



ACER Workshop on the Network Code for Requirements for Grid Connection applicable to all generators

Ljubljana
03 September 2012

Who we are

The logo for Alstom, consisting of the word "ALSTOM" in a bold, blue, sans-serif font. The letter "O" is stylized with a red circle inside.The logo for GE Energy, featuring the GE monogram in a blue circle on the left and the text "GE Energy" in a blue, sans-serif font on the right.The logo for Siemens, consisting of the word "SIEMENS" in a bold, blue, sans-serif font.The logo for Ansaldo Energia, featuring a stylized turbine icon on the left and the text "Ansaldo Energia" in a blue and red font. Below it, the text "A Finmeccanica Company" is written in a smaller font.The logo for MAN, consisting of a stylized arch above the letters "MAN" in a bold, blue, sans-serif font.The logo for ŠKODA POWER, featuring the ŠKODA logo on the left and the text "ŠKODA POWER" in a blue font. Below it, the text "A Doosan company" is written in a smaller font.The logo for Doosan, consisting of the word "DOOSAN" in a bold, blue, sans-serif font, with a green and blue graphic element to the right.The logo for Dresser-Rand, consisting of the text "DRESSER-RAND" in a bold, black, sans-serif font, underlined with a red line.The logo for Rolls-Royce, featuring the Rolls-Royce crest on the left and the text "Rolls-Royce" in a blue, serif font on the right.The logo for Solar Turbines, consisting of the text "Solar Turbines" in a bold, black, sans-serif font, underlined with a yellow line. Below it, the text "A Caterpillar Company" is written in a smaller font.

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

Where we stand

- EUTurbines is an active member of several ENTSO-E consultations (NC RfG, NC LFC&R...)
- Our Grid Code Task Force proposes technical feedback to TSOs proposals
- The group provided some support and suggestions to the draft NC RfG, through:
 - Stakeholder's workshops
 - NC RfG Users Group meetings
 - ENTSO-E NC RfG web consultation interface
 - One position paper (Output vs. frequency req't)

Summary of Comments

- 12 main areas of concern
- One item partially satisfactory
- One item NOT satisfactory

Topic	Issue	Outcome	Conclusion
Retroactive application	Not clear	Modified - introduce 2 years lapse time	Satisfactory
Compatibility with Combined Heat and Power plant (CHP)	Prime focus of CHP is to serve process, not grid	Modified - allows exemptions	Satisfactory
Frequency Range	To wide, out of IEC 60034	Modified - frequency range revised for continental Europe	Satisfactory
Rate of change of Frequency	No evidence of generator capability	Removed	Satisfactory
Power Output vs. Frequency fall	Technical hurdles to achieve requirements	Still as it is - EUTurbines proposed position paper to tackle rq't	Not Satisfactory
Frequency Sensitive Mode	Parameter of response, which could be required in <30sec	National codes may interpret and supersede with more stringent requirement	Partially satisfactory
Fault Ride Through	Unclear requirement and clearance time too long	Rq't to add pre and post fault added	Satisfactory
Grid Separation detection	Use of circuit breaker position detection not allowed. Limit of partial rejection not defined	Method of detection to be agreed between power plant owner and TSO. Maximum load rejection limited to 45%	Satisfactory
Autoreclose on radial line	No recognition of mechanical impact	Removed from code	Satisfactory
Switching to houseload	Use of circuit breaker position detection not allowed.	Can use generator circuit breaker	Satisfactory
Torsional Stress	Active power step of 50% Pmax may be routine and design intent of shaft lines	Removed from code	Satisfactory
Reactive power and voltage range	Range too wide, need for on-line tap changer	TSO shall define within NC RfG max limits. Operation w/o OLTC recognised	Satisfactory

Frequency Sensitive Mode

Ref: Art 10 and Art 7, NC RfG 12/06/12

Parameters	Ranges or values
Active Power range related to Maximum Capacity (Frequency response range) $\frac{ \Delta P_1 }{P_{max}}$	1.5 – 10 %
Maximum admissible initial delay t_1 unless justified otherwise for generation technologies with Inertia	2 seconds
Maximum admissible initial delay t_1 unless justified otherwise for generation technologies without Inertia	as specified by the Relevant TSO while respecting the provisions of Article 4(3)
Maximum admissible choice of full activation time t_2 , unless longer activation times are admitted by the Relevant TSO due to system stability reasons	30 seconds

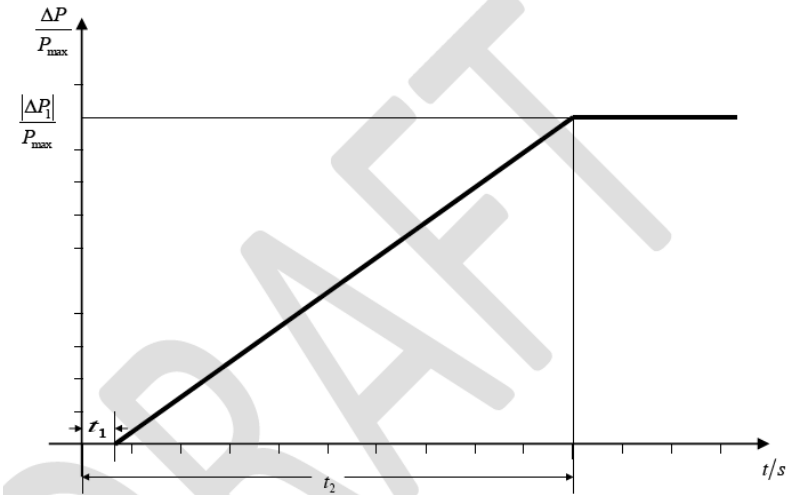


Table 5: Parameters for full activation of Active Power Frequency Response resulted from Frequency step change (explanation for figure 6).

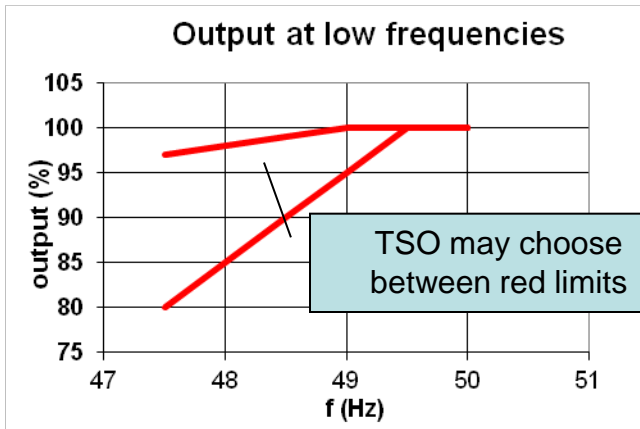
- Full activation time is « maximum » 30 sec... but it can be lower!
- Impact on machine design – lower time frame may be difficult to achieve
- Decision is left to TSOs... without guidance or limitations (Art. 7 ...” introduce [...] more detailed or more stringent provisions”)

Power Output vs. Frequency fall

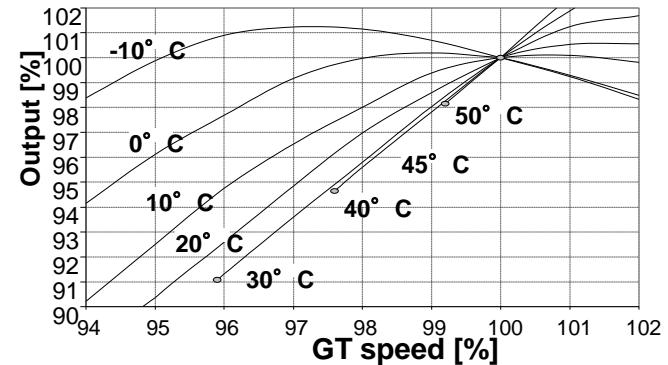
Ref: Art 8, NC RfG 12/06/12

NC RfG 12/06/12

Physical Behaviour



GT power output (typical – without compensation)



- Goal.. Not to get power imbalance worst
- Remain connected is not the only prime focus ...Require to maintain residual power above a given limit

- Reduce speed...reduce power
- Handling requirement in the past:
 - Compensation features: increase firing temperature, open inlet guide vanes, inject steam or water in the compressor...may take more than a few seconds to react...
 - Limited in ambient temperature (25° C UK –driven)
- **Limitations...compressor surge limits, firing temperature**

Power Output vs. Frequency fall

Ref: Art 8, NC RfG 12/06/12

Issues	Alternative
<ul style="list-style-type: none"> — Cost: <ul style="list-style-type: none"> • Require additional hardware • If unit has no headroom below limits, shall reduce nominal power... Not acceptable per efficiency and flexibility requirements — Risk of failure <ul style="list-style-type: none"> • Priority given to counter measure rather than stability...risk of losing the generators • Would worsen the situation — Is this reliable?....this cannot be tested in real conditions! 	<p><i>„A bird in the hand is worth two in the bush”</i></p> <ul style="list-style-type: none"> • Focus on keeping units on-line, with high reliability • Avoid risky counter measures, take into account physical behaviour • Ask generating units to publish the off frequency performance data (without compensation). Those are more credible than with compensation methods. • TSOs can then adapt their off-frequency schemes (e.g. consumption load shedding schemes) • More predictable behaviour during event

Conclusion

- Thank you for transparent consultation and good discussions
- Great progresses on the NC RfG draft... 90% of EUTurbines comments have been taken into consideration
- Remaining concerns:
 - Certainty of obtaining an admissible agreement on power output vs. frequency (Art 10)... (see EUTurbines position paper and proposal for verbiage)
 - Room for TSO's interpretation (Art 7):
 - Requirements quite clear today, but...
 - Should define the process and limitations on unexpected tightening of the requirements.
- EUTurbines would be glad to participate in any further discussion



BACK-UP

Power Output vs. Frequency fall

Ref: Art 8, NC RfG 12/06/12

EUTurbines proposes to add in Art 8. 1. e)

- [...]“With regard to underfrequency maximum power capability reduction for some generation technologies, some synchronous generation technologies **inherently** deliver falling mechanical power with falling frequency. **For grid stability reasons, being the main objective under such conditions, the generating unit rather should stay connected than bearing the risk of a total trip due to the necessary fast activation of power compensation measures. The generating unit owner provides data to the relevant TSO about the expected output behaviour with frequency and other relevant parameters (e.g. ambient temperature). [...]**”

Unexpected tightening of req'ts ?

Ref: Art 7, NC RfG 12/06/12

Article 7

RELATIONSHIP WITH NATIONAL LAW PROVISIONS

This Network Code shall be without prejudice to the rights of Member States to maintain or introduce measures that contain more detailed or more stringent provisions than those set out herein, provided that these measures are compatible with the principles set forth in this Network Code.

...still concerning to see that harmonization is only partly done

Thank you

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

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