

Notice: „Stakeholder“ in the context of this document means the representatives of Eurelectric, EDSO for Smart Grids, CEDEC, Geode, IFIEC as well as VGB Powertech at the European stakeholder Committee Grid Connection, who have contributed to this paper.

## Stakeholders' position to questions raised in CENELEC's slides

As a reminder:

### Question 1: Other active power setpoints during LFSM - O

Article 13(2)g states: “the power-generating module shall be capable of operating stably during LFSM-O operation. When LFSM-O is active, the LFSM-O setpoint will prevail over any other active power setpoints.”

In a Distribution grid there might be the situation, that output power needs to be reduced due to local grid congestions or voltage stability issues. The statement of EU 2016/631 that LFSM-O setpoint will prevail over any other setpoint poses the question if a further reduction or output power for example due to local congestion issues. Also during overfrequency situations a DSO needs to have the right to react on congestion situations.

We therefore expect, that also during LFSM-O operation a setpoint provided by the DSO below the LFSM-O set point shall be complied with.

We understand Article 13(2)g to state: When LFSM-O is active, the LFSM-O setpoint will prevail over any other active power setpoints which would result in an increase of power above the LFSM-O setpoint.”

Is our understanding correct?

### Answer 1

LFSM, Overfrequency as Underfrequency, will be active only in emergency condition.

Counteraction to this situations are supposed to be of highest priority and the NC requirement of article 13(2)g intend to underline this need.

In a situation as described in the question, Article 13(2)(g) shall be understood, that any action of a DSO, which would contradict the objective of LFSM-O, which is active power reduction in case of high frequencies, shall be prohibited.

## Stakeholders' answer

### Message

Stakeholders clearly acknowledge the importance of solving emergency situations immediately. But we would like to point out that there is a limit to the necessity of a TSO solving system-wide issues: this is, solving local emergency situations. Ignoring this limit does not only interfere with the responsibilities and duties of the local entity, but will ultimately put system stability at risk. Therefore, in contrast to the proposal of ENTSO-E, local actions aiming at local emergencies must always prevail over measures requested to solve global emergencies.

The ENTSO-E position seems illogical in this regard. If the DSO cannot constrain the generation output for local network management, the DSO will instruct the generation to come off the system. In either case it therefore follows that the generation will not be available to modulate its output for TSO purposes.

Besides that, deviations of generators into the relieving direction (i.e., feeding less active power than required during LFSM-O or feeding more during LFSM-U) should always be tolerated.

### Justification

Deviations of generators into the relieving direction should always be tolerated as no party is harmed and there shouldn't be a limit to any helpful, voluntary actions.

CENELEC's question is limited to generators following a LFSM-O characteristic, as described in Art. 13 of NC RfG. In such situations, generators are obliged to have the capability to lower their output power automatically to a value described by a certain characteristic.

Usually, local emergency situations in distribution systems are caused by contingencies, thus raising the need for further curtailment of connected generators. European DSOs do not see any situation where they should require a generator to feed in more active power on their own account, as ENTSO-E assumes in its answer to CENELEC's first question.

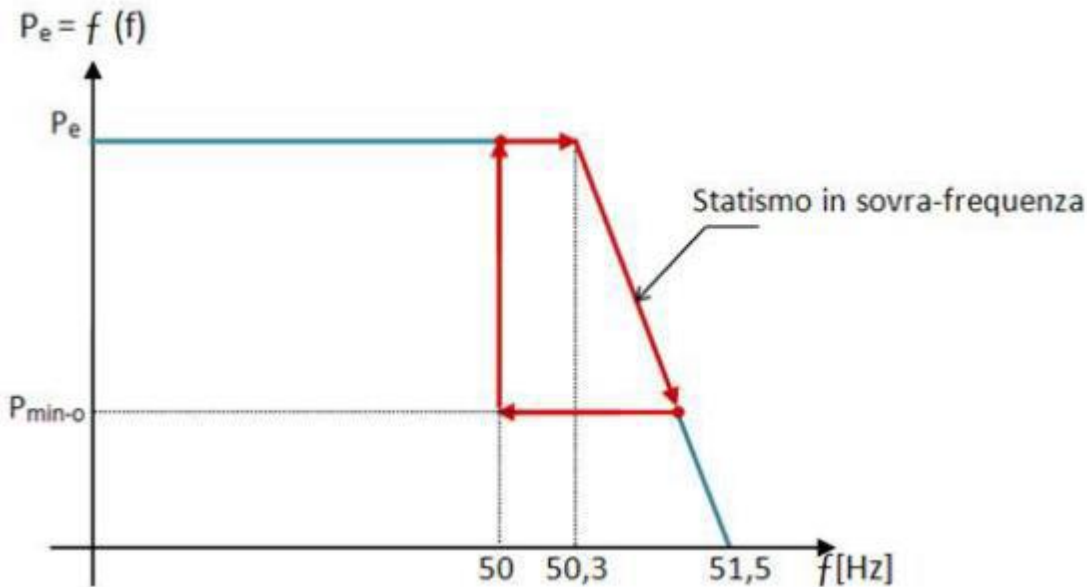
From stakeholders' point of view, a realistic situation could arise during LFSM-U (as described in Art. 15 paragraph 2 c) of EU 2016/631). First of all, it must clearly be stated that NC RfG does not require the LFSM-U setpoint to prevail over any other active power setpoints. That is clearly welcomed by stakeholders. During LFSM-U there might be local situations in a distribution system (e.g. local congestions) which lead to curtailment of generators. It must be emphasized that in (some) distribution systems – in contrast to the transmission system - generators are connected to the system only n-0-secure. In such situations, the setpoint of the local system operator (usually the distribution system operator) must prevail over the LFSM-U characteristic or any other setpoint which requires the generator to feed in more active power. Otherwise, the local congestion can't be relieved, which will ultimately lead to triggering of protection systems. Relieving local congestions need local measures on a very limited number of generators. On the other hand, for the solution of global issues like system imbalances, TSOs can access millions of generators. Triggering of protection systems and switching off of a certain line in situations where distribution systems already experience high-load situations can lead to uncontrollable resulting protection systems' triggering, which can end up in the disconnection of a whole distribution system. That means, in the end several hundred megawatt of distributed generation might be disconnected, where in the beginning the curtailment of 30 MW of a single generation facility would have solved the issue.

It is therefore obvious that local system management actions must always prevail over global emergency actions.

As a reminder:

#### Question 4: LFSM-O operation with hysteresis

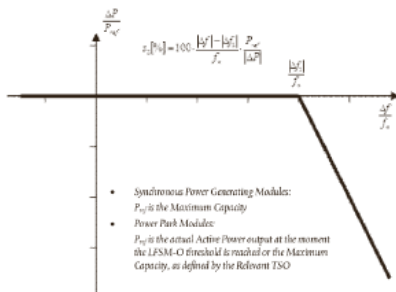
Is a LFSM-O implementation including a hysteresis as proposed below in conflict with Article 13 2?



#### Answer 4

Article 13(2)(a) defines: “the power-generating module shall be capable of activating the provision of active power frequency response according to figure 1 at a frequency threshold and droop settings specified by the relevant TSO”.

Figure 1 defines the course of the active power frequency response:



Above the frequency threshold to be defined by the relevant TSO, the active power output shall vary in a linear way as a function of frequency. The gradient of the active power variation is defined by the droop, which shall be also specified by the relevant TSO. Article 13(2)(a) does not distinguish between a decrease of active power output in case of increasing frequency and an increase of active power output in case of decreasing frequency, therefore in both cases the linear variation according to figure 1 shall apply. A hysteresis as proposed by CENELEC is not foreseen by the text of Article 13(2)(a).

## Stakeholders' answer

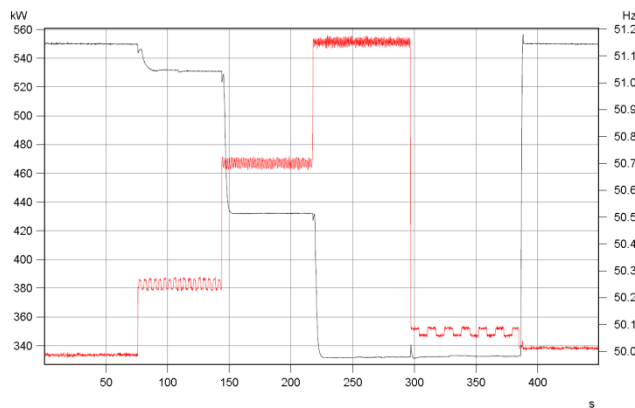
### Message

Again, deviations of generators into the relieving direction (i.e., feeding less active power than required during LFSM-O, let it be due to market or operational or any other reason) should always be tolerated.

Considering the characteristic included in the question of CENELEC, even though it can be considered as being more relieving than a proportional droop, it bears the risk of jeopardizing system stability. Therefore, the characteristic included in CENELEC's original question shouldn't be used.

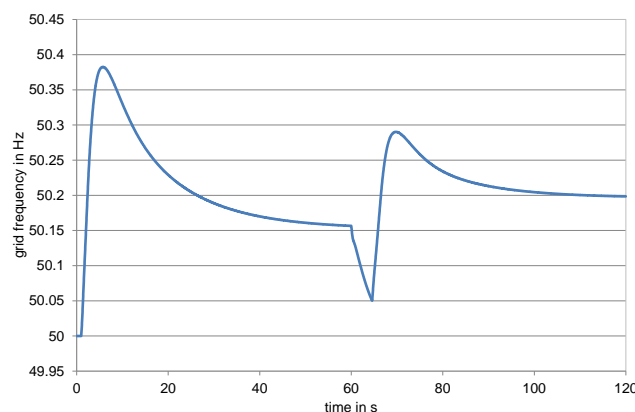
### Justification

The proposed characteristic will put the secure operation of the system at risk. The problem is that modern inverters can follow the characteristic very exactly and quickly, including the steep ramp when frequency reaches slightly less than 50.01 Hz. A similar characteristic was used in Germany in the past. Tested inverters show a behavior as depicted in Figure 1:



**Figure 1: Active power reduction due to over-frequency of a PV-inverter with high output power (red: frequency, black: output power)**

In a system, such steep ramps will lead to an overshoot of generation when frequency drops back to 50.0 Hz. Taking into account the slow answer of reserves, frequency will deviate again, as Figure 2 reveals<sup>1</sup>:



**Figure 2: Exemplary behaviour of grid frequency when using CENELEC's characteristic**

<sup>1</sup> Taken from: M. Wilch, "Disadvantages of non-optimal Implementations of Power Reduction during over-frequency events", 1<sup>st</sup> International Workshop on Integration of solar power into power systems, Aarhus, 2011.

To avoid such an unsatisfying behavior, the characteristic as proposed by CENELEC should not be used.

The curve in Figure 1 (RfG) should be seen as a cap. During raise of the frequency, the active power should be reduced as soon as possible to or below the cap. During frequency recovery, the costs for unbalance are an incentive for generators to follow this cap as soon as possible. If however, due to processes or other considerations a delayed response (raise of active power towards the cap) during frequency recovery occurs, it does not endanger the system stability and is as such allowed.