



Spring 2024



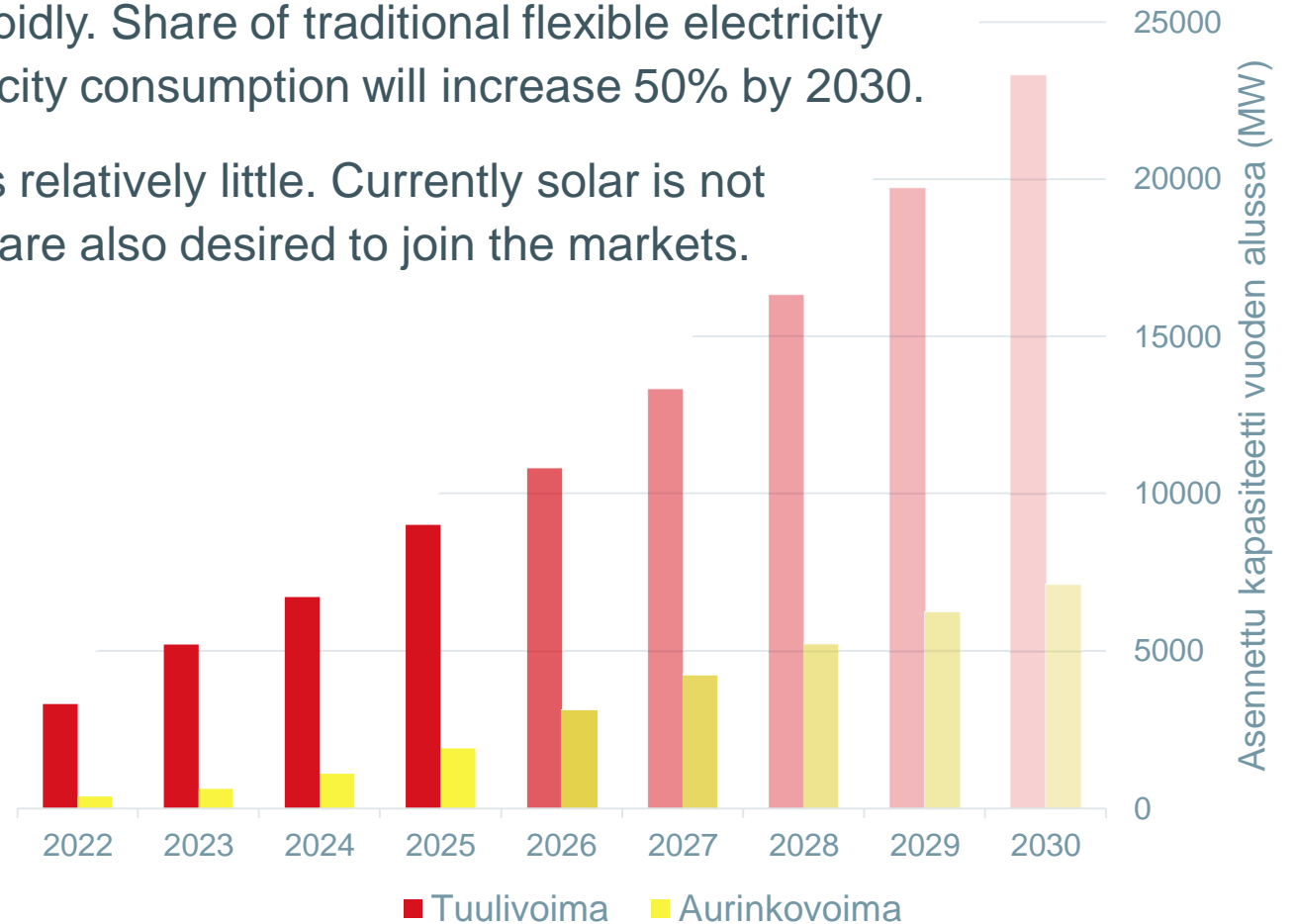
# Reserves and reserve markets

Basic Concepts

**FINGRID**

# Energy transition is ongoing

- Wind and Solar production is increasing rapidly. Share of traditional flexible electricity generation in the grid is decreasing. Electricity consumption will increase 50% by 2030.
- Wind is participating in the reserve markets relatively little. Currently solar is not participating at all. New consumption units are also desired to join the markets.
- Utilizing flexibility will contain grid fees, balancing costs, and creates additional revenue streams.



# Balancing electricity production and consumption

- Electricity must be always produced and consumed equal amounts.
- Market participants try to balance their electricity consumption and production in the electricity markets (Day-Ahead and Intraday)
- Fingrid as a system operator balances the system in real time with the reserve products that are procured from the reserve markets.



# Reserves in general



- There are both manual and automatic reserves – five different reserve products that can regulate the balance both directions
- Faster automatic reserves activate automatically based on the grid frequency or by a signal sent by Fingrid.
  - Frequency-controlled reserves respond to sudden changes in the grid
- Manual reserve products are activated by the order of Fingrid's Balance Management
- Manual and signal activated reserves free faster frequency-controlled reserves to be used again

# Reserve markets

- Fingrid procures reserves market based. **Fingrid creates the demand, and the market participants create the supply. Competition promotes efficiency.**
  - Reserve markets are marginally priced: the most expensive accepted bid determines the price for all volume
  - The one with lowest cost of providing the reserves gains the most profit
- Capacity and Energy markets
  - On the **Capacity Markets** the reserve provider upkeep reserve capacity the amount they have sold. The compensation is settled based on the capacity. Some products also have an energy activation compensation.
  - On the **Energy Markets** reserves are activated. The compensation is settled based on the activated energy.
- Access to Nordic and European reserve markets

# Reserve products

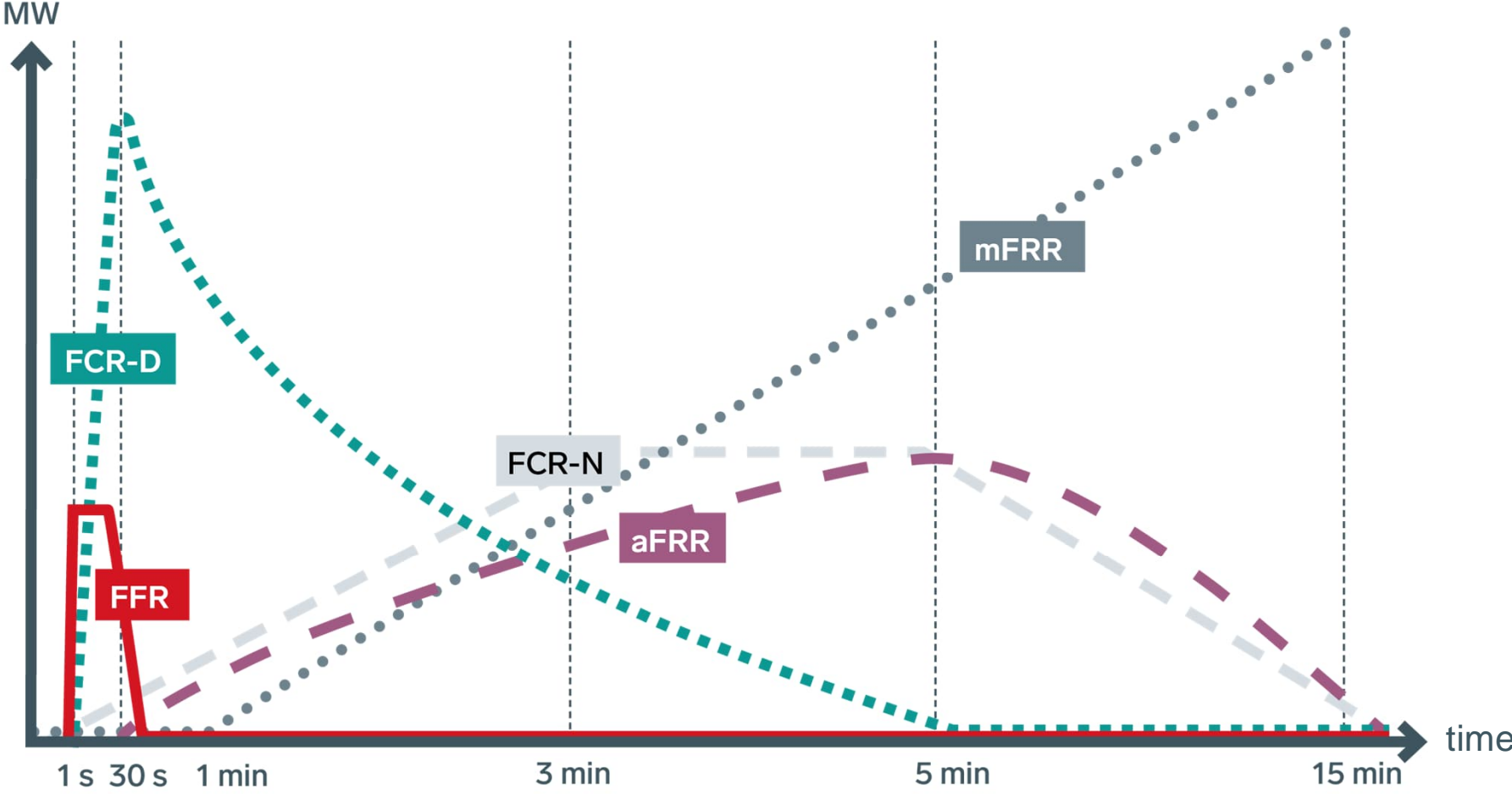
## Additional revenue streams

	Reserve product	Activation time	Activation capability	Fingrid's obligation 2024	Prices 2023	Minimum bid size
<b>Hz</b>	FFR Fast Frequency Reserve	1 s	5 - 30 s	0 – 60 MW	47 €/MW	1 MW
	FCR-D up Frequency Containment Reserve for Disturbances, Up Regulation	<10 s	1 h**	295 MW	12 €/MW	1 MW
	FCR-D down Frequency Containment Reserve for Disturbances, Down Regulation	<10 s	1 h**	240 MW	14 €/MW	1 MW
	FCR-N Frequency Containment Reserve for Normal Operation	3 min	1 h	122 MW	36 €/MW	0,1 MW
	aFRR up Automatic Frequency Restoration Reserve, Up Regulation	5 min	1 h	46 – 62 MW	42 €/MW	1 MW
	aFRR down Automatic Frequency Restoration Reserve, Down Regulation	5 min	1 h	46 – 62 MW	30 €/MW	1 MW
	mFRR up Manual Frequency Restoration Reserve, Up Regulation	15 min	1 h	880 – 1300 MW	24 €/MW	1 MW
	mFRR down Manual Frequency Restoration Reserve, Down Regulation	15 min	1 h	300 – 350 MW	18 €/MW	1 MW

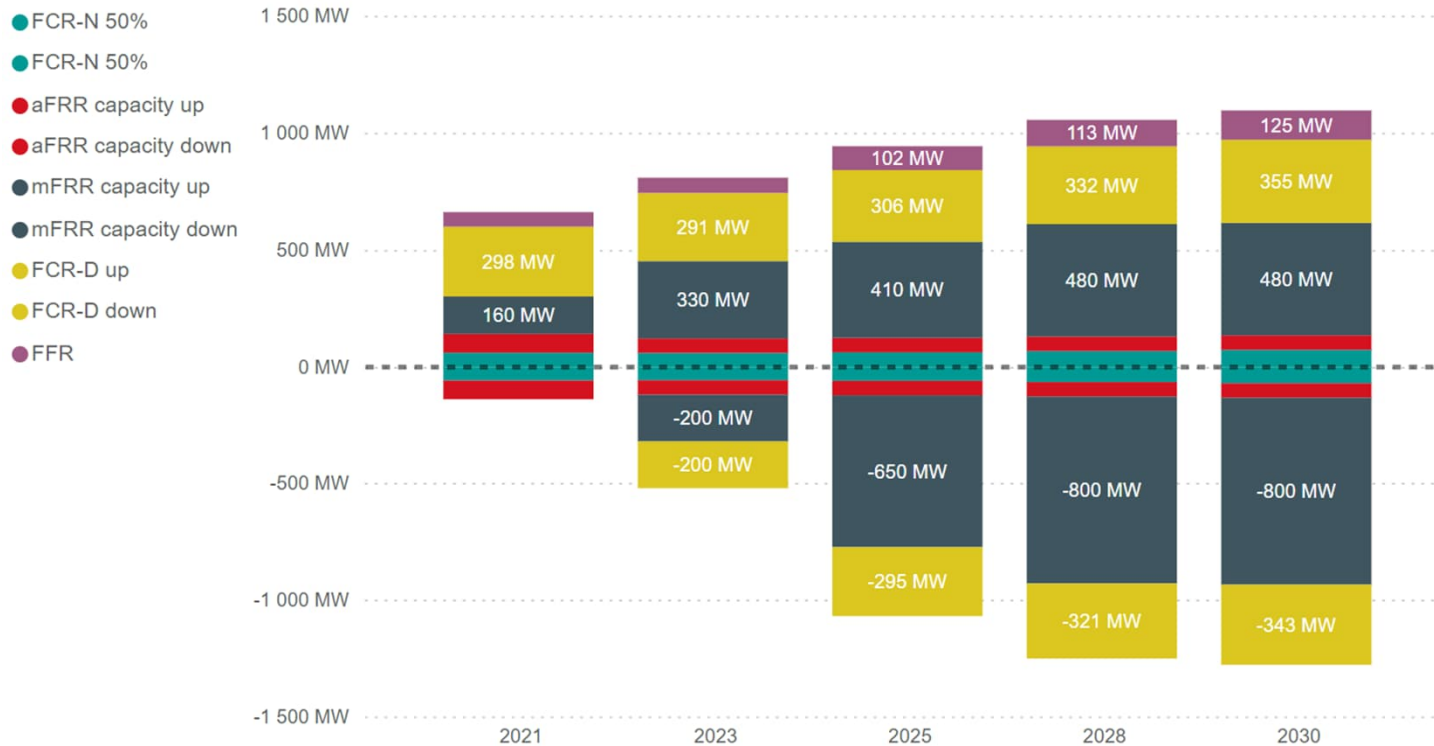
\* Volume weighted average price for the reserves procured from Finland

\*\* For Limited Energy Resources (LER) 20 min

# Activation principles of reserve products



# Reserve procurement is forecasted to increase



- **800 MW → 2000+ MW for each hour**
- mFRR capacity is used in preparation of dimensioning fault
- FCR-D down procurement continues to grow
- The need of FFR increases during hours of low inertia
- **Additionally, energy activations are predicted to increase**



# What is required to participate in the reserve markets?

- 1** **Technical implementation** – asset regulation capabilities and automation
- 2** Asset **prequalification test** together with Fingrid (automatic reserves)
- 3** **Information exchange**, partly real time data transfer
- 4** **Control room**, particularly for mFRR energy market
- 5** **Signing the reserve contract**, standard contracts on Fingrid web site
- 6** **Daily trading**. Possible to use service a provider

More information:

[https://www.fingrid.fi/en/electricity-market/reserves\\_and\\_balancing/](https://www.fingrid.fi/en/electricity-market/reserves_and_balancing/)

# Summary

- Flexible production and consumption can provide reserves. Wind and solar production and consumption is needed in the reserve markets.
- Utilizing flexibility curbs TSO fees and balancing costs. Participation enables earning opportunities.
- **Consider Reserve capabilities already during investment phase**
  1. Remote control capabilities
  2. SCADA connection and real time data exchange
  3. All operative contracts to include reserve use

# More information on Fingrid web site

## Contact us!

- About reserves
    - [https://www.fingrid.fi/en/electricity-market/reserves\\_and\\_balancing/](https://www.fingrid.fi/en/electricity-market/reserves_and_balancing/)
  - Fast Frequency Reserve (FFR)
    - [https://www.fingrid.fi/en/electricity-market/reserves\\_and\\_balancing/fast-frequency-reserve/](https://www.fingrid.fi/en/electricity-market/reserves_and_balancing/fast-frequency-reserve/)
  - Frequency containment reserves (FCR)
    - [https://www.fingrid.fi/en/electricity-market/reserves\\_and\\_balancing/frequency-containment-reserves/](https://www.fingrid.fi/en/electricity-market/reserves_and_balancing/frequency-containment-reserves/)
  - Automatic frequency restoration reserve (aFRR)
    - [https://www.fingrid.fi/en/electricity-market/reserves\\_and\\_balancing/automatic-frequency-restoration-reserve/](https://www.fingrid.fi/en/electricity-market/reserves_and_balancing/automatic-frequency-restoration-reserve/)
  - Balancing energy and balancing capacity markets (mFRR)
    - [https://www.fingrid.fi/en/electricity-market/reserves\\_and\\_balancing/balancing-energy-and-balancing-capacity-markets/](https://www.fingrid.fi/en/electricity-market/reserves_and_balancing/balancing-energy-and-balancing-capacity-markets/)
  - Reserve Trading and Information Exchange
    - [https://www.fingrid.fi/en/electricity-market/reserves\\_and\\_balancing/reserve-trading-and-information-exchange/](https://www.fingrid.fi/en/electricity-market/reserves_and_balancing/reserve-trading-and-information-exchange/)
  - Market data
    - <https://www.fingrid.fi/en/electricity-market-information/reserve-market-information/>
    - <https://data.fingrid.fi/>
- ✓ Reserve product pages contain market introductions and standard contracts

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