

ENTSO-E Amendment proposals

Tackling new system needs in the grid connection network codes

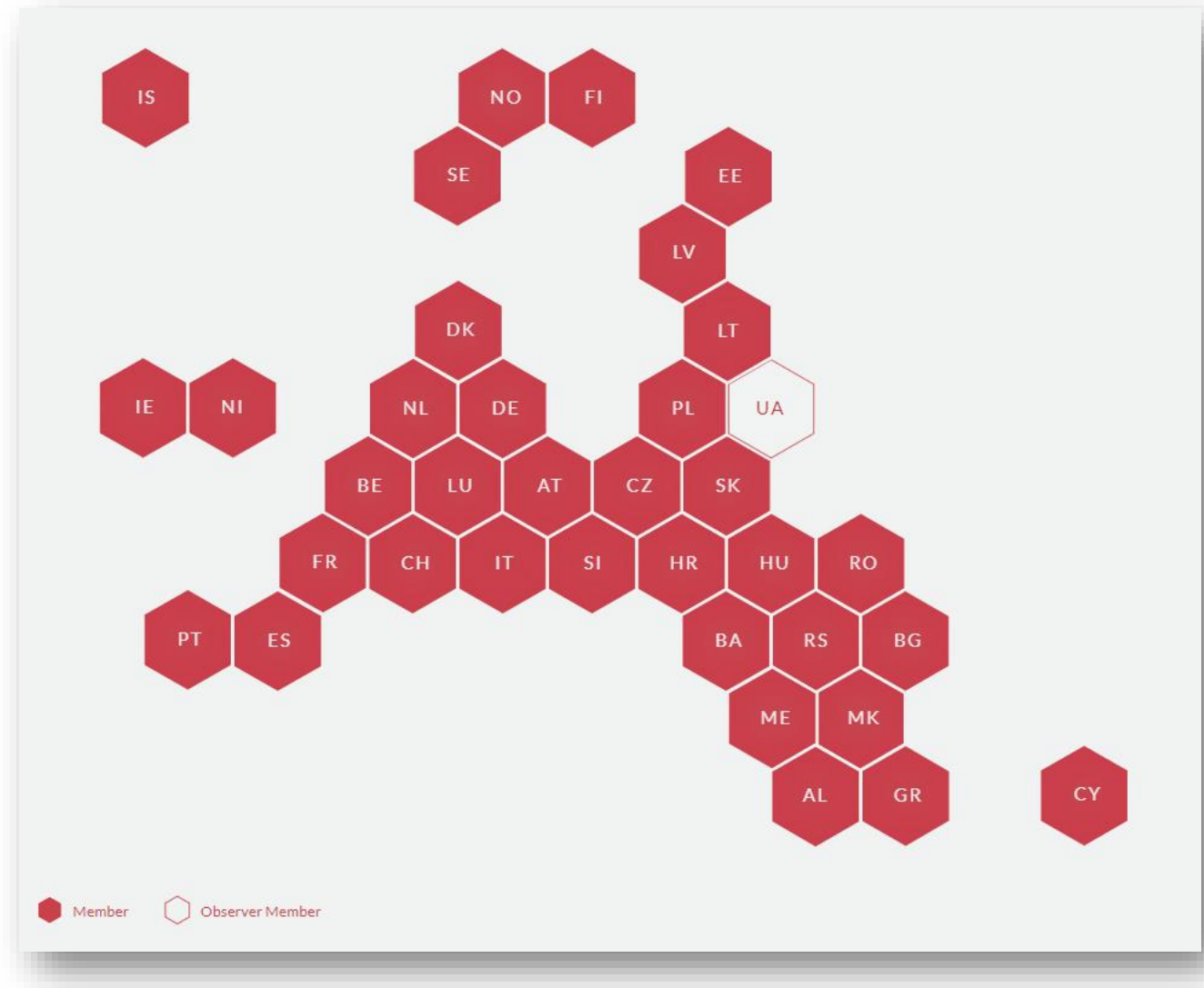
ACER Public Workshop, 25th October 2022.



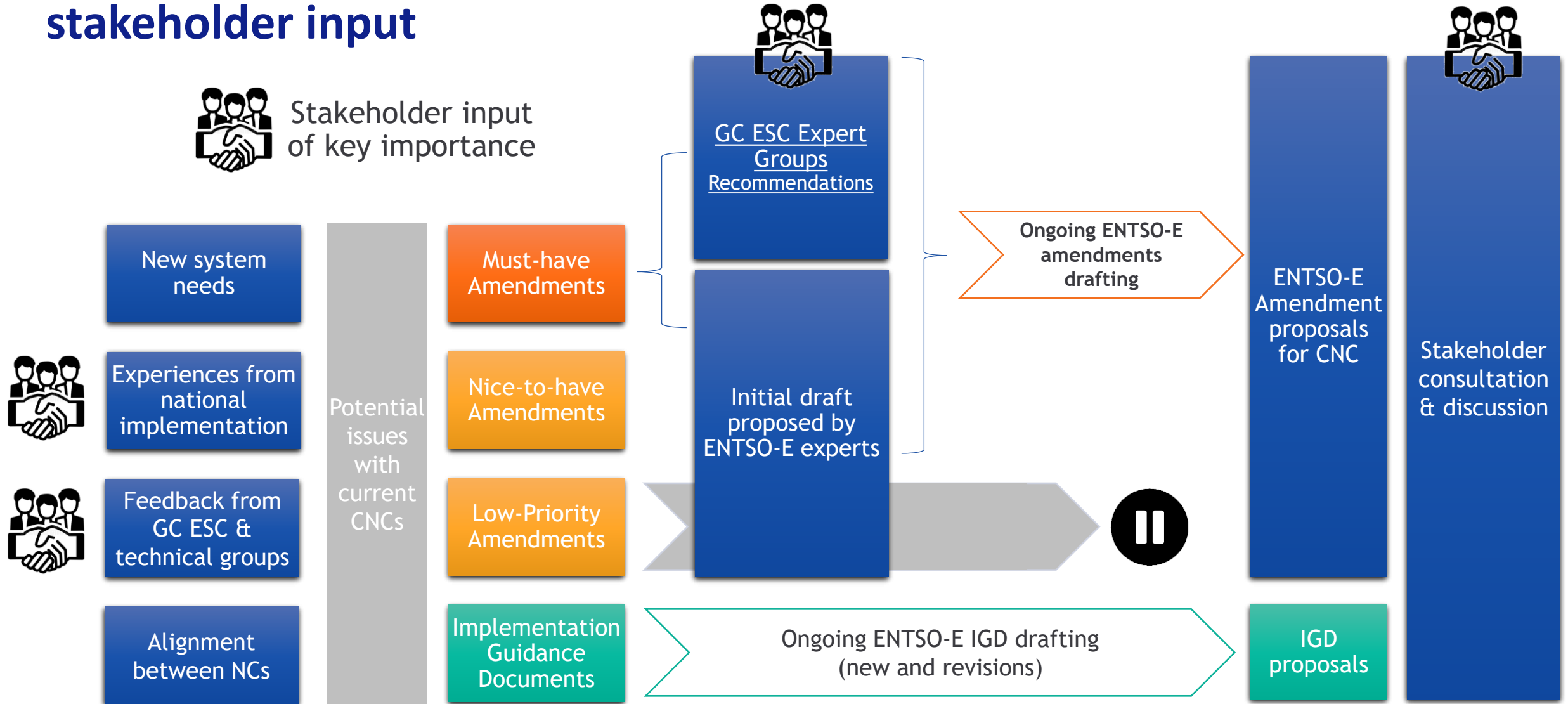
About ENTSO-E

ENTSO-E, the European Network of Transmission System Operators for Electricity, is the association for the cooperation of the European transmission system operators (TSOs). **The 39 member TSOs representing 35 countries** are responsible for the secure and coordinated operation of Europe's electricity system, the largest interconnected electrical grid in the world. In addition to its core, historical role in technical cooperation, ENTSO-E is also the common voice of TSOs.

ENTSO-E brings together the unique expertise of TSOs for the benefit of European citizens by keeping the lights on, enabling the energy transition, and promoting the completion and optimal functioning of the internal electricity market, including via the fulfilment of the mandates given to ENTSO-E based on EU legislation.



ENTSO-E approach for updating Connection Network Codes – stakeholder input



- “Must-have” amendments without which secure operation of the power system would be increasingly compromised
- “Nice-to-have” amendments which would provide cost-effective overall benefits to society
- “Low-priority” amendments which can be taken on board where opportunity allows

Expert Group outputs

ENTSO-E supports the output of all the various Expert Groups under GC ESC:

- EG PSH (Requirements for pump-storage hydro power generation modules.), work completed
- EG MCS (Mixed customer sites with generation, demand and storage, and definition of system users.), work completed
- EG STORAGE (Identification of storage devices.), work completed
- EG CSM (Criteria for significant modernisation), work completed
- EG BftA (Baseline for type A power-generating modules), work completed
- EG ISSM (Interaction Studies and Simulation Models for PGM/HVDC), work completed
- EG CROS (Connection Requirements for Offshore Systems), work in progress
- EG ACPPM (Advanced Capabilities for Grids with High Shares of Power Park Modules), work in progress
- EG HCF (Harmonization of Certification and product Family grouping), work in progress

-> Link to the ENTSO-E webpage of Experts Groups: https://www.entsoe.eu/network_codes/cnc/expert-groups/

-> where necessary ENTSO-E has made slight adaptations to the proposed amendments

-> the spirit of all amendments has been respected

-> where ENTSO-E had diverging views it was discussed with the EG (i.e. LFSM-U-ESM)

ENTSO-E Work Outputs

NC RfG and NC DC legal text is prepared in the consolidated documents in the Track Changes mode.

NC RfG and NC DC Amendment proposals are supported by detailed justifications.

All related documents will be publicly available after ACER's Public Consultation is completed in November 2022.

Text Integration issues into ACER Survey Tool:

- There are amendments proposals with more than 5000 characters.
- There amendments with figures and tables.

63 NC RfG Amendments Proposals

List of NC RfG Amendment Proposals, 1/5

Whereas: Requested behavior outside a defined requirement of the NC

Art. 2.15 Definition of Connection Point

Art. 2.16 Definition of Pmax

Art. 2.17: Definition for PPM

Art. 5.1 : Determination of Significance - for Offshore

Art. 6: Application of Code - correction in title

(slightly modified) EG proposals

across Code: Storage Requirements (EG Storage)

Art. 5.2 Determination of Significance - Voltage Criteria (EG MCS)

Art. 4.1(a) Concept of substantial modification (EG CSM)

Art. 6.2: specific requirements for Pump-storage Hydro plants (EG PSH)

Art. 13 & dedicated Art. Xs in SPGM/PPM specific part: FRT withstand capability and PFAPR for Type-A PPM (EG BftA)

List of NC RfG Amendment Proposals, 2018-2022, 2/5

Type A

Art. 13.(a)(i) Extension of frequency range in Table 2 (overshoot)

Art. 13.1(a): Frequency range of Ireland synchronous area

Art. 13.1.b: RoCoF-withstand capability

Art. 13.1.x: Minimum Df/dt (RoCoF) for loss of mains

Art. 13.2 LFSM-O response time

Art. 13.2 Priority of LFSM-O

Art. 13.2.(c) Frequency range and droops (easy links)

Art. 13.7 (automatic connection) & Art. 14.4.a (Reconnecting to the network after an incidental disconnection)

Type B

Art.14.3 & Art.16.3 Fault Ride Through non-exhaustive requirement

Art. 14.3 & Art. 16.3 - New needs: Lack of requirement for consecutive faults

Art. 14.3.x Introduction of HVRT requirements

Art. 14.5.b - unit transformer protection

Art. 14.5.d - Capabilities (Connection requirement) of periodical data exchange linked with operation requirements

List of NC RfG Amendment Proposals, 2018-2022, 3/5

Type C

Art. 15.2.c: LFSM-U - Response time and threshold

Art. 15.2.c: Priority of LFSM-U

Art. 15.2.d: Frequency response insensitivity (FSM)

Art. 15.2.c & 15.2.d: Allowable delay for activation of active power frequency response

Art. 15.2.d.v Duration of the FSM support

Art. 15.2: Full activation time of FSM support

Art. 15.2.d: New table and figure for df1 thresholds (used for FSM/LFSM-U/O)

Art. 15.2.d.vii Notification of parameters

Art. 15.3: Capability of disconnection at voltage values

Art. 15.4.a: Black Start Capability ("dips in Voltage")

Art. 15.5: Capability to take part in island operation

Art. 15.5.c: Quick re-synchronization capability (should be requestable)

Art. 15.6.c: Simulation Models

Type D

Art. 16.2: Mismatch between voltage range and material standards

Art. 16.4.d Agreement vs TSO proposal or contract

List of NC RfG Amendment Proposals, 2018-2022, 4/5

SPGM/PPM specific

Art. 17.2.a & Art. 20.2.a: Reactive power capability

Art. 17.2.b, Art. 19.1 & Art. 19.2 : Lack of specifications of robustness of automatic control outside capability for type B

Art. 18.2 & Art. 18.2.b as well Art. 21.3.b & Art. 21: Range of voltage without voltage regulation support

Art. 18.2.b, Table 8 as well Art. 21.3.b, Table 9 & Art. 25.5, Table 11: Maximum range of voltage level in PU

Art. 18.2 Maximum range of steady-state voltage level in PU

Art. 19.2: Power System Stabilizers in SPGM

Art X (before 20): Grid forming capabilities

Art. 21.3.d: Reactive & Voltage control modes

Art. 21.3.d: Capability to re-select control modes

Art. 21.4 - Active Power Forced Oscillations

Art. 22: Power Oscillation Damping in PPM

List of NC RfG Amendment Proposals, 2018-2022, 5/5

Offshore

Art. 25.1: Voltage table applicable above 110kV

Operational Notification Procedure

Art. 29: General provisions

Art. 30 : Operational Notification Procedure of type A power generating modules

Art. 32: Procedure for type B and C power generating modules

Art. 42.3: Compliance monitoring

Art. 50: Compliance tests for offshore power park modules

Art. 70: Withdrawal of emerging technology classification

across Code: Stable PGM Control

24 NC DC Amendments Proposals

List of NC DC Amendment Proposals, 1/4

Whereas: Requested behaviour outside a defined requirement of the NC

Art. 1.1.a Subject matter

Art. 2.3 Definition of ‘transmission-connected distribution facility’

Art. 2.4 Definition of ‘demand unit’

Art. 4: Scope

(slightly modified) EG proposals

Art. 3.2.b: Pumped-hydro units should be excluded from the NC DC

List of NC DC Amendment Proposals, 2018-2022, 2/4

Short-Circuit Requirements

Art. 14.1 Short-circuit requirements / calculation basis

Art. 14.2 Short-circuit requirements / current contribution

Art. 14.3-9 Short-circuit requirements / threshold

Reactive power

Art. 15.1.b.i&ii reactive power / removal of “power factor”

Art.15.2 reactive power / DSO-TSO interface 25%

Annex II Voltage ranges

List of NC DC Amendment Proposals, 2018-2022, 3/4

Demand disconnection and reconnection

Art. 19.1 LFDD / application

Art. 19.1.c & (.ii) LFDD / functional capabilities

Art. 19.1.d LFDD / input signal

Art. 19.4.c Remote disconnection

Art. 19: Cascading of requirements

Simulation Models

Art. 21.3.a Simulation models / content

Art. 21.4 Simulation models / sub models

Art. 21.5 Simulation models / relevant SO

List of NC DC Amendment Proposals, 2018-2022, 4/4

Operational Notification Procedure

Art. 24.3.e ONP / wrong reference

Art. 22.1 ONP / General

Power Quality

Amendment 20: Art. 20 Power quality / Voltage distortion also changes in RfG & HVDC

Frequency related requirements

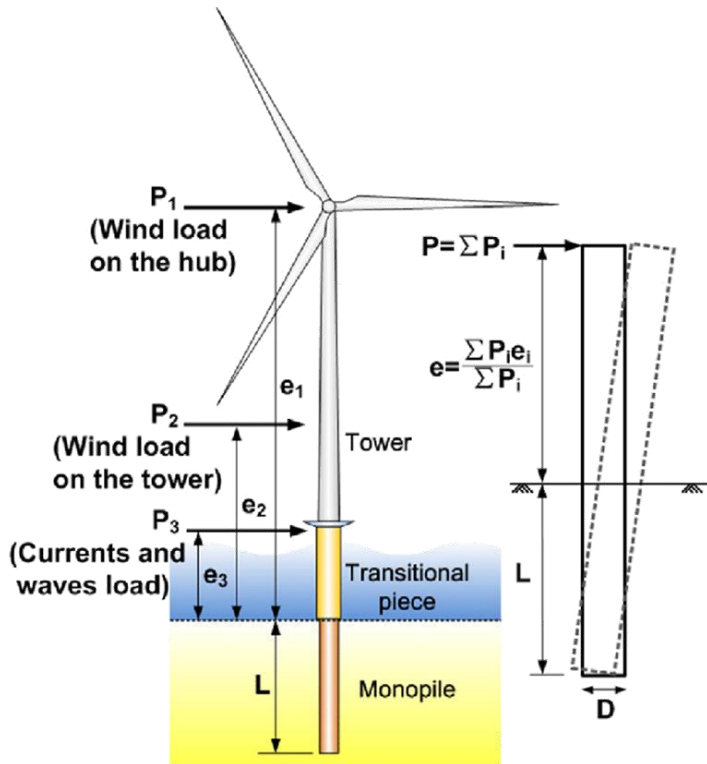
Annex I Extension of frequency range

Limited Frequency Sensitive Mode - Underfrequency Consumption (LFSM-UC)



Examples

RfG – Amendment on Art. 21.4: Active Power Forced Oscillations



Background of the proposed modification

- Analysis has shown that the active power tower forced oscillations can sum up between different wind parks.
- The forced oscillations are in the frequency range of the existing CE Interarea oscillation modes (i.e. 0,15 Hz-0,25 Hz).

Implications if the proposed modification is not accepted

- The planned and rapid expansion of wind generation could increase the interaction of windfarms with the ENTSO-E grid and stimulate larger, continuous oscillations, and influence negative the damping of the existing interarea modes.
- Forced oscillations from tower vibrations in offshore wind farms may grow and become a cross border issue.

Main points of the ENTSO-E amendment proposal for RfG Article 21.4

- In Art. 21 (requirements for type C PPMs) a new article for type C PPM:
No control system or design characteristic of a power park module shall impose forced oscillations to the power system as periodic variation outside nominal frequency of any electrical quantity related to the power output at the connection point.

DC NC – Amendment on new Limited Frequency Sensitive Mode-Underfrequency Consumption

Background of the proposed modification

- Frequency-related requirements must account for the energy system which is transforming during the green transition.
- To prevent the triggering of LFDD and to account for a reduced effectiveness of LFDD a new limited frequency sensitive mode for various demand units (LFSM-UC) is introduced. Besides that it is important that the demand units remain connected to the grid on high RoCoF cases.



Implications if the proposed modification is not accepted

- In case of rare but severe frequency events it can be expected that more stages of LFDD will be triggered and some consumers would be faced with complete blackouts.
- As the effectiveness of LFDD will be reduced in the future there is also an increased risk that the LFDD concepts are sufficient to prevent a system wide blackout in exceptional cases.
- During severe frequency events, especially on over-frequency case, the trip of large scale demand units would jeopardise system security.

Main points of the ENTSO-E amendment proposal for the NC DC

- In Whereas section it is proposed to define the need for LFSM-UC
- New Title XX that defines requirements for connection of electrical charging demand units, power-to-gas demand units and temperature-controlled devices.
 - LFSM-UC in coordination with requirements for LFDD
 - RoCoF withstand capability
 - FRT as non-exhaustive requirement
- New chapter on operation notification procedures

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