNC.
 3. Requirements shall **also be applied in consumption mode**.
 4. Only where necessary specific requirements shall be introduced (e.g. limited energy reservoir or transition for consumption to generation)
- >> General concept should be explained in Whereas

Feedback to ACER proposal

- ✓ ENTSO-E's proposal endorsed the output of the Expert Group "storage" – with minor updates.
- ✓ ENTSO-E share the view of ACER that ESMs will play a key role in the system and it is necessary to introduce requirements for the grid connection.
- ✓ ENTSO-E supports in general the proposal of ACER.

Storage Expert
Group:
PHASE II FINAL REPORT

Feedback to ACER proposal – General

- The *Whereas* should include the underlying concept of implementation.
- If V2G is defined as an ESM, no explicit mentioning of V2G is required thereafter. ENTSO-E supports including charging points or installations as ESMs and differentiating only the vehicles (this distinction should be more explicit).
- As a matter of form the exception for storage devices should be deleted from Art. 3

(s3) An electricity storage module connected to a network by a synchronous generator has to meet the same requirements as a synchronous power generating module and an electricity storage module connected to a network by a non-synchronous generator or through power electronics has to meet the same requirements as a power park module (which could include electric vehicles that comply with the definition of electricity storage).

(67) 'electricity storage module' or 'ESM' means a synchronous power-generating module or a power park module which can inject and consume active power to and from the network for electricity storage, excluding pump-storage power-generating modules. A V2G electric vehicle and associated V2G electric vehicle charging point or installation with a bidirectional functionality is regarded as an electricity storage module;

6. Electricity storage modules and V2G electric vehicles and associated V2G electric vehicle charging points or installations shall be capable of satisfying the requirements of this Regulation both when the electricity storage module or V2G electric vehicle charging points or installations injects and consumes active power to and from the network.

(d) storage devices except for pump-storage power-generating modules in accordance with Article 6(2).

Feedback to ACER proposal – P_{ref} for (L)FSM

– As for PPMs: The P_{ref} should be defined by the relevant TSO.

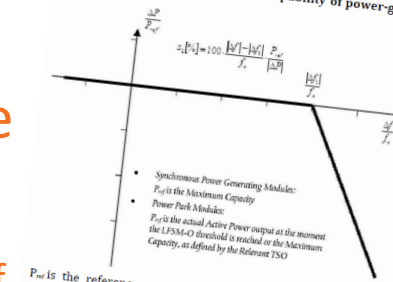
– P_{ref} should be the same as for already specified for PPM/SPGM -> so no more specification should be required. In consumption mode of ESMs, the P_{ref} should be P_{max} (exhaustively).

In the case of electricity storage modules, P_{ref} could be the actual active power at the moment the LFSM-O threshold is reached or the maximum capacity or maximum consumption capacity, as agreed with the relevant system operator.

- Synchronous Power Generating Modules:
 P_{ref} is the Maximum Capacity
- Power Park Modules:
 P_{ref} is the actual Active Power output at the moment the LFSM-O threshold is reached or the Maximum Capacity, as defined by the Relevant TSO

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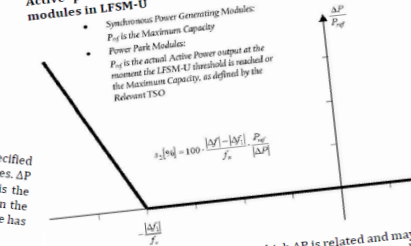
Active power frequency response capability of power-generating modules in LFSM-O



P_{ref} is the reference active power to which ΔP is related and may be specified differently for synchronous power-generating modules and power park modules. ΔP is the change in active power output from the power-generating module. f is the nominal frequency (50 Hz) in the network and Δf is the frequency deviation in the network. At overfrequencies where Δf is above f_d , the power-generating module has to provide a negative active power output change according to the droop S_o .

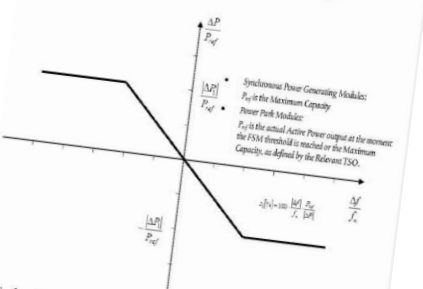
In the case of electricity storage modules, P_{ref} could be the actual active power at the moment the LFSM-O threshold is reached or the maximum capacity or maximum consumption capacity, as agreed with the relevant system operator.

Active power frequency response capability of power-generating modules in LFSM-U



P_{ref} is the reference active power to which ΔP is related and may be specified differently for synchronous power-generating modules and power park modules. ΔP is the change in active power output from the power-generating module. f is the nominal frequency (50 Hz) in the network and Δf is the frequency deviation in the network. At underfrequencies where Δf is below f_d , the power-generating module has to provide a positive active power output change according to the droop S_o . In the case of electricity storage modules, P_{ref} could be the maximum capacity or the maximum consumption capacity at the moment the LFSM-U threshold is reached or the maximum capacity or maximum consumption capacity as agreed with the relevant system operator.

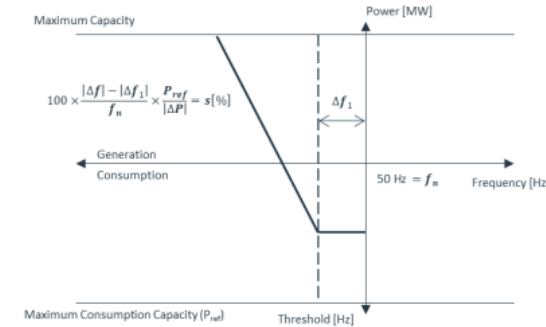
Active power frequency response capability of power-generating modules in FSM illustrating the case of zero deadband and insensitivity



P_{ref} is the reference active power to which ΔP is related and may be specified differently for synchronous power-generating modules and power park modules. ΔP is the change in active power output from the power-generating module. f is the nominal frequency (50 Hz) in the network and Δf is the frequency deviation in the network. In the case of electricity storage module, P_{ref} could be the maximum capacity or the maximum consumption capacity at the moment the FSM threshold is reached or the maximum capacity or maximum consumption capacity as agreed with the relevant system operator.

Feedback to ACER proposal – LFSM-U-ESM

- ENTSO-E supports the harmonized and simplified approach for LFSM-U-ESM but points out that 49Hz might not be suitable for all Synchronous Areas.



(c) The frequency threshold shall be adjustable between 49,8 Hz and 49,5 Hz inclusive. The default frequency threshold shall be 50 Hz reduced by Δf_1 where Δf_1 is defined in [Table X of Article 15.2.d](#).

(e) Instead of the capability referred to in paragraph (a), the relevant TSO may choose to allow electricity storage modules of Type A in consumption mode within its control area automatic disconnection at randomized frequencies, ideally uniformly distributed, between the frequency threshold and 49 Hz.

Automatic low frequency demand disconnection scheme characteristics:

| Parameter | Values SA Continental Europe | Values SA Nordic | Values SA Great Britain | Values SA Ireland | |
|---|------------------------------|------------------|-------------------------|-------------------|----|
| Demand disconnection starting mandatory level: Frequency | 49 | 48,7 – 48,8 | 48,8 | 48,85 | Hz |

Feedback to ACER proposal - FSM

- ENTSO-E opposes to allow special storage facilities to have less stringent FSM requirements.
- From ENTSO-E perspective this might be discriminatory.

—the actual delivery of active power frequency response depends on the operating and ambient conditions, as well as, on the underlying energy storage technology, of the power-generating module when this response is triggered, in particular, but not limited to, limitations on operation near maximum capacity at low frequencies according to paragraphs 4 and 5 of Article 13 and available primary energy sources;

- the TSO shall take into account the time needed for some technologies of electricity storage modules to switch from consumption mode to generating mode or vice versa and also the fact that the droop primary frequency control characteristic in consumption and generating mode could be different;

Thank you very much for your attention

Our values define who we are, what we stand for and how we behave.
We all play a part in bringing them to life.



EXCELLENCE

We deliver to the highest standards.
We provide an environment in which people can develop to their full potential.



TRUST

We trust each other, we are transparent and we empower people.
We respect diversity.



INTEGRITY

We act in the interest of
ENTSO-E



TEAM

We care about people. We work transversal and we support each other.
We celebrate success.



FUTURE THINKING

We are a learning organisation.
We explore new paths and solutions.

We are ENTSO-E

Backup: ERAA 2023 Capacity evolution - focus on Flexibility

