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| Fingrid Oyj |
| Application for approval of a reserve unit for frequency containment reserve (FCR) |
|  |

[Name of the Reserve Provider]

[Name of the Reserve Unit]

[ ] FCR-N
[ ] Dynamic FCR-D up
[ ] Static FCR-D up
[ ] Dynamic FCR-D down
[ ] Static FCR-D down

Date

 [DD-MM-YYYY]

# Introduction

Reserve provider will fill in this form for every reserve unit that they wish to offer to the frequency containment reserve markets. Sections 1-3.1 should be filled in before the prequalification tests and sent to Fingrid for approval. Rest of the form is completed after the prequalification. The information requested in the form is mandatory, and it must be supplemented, if necessary, at Fingrid's request. The application form is based on Appendix 2 of the Frequency containment reserves market agreement: Technical Requirements for Frequency Containment Reserve Provision in the Nordic Synchronous Area [1].

The application form and its mandatory attachments are sent to Fingrid via RESTORE-portal. If the provider does not have access to RESTORE (new providers), application will be sent to Fingrid via email.

# Summary

|  |
| --- |
| Type of the reserve unit:[ ]  Single reserve resource [ ] Aggregated reserve unitName of the reserve unit: Prequalification date:Reason for the application:[ ]  New reserve unit [ ]  Periodic renewal of prequalification[ ]  Notable change in the reserve unitIf the reason is ”notable change”, please describe the change below: Indicate if type approval is applied for:[ ]  Yes [ ]  NoIndicate if the new resource is added to already existing reserve unit:[ ]  No[ ]  Yes. The new resource can fulfill the technical requirements independently. Only the new resource is tested.[ ]  Yes. Increase up to 25 %[[1]](#footnote-2) of capacity of a Static FCR-D reserve unit. Only the new resource is tested.[ ]  Yes. Increase over 25 % of capacity of a Static FCR-D reserve unit OR add new resources to a dynamic FCR-D or FCR-N reserve unit. Whole reserve unit is tested.Control of the reserve unit:[ ]  Local control [ ]  Central controlControl method:[ ]  Continuous (linear) [ ]  Non-continuous (stepwise linear)Indicate if the reserve unit utilizes mode shifting (fill in for FCR-D):[ ]  Yes [ ]  NoType of the reserve unit:[ ]  Production [ ]  Consumption [ ]  Energy storage [ ]  Other, which?Energy reservoir of the reserve unit:[ ]  Unlimited energy reservoir [ ]  Limited energy reservoir (LER) |

Fill in applied reserve capacities for each product in Table 1. Fill in information about the response of the unit in Table 2. Fill in only relevant sections.

*Table 1. Applied reserve capacities*

|  |  |  |  |
| --- | --- | --- | --- |
|  | Maximum capacity | Minimum capacity |  |
| $$C\_{FCR-N }$$ |  |  | MW |
| $$C\_{FCR-D up }$$ |  |  | MW |
| $$C\_{FCR-D down}$$ |  |  | MW |

Table 1. The steady state response of the reserve unit and reduction factors. Reduction factors are filled in only for units that could not fulfill the requirements of Appendix 2 without them. \*Load means the baseline power of the unit, e.g. power when reserves are not activated. Low/high load means the lowest/highest baseline power that will be used during reserve provision. If reserves are maintained only on one load level, there is no need to test multiple loads. \*\*Droop means the relation of frequency change and power change. The smaller the droop, the higher the reserve capacity. If reserves are maintained always with the same capacity, only one droop condition needs to be tested.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | Theoretical steady state response [MW]Pss\_theoretical | Steady state reduction factor*Kred,ss* | Dynamic reduction factor*Kred,dyn* |
| **FCR-N** | high load\*, high droop\*\* |  |  |  |
| high load, low droop |  |  |  |
| low load, high droop |  |  |  |
| low load, low droop  |  |  |  |
| **FCR-D up** | high load, high droop |  |  |  |
| high load, low droop |  |  |  |
| low load, high droop |  |  |  |
| low load, low droop |  |  |  |
| **FCR-D down** | high load, high droop |  |  |  |
| high load, low droop |  |  |  |
| low load, high droop |  |  |  |
| low load, low droop |  |  |  |

Fill in in table 3 the tests that are to be performed and the operational conditions for the tests.

Table 3. Tests to be performed and their operational conditions. Mark tests that are to be performed with X. Include other relevant information about the test to “Additional information” -column. This relevant information could be for example if FCR-N + FCR-D combination is tested with FCR-D ramp test. Or if endurance or mode shifting is tested with FCR-D ramp test.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | high load, high droop | high load, low droop | low load, high droop | low load, low droop | Additional information |
| **FCR-N** | Step test |  |  |  |  |  |
| Sine test |  |  |  |  |  |
| Linearity test |  |  |  |  |  |
| Energy management test |  |  |  |  |  |
| **FCR-D up** | Ramp test |  |  |  |  |  |
| Ramp test for static FCR-D |  |  |  |  |  |
| Sine test |  |  |  |  |  |
| Linearity test |  |  |  |  |  |
| Energy management test |  |  |  |  |  |
| **FCR-D down** | Ramp test |  |  |  |  |  |
| Ramp test for static FCR-D |  |  |  |  |  |
| Sine test |  |  |  |  |  |
| Linearity test |  |  |  |  |  |
| Energy management test |  |  |  |  |  |

Notify also if measurement device is tested and which reserve product will be active during the one-hour active provision -test. Please note that history data as in Fingrid’s signal list should be provided from the one-hour active provision -test.

# Overview

## Information of the balancing service provider

Fill in in Table 4 the information of the company that will be acting as a balancing service provider (BSP) for the reserve unit in question. Balancing service provider is the party that will be signing reserve market agreement with Fingrid. If all the information can not be filled in during prequalification process (e.g. IP addresses and real-time telemetry information), the application can be returned as incomplete in this respect and supplemented later before trading begins. This information is used for configurating of the IT system and the contacts are saved into Fingrid’s customer management system.

*Table 4. Information of the company acting as a balancing service provider.*

|  |  |
| --- | --- |
| Company name |  |
| Business ID |  |
| VAT-number |  |
| Address |  |
| BSP’s EIC-X code \* |  |
| BSP’s or service providers EIC-V code (production environment) \* |  |
| BSP’s or service providers EIC-V code (test environment) \* |  |
| Does the BSP or a service provider have access to Vaksi? |  |
| Fixed IP address for Vaksi |  |
| Contact information: Contracts – natural person, phone & email |  |
| Contact information: Telecommunications & operation – natural person, phone & email  |  |
| Contact information: Prequalification tests and technology – natural person, phone & email  |  |
| Contact information: Billing and reporting – natural person, phone & email  |  |
| Vaksi Contact / shared account for password reset  |  |
| Restore user (if not existing already) - natural person, phone & email |  |
|  |  |

\*EIC codes can be requested from Fingrid if necessary, [EIC codes - Fingrid](https://www.fingrid.fi/sahkomarkkinat/markkinoiden-yhtenaisyys/eurooppa-yhteistyo/eic-koodit/)

## Information of the reserve unit

Fill in in Table 5 the information of the reserve unit. If an aggregated reserve unit includes many individual resources, use attachments to provide this information.

*Table 5. Information of the reserve unit*

|  |  |  |  |
| --- | --- | --- | --- |
|  | Reserve resource 1 | Reserve resource 2 | [….] |
| Name |  |  |  |
| Technology |  |  |  |
| Rent |  |  |  |
| Owner |  |  |  |
| Balance responsible party |  |  |  |
| Nominal power [MW] |  |  |  |

## Information of the service providers

Fill in in Table 6 the information of possible service providers of the BSP. Add columns if necessary.

*Table 6. Information of the service providers*

|  |  |  |
| --- | --- | --- |
|  | Service provider 1 | […] |
| Company name |  |  |
| Acquired service (equipment, testing, IT, trading, operation) |  |  |
| Address |  |  |
| Business ID |  |  |
| Contact person |  |  |
| Phone number of the contact person |  |  |
| Email of the contact person |  |  |
|  |  |  |

# Description of the reserve unit

## Technical data

Give technical data of the reserve unit.

*Examples of such data is given below. For other technologies than the ones listed below, similar technical data should be provided.*

*Production:*

* *Generator: Rated apparent power [MVA], inertia constant H [MWs/MVA]*
* *Turbine: Rated power [MW], inertia constant H [MWs/MVA]*
* *Hydro power plant: Water starting time constant Tw [s] at rated head [m] and at rated turbine power, using the rated turbine power as base power*
* *Wind power plant: Rated wind speed [m/s]*
* *Minimum and maximum power [MW]*

*Consumption:*

* *Type of consumption and its properties*
* *Minimum and maximum power [MW]*

*Energy storages:*

* *Rated apparent power [MVA]*
* *Rated energy capacity of the energy storage [MWh]*
* *Energy storage maximum and minimum state of charge [MWh]*

## Activation and deactivation

Describe the activation and deactivation:

*> Are there any delays? If yes, describe the reasons the delay and report the magnitude of it.*

 *> If the application concerns Static FCR-D, describe the activation, deactivation, and recovery.*

*> Report, if FCR-D continues its linear activation over frequency limits 49.5 Hz and 50.5 Hz.*

*> Describe the operation principle of the control system: local/central (frequency measurement, calculation of the control signal)*

*> If activation is controlled from a centralized system, describe shortly the architecture and IT security related practices (e.g. responsibilities, access management, facility security, preparedness for disturbances)*

## Control system

Describe the control system of the reserve unit:

*> Describe how power response is calculated based on the measured grid frequency. Include for example equations for the calculations and possible signal processing.*

*> Present a block diagram of the controller/relay. Include values for controller parameters. Include power and frequency measurements in the diagram and explain abbreviations.*

*> If stepwise linear control is utilized: give a reason why stepwise response was chosen and give the control curve in a table-form.*

*> If the reserve unit can deliver multiple reserves or other frequency controls (FCR, FFR, FRR, FSM, LFSM) simultaneously, describe how the simultaneous provision is executed:*

* *Include a general description of activation of the reserves, their possible dependencies, changing of controller modes etc.*
* *Describe the possibility enable and disable individual reserve products.*
* *Describe the method that ensures that there is enough capacity for all the maintained reserve products.*
* *Notify if limited frequency sensitive modes (O-LFSM, U-LFSM) are defined for the unit and describe how they are implemented in the control system.*

*> If the application concerns an entity that utilizes mode shifting, describe the transitions between the modes (high performance, high stability).*

*> Describe how the maintenance of FCR starts/ends in the beginning/in the end of a market time unit if frequency is not equal to 50 Hz.*

## Aggregation

If the application concerns aggregated reserve resources, describe how the aggregation system works:

*> Describe the operation of the aggregation system, e.g. What logic is used to activate individual resources?*

Specify which of the options below to use:

[ ]  Prequalification test static, operation static

[ ]  Prequalification static, operation dynamic

[ ]  Prequalification dynamic, operation static

[ ]  Prequalification dynamic, operation dynamic

[ ]  Type approval (only for max. 100 kW resources)

> *Describe how the options selected above are applied and justify why*.

*> If type-approval is applied for, a description of the type-approved resource shall be provided in the application.*

## Limitations of energy storages

Indicate whether there are any restrictions related to energy storage:

*> Describe the possible limitations of the energy storage (e.g. endurance of activation at full reserve capacity).*

*> Describe how the length of the activation of the energy storage has been calculated. For example, use equations 20 and 21 from source [1].*

*> Describe the strategy for restoring the energy storage. In the case of limited energy reservoir (LER), describe how the energy management functions (NEM and AEM) have been implemented.*

*>Describe how activation, deactivation, energy management etc. are implemented with multiple reserve provision.*

*>LER-entities: describe how remaining endurance (which is included in the real-time telemetry signals) is calculated.*

## Calculation of reserve capacity

*> Describe the method used to calculate the theoretical steady state response. Report how the control parameters, the magnitude of the load (the power of the unit without active reserves) and external conditions (e.g. fall height, temperature) affect the response. See examples in Annex 1 of source [1].*

*> Describe how the maintained capacity (included in the real-time data exchange) is calculated. Indicate how often the value will be updated.*

*> Describe how the activated FCR (which is included in the historical data) is calculated.*

## Calculation of baseline

If the power of the reserve unit varies according to the conditions, describe the variation and its causes.

*> Describe how variations in the power of the reserve unit are taken into account when determining the available reserve capacity for trading. For example, what forecasts are used, how accurate the forecasts are, what margin is used, etc.*

*> Describe how the reference capacity (baseline) of the reserve object is calculated during operation.*

*- Example: a reserve object has a controlled setpoint that determines the reference power.*

*- Example: reference power is dependent on wind speed. Describe how it is calculated (e.g. measurement data and models used, accuracy of data/calculation, refresh interval...). Examples of calculations and more detailed requirements for validating reference power for weather-dependent production can be found in the source [2]. Attach the one-month data on calculated and measured instantaneous power required in source [2], if not already provided.*

## Logging of measurements

Describe the method used for continuous recording of measured values. If different measurement arrangements are used during the prequalification test, they are described in section 4.2.

> *Describe how the power and frequency measurements are carried out and the factors affecting the measurement.*

* *Report the entire measurement chain with time delays.*

*> Enter the values for measurement accuracy, measurement resolution and sampling rate in Table 7 below. Please attach appropriate documentation, e.g. technical data of measuring instruments (data sheet).*

*> Indicate where the history data will be stored and how long it will be stored.*

*> Specify the time zone to be used for timestamping.*

*Table 7. Summary of data storage and logging.*

|  |  |  |  |
| --- | --- | --- | --- |
|  | Accuracy | Resolution | Sampling rate |
| Instantaneous active power |  % | MW | s |
| Measured grid frequency  | MHz | MHz | s |
|  |  |  |  |

# Prequalification test and test results

## Overview of the prequalification

Indicate the time and place of the prequalification test:

Describe the general operating conditions during the tests:

> *Include a brief description of how the conditions can be expected to have affected the test result.*

## Test method

Describe how the reserve unit was tested:

*> Describe the test method.*

*> If different measuring and recording devices were used in the tests than in normal use, describe them and fill in Table 8 with information on the accuracy, resolution, and sampling rate of the devices. Fill in at least the information about the measurement of the synthetic frequency signal.*

*> Specify the time zone for logged data.*

*> If the test signal is generated programmatically in the controller, report the time constant (TFME) of the frequency measurement device. For examples of how to calculate a time constant, see section 4.4 of source [1].*

*Table 8. Summary of data recording and logging during testing.*

|  |  |  |  |
| --- | --- | --- | --- |
|  | Accuracy | Resolution | Sampling rate |
| Instantaneous active power |  % | MW | s |
| Measured grid frequency  | MHz | MHz | s |
| Syntheticfrequency signal  | MHz | MHz | s |
|  |  |  |  |

## Test results

List the attachments that contain the test results:

*> Include the necessary reports and measurement data.*

*> The data recorded during the tests shall include at least the quantities listed in the column "Test" of Table 19 of source [1] and shall be reported in the format described in Chapter 6.2.1 [1].*

*> Log the 1-hour active delivery data in the same format as the historical data. The instructions can be found in Fingrid’s reserve trading and information exchange guidelines. If the application concerns two or all reserve products, one hour of active frequency control only needs to be done for one product.*

# Reporting of real-time data

*> Describe in Table 9 how real-time data is delivered to Fingrid. Who provides the necessary real-time data and with what technology.*

*>Check the current contract requirement from Fingrid’s reserve trading and information exchange guidelines and from Reserve information exchange - signal list.*

*> Contact Fingrid's real-time information exchange expert about the implementation of information exchange.*

*> Please note that it may take time to set up real-time information exchange, so this step should be started early.*

*Table 9. Description of real-time information exchange*

|  |  |
| --- | --- |
| Information | Description |
| Real-time communication method |  |
| Is real-time telemetry between the reserve provider and Fingrid already in use? |  |
| Does the reserve provider use a service provider to implement real-time telemetry? If yes, please indicate the name of the service provider. |  |
|  |  |

# List of attachments:

*Write a list of all application attachments.*

* *Test report*
* *Test data*
* *etc.*

# References

|  |  |
| --- | --- |
| [1]  | Technical Requirements for Frequency Containment Reserve Provision in the Nordic Synchronous Area, effective from 1.9.2023.  |
| [2] | Guideline for providing automatic reserves from intermittent generation, valid from 11.4.2024. |

1. For reserve units smaller than 20 MW, up to 50 % or 5 MW increase is allowed (which one is smaller). [↑](#footnote-ref-2)