3.1 Dynamic Stability Assessment / Management
-Response to open/pending questions from stakeholder workshops

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12th December 2019

Pending questions from DSA stakeholder WS's

Questions/Remarks - 2nd WS – RG CE	Replies
(Eric Dekinderen) the presentation says that in future RoCoF will be 2 mHz/seconds, and it says on the slides that it is approved by stakeholders: which stakeholders have approved it? Have the generators accepted this? (GE has stated that 1 mHz/seconds is the upper limit for many installations)	The discussions at the workshop clarified that the confusion primarily were based on lack of information on the measurement window for averaging the measurement. The applied averaging window in RG CE is 200 msec. Further details are to be found in IDG on RoCoF.
(Luca Guenzi) how was the information collected for defining RoCoF? RoCoF shall be always associated to time window. Which time window is associated with the RoCoF of 2 Hz/s. What is the meaning of system resilience (the system will become unstable, frequency will crush?)	An averaging window of 200 msec have been applied. The meaning of resilience is the system becomes unstable and system split might occur.

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Questions/Remarks - 2nd WS – RG CE	Replies
(Luca Guenzi) / 6% droop -> valid for any size of generating unit? Any area within RG CE?	Based on the TSO dynamic simulation results the droop shall be defined by the relevant TSO which involved the capacity of the generating units connected.
(Luca Guenzi) / response time of 1s seems to be unrealistic for big power plant, based on the capacity of fast valving). Feedback had been provided that this is not feasible for many technologies, unless opening their main CB. Some technologies have also minimum load. How this has been taken in consideration? Finally, this 1s is not, as far as I know, taken in consideration in the implementation at national level.	The characteristics of the generation portfolio is a part of the electrical simulation model so all details of the structural information is taken into consideration in the TSOs dynamic simulation assessment. This question must be discussed on national level with the relevant TSO.
(Luca Guenzi) / not sure I understand the concept of having no minimum inertia requirement and having a problem of high RoCoF. My takeaway is that a 1 Hz/s RoCoF is ok for the RG CE system and 2 Hz/s is not, then minimum inertia shall be specified to meet the 1 Hz/s RoCoF. Has this analysis been carried out?	The discussions at the workshop clarified that the confusion primarily were based on lack of information on the measurement window for averaging the measurement. The applied averaging window in RG CE is 200 msec. Further details are to be found in IDG on RoCoF.

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(Luca Guenzi) I'm wondering if RG CE as a conclusion can recommend a DSA for smaller synchronous area can be considered. For smaller area ("local"), DSA can be carried out with more detail and minimum inertia defined. That would prevent the creation of critical areas with a too low inertia. Maybe, considering too large synchronous area with too many contributors, can create problem in defining and calculating such minimum value. (if the minimum inertia value is recognized even as an indicator of criticality where remedial action shall be considered). Could you crosscheck if this approach could be viable?	The comment have been raised at the TSO workshops on DSA and will be addressed on national level.
(Jakub Fijalkowski) On which scenario is the study based? Is small signal stability considered – it could be an issue, if conventional modules out of operation? This is a critical scenario for future – the focus should be on this rather than minimum inertia	The presenter responded with the scenarios applied. The workshop attendees agreed to the recommendation on focusing more than just inertia.

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Questions/Remarks - 2nd DSA WS – RG CE	Replies
(Jakub Fijalkowski) On which scenario is the study based? Is small signal stability considered – it could be an issue, if conventional modules out of operation? This is a critical scenario for future – the focus should be on this rather than minimum inertia	The presenter responded with the scenarios applied. The workshop attendees agreed to the recommendation on focusing more than just inertia.
(Luca Guenzi) no mention to the max RoCoF expected. Is there any study based on the scenarios considered?	References given in the 2nd DSA WS material.
(Luca Guenzi) my takeaway is that the target is the frequency variation and some specific product shall be designed (to be defined) as market product (not requirements for generators)	Comment noted.
(Luca Guenzi) what about the inertia contribution from the loads, how is this considered in the study?	Not yet included.
(Luca Guenzi) still not sure if minimum inertia can be really considered irrelevant as system target (is this not already used in the real time evaluation as a trigger for critical condition?)	The simulations and scenario discussion shall include all essential systems stability aspects including small signal stability, inertia as well as voltage stability aspects.

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Questions/Remarks - 2nd WS – RG EI/NI	Replies
(Luca Guenzi) any other solution in term of operation is possible (like pre-defining feasible configuration?)	Comment noted, but not considered yet.
(Luca Guenzi) How are RoCoF and frequency limits taken into account, are they considered as inputs or outputs of the calculation for minimum inertia calculations?	As specified in the tools applied for online analysis in Eireland – reference: link to be provided.
(Johanna Doyle) In GB 30% of inertia could come from demand side response, what is the situation in Ireland?	Still pending to be answered.
(Eric Dekinderen) The cooling of data centres can react very fast, is this used?	Not yet fully addressed – demand side response will addressed in future studies.

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Questions/Remarks - 2nd WS - RG GB	Replies
(Eric Dekinderen) Why the loss of supply is not considered? (slide 62)	Response still pending.
(Johanna Doyle) Why is increasing system inertia considered less effective than reducing the largest loss? (slide 66)	Response still pending.
(Fernando Morales) What is the impact of market?	Market products on the inertia area could change the mindset of ancillary service providers.

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Questions/Remarks - 2nd WS - RG GB	Replies
(Damian Jackman) It does not seem credible that it is more effective to constrain the largest infeeds than add extra inertia. For example, when the inertia drops such that the largest infeed is below 700 MW, then every interconnector and every thermal station must be operated below this threshold, so there may be as many as 10 to 15 infeeds which require constraining as a result of low inertia - in addition to 'sterilising' the affected thermal generators' capabilities to provide primary and secondary response due to more limited headroom. Whilst the situation will be helped by adjusting the ROCOF settings on embedded generators, this will take at least 3 - 4 years to complete by which time the system inertia will have dropped further, cancelling out much of the short term benefit obtained from relaxing the ROCOF settings. However this view is understandable when your only tool is a hammer, as every problem then looks like a nail… so when will NG consult on a cost-benefit to convert soon-to-be-retired thermal generation to synchronous compensators? Such a holistic solution would also provide many other benefits such as synchronizing torque, fault contribution, reduced primary response holding requirement and greater reactive capability. NG and SPT's 'Project Phoenix' was supposed to address the commercial aspects of synchronous compensators but over 18 months since that project began no progress has been made on a cost benefit and the costs to the consumer of managing the system continue to rise.	Comments noted an must be taken into consideration in the RG GB.

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Questions/Remarks – 2nd WS - general	Replies
(Luca Guenzi) If the studies show that there are no issues with inertia, should inertia still be considered in TYNDP? Should the focus in future be on small signal stability instead of inertia?	The simulations and scenario discussion shall include all essential systems stability aspects including small signal stability, inertia as well as voltage stability aspects.
(Jakub Fijalkowski) Seeing that CE and Nordic SAs don't have issues with inertia, should it still be considered in TYNDP?	To be addressed by the cross code project on inertia in corporation with the TYNDP team.
(Mário Bruno Ferreira) In my view it can be challenging to take into account the inertia from embedded generation in distribution grid. Maybe one shall push from TSO/DSO framework data integration. Another challenge from SDC (TYNDP) is to forecast the place for system separation at RGCE area. The things for TSO/DSO data integration are not so easy I think, as it depends on a country. Maybe as stated by ENTSO-E RDI it shall be a concept of "Data Integrator" entity as each Country that shall take off from all these TSO/DSO frameworks. I think, more involvement from national NRAs is needed, in order to clarify Energy Market Data requirements.	Comment and recommendation noted. NRAs to respond on this recommendation.

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Questions/Remarks – 2nd WS - general	Replies
(Luca Guenzi) TSO is imposing DSO the collection of info from the grid but overall, I expect this to be ok as far as the system move the emergency. In emergency, maybe communication shall be considered as not available.	Requirements to availability of communication mean are specified in NC ER. In general lack of communication is not an issue as deployed predefined schedules could be activated on incidence criteria's.
(Eric Dekinderen) The intended interpretation of the table on slide 13 to be further explained. Instead of RoCoF threshold value the percentage of RES should be shown.	Comment noted.
(Uros Gabrijel) Does geographical location of units with inertia make a difference for CE? Is it taken into account when developing the scenarios?	Yes, the location is a part of the structural information exchanged and applied the various scenarios.
(Johanna Doyle) What is the contribution from demand side to the inertia in Nordic and CE SAs? How is it taken into account?	The demand side response model will be considered within the grid models.
Luca Guenzi) If the study for RG CE says that there is no need to define minimum inertia, then why 1 Hz/s RoCoF is the target? Also 2 Hz/s should not be a problem then.	This question to be answered in the scope RfG revision.

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Questions/Remarks - general	Replies
(Luca Guenzi) the response time 1 second is not implementation on national level in RG CE	To be discussed on national level.
(Eric Dekinderen) The costumers are forgotten, for a steal mill RoCoF 1 or 2 Hz/s is not acceptable	As stated earlier the measurement window is crucial to specify in order to discuss the same subject.
(Fernando Morales) RoCoF is locational, it influences the risk of splitting – should look also at emergency operation (beyond SO GL).	The workshop attendees agreed to this recommendation.
(Fernando Morales) For Nordic SA main solution is demand side, is energy storage also considered?	Not yet, but will be a part of the Inertia 2020 study.
(Jakub Fijalkowski) Inertia is not the only problem, also small signal stability is an issue, this should be brought to study group.	The workshop attendees agreed on the recommendation.
(Fernando Morales) Is there any plan to conduct a CBA to propose the most economic option?	Have been proposed to the market committee as a part of the discussion on market products focusing inertia. A CBA could be an outcome of this discussion, but for now the fundamental aspects of a product are in discussion.

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Questions/Remarks	Replies
(Eric Dekinderen) The paper (TYNDP scenarios - https://tyndp.entsoe.eu/tyndp2018/scenario-report/) describes two scenarios : 1. Interconnected system for continental Europe with a major incident (loss of 3 GW of generation) : no problem 2. Analysis of events after a system split with an island at lower frequency and an island at higher frequency I do not understand following items in the second part : Figure 6 – 8 give the ROCOF as a result of two parameters : the imbalance and the non-synchronous share. I suppose that synchronous condensers have also an impact but that condensers are not included in this study. In a later stage, synchronous condensers have to be considered as synchronous generation. Is this correct?	The approach focuses on the system inertia which will consider contribution from synchronous generators as well as load response. Therefore, synchronous condensers are also included but not explicitly modelled.

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Questions/Remarks	Replies
(Eric Dekinderen) Figure 6 (TYNDP 2018) is in my opinion not realistic by supposing that a fleet of synchronous generators is operating at 0.5 of Pmax. The majority of PGMs have an optimal technical efficiency at Pmax and also the exhaust gases are optimal at Pmax. Also I have been told that the majority of fuel-fired PGMs have to respect a technical minimum power injected into the grid for a stable operation. I have forgotten the value of this technical minimum.	The operating point of the synchronous machines is an important factor when determining the system inertia. 50 per cent loading is a low value which gives a higher system inertia. Under normal operating conditions we agree that you would normally operate machines close to Pmax where the efficiency is high. On the other hand, it can be beneficial to "ride through" hours with low prices by operating a thermal power station at technical minimum to avoid the start-up costs. The experience from Denmark is that thermal power plants have been optimised to operate down to 10-30 per cent of Pmax to remain connected during windy periods. Please also recall that for hydro power plants (e.g. run-on-the river, pump storage etc.) the operation point can be quite variable due to different reasons – water restrictions, synchronous condenser mode, must-run due to ancillary service provision etc.

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Questions/Remarks	Replies
(Eric Dekinderen) The time constant in table 1 is a result of 2 inputs : the imbalance and the ROCOF according to figures 6 -8. Is this correct? Is it allowed to read table 1 in the opposite direction : with a given Tn according to formula 1 & 2 and a given imbalance, the ROCOF can be considered as output?	Yes, this is correctly understood: The intention with the report is to provide guidance to the TSOs in order to determine the requirement suitable for his generation portfolio and system properties. The relation between RoCoF, imbalance and system inertia is given by the following formula $$\mathrm{RoCoF}_{\max} = \frac{df}{dt}_{\max} = \frac{\Delta P_{\mathrm{Imbalance}}}{P_{\mathrm{Load}}} * \frac{f_0}{T_{\mathrm{N}}}$$
(Eric Dekinderen) Figure 10 gives the description of the reaction at a step over-frequency to visualise the meaning of the notion $t_{95\%}$. This notion is used in figure 11 to describe the increase in frequency. But what about the measuring time needed to define the exact frequency. I have been told that an exact measurement needs 500 msec or more. Why is this period of time not included in figure 11?	In figure 10 the measurement time is displayed and you are right that this is missing in figure 11. However, the measurement time depends on the application which we have addressed in the following reference https://docstore.entsoe.eu/Documents/SOC%20documents/Regional_Groups_Continental_Europe/2018/TF_Freq_Meas_v7.pdf A reliable frequency measurement can be obtained in 5-10 cycles and not 500 msec.

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(Eric Dekinderen) The basic assumptions of figure 11 seem extraordinary to me : a system load of 440 GW and an imbalance of 30% and a synchronous operation point of 50%. I cannot imagine what kind of system split could cause those input parameters. Is it correct that for a lower load (e.g. 50 GW or 100 GW) or for a synchronous operation point of 85%, the consequences are even worse?	It completely depends on where the system split takes place and which properties are available in the islands after the separation. This means that 30% imbalance can occur for a smaller part of the system with high exchange to the remaining part.
(Eric Dekinderen) About the sentence "By not exceeding the maximum ROCOF condition …." on page 18 first bullet, I suppose that this value is 3 Hz/sec. Is this correct?	All values from table 1 which are not marked in grey are used as input. Again, we need to highlight that the study are assessing the sensitivity against various parameter changes.