

Conclusion of the Power-to-Gas Stream of Work

Hydrogen Europe



Agenda

1. Definition of Power-to-Gas units and threshold of implementation
2. Non-exhaustive low voltage FRT profile parameters
3. Non-exhaustive droop for LFSM-UC as well as change in the response time for LFSM-UC
4. Alkaline Water Electrolysis OEM position on DCC 2.0 regulation
5. Implementation pathways

Definition of Power-to-Gas units and threshold of implementation

Article 2 – Definitions

The following three definitions are suggested to be updated and included in Article 2:

(**1) ‘power-to-gas demand unit’ means the smallest, independently operable demand unit that converts electricity to gases ~~(such as hydrogen or, with subsequent methanation, synthetic methane or other gases),~~ including all components needed to sustain the electrolytic process.

(**3) ‘minimum technical operating level’ or ‘P_{min-C}’ is the operation level of active power where the demand unit can operate without negative influence on the inherent process of its work, such as charging or electrolysis.

(**6) ‘Maximum consumption capacity’ or ‘P_{max-C}’ means the maximum continuous active power which a demand unit can consume as specified in the connection agreement.

Article 3 – Scope of application

The following new paragraph is suggested to be included at the end of Article 3:

4. Unless stated otherwise, requirements shall apply at the connection point(s) of the demand facility.

Article 16 – Protection requirements

The following new paragraph is suggested to be included at the end of Article 16:

5. Electrical protection of the demand facility shall not withhold the technical capability of demand units to comply with the requirements of this Regulation.



Good compromise on definition.
Reduces risk in projects

☐ It applies to Power to Gas facilities of > 800 W.

Non-exhaustive low voltage FRT profile parameters

- c. When the network voltage resumes, after the fault has been cleared, to ~~a value within the voltage range of 0,85 pu – 1,1 pu~~, a value within the voltage range specified in Art. XX.1(b) for unlimited time of operation, a power-to-gas demand unit shall recover its active power consumption level at the connection point ~~The relevant TSO shall specify the magnitude and time for active power recovery~~ according to the specification provided by the relevant TSO. The relevant TSO shall define:
- (i) A magnitude and accuracy within the range from 80% to 100% of the pre-disturbance active power consumption level.
 - (ii) A recovery time in the range from 1 seconds to 5 seconds, except for the synchronous area Ireland and Northern Ireland where the range shall be 0,5 seconds to 5 seconds.

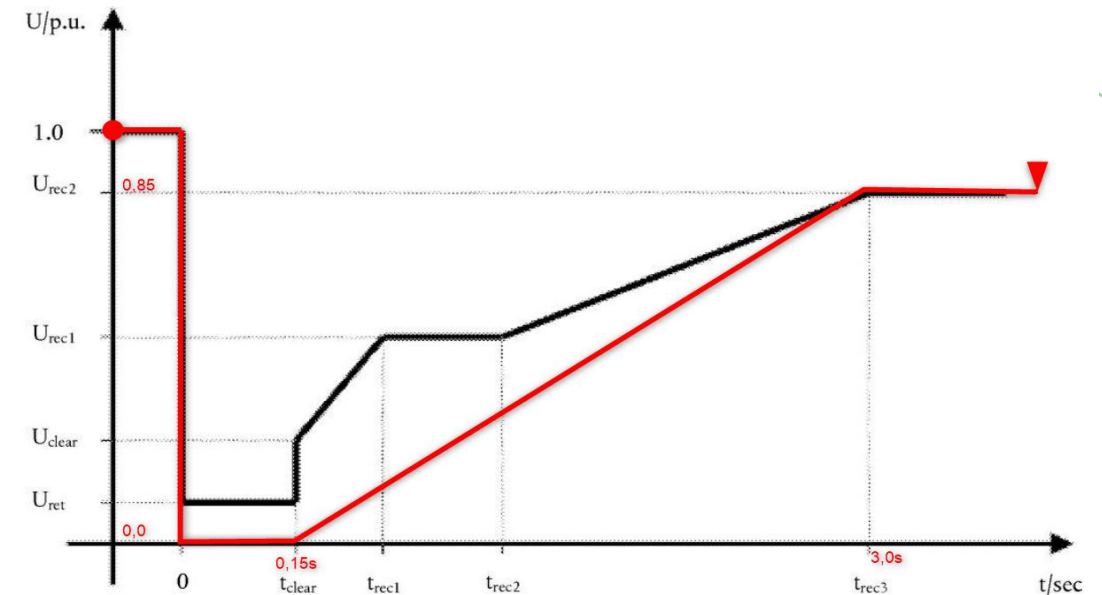
When defining the magnitude and accuracy of the active power recovery as defined in point (i), the relevant system operator, in coordination with the relevant TSO, shall take into account the consumption voltage dependency of the power-to-gas demand unit at the connection point within the voltage range for unlimited operation time as defined in Art. XX.1(b)

- d. The relevant system operator, in coordination with the relevant TSO, shall define a longer recovery time for operation, if it is required to preserve or to restore system security.

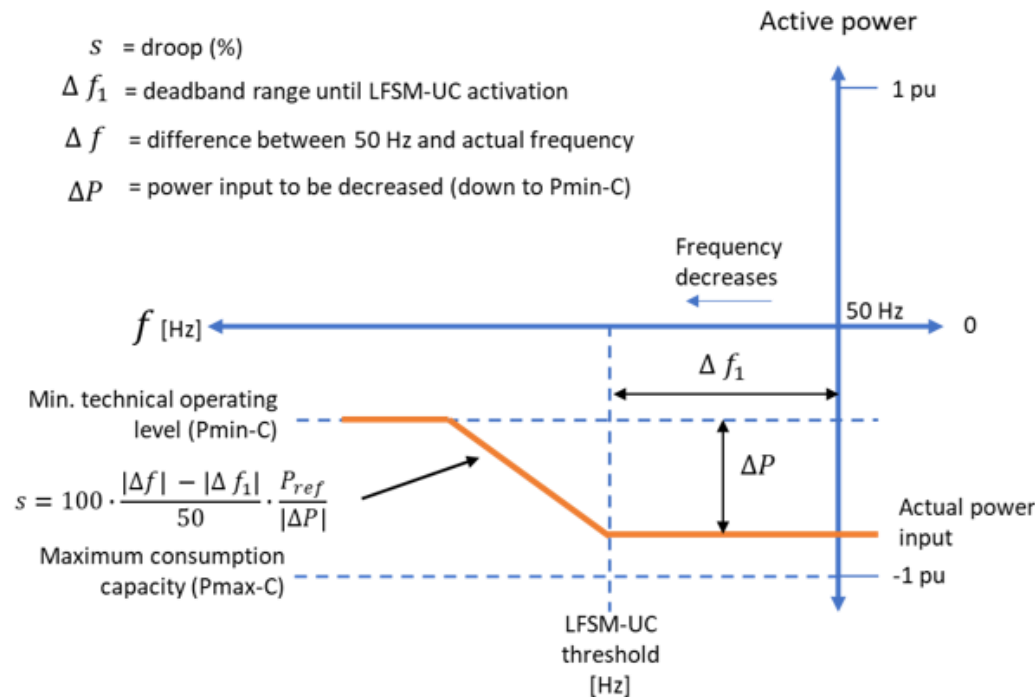
- ☐ Ireland is outside of the core market of OEMs with current FRT ranges
- ☐ Update of the FRT profile for P2G

Inclusion of magnitude, accuracy and time for active power consumption recovery after low voltage FRT events and consideration for voltage-dependent loads.

✓ Good compromise as it provides clear boundaries for product development



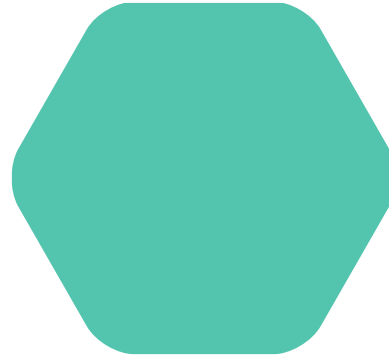
Non-exhaustive droop for LFSM-UC as well as change in the response time for LFSM-UC.



- b. ~~The droop s shall be 5%.~~ The droop settings shall be specified within a range of 2% and 12%. The relevant TSO shall determine the applicable setting for its control area in coordination with the TSOs of the same synchronous area to ensure minimal impacts on neighbouring areas.
- i. The response time for LFSM-UC for active power change in case of changing frequency, shall be as fast as technically feasible and less or equal to 0,5 seconds for an active power setpoint change of 30% of maximum consumption capacity, and less or equal to 1,2 seconds for an active power setpoint change down to the minimum technical operating level. The same response time applies when frequency recovers. ~~The relevant system operator has the right to request the demonstration of technical evidence of the response time.~~
- j. The power-to-gas demand unit shall not intentionally cause the delay of the start of active power change.
- k. When LFSM-UC is active, the LFSM-UC setpoint shall prevail over any other active power setpoints which would result in an increase of active power consumption above the LFSM-UC setpoint.

Figure (3)XX.c Pref is either the actual active power at the moment the LFSM-UC threshold is reached or Pmax-C as determined by the relevant TSO for its control area in coordination with the TSOs of the same synchronous area to ensure minimal impacts on neighbouring areas.

❑ **Alternative scheme proposed (utilizing load shedding logic) as an alternative to LFSM implementation, as this is the case in other MS (such as DE). In the end, this was not accepted by ENTSO-E and while some stakeholders currently do not have the intrinsic capability, this poses significant challenges for a share of OEMs.**



Alternative pathways to LFSM

- ❑ The alternative to LFSM compliance was ultimately not reflected in the final text
- ❑ The absence of alternative compliance pathways raises questions on how alkaline Power to Gas technologies can contribute to grid stability while meeting the same system objective.
- ❑ This could have broader implications for technology neutrality, project deployment and the scale-up of the European hydrogen economy

Alkaline Water Electrolysis OEM position on DCC 2.0 regulation

43rd GC ESC Meeting

07.10.2026 | John Cockerill Hydrogen, Nel Asa, Sunfire, thyssenkrupp nucera

AWE DCC 2.0 position | Alkaline electrolyzer OEMs see the necessity to modify particular sections of the DCC 2.0 proposed by ENTSO-E

AWE OEM group DCC 2.0 status



Fault Ride Through (FRT)



Reactive Power Compensation



Limited Frequency Sensitive Mode (LFSM-U)

AWE OEM group view on LFSM-U

Current LFSM-U requirements have raised concerns among alkaline electrolyzer manufacturers regarding their application to large-scale P2G facilities.

While rapid load reduction during an LFSM-U event is broadly supported, questions remain regarding the optimal recovery behavior.

Depending on system characteristics and generation mix, a more gradual recovery may in some cases better support overall system stability.

Initial exchanges with grid experts appear to support further assessment and have identified alternative compliance approaches, including load-shedding.

We encourage stakeholders to review the current LFSM-U framework, including the exclusion of load-shedding, and assess whether additional implementation pathways could achieve the same system objective.

LFSM case study | LFSM recovery could mean around 690 MW of additional demand in just 1.2 seconds for a European example plant

Case study outlined

- Illustrative extreme scenario assuming a symmetric ramp -



Green Hydrogen Plant

- Plant size: 760 MW
- Operating range: 10 to >100%
- Ramp-rate (up/down) ~75%/second (LFSM compliant)



Frequency Event

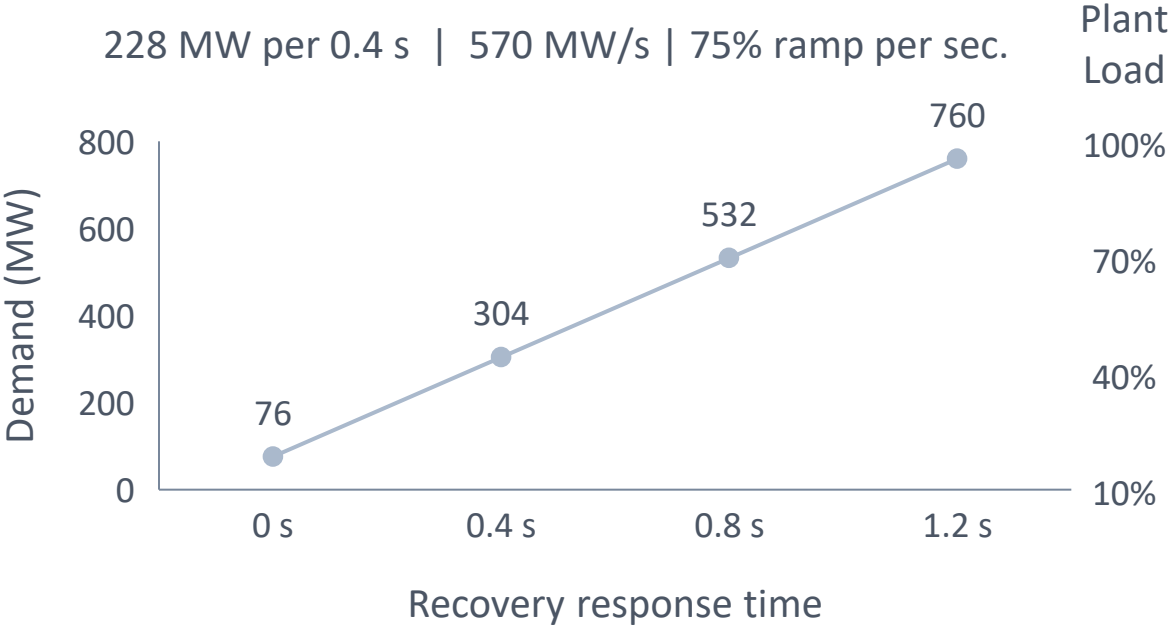
- Frequency drops to 49.x Hz
- Demand reduction from 100% to 10% in 1.2s (76 MW) to support the grid via LFSM-U
- Subsequent ramp-up to initial load-point at 100% (760 MW)

LFSM case study implications

Recovery after frequency stabilises at 50 Hz

- Reduction to 10% and recovery in 1.2s are scenario assumptions -

+684 MW in 1.2 s



Illustrative case study calculation using internal assumptions

Implementation roadmap for DCC 2.0

- ❑ Transient period with pilot-testing phases so that project developers can build, test, improve and validate the plant, without risking the business case due to delayed production
- ❑ There are no sufficiently large laboratory test environments for P2G OEMs since units of several 10 MWs and project specific adaptations need to be tested on-site. Also the laboratory would be blocked for years for every test (erection and commissioning). The case is very different than for an EV or heat pump with standardized products and laboratory environments.

