EUTurbines

NC RfG User Group Meeting

Brussels

22 March 2012

EUTurbines

WHO we are

ALSTOM

GE Energy

SIEMENS

AnsaldoEnergia
A Finmeccanica Company

MAN

ŠKODA

ŠKODA POWER
A Doosan company

DOOSAN

DRESSER-RAND

Rolls-Royce

Solar Turbines
A Caterpillar Company

70.000 employees in the sector
Business Volume 25 billion €
More than 6 billion € purchase volume in Europe (mostly to SMEs)

Summary of Comments 1/2

1 NC RfG requirements forcing a significant cost or causing a reliability loss must allow alternative solutions, based on a transparent risk assessment and/or CBA.

- Art. 11 & 13: FRT stability times up to 250 ms are not always achievable
- Art.12,2.b): Underfrequency maximum power capability:
- Art.12,3,fig.6: Reactive power capability requires possibly oversized components

2 Industrial power plants with combined steam and electricity production are not capable to fulfill all frequency response requirements as currently defined due to their dual purpose.

3 The NC RfG should define the process and limitations when national regulations based on the NC RfG are being developed, in order to avoid uncertainty about time of application, as well as future and unexpected tightening of the requirements.

- Art. 3: application to new generators
- Art 6 in general,
- Art.10 Table 5.1: HV ranges

Summary of Comments 2/2

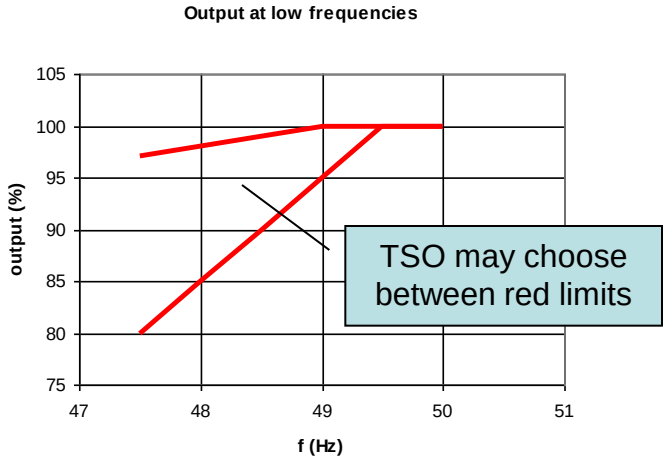
4 The NC RfG shall avoid the interpretability of the requirements and provide clear definitions where necessary.

- Art 9, 2 c) Frequency response in LFSM mode as fast as technically feasible: this definition is not useful
- Art 9, 4 b): Frequency of additional torsional stress events has to be indicated for a design assessment
- Art. 9, 6 f): Simulation model requires clearer limitation of scope
- Art. 9, 5 a) Black start capability definition too wide and at the same time not using the generator frequency capability
- Art. 2, Definition of Maximum Capacity, Minimum Regulating Level and Droop relevant for other requirements in the NC , but are not clear.

5 Fault Ride Through

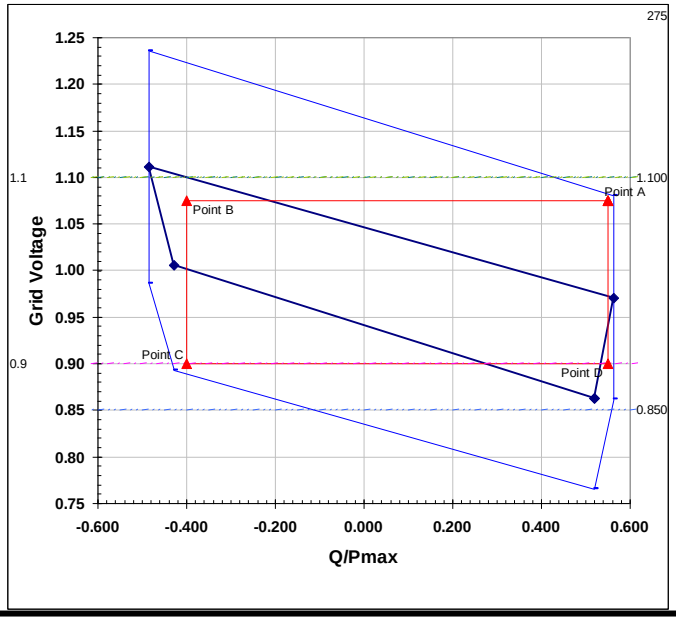
- Art 9,11, 13 still open to interpretation, an appendix defining the interpretation and the method of simulation should be added.
- Art 9,11, 13 fixed FRT-profiles, but open prefault and postfault conditions are not acceptable.

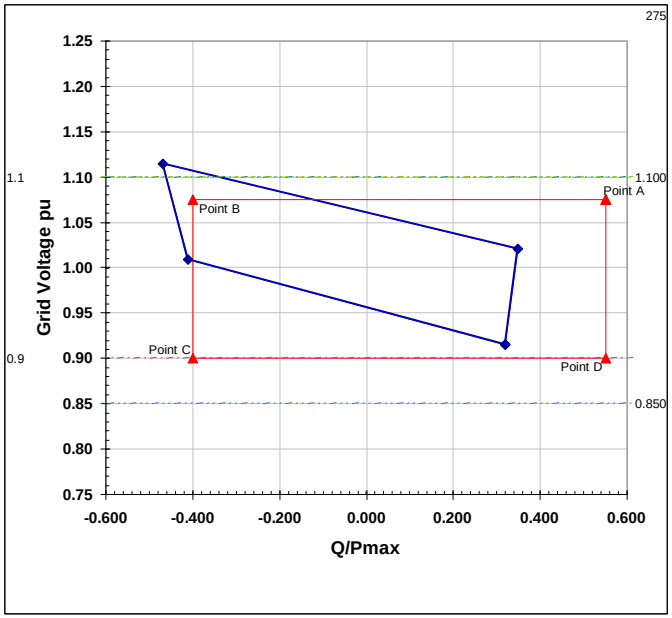
NC RfG versus alternatives 1/2

NC RfG	Alternative
Art 12, 2 b): output level at low frequency - Requires compensation technology for output drop e.g. of gas turbines, depending on ambient conditions - compensation dynamically limited (effect might be too late) - not testable under real conditions - risk of failure, losing the total generator output and the stabilizing effect of a connected generator in critical situation!  	- Focus must be on stabilizing effect of reliably connected generators under disturbed conditions - take into account the physical behaviour - alternative measure: load shedding on consumption side might be activated earlier due to slightly faster frequency drop - plant owner / manufacturer provides expected project specific behaviour as parameterized curves for information to TSO

NC RfG versus alternatives 2/2

NC RfG	Alternative
-Art. 12 Fig 6 Reactive Capability -Continental Europe -Generator power factor 0.8 - OLTC +/-10% range -Generator voltage +/-5%	-Generator power factor 0.9 -Off circuit taps -Generator voltage +/5% -Grid Shunt Reactive compensation





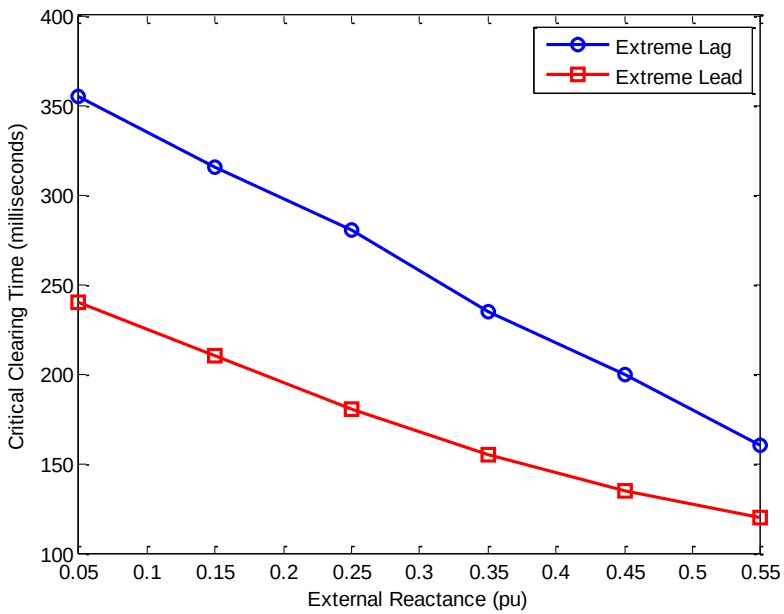
Fault Ride Through 1/2

- Voltage dips below 30% retained and clearance times longer than 150ms should be agreed between TSO and Generator.
- Clearance times up to 250mS may not be achievable
- Rotor inertia is fixed by choice of turbine generator, which is optimised for site process or thermal conditions.
- Grid re-enforcement and protection improvement should be part of the solution.

Chart showing variation in CTC with external reactance and generator operating point for 0% retained voltage (H =6.5s).
Table showing variation of CTC with Rotor Inertia & Voltage dip

	Rotor Inertia (s)		
Voltage (%)	4	6.5	8
0	190	245	270
30	285	365	405
50	485	620	690

Aero derivative GTs have H as low as 1s!



Fault Ride Through 2/2

- Voltage profile at the Poc before during and after the fault,
- Present meaning of profile after the fault can be misinterpreted
  - Forced recovery profile?
  - Lower limit of natural recovery profile?
  - Series of discrete voltage dips verses time to be withstood (GB Grid Code)?
- Text should be clearer and an Appendix should be provided describing in more detail the requirements, including examples of simulation.

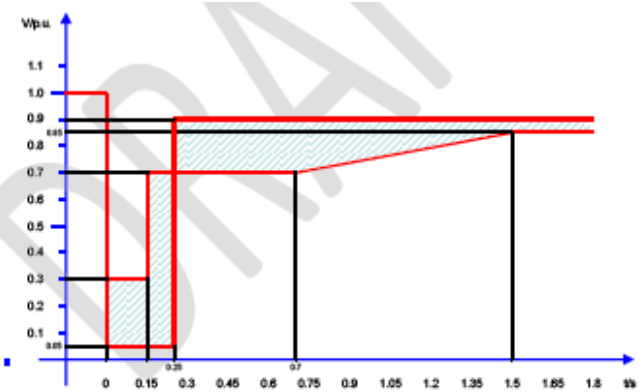


Figure 5 – Fault ride through profile of a Synchronous Generating Unit connected at voltage levels below 110 kV. The diagram represents the boundaries for a voltage-against-time profile by the voltage at the Connection Point, expressed by the ratio of its actual value and its nominal value in per unit before, during and after a fault. For the meaning of the shaded area see Article 11 paragraph 3 subsection a) point 2.

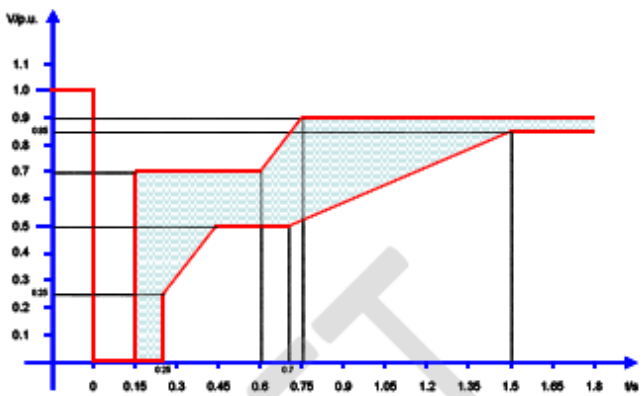


Figure 7 – Fault ride through profile of a Synchronous Generating Unit connected at voltage levels at 110kV or above. The diagram represents the boundaries for a voltage-against-time profile by the voltage at the Connection Point, expressed by the ratio of its actual value and its nominal value in per unit before, during and after a fault.

Thank you

Should you have any question, please contact the General Secretariat of EUTurbines:

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