



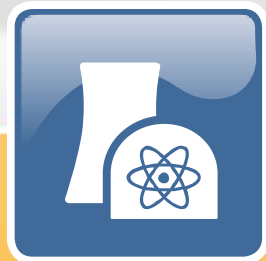
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COMMENTS ON THE VDE / FNN STUDY ABOUT TEMPORARY OVERVOLTAGES

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Voltage limits imposed by European grid codes

RfG NC Art. 16 (Table 6.2) imposes for **NEW** PGMs type D connected at 380 kV :

Synchronous area	Voltage range	Time period for operation
Continental Europe	0,85 pu-0,90 pu	60 minutes
	0,90 pu-1,05 pu	Unlimited
	1,05 pu-1,10 pu	To be specified by each TSO, but not less than 20 minutes and not more than 60 minutes

Note: 1 pu = 400 kV

GLSO Art. 29 imposes for **OLDER PGMs** not subjected to RfG NC :

1.If voltage at a connection point to the transmission system **is outside** the ranges defined in Tables 1 and 2 of Annex II to this Regulation, each TSO shall apply voltage control and reactive power management **remedial actions** in accordance with Article 22(1)(c) of this Regulation in order to restore voltage at the connection point within the range specified in Annex II and **within time range** specified in Article 16 of Regulation (EU) 2016/631 and Article 13 of Regulation (EU) 2016/1388.

2.Each TSO shall take into account in its operational security analysis the voltage values at which **transmission- connected SGUs** not subject to the requirements of Regulation (EU) 2016/631 or Regulation (EU) 2016/1388 **may disconnect**.

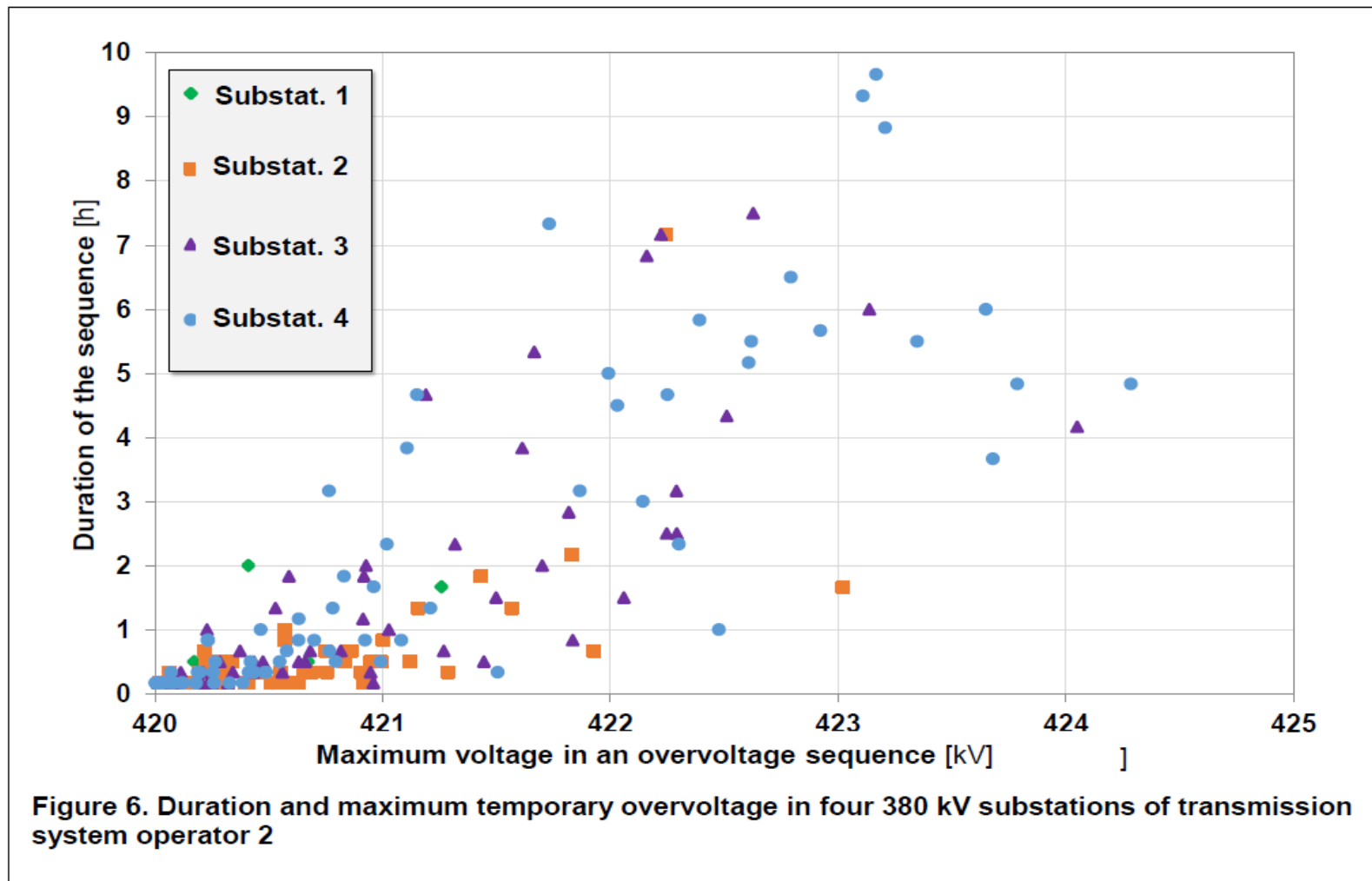
Facts presented in the VDE/FNN study (1).

The VDE/FNN study (English version) revealed some facts unknown until now.

Following sentences are copied 1-to-1 from this study:

- Page 11: In the European network codes ... a time-limited exceedance ... with 440 kV, 253 kV and **127 kV** for at least 20 min and **at most 60 min** is given.
- Page 11: ...specified for a continuous operating voltage U_m of 123 kV, 245 kV and 420 kV,
- Page 11: Whilst in one of the **transmission systems** under consideration there were no exceedances of U_m apart from two exceptional situations, with **one of the others** there were exceedances of 1 ...2% in some substations that sometimes **lasted for several hours**.
- Page 11: In another **distribution system** with both urban and rural character, the fluctuations were more pronounced, and sporadic exceedances of U_m occurred. In a few substations, exceedances of **U_m of more than 5%** were even observed for several hours.
- Page 18: In these systems sporadically voltages above 123 kV with a maximum value of **133 kV** have been reported. ... no information can be given about their frequency of occurrence.

Facts presented in the VDE/FNN study (2).



Note: Figure as presented in the VDE/FNN study on page 17

Limits of the VDE/FNN study.

This study was made exclusively for the German electricity system.

Some quotes:

- Page 11: In **Germany** ...
- Page 12: **German** 380 kV system
- Page 14 : usually installed in the **German** system ...
- and **19 other** places.

What about similar phenomena in other European countries?

Are ALL German TSO applying identical voltage procedures?

See sentence at page 11:

*Whilst in **one of the transmission systems** under consideration there were no exceedances of U_m ..., with **one of the others** there were exceedances of 1 ...2% in some substations that sometimes lasted for several hours.*

Is this “**one of the others**” extending his “voltage” problems to a **European level**?

Some questions.

- What has a grid-user to do if a voltage of ≥ 423 kV occurs **during > 1 hour**?
(RfG NC limits over-voltages at maximum 60 minutes)
- What has a grid-user connected at the 110 kV grid to do if a voltage **above 1,15 pu** is observed?
(RfG NC limits over-voltages at a maximum of 1,15 pu for 110 kV grids)
- What are the actions by grid-users not subjected to RfG NC and DCC NC, when the voltage is too high or the duration of the over-voltage event is too long?
Can a grid-user define independently its “disconnecting values” based on the standards / legislation applicable **at the moment of original connection**?
- What are the financial consequences / compensations if a PGM has to disconnect due to an over-voltage in the grid, beyond the limits specified in line with the European NC and creating also **an imbalance**?
- What about compensations if **damages occur due to an over-voltage** in the grid, beyond the limits as specified in the European NC?
- Is the VDE/FNN study not the argument to ask the EC to draft also a **network code for TSOs** in order to protect the rights of all grid-users (including DSOs)?

Questions ??