Instructions for balancing service providers
4.7.2023

Fingrid's reserve trading and information exchange guidelines

FINGRID

Contents

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Introduction

Introduction

- The guidelines in this document contain specific information about how the infomation exchange with Fingrid on different reserve market places should be implemented

- The document contains e.g. information about bid submission to different reserve markets, receiving market results as well as instructions on how to implement real-time reporting

- The main channels for information exchange between balancing service providers and Fingrid are:

  - ECP (Energy Communication Platform): **Bid submission, receiving market results, electronic activation for mFRR-bids**

  - Vaksi Web – User Interface: **Bid submission, receiving market results, electronic activation for mFRR-bids**

  - EDI Messages: **Receiving market results, delivering reserve plans for yearly market**

  - FEN network (ELCOM, ICCP or IEC 60870-5-104 protocols): **Real-time reporting**

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aFRR capacity bids to Fifty NMMS

NMMS = Nordic Market Management System

- NMMS is a new platform developed by Fifty that is used on the aFRR capacity market

- Fifty operates as a service provider for Fingrid

- Finnish balance service providers submit their aFRR bids primarily to the NMMS platform, except for fallback situations described in slides 15-17 of this presentation

  - In these fallback situations aFRR bids are submitted manually through Vaksi Web

- Instructions and information about the aFRR capacity market are also available in the Nordic implementation guide. https://nordicbalancingmodel.net/wp-content/uploads/2021/03/Implementation-Guide-aFRR-capacity-market-BSP_v2.6.pdf

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Market design

- Daily auction D-1

- Gate opens: D-7 at 00:00 (CET)

- Gate closes: D-1 at 07:30 (CET)

- Results published in Normal case: D-1 at 09:00 (CET)

- Results published in Fallback case: D-1 at approximately 10:00 (CET)

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Bid rules

- Bids per bidding zone/hour/direction

- BSP send bids to FNMMS

- Volume - Min 1 MW and for indivisible bids Max 50 MW

- Divisible bids - BSPs have the opportunity to split bid by entering the minimum bid volume of the specified bid. For example: Bid: 45MW, Min: 20MW

- Block bids - No limit on the number of hours. However, it must be the same volume for all hours

- Exclusive bids - Different variants of bid combinations with different prices and volume where only one combination is possible to choose. However, it must apply to the same hours on all these combinations

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Bid submission NMMS (Electronic messages)

- It is possible to submit bids through electronic messages using EDX.

- Detailed instructions for the messages are available in the implementation guide: https://nordicbalancingmodel.net/wp-content/uploads/2021/03/Implementation-Guide-aFRR-capacity-market-BSP_v2.6.pdf

- More information about EDX from experts at Fingrid:

  - Antti Hyttinen, firstname.lastname@fingrid.fi, tel. 030 395 5353

  - Jussi Karttunen, firstname.lastname@fingrid.fi, tel. 030 395 4456

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Bid submission NMMS

- It is also possible to submit bids on the NMMS platform manually through the user interface or with Excel-import.

- Manual bid submission is done under the main menu *aFRR Capacity Market → Bid Entry*

- Select a date for which the bids are entered and click on *"Create"*.

Bid entry
aFRR Capacity Market / Auction data /

| Day | 31.12.2021 | | Bid zone | ×FI | Direction | All | BSP | All | | ⊗ Clear filters | ⟳ Update data |

Day 31.12.2021　Open 24.12.2021 00:00:02　Close 30.12.2021 07:30:00　Clearing 30.12.2021 09:10:00　State Bidding gate open　Market aFRR Capacity Market　**Create**　**Import**

- Select correct BSP, Bidding Zone *(FI)* and direction *(Up or Down)* and after that click *"OK"*

Bid entry
aFRR Capacity Market / Auction data /

| Day | 31.12.2021 | | Bid zone | ×FI | Direction | All | BSP | All | | ⊗ Clear filters | ⟳ Update data |

Day 31.12.2021　Open 24.12.2021 00:00:02　Close 30.12.2021 07:30:00　Clearing 30.12.2021 09:10:00　State Bidding gate open　Market aFRR Capacity Market　**Create**　**Import**　**Edit**　**Export**

BSP	Bid zone	DIR	Bid #	Price [€/MW/h]	Linked ID	Excl. group	Block	Min. [MW]	Offered quantity per hour [MW]																									Rejected	Reason	Note	Updated	Bid ID
									1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24					

- To edit the price and volume of the bid, click on *"Edit"*.

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Bid submission NMMS (Excel-import)

- Importing bids from Excel can be done under the menu a*FRR Capacity Market* → *Bid Entry*

- Select a date for which the bids are entered and click on *"Import"*.

- Select the correct file and click *"Open"*.

- The easiest way to create a ready template for bid submission is to create empty bid rows manually and click on *"Export"*. After this, the downloaded Excel-file can be edited and imported afterwards with *"Import"*.

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Results NMMS

- The results of the aFRR-auction can be viewed in two different places in the NMMS user interface:

  - 1. aFRR Capacity Market → Bid results

    - On this screen, you can see the originally offered volume (O-column, O = Offered) and the accepted volume (A-column, A = Acceped). Bids that have been accepted completely have a green background color. Partially accepted bids are colored yellow and rejected bids are orange.

Price [€/MW/h]	Linked ID	Excl. group	Block	Min. [MW]	1 O	1 A	2 O	2 A	3 O	3 A	4 O	4 A	5 O	5 A	6 O	6 A	7 O	7 A	8 O	8 A	9 O	9 A	10 O	10 A	O
							0		0		0		0		0		0		0		0		0		0	
							0		0		0		0		0		0		0		0		0		0	
10,00			-		4	4	4	0	4	0	4	0	4	0	4	4	4	4	4	4	4	4	4	4	4
20,00			-		3	3	3	0	3	0	3	0	3	0	3	3	3	3	3	3	3	3	3	3	3
72,00			-	0																					
72,00			-	0																					
74,00			-	0																					
76,00			-	0															45	45					
77,00			-	0																			56	53	
77,00			-	0																					

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Results NMMS

- 2. aFRR Capacity Market → Accepted bids

  - On this screen, you can only see the accepted volume. Bids that have been accepted completely have a green background color. Partially accepted bids are colored yellow and rejected bids are orange.

Price [€/MW/h]	Linked ID	Excl. group	Block	Min. [MW]	1	2	3	4	5	6	7	8	9	10	11
					0	0	0	0	0	0	0	0	0	0	0
					0	0	0	0	0	0	0	0	0	0	0
10,00			-		4	0	0	0	0	4	4	4	4	4	4
20,00			-		3	0	0	0	0	3	3	3	3	3	3
72,00			-	0											
72,00			-	0											
74,00			-	0											
76,00			-	0								45			
77,00			-	0										53	

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Results NMMS

- Additionally, a general view of every auction can be viewed on the screen *aFRR Capacity Market → Market totals*:

  - Accepted volumes per bidding zone

  - Marginal prices per hour and bidding zone

  - The overall cost of each auction

- Results are also published in NUCS and on the ENTSO-E Transparency platform

- The implementation of the NMMS does not influence the available datasets on Fingrid's Open Data website

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Fallback situations FIFTY MMS

- Contact persons for matters concerning FIFTY MMS:

- Office hours: Tuomas Mattila, puh. +358 (0)30 395 4180 or Antti Hyttinen, puh. +358 (0)30 3955353.

- Outside of office hours: Main grid control centre, tel. +358 (0)30 395 4210

- A fallback means a situation, where the NMMS is not working correctly (completely or partially).

- In fallbacks 1 and 2 submitting bids is done through Vaksi Web

- There are three main fallback scenarios that have been considered:

  1. NMMS does not close the bidding gate correctly at 7.30 CET (Fallback 1)

  2. NMMS is unable to calculate a result for the auction (Fallback 2)

  3. NMMS is unable to publish the results of an auction (Fallback 3)

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Fallback 1

- In this scenario, NMMS fails to receive bids and/or close the bidding gate correctly at 7.30 (CET).

- The deadline for declaring this fallback scenario is 7.35 (CET).

- If the fallback is declared, Fingrid's operator asks the BSP (by phone or other means) to submit the aFRR bids for the next day into the VAKSI system.

  - Submitting the bids into Vaksi is done manually through Vaksi Web. (see slide 26)

- Time for submitting the bids depends on the situation, Fingrid's operator will give instructions for this.

- The auction for the next day is run in Vaksi and the results are distributed through EDI-message and can also be viewed in Vaksi Web.

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Fallback 2

- In this scenario, Fifty NMMS fails to clear the market and calculate the accepted bids for the next day.

- The deadline for declaring this fallback scenario is 8.45 (CET).

- If the fallback is declared, Fingrid's operator asks the BSP (by phone or other means) to submit the aFRR bids for the next day into the VAKSI system.

  - Submitting the bids into Vaksi is done manually through Vaksi Web. (see slide 26)

- Time for submitting the bids depends on the situation, Fingrid's operator will give instructions for this.

- The auction for the next day is run in Vaksi and the results are distributed through EDI-message and can also be viewed in Vaksi Web.

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Fallback 3

- In this scenario, Fifty NMMS fails after market clearing but before market result is distributed.

- The deadline for declaring this fallback scenario is 9.00 (CET).

- If the fallback is declared, Fingrid's operator will distribute the auction results to the BSP via email. The email contains the following fallback files:

  - Excel sheet with the information about the accepted bids. The format of the excel sheet is similar to the user interface of NMMS after the results are published.

  - XML files that the BSP would have received via EDX in a normal situation.

- The results are distributed to the BSP as soon as possible after the fallback has been declared.
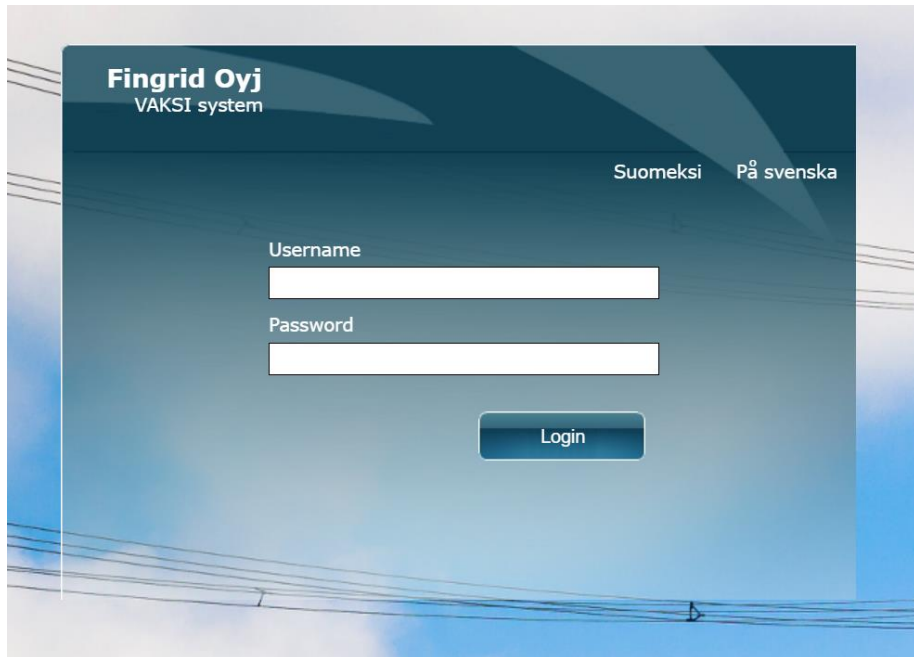
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Vaksi Web

Vaksi Web system

- Vaksi is an internet-based application for the management of the commercial data of the power system.

- Balancing service providers must submit their IP address or addresses, which will be used to access Vaksi, to Fingrid in advance. Both individual addresses and a joint address for the entire company configured with e.g. NAT are accepted. Access to Vaksi is only granted to the submitted addresses.

- Fingrid provides the login IDs, usernames and passwords to access Vaksi.

  - The IDs are company-specific.

  - Users must change their password in the Settings of Vaksi.

- One or more regulation market or reserve parties can be configured for a user ID.

  - The 'Regulation capacity markets' page (*Säätökapasiteettimarkkinat*) can only be accessed by parties operating on the marketplace in question.

  - Reserve parties are defined for FCR, aFFR and/or FFR hourly markets.

  - One party can be configured for more than one user ID (such as service provider and owner), but each party may only use one regulation bid order method (electronic order / phone call).

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Contact information and troubleshooting

- Contact persons for matters concerning Vaksi:

    - Office hours: Otso-Ville Rinne or Jyri Ruotsalainen, tel. +358 (0)30 395 4142 / +358 (0)30 395 4163

    - Outside of office hours: Main grid control centre, tel. +358 (0)30 395 4210

- Fingrid provides information about upcoming downtimes and problems detected on the front page of Vaksi and by email/phone where necessary.

- If Vaksi is down, regulation and reserve bids may be submitted by email/phone.

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Logging in to Vaksi

https://tasehallinta.fingrid.fi

- **Purpose**

  - User authentication and system login

- **Functions**

  - Username: Enter your username

  - Password: Enter your password. This is case sensitive

  - *Login* button: Launches user authentication and login process

- **Note!** The Vaksi application is recommended to be used with the Chrome browser, or alternatively, with Firefox.

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Vaksi front page and functions

- **Front page**

  - After logging in, you will be taken to Vaksi's front page.

  - Fingrid announces news, such as downtimes and updates, on the front page.

  - You can choose functions from the top menu.

  - The Regulation menu is only visible to regulation energy market parties, while the Reserve bids menu can only be seen by FCR hourly market / aFRR / FFR parties.

  - The content of the submenu that opens from the Reserve bids menu depends on pre-determined specifications made to the reserve party

  - To exit Vaksi, click *Logout* on the right in the top menu.

- **Windows and views**

  - Screens open either in a new tab or the same window depending on how the action was launched and the menu parameters.

  - When a screen opens in a new tab, the Vaksi front page will remain open on the background, allowing you to open other screens from it.

  - When the screen opens in the same window, the new screen replaces the contents of the previous page. However, the top menu will still be available.

  - **Note!** Avoid using your browser's Back button.

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Favourite and home screens

- Custom favourite and home screens can be accessed quickly from the top-right corner of the front page of Vaksi.

- To add a screen to your favourites, click the star icon on the top-right corner of the screen in question. ⭐ To set a screen as your home screen, click the triangle icon on the top-right corner of the screen. ▶ To undo your selection, click the icon again.

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FCR, aFRR and FFR hourly market bids

Submitting FCR, aFRR and FFR bids

- Submitting aFRR bids to Vaksi Web is only enabled in case of _fallbacks_ 1 and 2 of NMMS platform. In those cases, bids are entered manually by using screen: _FRR-A Reserve bid input_

- There are two ways to submit FCR and FFR bids into the Vaksi Web database and delete or adjust already submitted bids:

1. XML messages via the ECP bus

2. Vaksi Web user interface (Reserve bids menu)

   - Reserve products and their corresponding screens opening from Reserve bids menu:

     - FCR: Reserve → FCR order → Reserve bid input

     - FRR: Reserve → FFR → FFR Reserve bid input

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Submitting bids and transactions by electronic messages

Overview of MADES

- The transfer of bids and transactions as xml messages between Vaksi and balancing service providers is done via the ECP network based on the MADES communication standard.

  - MADES (MArket Data Exchange Standard) is the communication standard of ENTSO-E. It ensures that messages can only be read by the intended recipient.

  - ECP (Energy Communication Platform) is an implementation of the MADES standard
    - Balancing service providers must set up an ECP endpoint on their servers and register in Fingrid's ECP network
    - The enterprise application of balancing service providers communicates with its own ECP endpoint using the MADES API
    - The ECP endpoint transfers files to Fingrid's endpoint via Fingrid's ECP broker
    - For more information about ECP, please visit https://www.entsoe.eu/data/ecp/

- XML messages are based on the ERRP or CIM message standards of ENTSO-E.

  - https://www.entsoe.eu/publications/electronic-data-interchange-edi-library/

  - More detailed implementation instructions and ECP installation instructions are available from Fingrid upon request
    - Jussi Karttunen, tel. +358 (0)30 395 4456; Antti Hyttinen, tel. +358 (0)30 395 5353

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Bid submission through ECP

- Separate implementation guides for the submission of XML bids are available at Fingrid:

    - Antti Hyttinen, antti.hyttinen@fingrid.fi, tel. +358 (0)30 395 5353

    - Jussi Karttunen, jussi.karttunen@fingrid.fi, tel. +358 (0)30 395 4456

- When using ECP, Vaksi Web user interface still works as a back-up system. Reserve party is obligated to check the status of bids in Vaksi Web if:

    - Reserve party does not receive acknowledgement message after submitting bid via ECP

    - The market results received via ECP do not match the submitted bids in reserve party's system

- In addition to submitting bids, ECP can be used for:

    - Reporting FCR-N and FCR-D accepted bids as a product-specific hourly sum for the reserve party

    - mFRR (regulation bids) electronic activations

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Example of a XML-message (FCR-N bid)

```xml
<?xml version="1.0"?>
<ReserveBidDocument xmlns="urn:entsoe.eu:wgedi:errp:reservebiddocument:5:0" xmlns:xsd="http://www.w3.org/2001/XMLSchema" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <DocumentIdentification v="TESTBSPFCR201909271508"/>
    <DocumentVersion v="1"/>
    <DocumentType v="A24"/>
    <ProcessType v="A28"/>
    <SenderIdentification v="44X-DummyBSP100" codingScheme="A01"/>
    <SenderRole v="A12"/>
    <ReceiverIdentification v="10X1001A1001A264" codingScheme="A01"/>
    <ReceiverRole v="A11"/>
    <CreationDateTime v="2019-09-27T12:25:03Z"/>
    <ReserveBidTimeInterval v="2019-09-28T14:00Z/2019-09-28T16:00Z"/>
    <Domain v="10YFI-1--------U" codingScheme="A01"/>
    <SubjectParty v="44X-DummyBSP100" codingScheme="A01"/>
    <SubjectRole v="A12"/>
    <ReserveBidTimeSeries>
        <ReserveBidIdentification v="DummyBSP100_2019092814_Bid1"/>
        <AuctionIdentification v="FCR"/>
        <BusinessType v="Z03"/>
        <AcquiringArea v="10YFI-1--------U" codingScheme="A01"/>
        <ConnectingArea v="10YFI-1--------U" codingScheme="A01"/>
        <MeasureUnitQuantity v="MAW"/>
        <Currency v="EUR"/>
        <MeasureUnitPrice v="MAW"/>
        <Divisible v="A01"/>
        <LinkedBidsIdentification v="0"/>
        <BlockBid v="A02"/>
        <ReserveObject v="RO_TESTBSP1" codingScheme="NFI"/>
        <Direction v="A03"/>
        <Period>
            <TimeInterval v="2019-09-28T14:00Z/2019-09-28T15:00Z"/>
            <Resolution v="PT1H"/>
            <Interval>
                <Pos v="1"/>
                <Qty v="5.0"/>
                <Price v="7.00"/>
            </Interval>
        </Period>
```

Code for frequency controlled reserves (primary reserve)

Message time interval

Code for FCR-N market

Regulation Object –field from Vaksi Web

Time interval for single bid (always one hour for FCR-markets)

Offered volume of the bid

Price of the bid

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Submitting reserve bids with user interface

Submitting FCR, aFRR and FFR bids

Select desired reserve product from *Reserve bids* main menu

*Select the reserve product FCR-N, FCR-D up or FCR-D down

Select the time frame in the top-left corner and click 'Search'

Enter your bid either directly in the table on the screen by selecting 'Add new bid' or using the separate clipboard.

Save your changes. Once your bid has been successfully saved, the text 'Saved' appears on the top of the screen in green font.

*Only while submitting FCR-N and FCR-D bids

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Time limits for FCR, aFRR and FFR bids

	Deadline for submitting, adjusting and deleting bids	Earliest time for submitting bids
FCR	*6:30 p.m. (EET) for the next CET day	31 days from the time of submitting the bid
aFRR	Fingrid's operator determines	31 days from the time of submitting the bid
FFR	6 p.m. (EET) for the next CET day	31 days from the time of submitting the bid

*Balancing service providers can update a unit in an accepted FCR hourly market bid two hours before the start of the hour (The RO can be changed)

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Details of the FCR hourly market bid

- Required information:

  - Time: date and hour (hour start time, EET)

  - Volume (MW): volume of the bid to the nearest 100 kW

  - Price (EUR/MW,h): the offered sum must be in EUR

    - Minimum capacity for one FCR-N bid is 100 kW

    - Minimum capacity for one FCR-D bid is 1 MW

  - FCR-D bids require a type (consumption, production, other) and their regulation method must be set to 'one step' if the reserve in question is a one-step activated relay-connected reserve

- Optional information:

  - Regulating object for FCR-N bids: to view the predefined regulating object allowed for a reserve party in the drop-down menu, select 'Add new bid'. If there is anything missing from the regulating object -list menu, please contact Fingrid. The power plant name contains information about the balance responsible party and balance of the resource.

  - Aggregation for FCR-N bids: multiple bids can be aggregated into a single bid as long as the minimum bid size of 100 kW per balance responsible party is met

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Details of the aFRR hourly market bid

- Required information:

    - Time: date and hour (hour start time, EET)

    - Volume (MW): volume of the bid to the nearest 1 MW. Min bid volume 1 MW, max 50 MW

    - Price (€/MW,h): the offered sum must be in EUR

    - Production method: Hydropower or Heat

- All bids submitted to Vaksi must be divisible

- Block bids and exclusive bids are not allowed

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Details of the FFR bid

- Required information:

  - Time: date and hour (hour start time, EET)

  - Volume (MW): volume of the bid to the nearest 100 kW, minimum bid capacity is 1 MW

  - Price (EUR/MW,h): The price of the FFR bid in EUR

  - Type: Aggregated, Consumption, Production

- Optional details which are only added to combination bids:

  - Combination bid: empty, FCR-D hourly market, FCR-D annual plan

  - Regulation method: Linear, One-step. Regulation method of an FCR-D bid

  - Price of combination bid: Price of a combination FCR-D hourly market bid in EUR. If the field is empty, the price is the same as the FFR bid price.

Start			Ends			Quantity (MW)	Price (EUR)	Type	Combination bid	Way of regulation	Combination bid price (€/MW)		
28.04.2023 01	🔲	⏰	29.04.2023 01	🔲	⏰	0	0	Consumption ∨	FCR-D up hourly market ∨	One step ∨		√	✕

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FFR combination bids

- FCR-D hourly market combination bids can be viewed in the FCR-D bids and transactions reporting screen after the FFR procurement has been made and the deadline for submitting FCR-D bids has expired.

  - FFR transactions of a combination bid are reported in the FFR bids and transactions search screen

    - This also includes the FCR-D annual plan component of a combination bid

  - Transactions of the FCR-D hourly market component of a combination bid are reported in the FCR bids and transactions search screen

- The FCR-D annual plan component of a combination bid cannot be adjusted after the deadline for submitting FFR bids has expired.

Type	BSP	Start	Ends	Power	Price	Type	Combination bid	Way of regulation	Combination bid price (€/MW)	OfferId
FFR trade	TESTI FGS	12.03.2020 05:00	06:00	5.0	5.00	Aggregated	FCR-D up year plan			
FFR trade	TESTI FGS	12.03.2020 05:00	06:00	2.0	5.00	Production				
FFR trade	TESTI FGS	12.03.2020 06:00	07:00	2.0	2.00	Production				
FFR trade	TESTI FGS	12.03.2020 07:00	08:00	5.0	12.00	Aggregated	FCR-D up year plan			
FFR trade	TESTI FGS	12.03.2020 07:00	08:00	2.0	12.00	Production				
FFR trade	TESTI FGS	12.03.2020 07:00	08:00	10.0	12.00	Production	FCR-D up hourly market	One step	5.00	

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Assignment of an aFRR reserve obligation to another BSP

Assignment of an aFRR reserve obligation to another BSP

- Before assigning an aFFR obligation, a BSP must determine an obligation assignment pair and inform Fingrid. The obligation can only be assigned to another BSP if:

  - the obligation assignment pair has been predetermined and approved by Fingrid,

  - the aFRR procurement has occurred,

  - Fingrid is notified no later than one hour before the Market Time Unit to which the maintenance of the reserve obligation applies.

- After both BSP-parties have approved the assignment of the reserve obligation from one BSP to another, they must notify Fingrid and correct their reserve obligations in Vaksi's "*AFRR Velvoitteen siirto*" –view.

- After all the requirements are fulfilled, and the BSPs' reserve obligations correction columns match, should the assignment of an aFRR reserve obligation to another BSP be approved.

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FCR yearly market plans

FCR yearly market plans

- Binding plans must be submitted no later than 18:00 (EET) for the next day

- The yearly market plans must be sent to the LTJ extranet of Fingrid electronically using the identifier FI_party_FCRN/FCRD/FCRD_ALAS_SUUN

  - FCRD = frequency containment reserve for disturbances up (FCR-D up)

  - FCRN = frequency containment reserve for normal operation

  - FCRD_ALAS = frequency containment reserve for disturbances down (FCR-D down)

  - party = party ID, such as Fingrid = FG

- EDI message, DELFOR messaging

- The hourly volumes are submitted for the hours of a day in the CET time zone in MW

- Note! A separate yearly market plan is required for relay-connected loads serving as frequency containment reserve for disturbances, and a separate balance-specific plan is required for aggregated units of different balance responsibilities / balances in the frequency containment reserve for normal operation

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Regulation bids

Submitting regulation bids

- There are two ways to submit regulation bids into the Vaksi Web database and delete or adjust already submitted bids:

  1. XML messages via the ECP bus

     - In the same way as with <u>FCR and FFR</u> bids

  2. Vaksi Web user interface (Regulation menu via Regulation bid input screen)

- **Deadlines for submitting bids**

  - Offers must be submitted and they can be adjusted/deleted no later than 45 minutes before the beginning of the hour in question. If there is a failure in the resource after this deadline, the regulation energy market party must contact Fingrid to delete the bid.

  - Bids may be submitted for a maximum of 31 days from the time of submitting the bid.

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Submitting regulation bids with user interface

Submitting Regulation bids

1. Select the time frame in the top-left corner and click 'Search'

2. Enter your bid either directly in the table on the screen by selecting 'Add new bid' or using the separate clipboard.

    - 'Add new bid': A table opens at the top of the screen where you can submit individual bids or the same bid but for a longer period of time.

    - Clipboard: We recommend using the clipboard to submit more complex bids because the necessary data can be copied to the clipboard for example from an Excel spreadsheet. The clipboard requires standard bid information, but the data in the reserve and aggregation fields is given in numbers. The data must be tab delimited, but you can also use a semicolon or comma. After adding your bids to the clipboard, export your data to the table by selecting 'Export to table >>'.

3. Save your changes. Once your bid has been successfully saved, the text 'Saved' appears on the top of the screen in green font. Saved bids are in black font if the bid in question is not a reserve bid, which are highlighted in red font.

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Details of a regulation bid

- Required information:

  - Time: date and hour (hour start time, EET)

  - Volume (MW): volume of the bid in full megawatts; in downward balancing bids, the volume is negative

  - Price (EUR): the price of the bid in EUR. Maximum price of a regulation bid is 10 000 €/MWh and minimum -10 000 €/MWh

  - Power plant: To see the pre-defined power plants determined for a regulation market party in the 'Power plant' drop-down menu, select 'Add new bid'. The plants can also be seen in the List of regulation market power plants. If there is anything missing from the power plant list menu, please contact Fingrid. The power plant name contains information about the balance responsible party of the resource.

  - Other information required for bids includes location and balance (consumption/production), but these are defined in the power plant list and need not be added to the bid separately. The location and balance are displayed as part of the bid on the Regulation bids and transactions screen and the Transaction reporting screen.

  - BSPs can submit maximum of 5 under 5 MW bids for up- and down-regulation per hour (total of 10 under 5 MW bids per hour)

- Optional details

  - Aggregation: see the 'Aggregated regulation bids' page (*Aggregoidun säätötarjouksen syöttö*).

  - Reserve: see the 'Separation of reserve bids' page (*Reservitarjousten erottelu*).

FINGRID

Aggregated regulation bids

- The bids must be entered separately for each power plant name, and they must be given the same combination number in the aggregation field. The numbers are intended to separate regulation bids with different prices, and they are used sequentially. On the clipboard, the numbers 1-10 correspond to the aggregation combinations.

Tarjoukset / TESTI2   Kohdejakso: 17.03.2017 00 - 17.03.2017 01

16.03.2017 13:48

Talleta | Tulosta | Leikepöytä

Lisää uusi tarjous

Aika	Määrä (MW)	Hinta (Eur)	Laitos	Reservi	Aggregointi			
17.03.2017 00	5	50,00	Kulutus_FG		Aggregoitu 1			
	5	50,00	Tuotanto_FG		Aggregoitu 1			

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- The aggregated bids are displayed on the 'Bids and transactions' page as upper level sum bids, and partial bids can be viewed by clicking an upper level bid.

Säätötarjoukset ja kaupat   Kohdejakso: 17.03.2017 00 - 17.03.2017 01

VAKSI 16.03.2017 13:51

Tulosta | Lähetä | Raportointi... | Osapuolet | Aktivoi uudestaan | Sulje

Päivämäärä: 17.03.2017 00 Hae ☐ Automaattipäivitys

ELSPOT 0 Eur

Säätötarjoukset ja kaupat

Lisää

	Kumuloitu MW	Eur	MW	Tarjoaja	Tase	Alue	Laitos	Aktivointi	Teho	Alkaa	Päättyy	Energia	Tyyppi	Laitos	Selite	
Ylös	10	50,00	10	TESTI2	Aggregoitu	Etelä	Aggregoitu 1									
		50,00	5	TESTI2	Kulutus	Etelä	Kulutus_FG									
		50,00	5	TESTI2	Tuotanto	Etelä	Tuotanto_FG									

- If Fingrid orders only a part of an aggregated bid, the transactions are concluded for all partial bids in proportion to their bid sizes. A residual bid is identified by adding the letter A at the end of the name.

FINGRID

Separation of reserve bids

- Reserve power plant bids must be separated into reserve bids when submitting a bid. These bids are used after the voluntary regulation and regulation capacity bids, and they are highlighted **in red** font.

- Reserve field of the table is selected to *Reserve power plant* or number 2 is entered to the clipboard as a number

- If you are submitting a standard regulation or regulation capacity bid, leave the Reserve field empty or enter 0.

FINGRID

Example of submitting a regulation bid

Normal regulation bid

Reserve bid

Aika	Määrä (MW)	Hinta (Eur)	Laitos	Reservi	Aggregointi
20.08.2022 00	10,0	50,00	Powerplantgroup1_DUMMY		
20.08.2022 01	10,0	50,00	Powerplantgroup1_DUMMY	Varavoima	
20.08.2022 02	10,0	50,00	Powerplantgroup1_DUMMY		Aggregoitu 1
	10,0	50,00	Powerplantgroup1_DUMMY		Aggregoitu 1
20.08.2022 03	50,0	50,00	Consumptionplant2_DUMMY		

Aggregated regulation bid

Same view on the clipboard:

```
PP.KK.VVVV TT<tab>Määrä (MW)<tab>Hinta (Eur)<tab>Laitos<tab>Reservi<tab>Aggregointi
20.08.2022 00  10  50  Powerplantgroup1_DUMMY 0    0
20.08.2022 01  10  50  Powerplantgroup1_DUMMY 2    0
20.08.2022 02  10  50  Powerplantgroup1_DUMMY 0    1
20.08.2022 02  10  50  Powerplantgroup1_DUMMY 0    1
20.08.2022 03  50  50  Consumptionplant2_DUMMY    0     0
```

FINGRID

Deleting a regulation bid

- To delete an individual bid, click the recycling bin icon in the data entry table: 🗑

  - The bid is then shown with strikethrough in the table.

  - Save your changes.

- If you need to delete more than one bid, we recommend using the clipboard:

  - Select the time frame from which you want to delete bids.

  - Select clipboard.

  - Clear the clipboard but leave date and hour. If the date and time are not left, no changes will be made to the bid even after saving.

  - Select 'Export to table >>' and save.

FINGRID

mFRR capacity market

Submitting mFRR capacity bid*

- BSPs can enter, modify and delete bids manually in Vaksi Web under the menu:
  - Regulation → mFRR capacity hourly markets → 1 h mFRR capacity bid input

- More information on submitting and updating capacity bids can be found from the mFRR capacity market implementation guide: https://www.fingrid.fi/globalassets/dokumentit/fi/sahkomarkkinat/reservit/implementation-guide-mfrr-capacity-market.pdf

- **Time limits for bidding**
  - Bids must be submitted before 9.30 (EET/EEST) for the next CET day
  - Bids may be submitted for a maximum of 31 days from the time of submitting the bid

FINGRID

Details of mFRR capacity bid*

- Direction (up/down)

- Regulation area (North/Central/South)

- Hour

- Price(€/MW,h), between 0.01 – 10 000 €

- Volume (MW), 1 MW resolution

  - Minimum bid size is 1 MW and maximum bid size is 50 MW

- More information about the details of capacity bids can be found from the mFRR capacity market implementation guide:
  https://www.fingrid.fi/globalassets/dokumentit/fi/sahkomarkkinat/reservit/implementation-guide-mfrr-capacity-market.pdf

* Valid from 30.11.2022

FINGRID

Activation

Activation

- For frequency containment reserve for normal operation (FCR-N), frequency containment reserve for disturbances (FCR-D up & FCR-D down) and fast frequency reserve (FFR), the regulation is autonomous and based on the local frequency measurement.

- Fingrid issues the aFRR activation signal through the ELCOM or ICCP protocol, which requires access to the FEN network.

- In the regulation energy market, Fingrid orders bids electronically or by phone call

  - An electronic order is placed through the Vaksi extranet or an XML message via the ECP bus maintained by ENTSO-E using the MADES data exchange standard (MADES = MArket Data Exchange Standard)

  - For electronic orders, the minimum bid volume is 1 MW. For other orders, the minimum volume is 5 MW

  - An electronic order is required for bids acquired through the regulation capacity market

FINGRID

Undelivered reserve

- The reserve supplier can only participate in the reserve market with available reserve capacity, i.e. in the event of a failure, submitted offers must be edited/deleted.

- If a restriction appears for the reserve supplier at the time of use or for future market time periods (in which the party has binding offers or approved trades), the planned maintenance of the reserve must be carried out at the party's other approved reserve sites.

- If fault limits or completely interrupts the maintenance of the reserve, the Reserve supplier must notify Fingrid without delay in writing to the address reservit@fingrid.fi and Fingrid reserve responsible (information available at Fingrid www-site). The notification must contain information about the party, the reserve object, a description of the reasons for the failure and the estimated start and end of the obstacle.

- In addition, BSP-specific shortfalls in reserve capacity of more than 10 MW or unfeasible mFRR energy offers must be reported to Fingrid's central network center at tasehallinta@fingrid.fi or by phone.

- If the reported disruption in maintenance is determined by Fingrid to be a force majeure (see definition in contract appendix 1), no sanctions will accrue to the Reserve supplier. The reserve supplier must mention separately if some of the sanctions are not on the invoice.

FINGRID

Electronic ordering of regulation energy bids through the Vaksi extranet
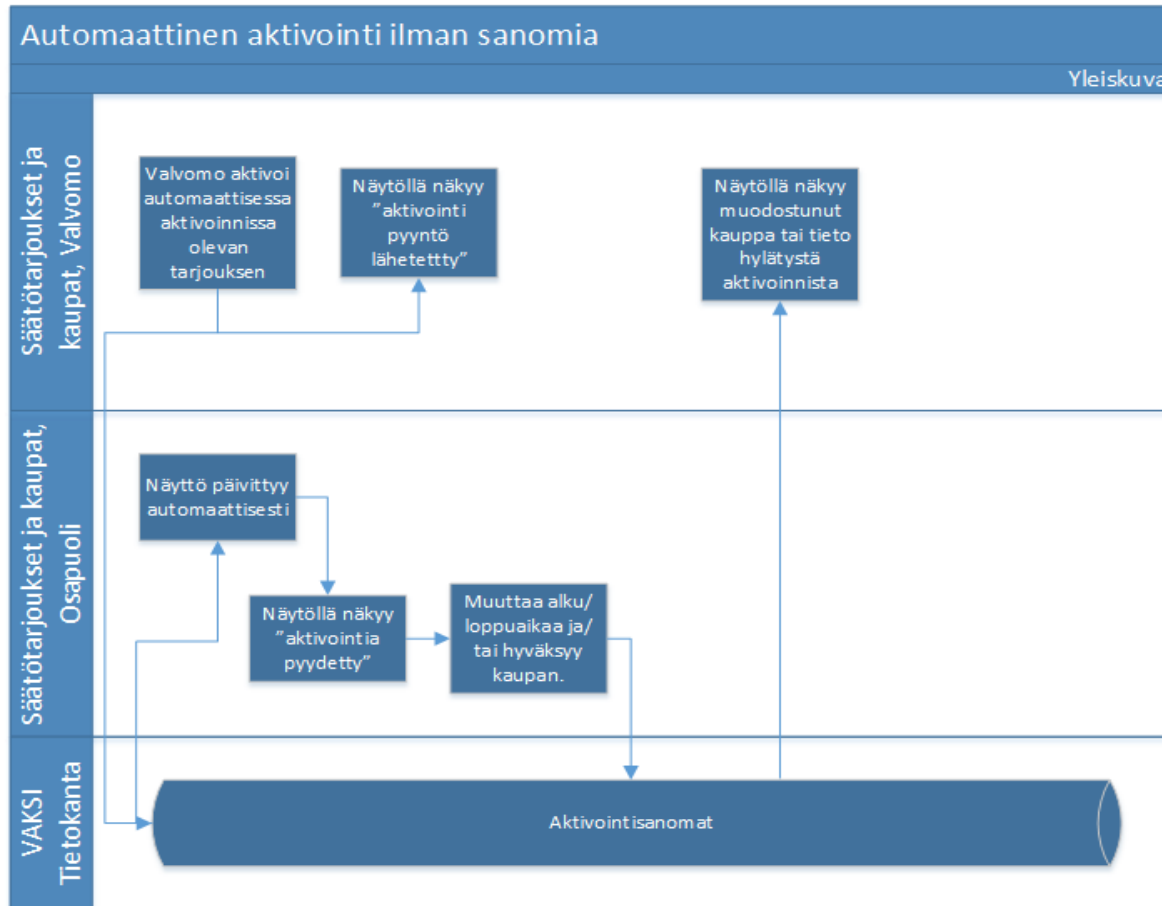
- A market party can see an order in the regulation energy market in the Vaksi system

- The order is accepted on the Vaksi extranet

- It is not possible to create an alert for an order on the Vaksi extranet

- Alerts can be issued to parties as ELCOM messages recorded e.g. in the operation control system or operation support system

FINGRID

Electronic ordering of regulation energy bids using messages
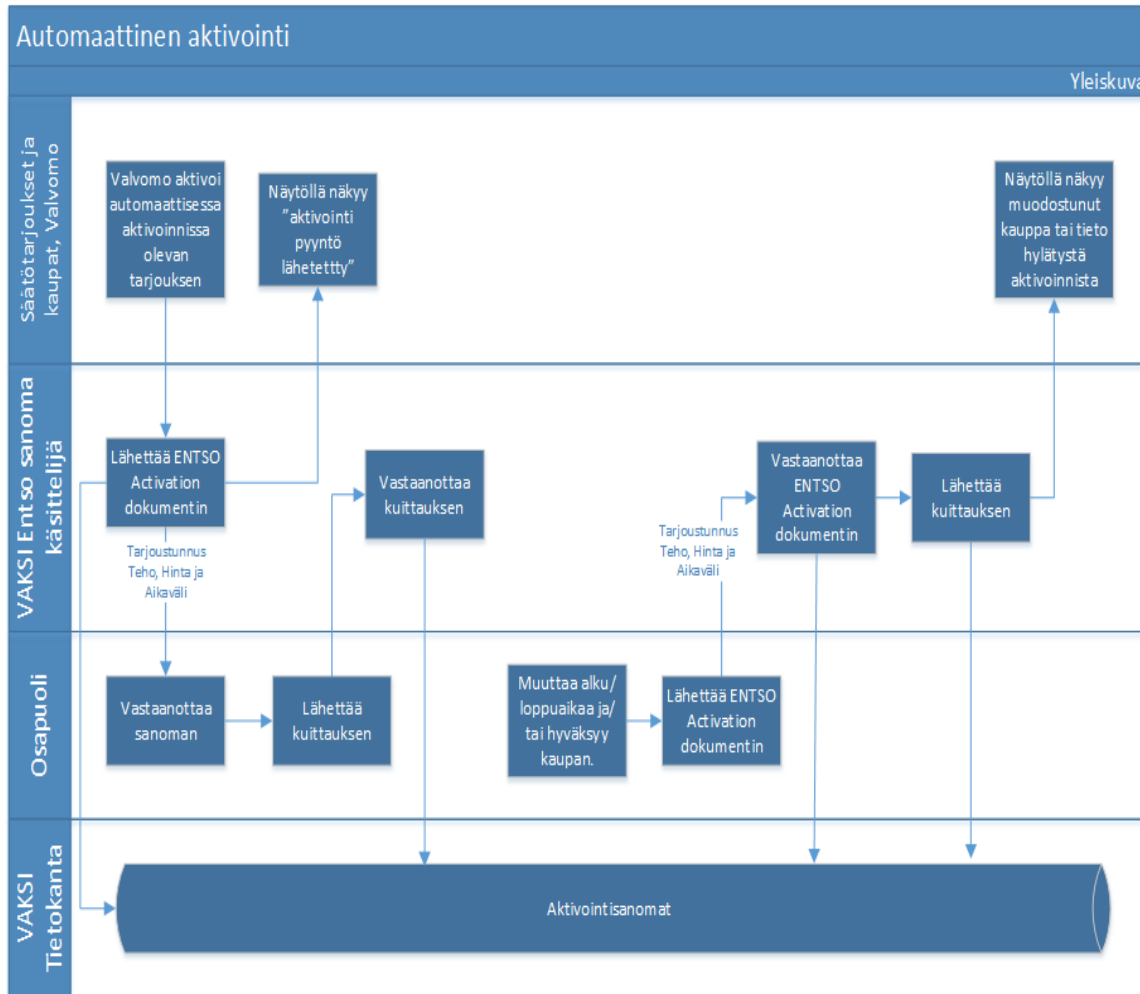
- An order in the regulation energy market is sent to a party as a message (ENTSO-E ERRP activation document)

  - https://eepublicdownloads.entsoe.eu/clean-documents/EDI/Library/cim_based/schema/Historical_activation_document_uml_model_and_schema_v1.1.pdf

- The party's system sends an acknowledgement that the order message has been received

- The party must send a message acknowledging an accepted order

FINGRID

Document	Attribute	Code and description
ERRP Activation Document		**Activation Document**
	Document Identification	Unique identification of the document
	Document Version	Fixed 1
	Document Type	**A36** Deactivation document **A39** SATCR activation **A40** DATCR activation (normal activations based on MOL) **Z15** DATCR activation, move (change) of planned production **A41** Activation response Code **A39** *SATCR activation* is only used in Denmark.
	Process Type	**A29** Secondary reserve process, i.e. FRR-A market **A30** Tertiary reserve process, i.e. Balance regulation market
	Sender Identification	Identification of the party who is sending the document
	Sender Role	**A04** System operator **A27** Resource Provider
	Receiver Identification	Identification of the party who is receiving the schedules
	Receiver Role	**A04** System operator (for the response) **A27** Resource Provider
	Creation Date Time	Date and time for creation of the document
	Activation Time Interval	The beginning and ending date and time of the period covered by the document
	Domain	National area
	Order Identification	Unique identification of the activation order "Activation ID". The same *Activation id* is used in the request and the response.
	Order Identification Version	The version of the activation order. Incremented with one for each transmission of the document from the System Operator. The same version is used in the request and the response.
		Activation Time Series
	Allocation Identification	Reference to relevant bid or an "Move of planned production ID". The "Move of planned production ID" is only used for Document Type **Z15** (DATCR activation, move (change) of planned production)
	Resource Provider	The identification of the Resource Provider related to the contract identification
	Business Type	**A01** Production **A04** Consumption **A12** Secondary control (A time series concerning secondary reserve) (**FRR-A,** earlier **LFC**) **A96** Automatic frequency restoration reserve **A97** Manual frequency restoration reserve
	Acquiring Area	Market Balance Area
	Connecting Area	Market Balance Area (repeated from Acquiring Area)
	Measure Unit	**MAW** MW
	Direction	**A01** Up **A02** Down
	Status	*Only in the request:* **A10** Ordered (The quantities in the time series are to be activated) *Only in the response:* **A07** Activated (*The quantities in the time series have been activated*), i.e. confirmation

		A09 Cancelled (*The tender indicated in the time series has been completely cancelled. In this case the resources are no longer available to all Acquiring System Operators*), i.e. rejection.
	Resource Object	Identification of the resource that is used to supply energy capabilities to the System Operator
		Period
	Time Interval	The start and end date and time of the time interval of the period in question
	Resolution	The time resolution is always the difference between the Time Interval End and the Time Interval Start.
		Interval
	Pos	The position of the observation in a time series – Always 1
	Qty	The quantity for the interval in question
		Reason (Interval Level)
	Reason Code	**Z20** Frequency regulation **Z21** System regulation

```xml
<?xml version="1.0" encoding="UTF-8" standalone="true"?>
<ActivationDocument xmlns="urn:entsoe.eu:wgedi:errp:activatondocument:5:0"
 xmlns:xsd="http://www.w3.org/2001/XMLSchema"
 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <DocumentIdentification v="123456789"/>
    <DocumentVersion v="1"/>
    <DocumentType v="A40"/>
    <ProcessType v="A30"/>
    <SenderIdentification v="FG" codingScheme="NFI"/>
    <SenderRole v="A04"/>
    <ReceiverIdentification v="ASIAKAS" codingScheme="NFI"/>
    <ReceiverRole v="A27"/>
    <CreationDateTime v="2016-02-02T10:59:05Z"/>
    <ActivationTimeInterval v="2016-01-20T13:00Z/2016-01-20T14:00Z"/>
    <Domain v="10YFI-1--------U" codingScheme="A01"/>
    <OrderIdentification v="123456789"/>
    <OrderIdentificationVersion v="1"/>
  - <ActivationTimeSeries>
        <AllocationtIdentification v="98765432"/>
        <ResourceProvider v="LAITOS"/>
        <BusinessType v="A97"/>
        <AcquiringArea v="10YFI-1--------U" codingScheme="A01"/>
        <ConnectingArea v="10YFI-1--------U" codingScheme="A01"/>
        <MeasureUnit v="MAW"/>
        <Direction v="A01"/>
        <Status v="A10"/>
      - <Period>
            <TimeInterval v="2016-01-20T13:00Z/2016-01-20T14:00Z"/>
            <Resolution v="PT1H"/>
          - <Interval>
                <Pos v="1"/>
                <Qty v="20"/>
            </Interval>
        </Period>
    </ActivationTimeSeries>
</ActivationDocument>
```

FINGRID

Reporting and invoicing

Real-time reporting

- Delivery methods: FEN- or KoVa-FEN network (ELCOM, ICCP or IEC 60870-5-104 protocol), web data exchange

  - For aFRR, only ELCOM and ICCP protocol

- Real-time information exchange follows the currently valid Fingrid's <u>real-time information exchange guide</u>.

- A BSP must provide Fingrid a description of the execution of real-time information calculations.

- The required real-time signals for each reserve product can be found in Fingrid's <u>Reserve information exchange –signal list</u>.

FINGRID

FCR real-time reporting

- Required information from each reserve unit:

  - Volume of maintained reserve (MW), separately for FCR-N, FCR-D up and FCR-D down

- Additionally, for Limited Energy Reservoir's (LER):

  - Remaining activation capability (min), separately for FCR-N, FCR-D up and FCR-D down

  - Normal state energy management (NEM) status (on = 1, off = 0)

  - Alert state energy management (AEM) status (on = 1, off = 0)

- The volume of maintained reserve is reported to the nearest 0,01 MW for reserve units in measurement category A* and to the nearest 0,1 MW for other reserve units

- The update interval must be 60 seconds at most

* Rated power of the measured unit < 1,5 MW

FINGRID

FCR real-time reporting

- The volume maintained shall describe the actual available volume of a reserve. Activation of a reserve must not reduce the volume of the reserve maintained.

- The remaining activation capability of a reserve expresses how long the reserve could be fully and continuously activated with the energy currently available.

  - The reported activation capability of FCR-N is the minimum of the upwards and downwrads endurance.

- More information and the calculation formulas: Technical Requirements for Frequency Containment Reserve Provision in the Nordic Synchronous Area

FINGRID

FFR real-time reporting

- Required information from each reserve unit:

  - Volume of maintained reserve (MW)

- Describes the current actual volume of the FFR maintained. Activation of the reserve must not reduce the volume of the reserve maintained.

  - More information and the calculation formulas: The technical requirements and the prequalification process of Fast Frequency Reserve (FFR)

- The volume of maintained reserve is reported to the nearest 0,01 MW for reserve units in measurement category A* and to the nearest 0,1 MW for other reserve units

- The update interval must be 60 seconds at most

* Rated power of the measured unit < 1,5 MW

FINGRID

aFRR real-time reporting

- Required information from each reserve unit:

  - Volume of maintained reserve, separately for up and down regulation (MW)

  - Momentary active power (MW)

  - Amount of activated reserve (MW)

  - Retransmission of the activation signal sent by Fingrid

- Volume of maintained reserve describes the current actual volume of the maintained aFRR. Activation of the reserve must not reduce the volume of the reserve maintained.

- The volume of maintained reserve, momentary active power and the amount of activated reserve are reported to the nearest 0,1 MW.

- The update interval must be 10 seconds at most

FINGRID

mFRR real-time reporting

- Required information from each reserve unit:

  - Active power measurement (MW) or other real-time data that enables Fingrid to verify the activation of the reserve

- The active power is reported to the nearest 0,1 MW.

- The update interval must be 60 seconds at most

FINGRID

Reporting of FCR hourly market transactions

- The actual FCR hourly market transactions can be seen in Vaksi in the Reserve bids menu under 'Search for hourly market bids and transactions' (*Tuntimarkkinatarjousten ja kauppojen haku*). The tree menu on the home page also contains an Excel report where the transactions and bids are presented as hourly time series divided into production and consumption.

- Fingrid also reports the actual transactions to the providers electronically using EDI and DELFOR messaging the night before.

  - Prices of frequency containment reserve for normal operation and frequency containment reserve for disturbances separately, and a provider's bid that has been accepted

  - On request, data for production and consumption transactions can be delivered separately

  - Naming: PH/PF_RESTRANSACTIONS_PARTY_MW/PRICE (**FCR-N/FCR-D up**)

  - Naming: FCRD_DOWN_SALE_PARTY_MW/PRICE (**FCR-D down**)

  - Timing: 22:05, 22:20, 23:05, 23:45

- If the balancing service provider has sent the bids in XML format, Fingrid will also report the transactions in XML format. In the future, this reporting will replace EDI reporting completely.
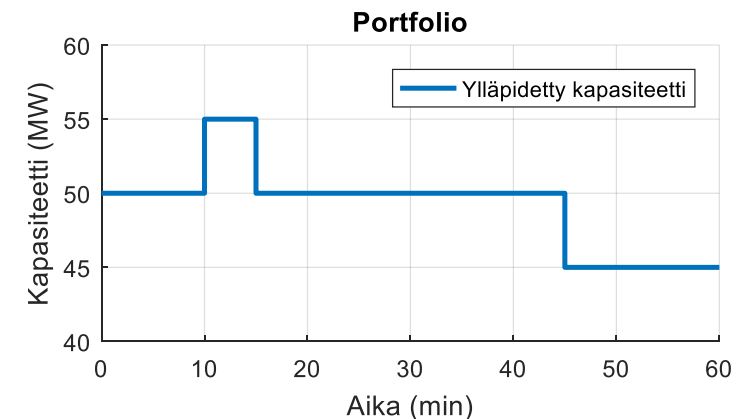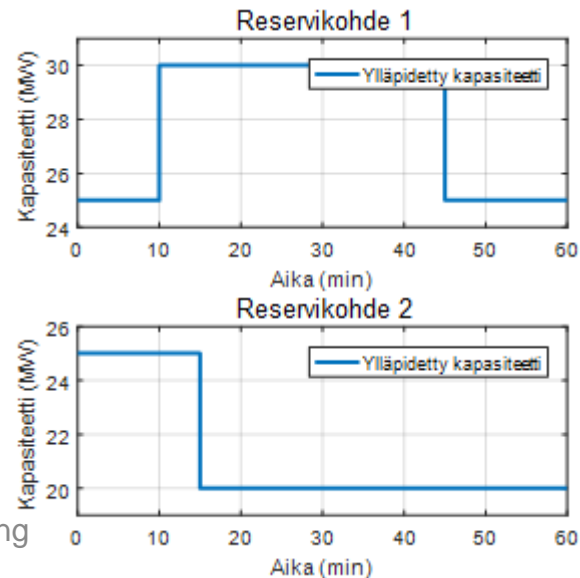
FINGRID

Reporting of FFR transactions

- Actual FFR transactions can be seen under 'Search FFR bids and transactions' (*FFR tarjousten ja kauppojen haku*) in the Reserves/FFR menu on Vaksi

- Fingrid also reports the actual transactions to the providers electronically using EDI and DELFOR messaging the night before.

  - FFR marginal price, accepted volume, volumes from combined bids

  - Naming: FI_FFR_PRICE_EUR; FFR_SUM_PARTY_MW; FFR_yearlyFCRD_PARTY_MW

  - Timing: 22:05, 22:20, 23:05, 23:45

- If the balancing service provider has sent the bids in XML format, Fingrid will also report the transactions in XML format.

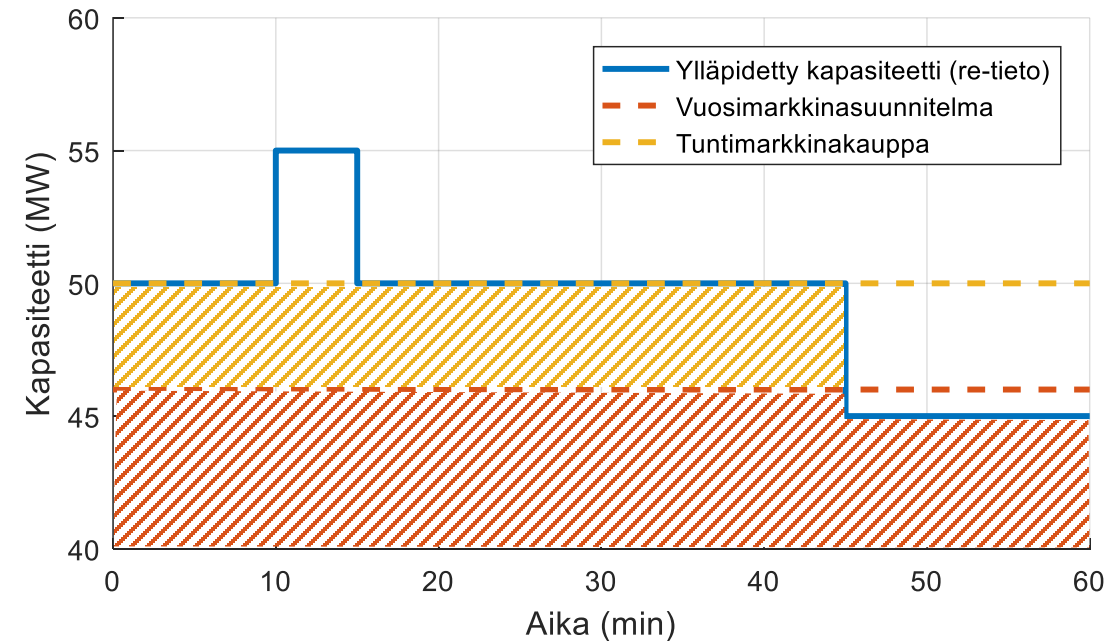**FINGRID**

Reserve invoicing based on real-time data

- The input data is unit-specific real-time data of a balancing service provider's maintained volume of FCR-N, FCR-D up, FCR-D down, FFR, aFRR up and aFRR down capacity. Maintained volumes of FCR-N, FCR-D, FFR and aFRR are calculated separately according to the same principle

  - 1-minute averages are calculated using real-time data, on which later calculations are based

  - 1-minute averages of reserve units in the same portfolio are added together
    → This yields the maintained portfolio-specific reserve capacity

Maintained reserve capacity may vary over time depending the operation of the unit!

FINGRID

Calculation principle of yearly and hourly market capacity to be used in invoicing

- Trading period-specific reserve capacity to be used in invoicing:
  Yearly market capacity:
  Red area / 60 min.

  Hourly market capacity:
  Yellow area / 60 min.

- Billing reviews are based on minute data, which is used to determine the hourly sum

- Sanctions are calculated on the basis of undelivered reserve capacity

FINGRID

Reporting and invoicing data of aFRR transactions

- Actual aFFR hourly market transactions can be seen on <u>NMMS platform</u> and under 'Search FFR-A bids and transactions' (*FFR-A tarjousten ja kauppojen haku*) in the Reserve bids menu on Vaksi.

- Fingrid also reports the actual transactions (MW) and the average prices of actual transactions (EUR/MW,h) separately for upward balancing capacity and downward balancing capacity for a day of the CET time zone, using EDI in DELFOR messaging.

- Ylläpitämättömän kapasiteetin osalta Reservitoimittaja maksaa Fingridille sanktiota.

- Balancing service provider shall pay a sanction to Fingrid for reserves that are not provided

- Balancing Service Provider shall send the invoice for the maintenance of the previous month's reserves to Fingrid on the tenth day of each month or the first working day following that date

FINGRID

Reporting of regulation bids and transactions

- The page 'Submitting regulation bids' (*Säätötarjousten syöttö*) shows the bids entered for a specific time period.

- Transactions and bids can be viewed on the 'Reporting of regulation bids and transactions' page using different search criteria.

- The tree menu on the home page also contains an Excel report, in which transactions and bids are shown as hourly time series divided into production and consumption.

FINGRID

Reporting of regulation capacity market results

- The results of the regulation capacity market will be reported in Vaksi:

  - Regulation → mFRR capacity hourly markets → 1 h mFRR capacity sale report

- It is also possible to report the result using a DELFOR message

  - Messages are sent daily after the procurement has been made

  - The message includes the capacity and marginal price of the party's accepted bids

  - The total procurement volume and the marginal price of the hour are also published on Fingrid's website and Open Data platform and on the ENTSO-E transparency platform

FINGRID

Reserve energy

FCR-N

- Fingrid reports the volume (MWh) of R energy electronically to the balance responsible party and, upon request, to the balancing service provider using EDI in MSCONS messaging

- The message includes the volume of reserve energy broken down by the parties and the change in time deviation

aFRR

- Fingrid reports the volume (MWh) of reserve energy electronically to the balance responsible party and, upon request, to the balancing service provider using EDI in MSCONS messaging. Reserve energy is reported separately for upward balancing and downward balancing

mFRR

- Actual regulation transactions and special regulation transactions as well as their prices are reported upon request

FINGRID

Invoicing

Invoicing

- Energy fees of the reserves are taken into account in conjunction with the imbalance power billing in the reserve object's balance responsible party's imbalance settlement. Balancing service provider shall invoice Fingrid according to the sold reserve capacity. The invoice shall include the following information:

  - Electronic invoicing primarily, billing addresses are available from: https://www.fingrid.fi/en/pages/contacts/billing-addresses/

  - Reference Fingrid's contact person, Reserves: Kim Nyyssönen

  - Invoice rows should include information about the service or product, what is sold (reserve product), amount (separately for not delivered amount), unit price, price without VAT, VAT amount, and price including VAT per row.

  - Invoicing period

  - The billing company's information: Official name, business ID, VAT ID, and payment address information.

FINGRID

History data

FCR and FFR history data

- Balancing Service Provider shall store history data for at least 14 days.

- Fingrid requests history data via email, and providers can appoint several contact persons for history data requests

- The data must be delivered as reserve unit-specific .csv files in a format specified by Fingrid (see next slide) after five work days from the request at the latest

- The file to be sent should be named in the format:

  [Date]_[Area]_[Resource]_[Interval]_[Timezone].csv, where

  [Date] is date at which the data is written to the file, format YYYYMMDD, e.g. 20180916
  [Area] is the area, where the reserve object is located, in Finland FI
  [Resource] is the name of the reserve object as it is written in the Restore-system
  [Interval] is the time period from which the history data is being delivered, format *YYYYMMDDThhmm-YYYYMMDDThhmm*, e.g. *20180914T0935-20180914T0935* (according to standard ISO 8601)
  [Timezone] is the time zone of the data,e.g. CET or UTC

FINGRID

FCR and FFR history data

- Format of the file to be delivered

  - The file must contain a title line and the corresponding value lines

  - The character encoding standard to be used is ASCII, fields must be separated by a semicolon (;), the decimal separator is comma (,) and the line break is ASCII/CRLF

  - Date and time must be presented in the format YYYYMMDDThhmmss.nnn in accordance with the ISO 8601 standard, where 'nnn' represents fractions of second

- The power (MW) and frequency (Hz) must be presented to three decimal places without units, for example 150,300 and 50,000

- Status information (on/off) must be reported as binary (0 = off, 1 = on)

- Sign rule for instantaneous active power: net consumption negative (-), net generation positive (+)

- The data save interval for FCR must be at least 1 second and for FFR at least 0,1 seconds

- Example of contents for FFR:

  DateTime,FfrCap,InsAcPow,GridFreq,ContSetP,ContMode,ContOutSig,inLimFfr
  20180914T093502.000;10,000;10,000;50,000;10,000;FFR1;0,000;0
  20180914T093503.000;10,100;10,100;49,990;10,100;FFR1;0,000;0

FINGRID

Required FCR history data:

Name	Description	Unit
InsAcPow	Instantaneous active power	MW
GridFreq	Grid frequency	Hz
Baseline	Power setting, calculated baseline	MW
Cap_Fcrn Cap_FcrdUp Cap_FcrdDo	Reserve capacity maintained	MW
Pmax	Maximum power of the Reserve Unit	MW
Pmin	Minimum power of the Reserve Unit	MW
ContStatus_Fcrn ContStatus_FcrdUp ContStatus_FcrdDo	Controller status	on/off
RegStr_Fcrn RegStr_FcrdUp RegStr_FcrdDo	Balancing power	MW/Hz
Endurance_Fcrn Endurance_FcrdUp Endurance_FcrdDo	Activation endurance*	min
NEM	Normal state energy management (NEM) status*	on/off
AEM	Alert State Energy Management (AEM) status*	on/off
Act_Fcrn Act_FcrdUp Act_FcrdDo	Activated reserve (calculated)	MW

Required FFR history data:

Name	Description	Unit
InsAcPow	Instantaneous active power	MW
GridFreq	Grid frequency	Hz
Cap_Ffr	Reserve capacity maintained	MW
ContSetP	Controller set value	MW
ContOutSig	Controller output (optional)	MW
ContMode	Controller mode	Character string
inLimFfr	Indicator of potential activation limitations (optional)	on/off

* For Limited Energy Reservoirs (LER) only

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