Autumn
2022

Wind power in the reserve markets

Opportunities for wind power in the reserve markets

FINGRID

Why should wind power producers join the reserve market?

- The full capability for flexibility is required to see through the energy transition cost-effectively while maintaining the current high standard of power system security
- For wind power producers, this is reflected in reasonable balance management costs and increasing earning opportunities
- Finnish balancing markets provide access to Nordic and European marketplaces

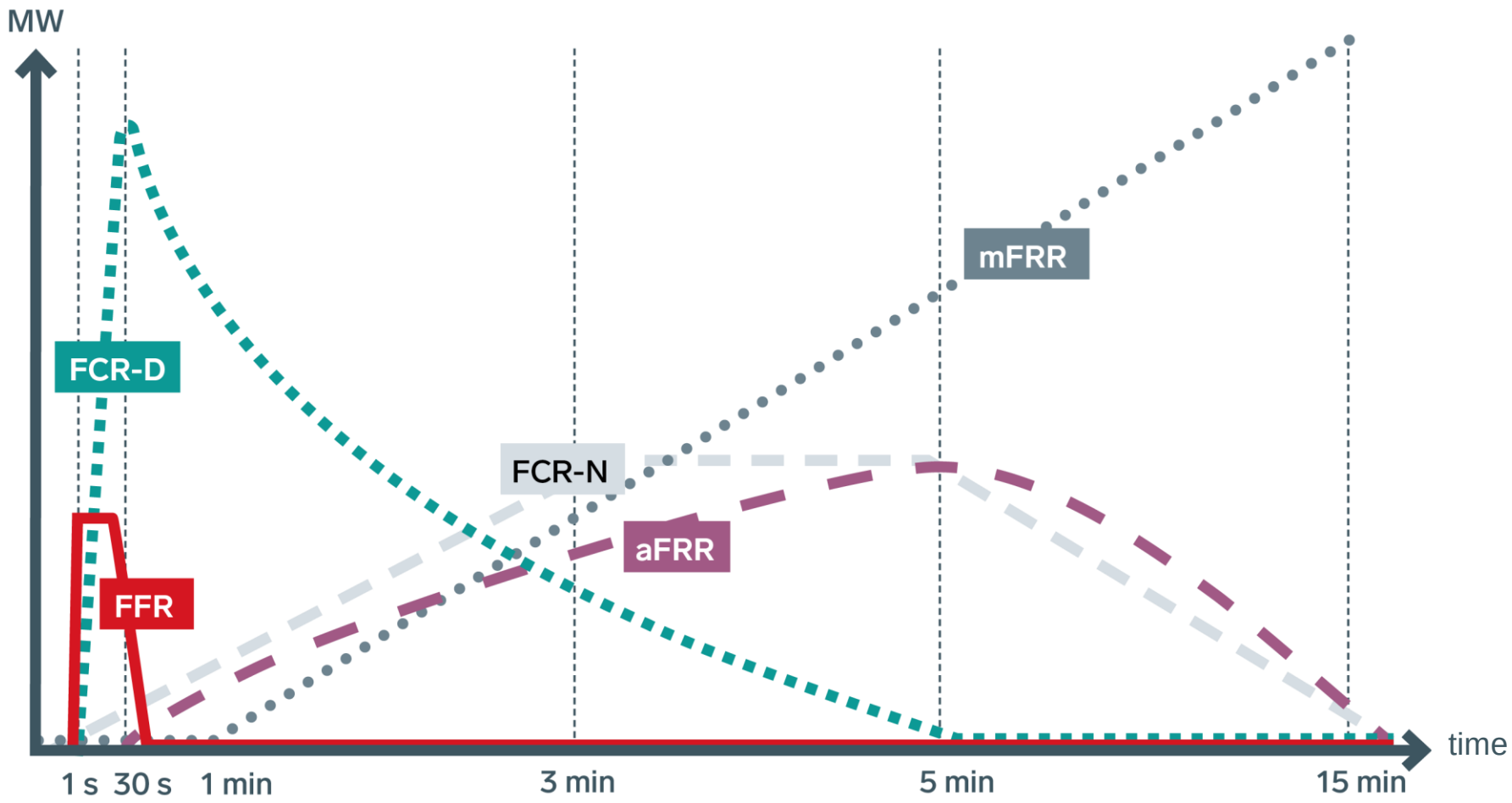
Balancing electricity production and consumption

The production of electricity must match consumption at all times.

Market parties seek to balance their electricity consumption and production in advance in the electricity market.

As the party with system responsibility, Fingrid balances electricity consumption and production in real time by purchasing reserve products in the balancing markets.

How reserve products work in principle



Reserve capacity and energy markets

Capacity market

Market place for reserve capacity

- The balancing service provider maintains reserves in an amount equal to the accepted bids
- In return for maintaining reserves, the supplier is paid a capacity fee in accordance with market result as compensation for making the reserve available
- Depending on the reserve product, the supplier may be paid a fee for activating the reserve on the basis of the energy market or the price of imbalance power. In some cases, no fee is paid.

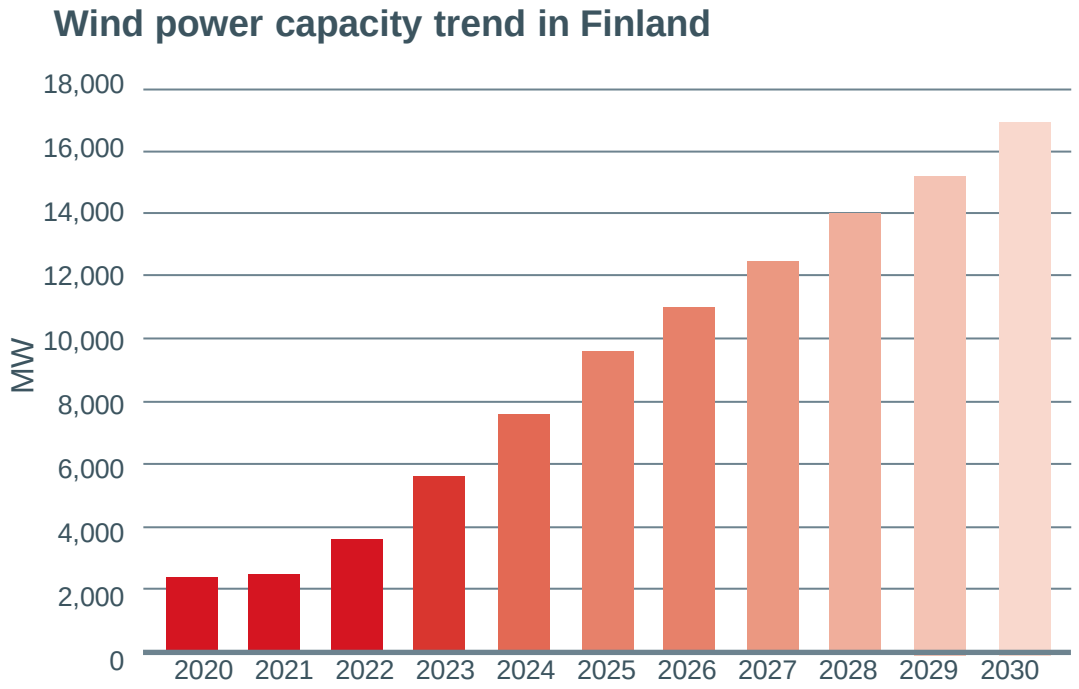
Energy market

Market place for activation of reserves

- The balancing service provider is obliged to submit energy bids in at least the same amount as the accepted bids in the capacity market
- Suppliers do not need to operate in the capacity market in order to submit bids in the energy market
- The supplier is paid an energy fee in accordance with market result when the reserve is activated. This is a compensation for using the reserve.

Finnish power system in a state of transition

- The amount of weather-dependent electricity production is increasing substantially, but new flexible capacity is lagging behind
- More flexibility is needed from both electricity production and consumption
- The energy revolution is increasing the need for reserves in the power system
- At the same time, this opens the door to new business opportunities for operators in the sector
- So far, wind power producers have had little involvement in the balancing markets



Technically, wind power has balancing capability

- Wind power has technically strong balancing capabilities, with potential response times as low as some seconds
- If it is windy, wind turbines can be down-regulated, limiting their power output
- Wind power can also be up-regulated if the power output has been limited in advance, meaning that some of the production is saved to allow for the output to be raised
- Good production forecasts are the basis for joining the reserve market

Reserve products suited to wind power

Reserve product		Activation time	Volume-weighted average price 2021 * (EUR/MWh)	Without limiting the power output	By limiting the power output
FFR	Fast Frequency Reserve	1 second	45.4	●	●
FCR-D up	Frequency containment reserve for disturbances, up-regulation product	< 10 seconds	12.6**		●
FCR-D down	Frequency containment reserve for disturbances, down-regulation product	10 seconds	31.5**	●	●
FCR-N	Frequency containment reserve for normal operation	3 minutes	21.9**		●
aFRR up	Automatic frequency restoration reserve, up-regulation product	5 minutes	38.9		●
aFRR down	Automatic frequency restoration reserve, down-regulation product	5 minutes	44.5	●	●
mFRR up	Manual frequency restoration reserve, up-regulation product	15 minutes	2.3		●
mFRR down	Manual frequency restoration reserve, down-regulation product	15 minutes	-***	●	●

* Price of the FCR-D down-regulation product, January–September 2022 ** Price in the hourly market *** Purchases of mFRR down-regulation capacity to begin in January 2023

Down-regulation of wind power in the balancing market (mFRR)

1. Balancing energy market

- The balancing energy market is a continuous marketplace where Fingrid accepts the balancing bids required to keep the power system in balance at all times
- Up-regulation (increasing production) and down-regulation (reducing production) are offered separately
- The activation time for balancing products is 15 minutes
- Balancing energy bids can be made 45 minutes before each hour
- All activated balancing bids are priced according to the most expensive balancing bid accepted

2. Balancing capacity market

- Balancing service providers in the balancing capacity market undertake to submit balancing bids to the balancing energy market during the preceding morning
- The balancing service provider is paid a capacity fee irrespective of whether the balancing energy bid is used
- Balancing energy bids can be priced freely, and the prices do not affect trading in the capacity market

CASE:

mFRR DOWN

- EUR 400,000 per year
- 50 MW of balancing capacity in the market
- 4,000 hours per year
- Example price: EUR 2/MWh
- Energy fee for activations in addition to this

Down-regulation of wind power in the frequency containment reserve for disturbances (FCR-D)

- The frequency containment reserve for disturbances is used to manage power system disturbances, and there are separate products for under-frequency disturbances (the up-regulation product) and over-frequency disturbances (the down-regulation product)
- It is activated automatically in response to the frequency of the power system
- Activation time < 10 s
- Activation duration: short
- FCR-D down-regulation for wind power means an automatic momentary reduction in output in the event of an over-frequency disturbance in the power system, and the energy impact of activation is small

CASE:

FCR-D DOWN

- EUR 5,300,000 per year
- 50 MW in the hourly market
- 4,000 hours per year
- Average price, January–July 2022: EUR 26/MWh

Down-regulation of wind power in the automatic frequency restoration reserve (aFRR)

- The automatic Frequency Restoration Reserve (aFRR) is activated automatically based on an activation signal sent by Fingrid every 10 seconds
- The full activation time is 5 minutes
- Fingrid purchases aFRR in the capacity market. Finland will be joining to the European wide energy market for aFRR (PICASSO) in 2024.

CASE:

aFRR DOWN

- EUR 20,500,000 per year
- 50 MW in the hourly market
- 4,000 hours per year
- Average price, January–July 2022: EUR 103/MWh
- Energy fee for activations in addition to this

Up-regulation of wind power in the automatic frequency restoration reserve (aFRR)

- When it is windy and the spot price is low, it may be worth limiting wind power output and offering part of the power in the reserve market as up-regulation capacity, e.g., to the aFRR
- All reserve products have a separate up-regulation product, except the frequency containment reserve for normal operation (FCR-N), which is symmetrical, meaning that it must be capable of both up- and down-regulation

CASE:

aFRR UP

- EUR 17,000,000 per year
- 50 MW in the hourly market
- 4,000 hours per year
- Average price, January–July 2022: EUR 85/MWh
- Energy fee for activations in addition to this

What is required to participate in the reserve markets?

1. Technical implementation
2. A prequalification test to determine the technical balancing capability together with Fingrid
3. Information exchange – partly real-time data transfer
4. Control centre operations, at least in the balancing power market
5. An agreement – the standard templates are available in the Fingrid website provides
6. Daily trading
   Possibile through service providers

https://www.fingrid.fi/en/electricity-market/reserves_and_balancing/

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