



**DEMAND FOR A MORE REALISTIC
RATE OF CHANGE OF FREQUENCY (RoCoF) VALUE
BASED ON RECENT SYSTEM SPLITS
ON 8 JANUARY & 24 JULY**

GC ESC 22 SEPTEMBER 2021



Requirements in RfG NC regarding RoCoF

Art.13.1.b : With regard to the rate of change of frequency withstand capability, a power-generating module shall be capable of staying connected to the network and **operate at rates of change of frequency up to a value specified by the relevant TSO**, unless disconnection was triggered by rate-of-change-of-frequency-type loss of mains protection. The relevant system operator, in coordination with the relevant TSO, shall specify this rate-of-change-of-frequency-type loss of mains protection.

Comments by VGB:

This requirement has to take into account that some processes in a PGM will trip as a consequence of a too high RoCoF value. In several Member States the TSO has determined the RoCoF value **without consensus / agreement from generators or consumers**.

Requirements in some Member States

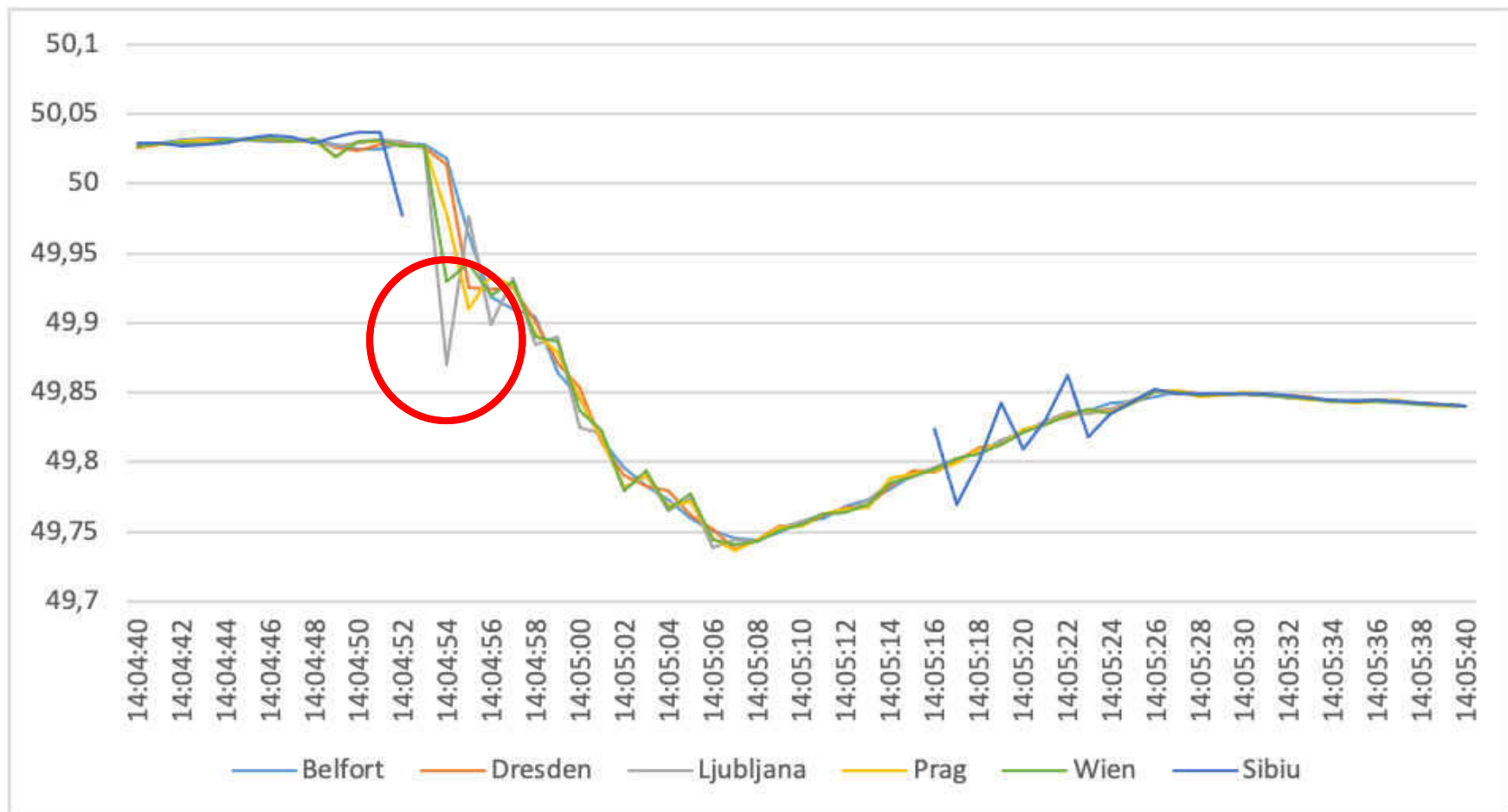
According to the European Commission and FGH study dated February 2021

Value [Hz/s]	MS+	Number of MS+	Comments
0,5 (n/a for SW)	IS*	1	* Defined for type B and D
1 (for 0,5s)	GB, NIE, IE, 50549*	3	* EN 50549-1/-2, here SPGM
1,5 (for 1s)	NO	1	
2 (n/a for SW)	AT, DK	2	
2 (for 0,5s)	CZ, ES, HR, HU*, PL, SI, SK, FI, SE, PT, 50549**	10	* Defined for type B, C and D ** EN 50549-1/-2, here non-SPGM
2,5 (n/a for SW)	EE	1	
2,5 (for 0,5s)	HU*, LT, LV	3	* Defined for type A
2,5 (for 0,1s until 1s)	IT	1	
1,25 (for 2s) or 1,5 (for 1s) or 2 (for 0,5s)	DE, LU, NL, RO	4	
Over - and underfrequency profile	BE, GR	2	
n/a	CY, BA, BG, CH, FR, ME, MK, RS	8	

In the past, ENTSOE has explained several times that in IE the worst incident is a loss of generation, in Continental Europe (CE) a system split.

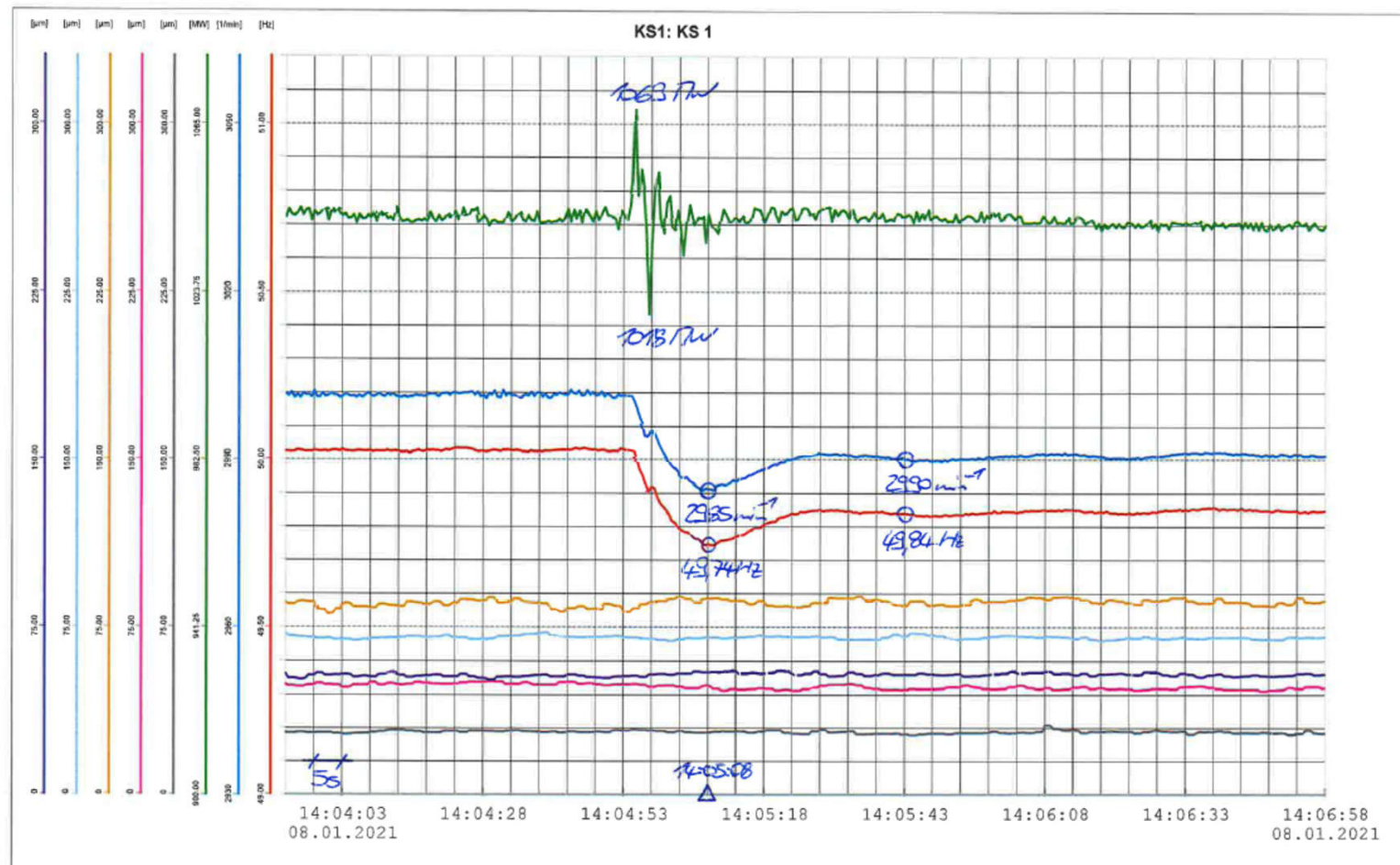
This should explain the difference between IE (1 Hz/sec) and CE (2 Hz/sec)

Frequency data on 8/1/2021 (according to www.gridradar.net)



Average RoCoF during 13 sec : 20 mHz/sec

Frequency data on 8/1/2021 (registered at a Swiss power station)



Average RoCoF during 15 sec : **20 mHz/sec**
 Max RoCoF during 500 ms: **55 mHz/sec**

Some quotes from the final report (1)

On 15 July 2021, ENTSOE has published its final report about the system split dated 8 January 2021.

See https://eepublicdownloads.azureedge.net/clean-documents/SOC%20documents/SOC%20Reports/entso-e_CESysSep_Final_Report_210715.pdf

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3.2.1 Disconnection of generation units or loads close to the separation line due to high transients

*Due to the high transients of voltage and frequency, a significant number of generation units and industrial or domestic loads were disconnected in both areas. The detailed breakdown of generation and load disconnection by country is presented in Section 3.3. The RoCoF at the centres of inertia in the North-Western area was -60 mHz / s and in the South-Eastern area $+300 \text{ mHz / s}$ (RoCoF values are deduced from the frequency measured at the centre of inertia and is a mean value for the complete area). Both values were quite far from the **current considered critical** limit of 1 Hz / s (for higher RoCoF values most of the current devices and schemes which protect the power system are too slow to react).*

Some quotes from the final report (2)

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RoCoF values of -60 mHz/s and $+300 \text{ mHz/s}$ were measured in the north-western and south-eastern areas, respectively. These values and related transients confirm the limit value of 1 Hz/s as a pragmatic sustainable RoCoF reference for the system. System separation events can serve as a valuable input to define normative incidents to be used in the dynamic system studies.

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Based on the recorded dynamic behaviour of the system it is observed that the RoCoF values after the separation were within the generation withstand capabilities. The event will be used to evaluate frequency stability evaluation criteria for Continental Europe and to verify the dynamic stability models.

VGB interpretation of the final report.

This report does not describe the consequences of a high RoCoF value on PGMs and consumers.

VGB experts are convinced that this report confirms a RoCoF withstand capability for grid users of **1 Hz/sec** as appropriate.

A detailed analysis of the RoCoF is missing in the report.

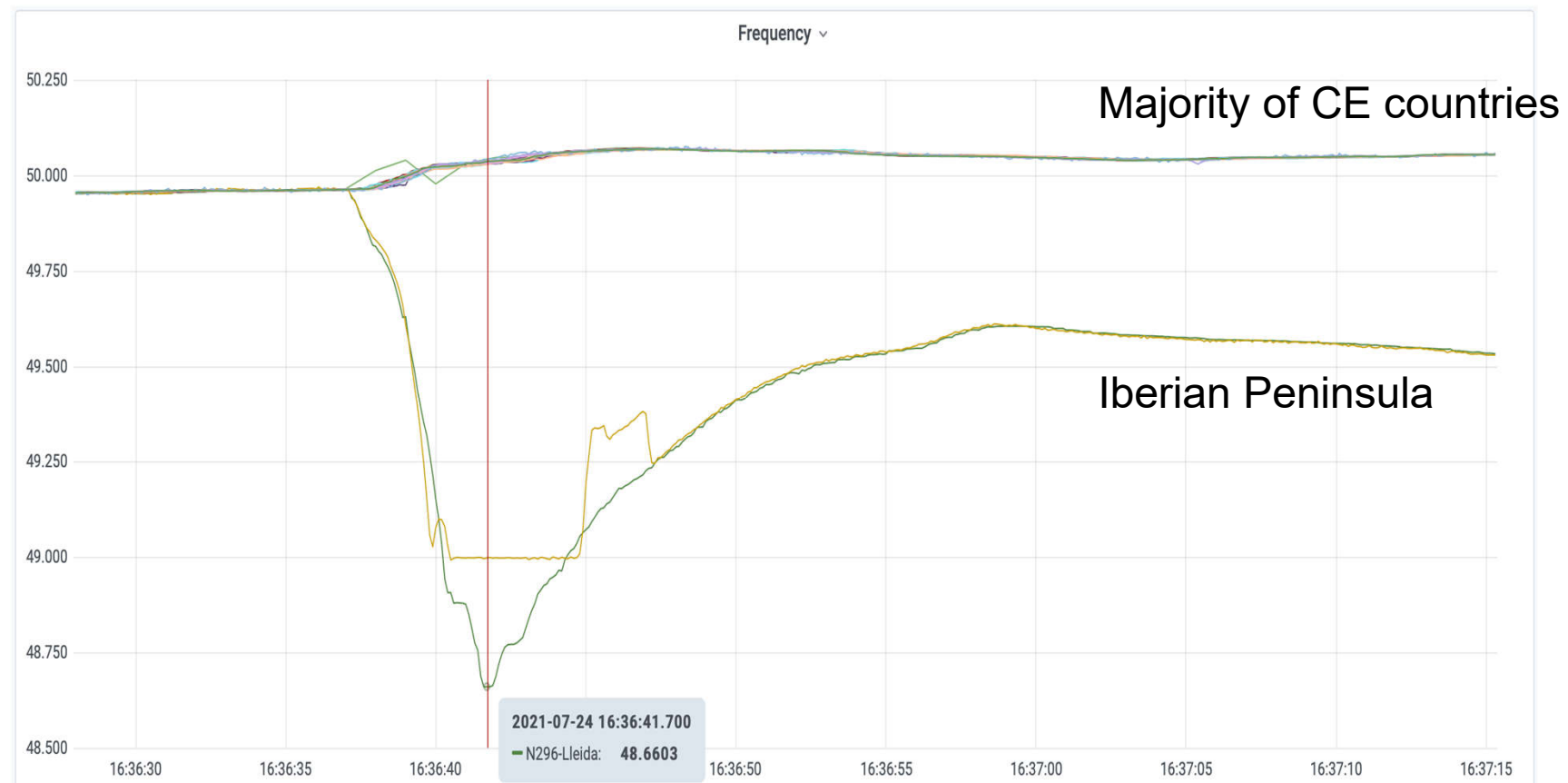
More information is needed about:

- Technical details about the registrations of the frequency made by TSOs
- Specifications of the TSO's measurement equipment or processes to define the RoCoF including the size of the measuring window because 3 sizes of the measuring window considered in the requirements of Member States: 0,5 sec / 1 sec / 2 sec (see FGH study slide).
- Any intention from ACER or ENTSOE to harmonise the measuring window. The FGH study mentions values of 0.5 sec, 1 sec and 2 sec.

This is not an indication of a **unique European level playing field** for grid users.

**ANOTHER SYSTEM SPLIT WITH
LIMITED INFORMATION ABOUT
THE MAXIMUM RoCoF
ON 24/7/2021**
ENTSO-E mail 20/8/2021

Frequency data (according to www.gridradar.net)



Average RoCoF during 3,6 sec : **280 mHz/sec**

Conclusions

The size of the sliding window (SW) of the frequency measurement in previous graphs is not specified.

Also in the ENTSOE report the size of the SW is not specified.

Recorded RoCoF figures in real life:

- - 20 mHz/sec for the 8/1/ system split (average value over 13/15 sec)
- - 60 mHz/sec and + 300 mHz/sec according to the ENTSOE report
- - 280 mHz/sec for the 24/7 system split (average value over 3,6 sec)

To compare with the 2000 mHz/sec requirement in some Member States

The huge difference between reality and requirement is **not justified**.

VGB asks for a detailed RoCoF analysis in all reports about system splits.

This analysis should be used for a discussion in a GC ESC about a RoCoF requirement that is justified by experience and based on Recital 25 of RfG NC.

VGB proposal

To start a **working group** to solve following issues:

- To distribute **frequency data** around the moment of the system split
- To specify details for the frequency measurements usable for the **definition of the RoCoF** including the size of the measuring window or the mathematical procedure to define the RoCoF
- To specify if the above mentioned RoCoF definition is used in the ENTSO-E reports.
- To **harmonise the measuring window**. The FGH study mentions values of 0.5 sec, 1 sec and 2 sec. This is not a sign of a unique European level playing field for generating companies.
- To define an **acceptable RoCoF** for the CE synchronous area based on real criteria in collaboration with ALL stakeholders, especially the generating companies.

Questions ??