European Network of
Transmission System Operators
for Electricity

Response to Stakeholder Feedback on the Proposal of New Technical Requirements for FCR

6 May 2022

The Nordic TSOs thank all stakeholders for taking the time to provide feedback on the draft New Technical Requirements for FCR[1]. We have compiled the received feedback for each chapter of the technical requirements document, and provide our response below.

General

Feedback: Overall many providers state that they are pleased with the restructuring of the documents, the decrease of testing time and the relaxations of some requirements. Since the testing is still going to be time consuming and costly, providers encourage the TSOs to develop methods for pre- and re-qualification with data from normal operation. The introduction of use of theoretical capacity calculations received positive feedback. Some providers see a risk that Kaplan turbines will not be able to fulfil the requirements for FCR-D and/or FCR-N. Some providers foresee the new requirements will result in decreased capacity of FCR and difficulty in delivering FCR and FRR at the same time. Providers also request that the TSOs educate providers on the new requirements and tests, and supervise the prequalification tests.

Response: Regarding the testing in general, we are interested in developing methods and criteria for reliable evaluation of entities' performance based on data from normal operation. We see this as a next step once the requirements are in place and we have gained more experience on the prequalification process. We take seriously the concerns about difficulties to fulfil the requirements. The requirements for FCR-D have been relaxed by changing the assumption on frequency dependent load and by excluding the performance scaling from the stability calculation. The FCR-N requirements have also been relaxed by changing the frequency dependent load assumption. We acknowledge that the requirements on FCR might impact the flexibility, especially with regards to availability of FRR, if the entities are not prequalified to deliver FCR at maximal load. However, we think that this problem will be mitigated by not strictly limiting the capacity to the tested capacity (see further details under the capacity headline later in this document). We have taken note of the request for education/training and supervision of tests, but we will have to consider this further.

Changes: Entities that have trouble fulfilling the stability requirement for FCR-N will be able to apply for a relaxed stability margin on the Nyquist criterion for FCR-N.

Implementation period

Feedback: One provider asked for a shorter implementation period or incentives to transition to the new requirements earlier than in 5 years. Other providers state that the five-year transition period is necessary due to the need of installing new governors and upgrading of equipment.

Response: We expect many providers to gradually transition to the new requirements as their current prequalification expires. For example, in Sweden, the largest providers are already scheduled to prequalify a certain percentage of their resources per year. We think it will be too challenging in terms of personnel and resources in general to transition faster than planned.

IT tool

Feedback: Providers urge the TSOs to make the source code for the IT tool available. It is suggested that the tool should automatically create test reports, or that the TSOs should provide a test report template.

[1] Technical Requirements for Frequency Containment Reserve Provision in the Nordic Synchronous Area, dated 14 March 2022. Available: fcr-technical-requirements-14.03.2022.pdf (svk.se)

Response: We are working on how to make the source code for the IT tool available to the providers. Templates for reports are the responsibility of each TSO in their national prequalification process. We are investigating the possibility to create automatic test reports with the IT tool.

Chapter 2: The prequalification process

Feedback: The controller block diagram is sensitive information which providers do not wish to share with the TSO. The tests should be sufficient to verify the correct behaviour of the frequency control.

Response: It is not possible to test everything, and we have reduced the testing a lot on request of the providers. With the amount of testing now suggested, we need additional information to verify that the control will work similarly in other operating conditions and for other disturbances than the tested disturbances. However, if the model is understood as very sensitive information a high level model can be submitted or an NDA can be signed, as long as the TSO can be confident that the control will follow the requirements.

Chapter 3: The technical requirements for the FCR products

Test program

Feedback: It would be preferable to avoid sine tests with 150 s and 300 s period to reduce the testing time.

Response: The testing has already been reduced and the long time periods are needed to ascertain the performance of FCR-N. Since this test is not repeated for all loads and droops, the increase in test time is considered minor.

Mode switching

Feedback: A large number of FCR providing entities might use mode shifting in FCR-D. The consequence will be de facto that the FCR-N band is extended from +/-100 mHz to +/-200 mHz. Secondly, a small disturbance that results in a frequency drop to just below 49.80 Hz will activate the high performance mode, which will be blocked for 5-15 minutes after activation. If the reference incident then occurs during the blocking time, a large share of the FCR-D will not activate the high performance mode. The frequency could drop significantly below 49.0 Hz, resulting in brown/black out. If this deterioration of the system robustness against the reference incident is not acceptable, there could be a limitation on the share of FCR-D with mode shifting (similar to the limit on static FCR-D).

Response: The performance of entities using mode shifting is tested equally to entities that do not use it. Hence, the performance using mode shifting must be "better" as the evaluation time is the same but the high performance mode is activated later (when the frequency threshold is crossed). The blocking time of the high performance mode in a small incident is relevant. The described situation is very unlikely and the impact will most likely not be as threatening as stated in the comment, but the share of entities using mode shifting will be monitored and actions will be taken if necessary.

Reduction factors

Feedback: It is unclear if there is a limit on the factors $K_{red,dyn}$ and $K_{red,ss}$.

Response: Yes, the total reduction factor must not be smaller than 0.9 for FCR-N, meaning that neither $K_{red,dyn}$ nor $K_{red,ss}$ can be smaller than 0.9. The smaller of the reduction factors is used as “final” reduction factor. The same applies for FCR-D where the total reduction factor must not be smaller than 0.75.

Changes: This has been clarified in the document.

Deactivation (3.1.2)

Feedback: One provider comments the "spike test" and requirement on fast activation and deactivation set a very small window for how fast of a ramp rate can be used in activation/deactivation without capacity limitations being imposed. Another provider asks what the purpose of this test and requirements 4 and 5 are.

Response: The purpose of the new "spike test" is to test deactivation performance, since we are aware that some resources are much slower at deactivating than at activating. The test aims at emulating a situation where a small disturbance occurs in a low inertia situation. In such a situation the tendency is to activate too much power compared to the size of the disturbance. The frequency will return quickly and FCR providing entities need to stop activation and/or deactivate to avoid a significant frequency deviation in the opposite direction. We understand that the window is narrow if the entities are unable to deactivate, and the test is designed to single out those that can deactivate from those that cannot. The power system needs a fast response, but since the disturbances will range from small to large, the system also needs reserves to activate gradually and be ready to stop activation and deactivate if the disturbance was relatively small.

Static FCR-D (3.1.3)

Feedback: Some providers are concerned that providers may want to prequalify entities with dynamic properties (for example Kaplan turbines) as Static FCR-D instead of Dynamic FCR-D, if the requirements for Dynamic FCR-D are strict and if there are no incentives to be dynamic. Some providers also suggest that the whole ramp test sequence for Dynamic FCR-D is not needed for Static FCR-D and that some of the ramps could be omitted for Static FCR-D. It is also suggested that it should be allowed to fulfil part of the Static and part of the Dynamic requirements, and that mode shifting should be allowed for Static FCR-D as well. The Dynamic/Static quota should be dynamic and updated regularly with no cap on the Static FCR-D unless it is needed because of the over-frequency issue. In general more information about the quota is requested.

Response: We encourage providers to provide Dynamic FCR-D if possible. The quota might become an incentive in the future, but will not be limiting during the next couple of years. Hence, we will consider other incentives. Regarding the test sequence for Static FCR-D, the we plan to clarify which tests are needed for Static FCR-D. They may not include all the ramps that are needed for Dynamic FCR-D. Providers that can fulfil parts of the Dynamic FCR-D requirements but not all are welcome to do that, but it is only possible to prequalify as Dynamic FCR-D if all of the requirements are fulfilled. We do not fully understand the need for mode shifting for Static FCR-D and would need a clarification on the purpose. Regarding the Dynamic/Static quota, there will be a limit on the quota of minimum 50 % Dynamic FCR-D, and the TSOs will continuously monitor the system to not implement too conservative limits.

Over- and underdelivery (3.1, 3.4)

Feedback: Some providers question why there are limits on over-delivery. Some also ask for the same margin in both directions (±10% in both directions instead of -5% and +10%).

Response: Under-delivery of reserves in steady state is more serious than over-delivery in steady state, because under-delivery means that the TSOs will lack the sufficient resources to contain the frequency. Therefore we cannot relax the limit for under-delivery below 5%. On the other hand, over-delivery of reserves will increase the steady state gain of frequency control in the system as a whole, which can have a negative impact on the system stability. In the requirements we give the possibility for some over-delivery by allowing scaling of the capacity if the performance requirements are not entirely fulfilled. We have introduced limits to the allowed scaling for the same reason: too much over-delivery will negatively impact the stability. In general, over-delivery from static reserves is more problematic than over-delivery from dynamic and continuous reserves, since the dynamic reserves will adjust their delivery continuously. Therefore we can relax the limit on over-delivery for dynamic and continuous reserves somewhat but we cannot relax this requirement for static reserves.

Changes: The margin in the direction of over-delivery in steady state has been increased for dynamic reserves (changed from 10% to 20%).

Frequency domain stability (3.2)

Feedback: The increase of the frequency dependent load assumption is welcome. To enable more hydro power units to fulfil the FCR-N requirements, even a further increase of this parameter to 1.5% would be welcome.

Response: We understand that the stability requirement is difficult for some entities but we are also reluctant to relax it further. Instead of relaxing this requirement overall we will allow exemptions for entities that have difficulties to fulfil the requirement. That way we encourage those entities that can achieve a good stability margin to do that. We do not think that it will be in the interest of providers to have a low stability margin, since it is performance and not stability that typically drives costs in terms of wear and tear.

Changes: It will be possible to get an exemption in the form of decreased margin on the Nyquist criterion for entities that can show by simulation or tests that they have tried to fulfil the requirement, but for technical reasons not fully reached the requirement. The distance between the point (-1,0j) and the Nyquist curve is in general required to be at least 0.43. All units get a margin on this so that distances down to $0.43 \cdot .95 = 0.41$ are considered to fulfil the requirement. The new exemption means that distances down to $0.43 \cdot 0.75 = 0.32$ will be considered to fulfil the requirements if the provider can show the TSO that they have put reasonable effort into increasing the stability margin.

Linearity (3.4)

Feedback: It should be allowed to provide no response to the fast sines. Hence, the dynamic linearity requirement should allow for this.

Response: In principle we agree that this should be allowed.

Changes: Providers can get exemption from dynamic linearity requirement as it is formulated if they show that the response is close to zero.

LER (3.5)

Feedback: The section on LER does not take into account entities that recharge from other sources than the grid. Examples on for example how to apply energy management to run-of-river hydro is needed. Providers also ask if the FCR-N delivery should not be energy neutral over longer time periods. One provider commented that the required power allocation for energy management in FCR-N is unnecessarily large, and suggested the actual installed energy capacity should be taken into account and the providers should be allowed to show satisfactory performance based on a series of frequency data provided by the TSO. It is suggested that the endurance test does not need to be longer than the endurance requirement.

Response: Entities that do not recharge from the grid will be allowed to suggest other solutions for energy management schemes. As an example, this includes run-of-river hydro. The provider is free to suggest how to handle energy management to ensure delivery of FCR. The FCR-N delivery cannot be assumed energy neutral for all time periods relevant for FCR provision from LER, and hence it is necessary to have requirements on the amount of energy and energy management. We will continue to work on the requirements and look into options to define a relation between the energy capacity and the power allocation for energy management. We are planning to develop the endurance test so that the entering and exit of the operation modes NEM and AEM are tested.

We will also continue to work on this section to define more detailed and concrete requirements before the implementation of the new requirements. The expected additions in the prequalification document concerning this section will not affect the legal methodologies.

Changes: It has been clarified that entities that do not use the grid for recharging can suggest other solutions to make sure they will always be able to deliver the contracted reserves.

Start and end of delivery (3.7)

Feedback: Providers asked for background and motivation to this requirement.

Response: The purpose of the requirement is to ensure the frequency containment process always works correctly and uninterrupted. Depending on the reserve market results, there can be a large number of providing entities that end or start provision at the hour shift. Despite the changes, on system level the activated FCR should remain proportional to the frequency deviation as closely as possible. If the described implementation is not feasible, the provider can suggest an alternative implementation. The requirements can also be implemented on portfolio level, for example by ending the provision of individual entities at different points in time so that in total a smooth response is achieved.

Change: It has been clarified that a portfolio level implementation is possible.

Baseline (3.8)

Feedback: The section does not cover entities that have a varying baseline and a control strategy where FCR is activated as a change from the varying baseline. It is suggested to include such entities. Providers also ask for more guidelines regarding baseline and forecasts of capacity.

Response: We have not had the intention to exclude such entities. In general the baseline can be varying, as long as it can be defined and the FCR response is correct. The baseline method has to be approved by the TSO in the prequalification process. We acknowledge the need to further develop and detail requirements on baseline calculations and forecasting. We are working to gain more knowledge and experience in these areas, for example through an ongoing pilot project in Sweden, https://www.svk.se/en/about-us/news/news/pilot-study-on-ancillary-services-from-resources-with-variable-production-or-consumption/. Please also refer to section 3.10 for additional information and requirements on varying processes and baselining.

Changes: Clarification has been made in the document that the baseline calculation should be included in prequalification and approved by the TSO.

Capacity and steady state response (3.9, 3.1)

Feedback: A provider commented that equations 22-24 do not take into account possible different steady state responses of FCR-N in each direction. There is also a question about whether the theoretical steady state response of FCR-N should be considered separately in each direction for requirement 1. Some more examples are needed with respect to how to interpolate reduction factors and how much capacity can be expected from different types of units.

Response: We have tried to make some clarifications in the document, and we also aim at including more examples in the tuning guideline that is being prepared.

Change: The equations have been modified so that the capacity of FCR-D takes into account if FCR-N has a larger steady state response in one or both directions, which will take headroom from FCR-D. It has been clarified in 3.1.1 that the theoretical steady state response is the minimum or average of the response in the two directions.

Aggregated resources (3.11)

Feedback: The text on dynamic prequalification is unclear and requirements 2 and 3 do not align with requirement 4. Some providers ask for numbers on how much capacity can be added under the dynamic prequalification.

Change: We acknowledge that the requirements on the flexibility of prequalification for aggregated resources are still vague and unclear. We will continue to work on this section to define more detailed and concrete requirements before the implementation of the new requirements. The expected additions in the prequalification document concerning this section will not affect the legal methodologies.

Central control (3.12)

Feedback: The term central controller is not clear in cases of distributed modular control systems.

Response: A central controller is regarded as a single point of failure. Therefore the maximum provision behind a central controller (even when fulfilling requirements on redundancy and availability) is the same as the maximum behind a single point of failure.

Chapter 4: Requirements on the measurement system

Feedback: Is there a particular reason to request such high measurement accuracies? The default value for measurement lag is high compared to typical equipment. The section should state some requirement on transducer response time. It should be stated which point the requirements refer to, i.e. where the power should be measured.

Response: The TSOs will reassess the accuracy requirements after gaining more experience. The default value for measurement lag is set high to incentivize providers to find documentation or test the measurement equipment. Recommendations on transducer response time will be included in the tuning guideline that is being prepared. The requirements refer to the grid connection point, but other suitable power measurements points can be agreed with the TSO (for example, at the generator).

Changes: The point of measurement has been clarified in the document.

Chapter 5: Testing requirements

Feedback: Some providers suggested that testing at a capacity lower than maximum and higher than minimum should be allowed. The worst dynamics are not always at high load. It is suggested that tests at low load should be done at the same operating point for high and low droop, and similarly for high load. Some providers were also concerned that the theoretical calculation of the steady state response would increase the complexity of the process.

Response: We wish to clarify that providers who have a steady state response calculation method that is verified by the prequalification tests will be allowed to deliver more than the tested capacity if the maximal capacity was not available during the test for example due to ambient conditions. We will develop the framework for capacity calculations further and define limits for how much the capacity can be increased with respect to the tested capacity. We also wish to clarify that it will still be allowed to base the steady state response calculation method on interpolation of test results, in line with the current practice. We acknowledge that different types of entities will have challenges at different points of operation and that max and min load may not always be the most relevant points for testing. However, we also need a common set of rules that are technology neutral. We do not see the importance of testing high and low droop at the same operating point instead of shifting the operation point depending on the droop, but welcome more input if this point is considered very important.

Ambient conditions

Feedback: It will never be possible to obtain results representative for all foreseeable operational conditions in the prequalification tests. It is a goal to strive towards, but still unattainable, and it is therefore an unfortunate formulation of the requirements. Moreover, related to testing of hydro units with a joint penstock, is it to be understood that it is up to the power plant owner how to run additional units during testing? Will the prequalified operating range of a unit be independent of the output of the remaining units?

Response: Units with common waterways can be tested either with the connected units in production or in standstill. It will be up to the provider to decide on this until the TSO gains more experience with such cases. Regarding the capacity, we encourage you to use test data in combination with theoretical calculations to determine how the capacity will be affected by different operating conditions, and use this information in the steady state response calculation method to get as good estimate as possible. The capacity may be different depending on whether other units are in operation.

Chapter 6: Requirements on real-time telemetry and data logging

Feedback: The requirements on real-time telemetry and other data exchange must be clarified and balanced in order to not cause unnecessary costs. Investments will be necessary and it is unclear at what level calculations should be made. The requirements on accuracy and resolution should be harmonized within EU.

Response: The real-time telemetry and data exchange will be determined by the local TSO and communicated in the national prequalification documents.

Chapter 7: Validity and exceptions

Feedback: Some providers request that it should be possible to be granted exemptions.

Response: Chapter 7 states that it will be possible to get exemptions in some cases. There are also some general exemptions on specific requirements described in the document. The TSO will also be able to give temporary exemptions if there are good reasons for doing so in individual cases.

Appendix

Feedback: The first example is power feedback which should not be used since it reduces the inertia response if used.

Response: This is correct and we have replaced this example.

Changes: The example has been replaced by another example.