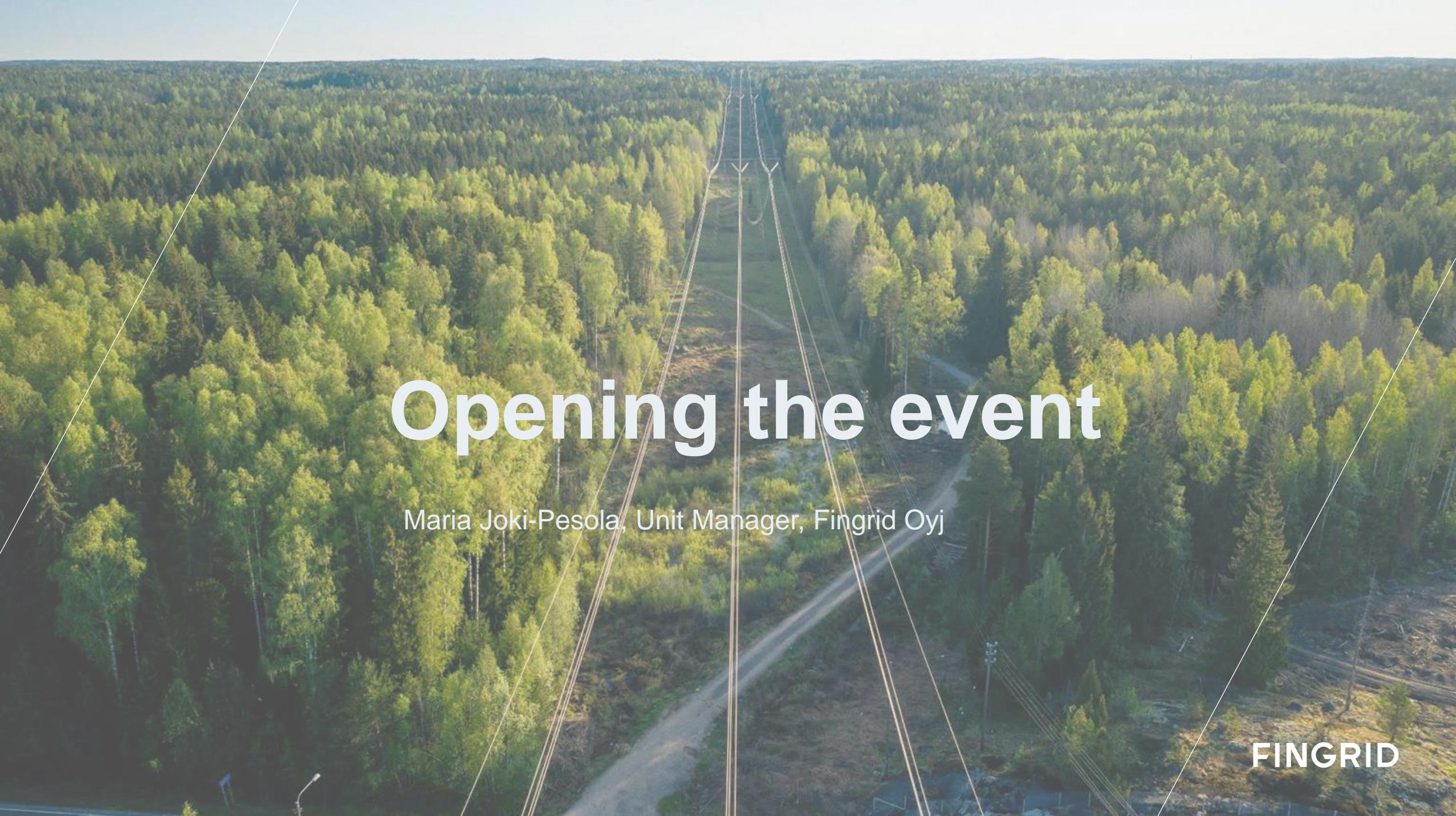


Reserve market day

Thursday 8 June 2023, 9 am–4 pm

Helsinki, Pasila, Tripla



An aerial photograph of a dense forest with a tall power line tower in the center. The tower is supported by several cables that stretch across the forest floor. The trees are a mix of green and brown, suggesting a late summer or autumn setting. The sky is clear and blue.

Opening the event

Maria Joki-Pesola, Unit Manager, Fingrid Oyj

FINGRID



	Rapid frequency reserve, Finland 18%, Nordic region total 0–300 MW (estimate)	Frequency Containment Reserve for Disturbances, Finland ~300 MW, Nordic region total 1,450 MW (up) and 1,400 MW (down)	Frequency Containment Reserve for Normal Operation, Finland ~120 MW, Nordic region total 600 MW	Automatic Frequency Restoration Reserve Finland ~40–60 MW, Nordic region total 300–400 MW	Balancing power and balancing capacity markets, Reference incident + imbalances of balance responsible parties
Activation	In the event of major frequency deviations, purchased in low inertia situations	In the event of larger frequency deviations, up- and down-regulation separately	In use constantly	Used in certain hours	If required

Speed

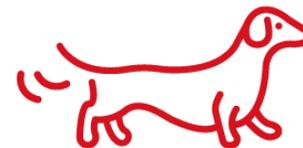
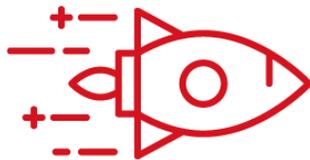
In a second

In few seconds

In three minutes

In five minutes

In 15 minutes



Meet the reserve market customer team



Jukka Kakkonen



Taneli Leiskamo



Tuomas Mattila



Mikko Haapamäki

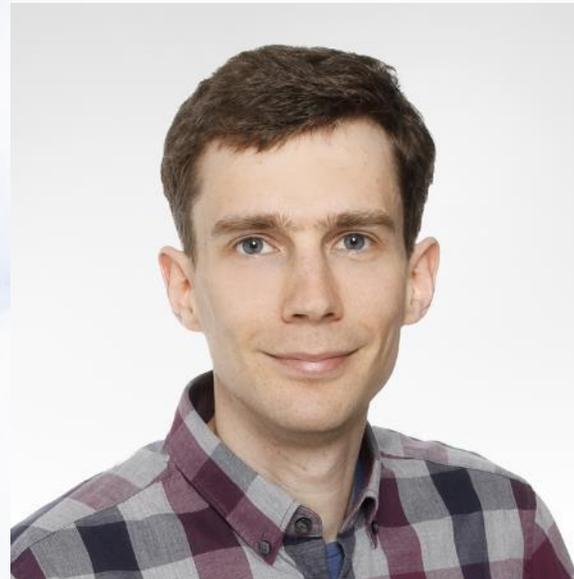
Product-specific and technical expertise



Taneli Leiskamo
FCR and FFR



Otso-Ville Rinne
mFRR



Tuomas Mattila
aFRR

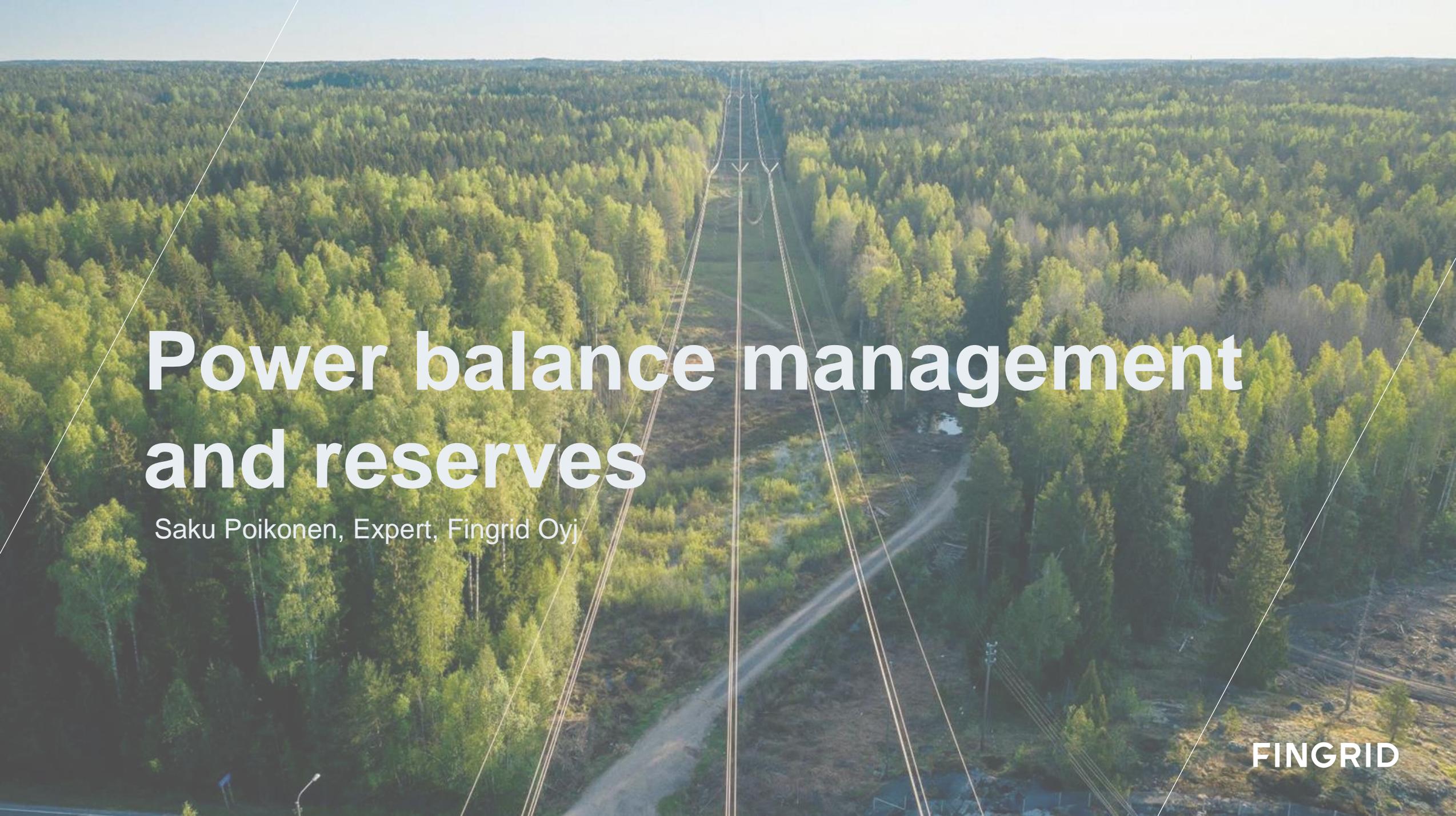


Pia Ruokolainen
Technical requirements
for reserves

Today's timetable

9:00 am	Morning coffee
9:30 am	The event begins
9:40 am	Power balance management and reserves
10:00 am	Latest news about frequency-controlled reserves (FCR & FFR)
10:30 am	Latest news about the automatic Frequency Restoration Reserve (aFRR)
11:00 am	Latest news about the manual Frequency Restoration Reserve (mFRR)
11:30 am	Lunch
12:30 pm	Reserve market surveillance
1:00 pm	Review of reserve purchases and the principles for purchasing reserves in 2023
1:40 pm	Balance responsibility and imbalance settlement
2:00 pm	Coffee break
2:45 pm	Outlook for the electricity market and purchases of reserves
3:45 pm	Summary
4:00 pm	End of the event

FINGRID

An aerial photograph of a dense forest with a power line tower and its associated cables running through the center. The trees are lush green, and the sky is clear. The image is framed by white diagonal lines in the corners.

Power balance management and reserves

Saku Poikonen, Expert, Fingrid Oyj

FINGRID

The Main Grid Control Centre operates 24/7/365

30 operators and 3 managers

BALANCE MANAGEMENT

- Power balance management
- Reserve markets
- Power adequacy

POWER SYSTEM MANAGEMENT

- Ensuring system security
- Transmission capacities
- Voltage level management

GRID MANAGEMENT

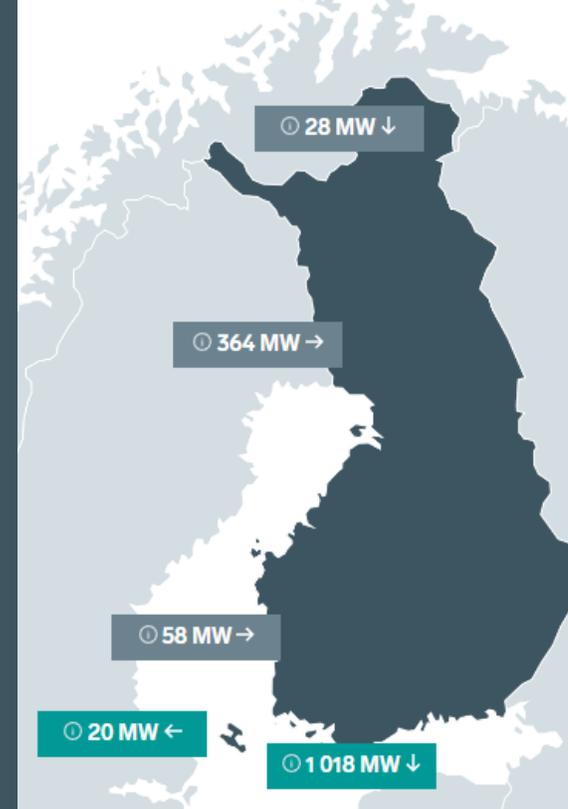
- Ensuring system security
- Switching management
- Disturbance resolution
- System security assessments

ICT

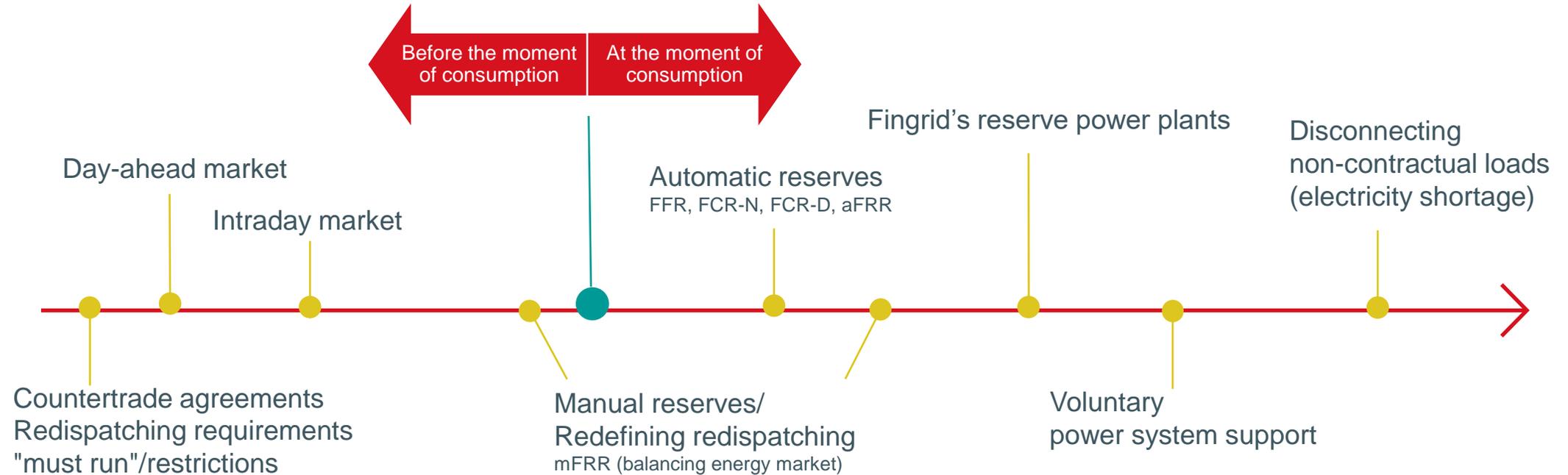
- IT – coordinating modifications
- IT – incident resolution
- Monitoring data flows and systems

Balance management amid the energy revolution

- Finland, Sweden, Norway and Eastern Denmark form a → Common synchronous system
- The system is evolving at an accelerating rate
- Forecasting systems and automation are becoming more important
- The adequacy of electricity is under scrutiny



Methods for balancing the power system



Day-to-day power balance management



- Maintaining the balancing energy market
- Transmission management
- Preparing for the near future
- Examining production plans and forecasts
- Analysis of the short-term adequacy of electricity

Working together to keep the lights on throughout the country

- Reserves underpin the power system
- Automatic reserves keep the system going
- The supply of manual reserves reflects the resilience to imbalances



Thank you



FINGRID

An aerial photograph of a dense forest with a power line tower and its associated cables running through the center. The text is overlaid on the left side of the image.

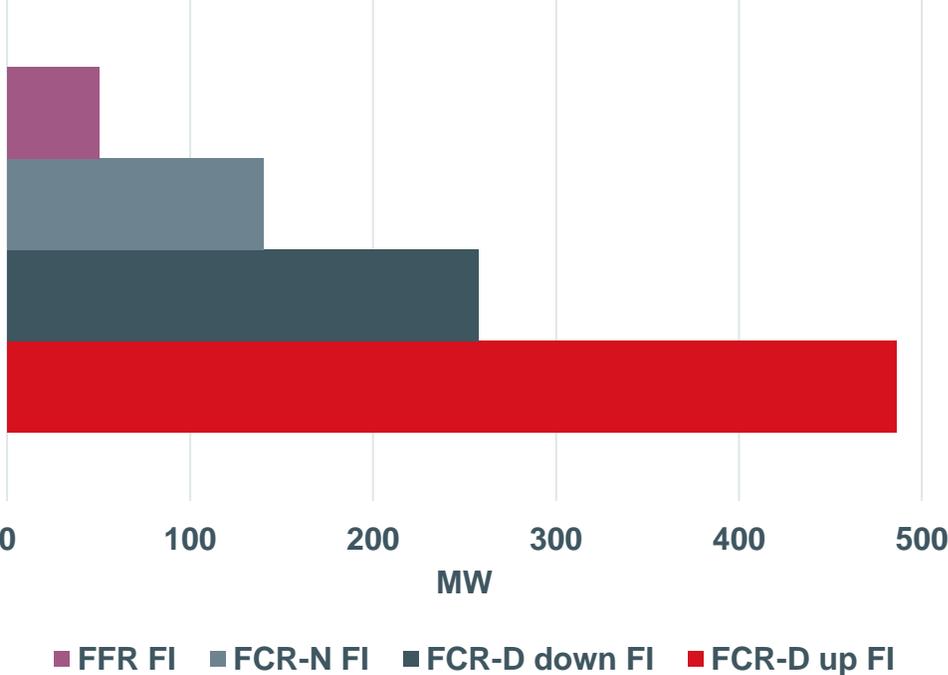
Latest news about frequency- controlled reserves (FCR & FFR)

Taneli Leiskamo, Specialist, and Pia Ruokolainen, Expert, Fingrid Oyj

FINGRID

Growing need for frequency-controlled reserves

Maximum volumes of frequency containment reserves maintained by Finnish balancing service providers in 2023



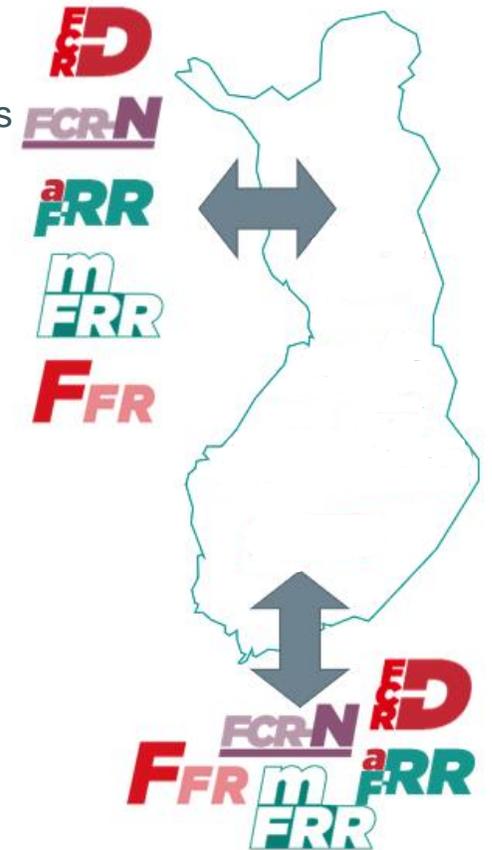
- The availability of FCR and FFR reserves in Finland and its neighbouring countries has been good, except for a few individual hours and the flood season.
- At times, it has also been possible to sell reserves in excess of Fingrid’s obligation to neighbouring countries.
- The need for FFR has increased and continues to increase.
- Fingrid has been purchasing FCR-D down reserves in greater volumes since January 2022, bringing them closer to Fingrid’s obligation related to the pan-Nordic demand for such reserves. Fingrid will next assess these volumes in the third quarter of 2023.

Proposed amendments to the FCR and FFR terms and conditions

- The new FCR and FFR terms and conditions are planned to take effect on 1 June 2024.
- Most significant proposed amendments:
 - Ensuring the volume of FCR-D capable of continuous regulation (dynamic FCR-D) if necessary
 - The energy treatment of FCR-N will be priced according to the regional price in the day-ahead market or the imbalance price, which is more favourable for balancing service providers
 - Combined FFR+FCR-N offers will be possible

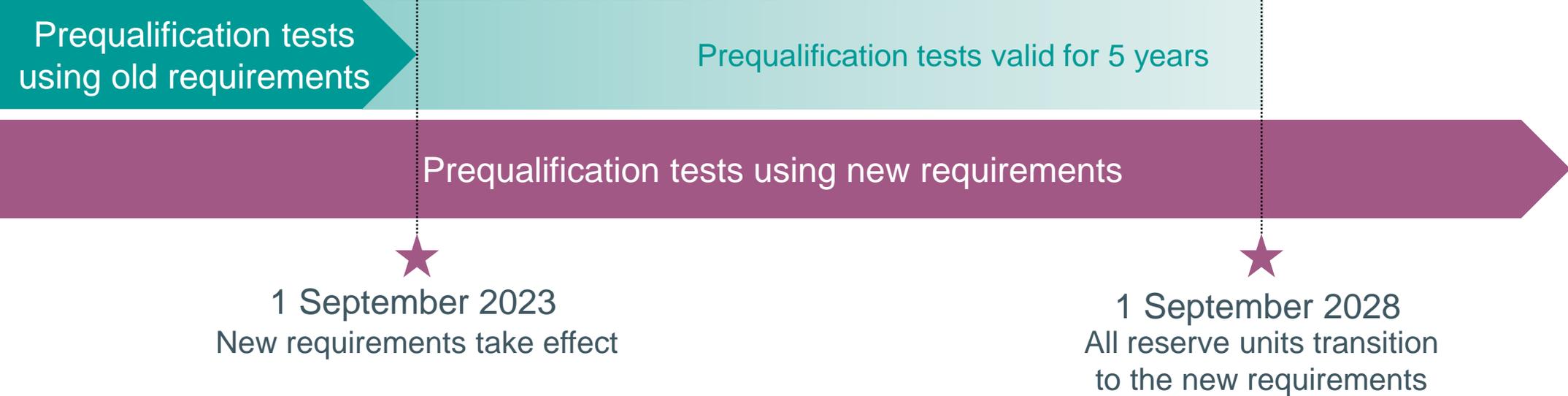
Cross-border trade will facilitate cost-effective system security and large-scale market benefits

- The Nordic transmission system operators maintain frequency containment reserves jointly.
- Balancing service providers sell reserves to the transmission system operator to which their resource is physically connected. Currently, the procurement procedures differ from one country to another.
- Under normal circumstances, TSOs can trade 1/3 of their reserve obligations within the Nordic region.
- Factors affecting cross-border trade:
 - Statnett has begun purchasing FCR-D up reserves in the market
 - Svenska Kraftnät and Energinet are planning changes in the FCR market as of 1 February 2024, such as a transition to marginal pricing.
- Fingrid's goal is pan-Nordic FCR-N, FCR-D and FFR markets.
- In the transition period, we will offer as many Finnish reserves as possible to satisfy our neighbouring countries' needs while fulfilling Fingrid's obligations and ensuring system security.



Introduction of new technical requirements for FCRs

Documentation of prequalification tests conducted using the old requirements must be submitted by 1 September



Changes to real-time and historical data requirements, subject to the same transition period as prequalification tests
See Fingrid’s reserve trading and information exchange guidelines of 22 May 2023

Dimensioning requirements for grid energy storage

	FCR-N	FCR-D upwards	FCR-D downwards
Required power upwards [MW]	$+1.34 \cdot C_{FCR-N}$	$+C_{FCR-Dupwards}$	$+0.20 \cdot C_{FCR-Ddownwards}$
Required power downwards [MW]	$-1.34 \cdot C_{FCR-N}$	$-0.20 \cdot C_{FCR-Dupwards}$	$-C_{FCR-Ddownwards}$
Required energy upwards [MWh]	$1 \text{ h} \cdot C_{FCR-N}$	$\frac{1}{3} \text{ h} \cdot C_{FCR-Dupwards}$	0
Required energy downwards [MWh]	$1 \text{ h} \cdot C_{FCR-N}$	0	$-\frac{1}{3} \text{ h} \cdot C_{FCR-Ddownwards}$

	Battery capacity	Max. FCR-N, power requirement	Max. FCR-N, energy requirement	Max. FCR-N
Example for FCR-N:	10 MW / 20 MWh	10 MW / 1.34 = 7.5 MW	20 MWh / (2*1 hr) = 10 MW	7.5 MW
	10 MW / 10 MWh	10 MW / 1.34 = 7.5 MW	10 MWh / (2*1 hr) = 5 MW	5.0 MW

Other news

- The precision at which the capacities of small reserve units are processed was changed to 10 kW
 - This applies to acceptable capacities (prequalification test) and real-time data
 - This applies to units with measured resources having a nominal power of less than 1.5 MW (accuracy of measurement requirement category A)
- In the FCR-N, reserve units under different balance responsibilities can now be combined into one offer → the minimum bid size of 100 kW can be aggregated from several small reserve units with different balance responsible parties
- Historical data on FCR activation was requested for the frequency disturbance on 26 April
- The submitted data will be reviewed this summer



Thank you



FINGRID

An aerial photograph of a vast, dense forest with a mix of green and yellowish trees. A tall power line tower stands in the center, with several power lines extending from it across the forest. The sky is clear and blue. The text is overlaid on the left side of the image.

Latest news about the automatic Frequency Restoration Reserve (aFRR)

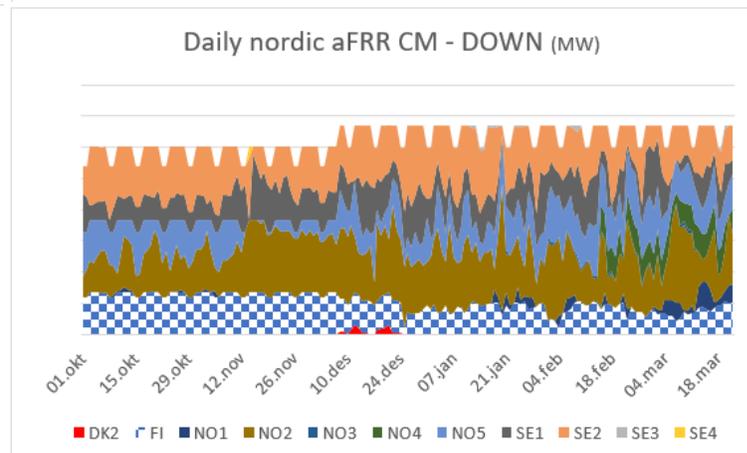
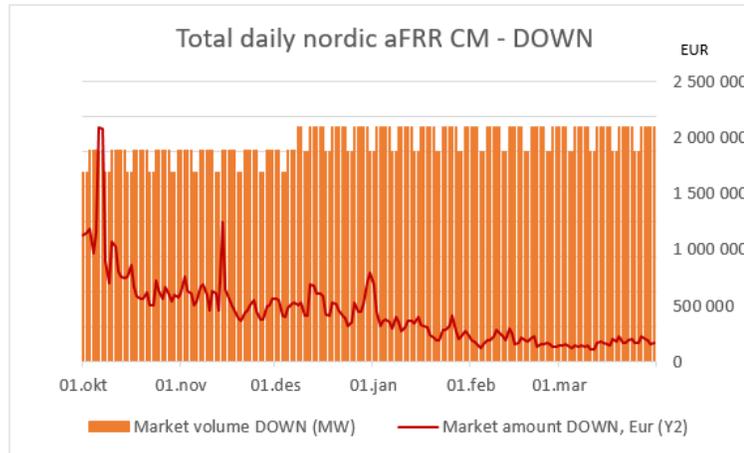
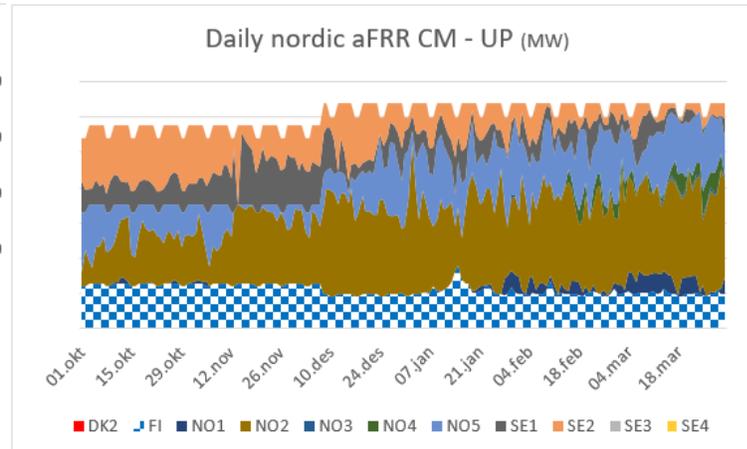
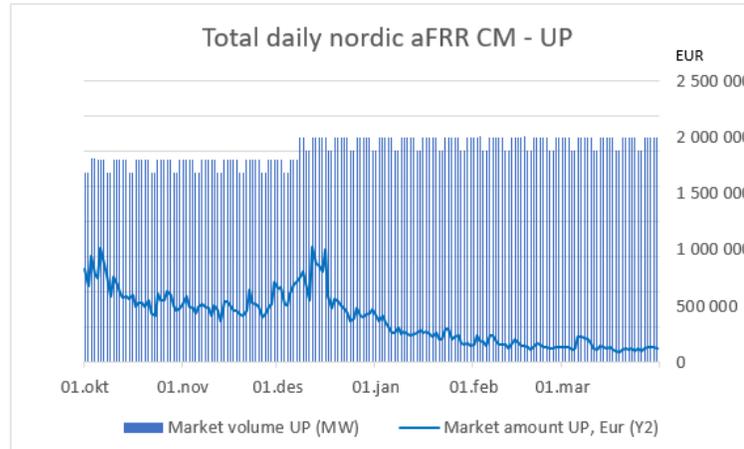
Tuomas Mattila, Expert, Fingrid Oyj

FINGRID

Nordic aFRR capacity market starts up

- The Nordic aFRR capacity market opened for trading on 7 December 2022
- Finland joined the market on 24 December 2022
- The allocation of cross-border transmission capacity for reserve capacity trading from Finland to Sweden is possible.
 - Fingrid can buy down-regulation capacity in the common market, and Finnish balancing service providers can sell up-regulation capacity to other transmission system operators in the common market.
- A market activity report was drawn up after 3 months of trading. The report will be published on Fingrid's website soon
- The aFRR capacity maintenance obligation is updated annually

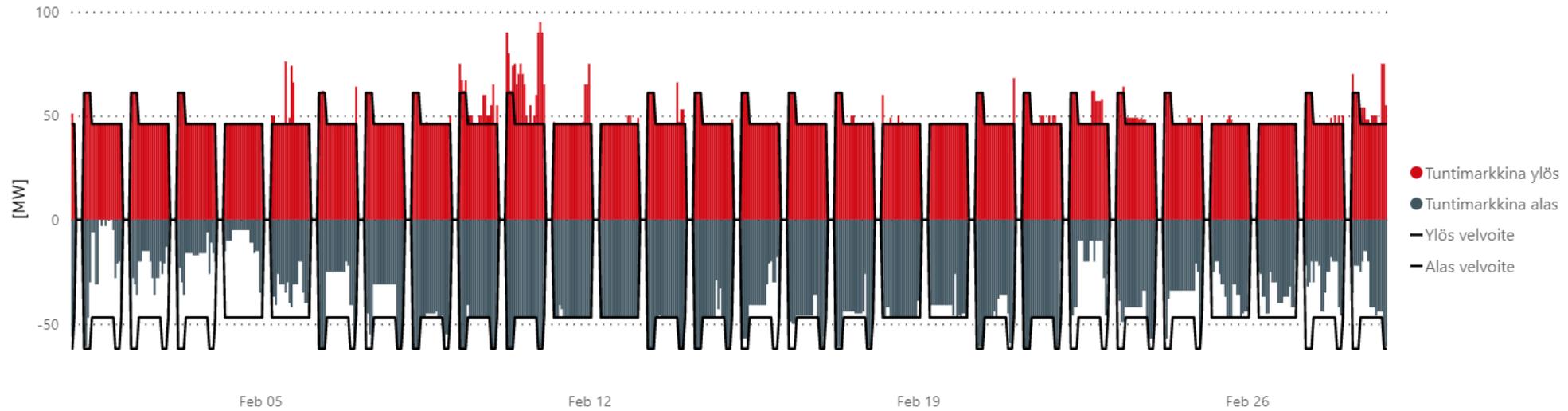
Large markets create efficiency



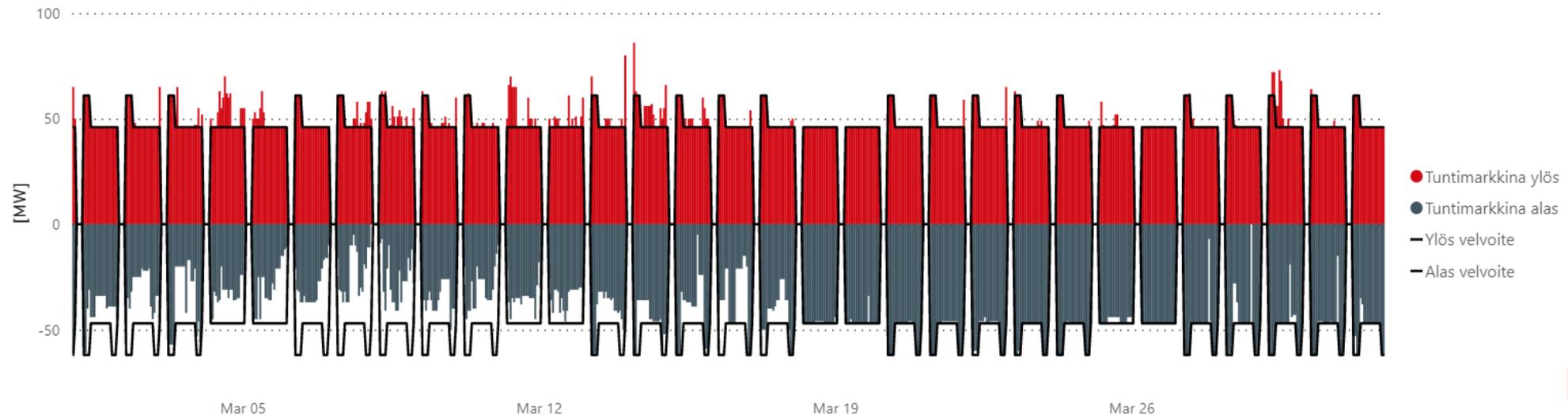
- aFRR capacity is mainly purchased from five bidding zones.
- Competition has increased at the Nordic level, prices have come down, and the number of bids has increased.
- The number of bids remains low in some bidding zones, and transmission capacity must be allocated to fulfil the needs of these zones
- The aim is to enable transmission capacity to be allocated in both transmission directions across all borders as quickly as possible

aFRR purchase volumes in February and March 2023

Automaattisen taajuudenpalautusreservin hankinta



Automaattisen taajuudenpalautusreservin hankinta



aFRR terms and conditions evolving

- In the terms and conditions for balancing service providers, effective as of 22 May:
 - Sanctions for unmaintained aFRR capacity
 - Real-time billing
 - Enabling an independent aggregator
- In the “PICASSO terms and conditions” due to take effect in June 2024:
 - The aFRR energy market and its impacts on the aFRR capacity market
 - Including an aFRR component in imbalance pricing
 - Revisions of the aggregation model, independent aggregators are only possible under separate pilot terms and conditions

An aerial photograph of a dense forest with a road and power lines. The text is overlaid on the image.

European aFRR marketplace PICASSO

FINGRID

European aFRR marketplace PICASSO

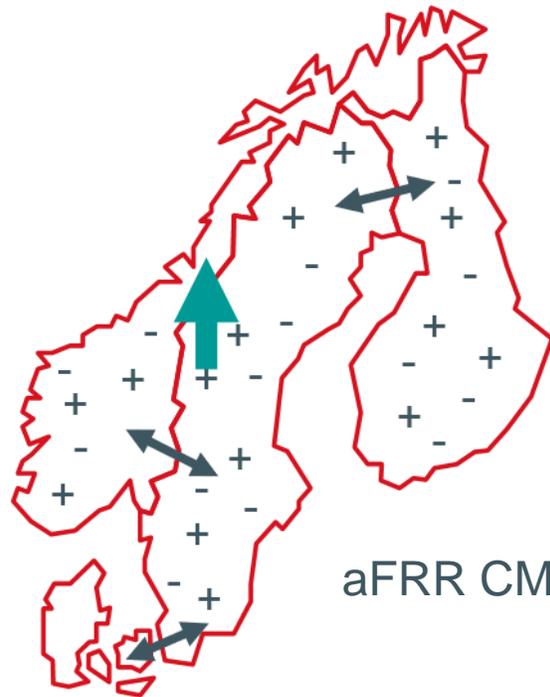
- A European marketplace for aFRR energy compliant with the energy balancing guidelines (EB GL)
- Bids for 15-minute periods. Bids are optimised in real time (every 4 seconds)
- In accordance with the Energy Authority's exemption permit, Fingrid will join the marketplace by 24 July 2024
- PICASSO began operating in June 2022. Transmission system operators from the Czech Republic, Germany and Austria have joined so far.



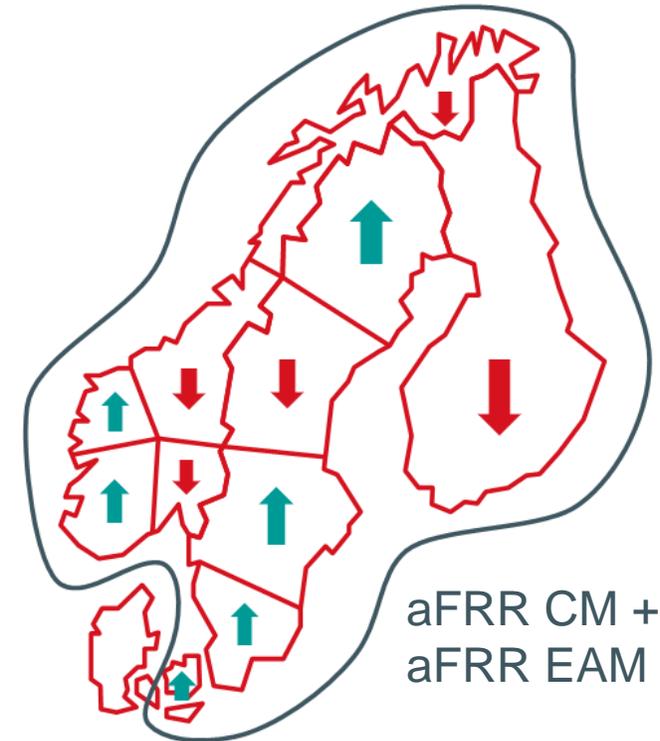
Source - https://www.entsoe.eu/network_codes/eb/picasso/

Target model for aFRR activations

Frequency-based aFRR regulation



aFRR regulation based on imbalances



Due to the delays to the Nordic Balancing Model Program, the target model will not be in use in the Nordic countries in summer 2024

National connection to PICASSO in summer 2024

Nordic aFRR capacity market

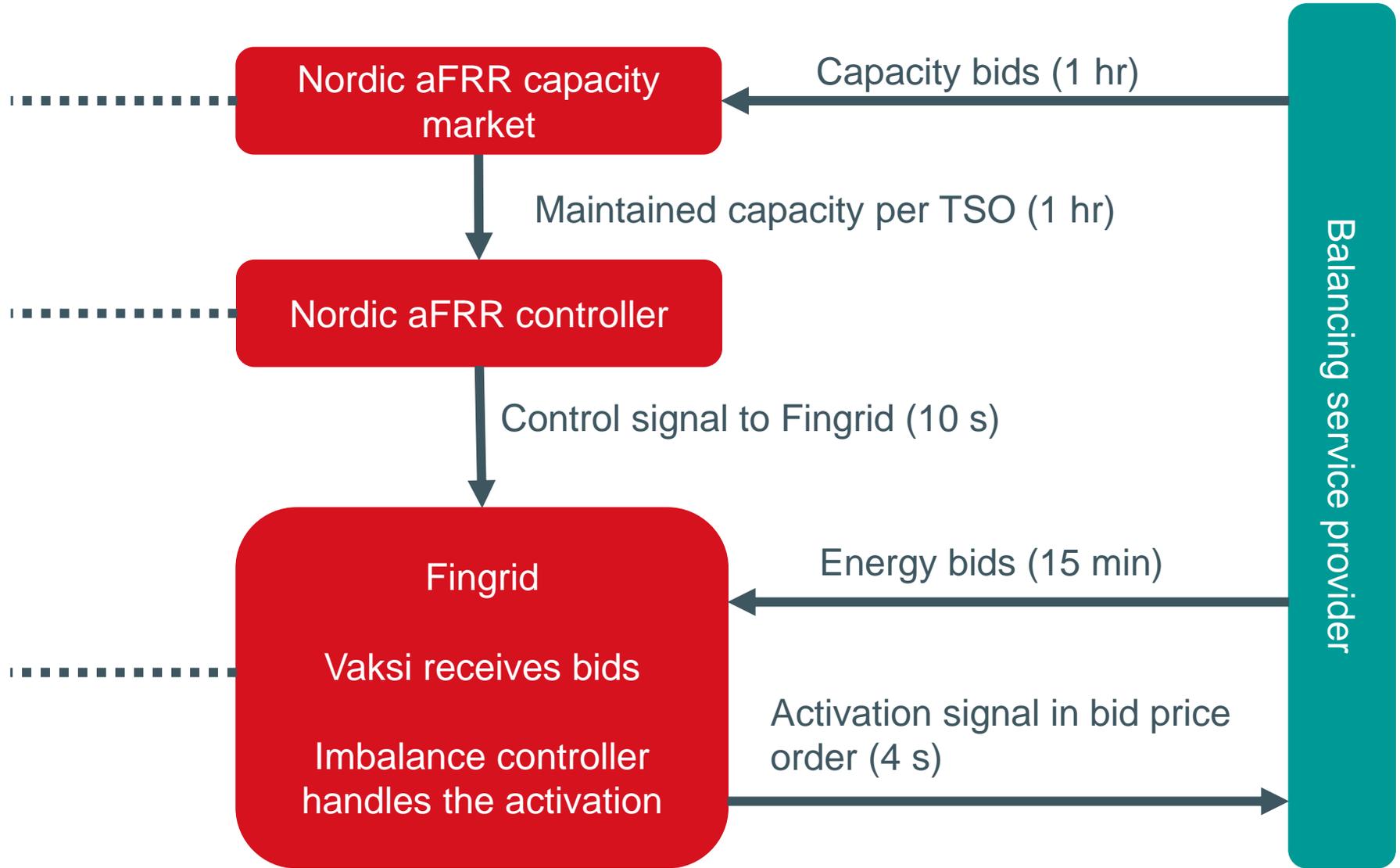
- Ensures aFRR capacity
- Specifies the share to be activated from Finland when a Nordic aFRR signal based on frequency is received
- An accepted bid carries the obligation to submit a bid in the energy market
- Marginal pricing, capacity fee

aFRR energy market

- PICASSO is effectively a national market until Finland's neighbouring countries join
- The aFRR activated in Finland is determined by the Nordic controller based on the frequency and maintained capacity
- Finland's aFRR activations are divided among operations based on energy bids in price order
- Voluntary aFRR energy bids are allowed
- Marginal pricing, energy fee



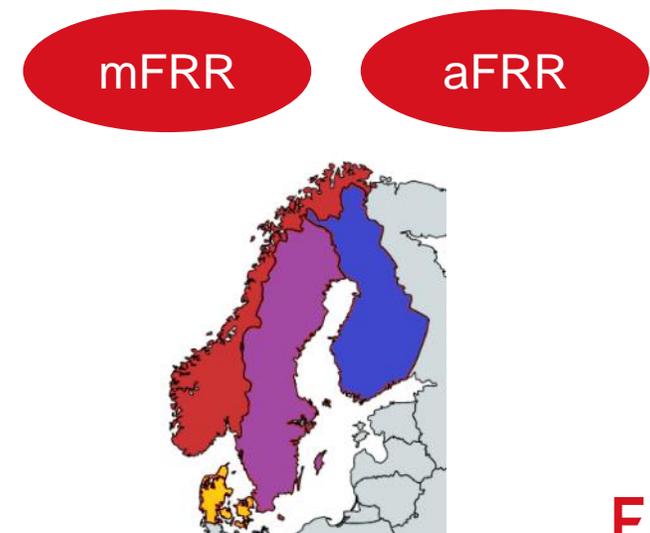
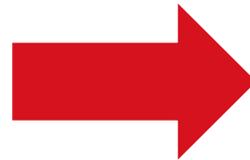
PICASSO Member
PICASSO Observer



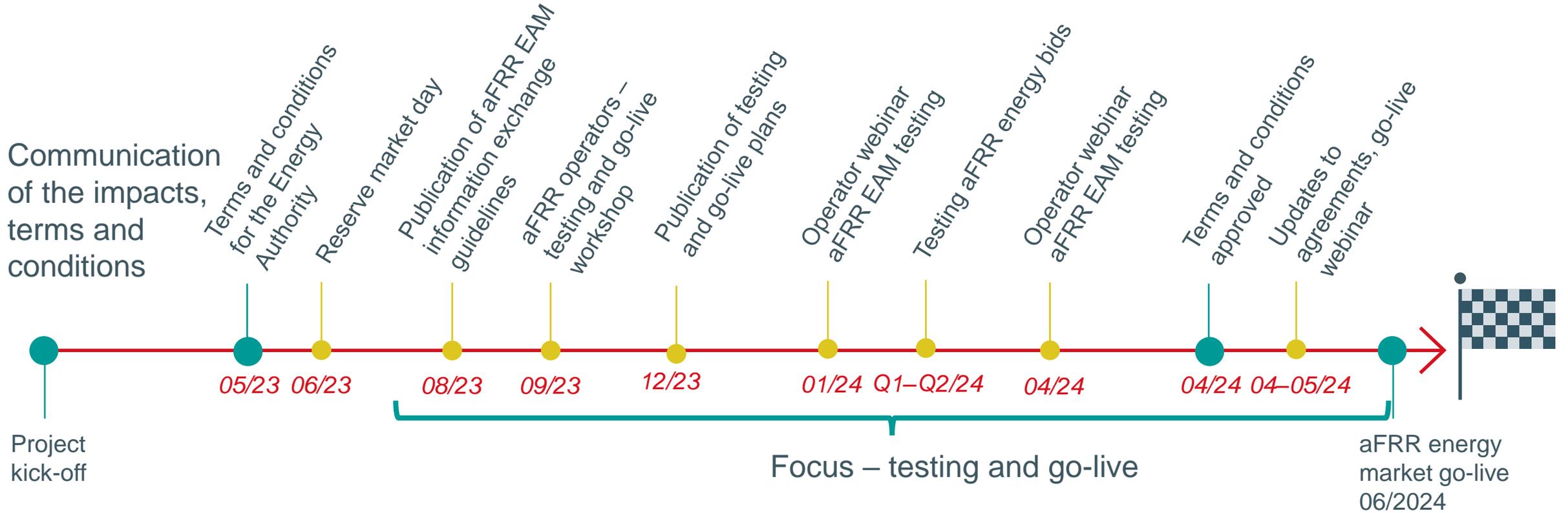
FINGRID

aFRR component included in the imbalance price

- Imbalance pricing will change when Finland begins using the aFRR energy market and PICASSO platform
 - In addition to mFRR prices, aFRR prices will be incorporated into imbalance pricing -> the more expensive of the two determines the imbalance price
 - The imbalance price is determined in each bidding zone separately



We will communicate the changes



European reserve marketplaces – Fingrid (in finnish)

Thank you



FINGRID

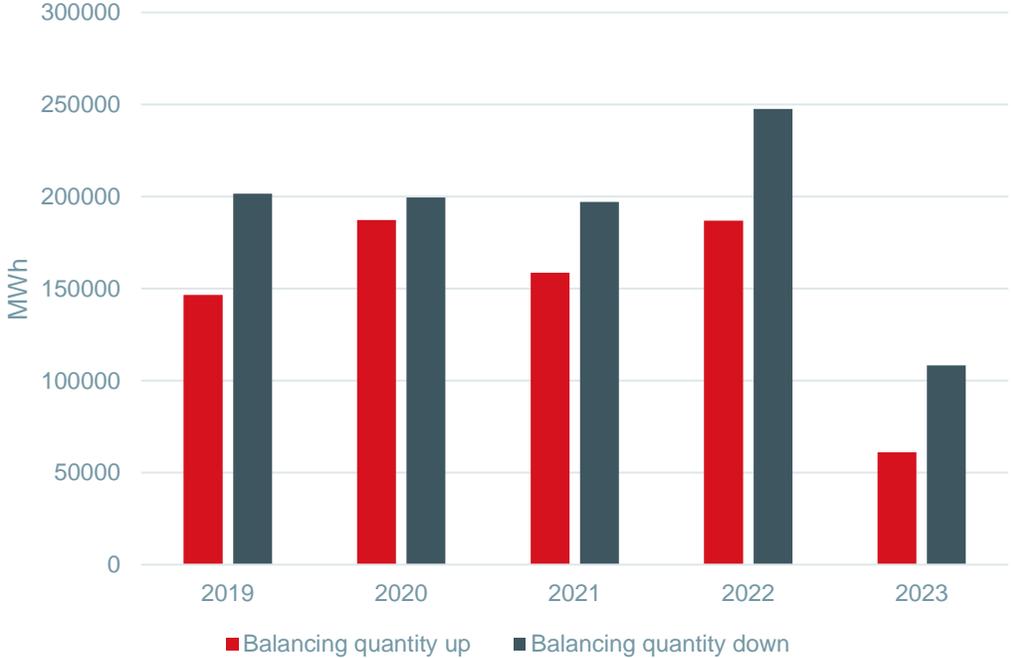


Latest news about the manual Frequency Restoration Reserve (mFRR)

Otso-Ville Rinne, Specialist, Fingrid Oyj

FINGRID

Negative electricity prices have also become more common in the balancing energy market



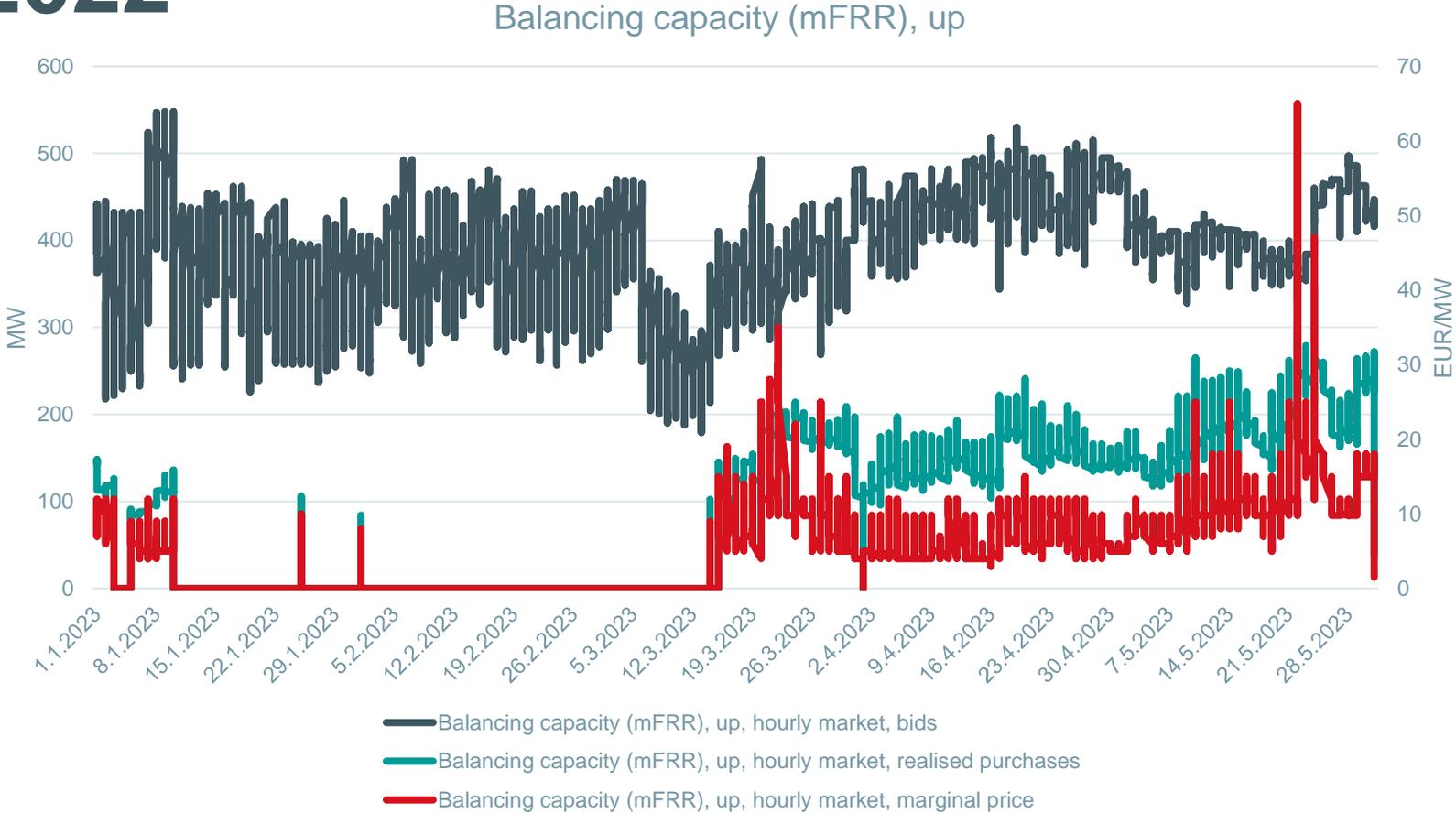
- When the electricity price in the day-ahead market is low, negative down-regulation prices are more likely
 - In such a case, it is also more likely that down-regulation will be needed
- Fingrid aims to expand the real-time publication of balancing energy prices

The Nordic mFRR capacity market is delayed

- The Nordic mFRR capacity market is delayed from the schedule previously announced (Q2/2024)
- The Nordic authorities did not reach a consensus on the method for reserving cross-border transmission capacity
 - Consequently, Statnett and Svenska Kraftnät withdrew from the authorities' process on 18 April
- Next:
 - The need to alter the methods for power conversion limitations between mFRR capacity markets and/or synchronous areas will be studied
 - A new schedule will be estimated as part of the Nordic balance management roadmap

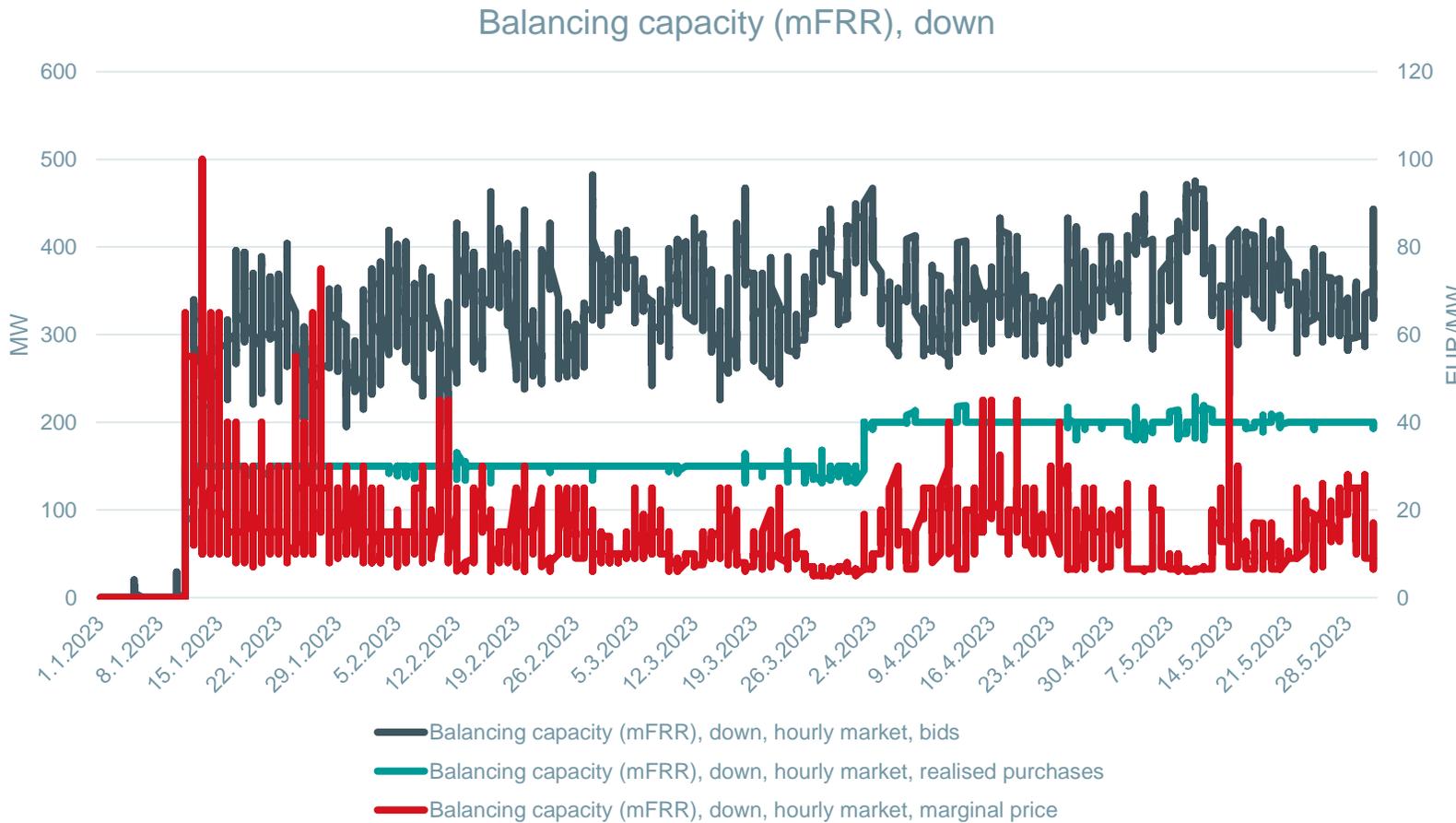


Hourly purchases of up-regulation in the mFRR capacity market began in December 2022



- The purchases ensure a sufficient number of up-regulation bids (corresponding to the dimensioning fault) in the energy market
- Purchases are based on Fingrid’s own and leased reserve power plants

Hourly purchases of down-regulation in the mFRR capacity market began in January 2023



- The purchased volume will be assessed and, if necessary, increased quarterly
- The aim is that the purchases ensure a sufficient number of down-regulation bids (corresponding to the dimensioning fault) in the energy market

All balancing energy billing is transferred to eSett

- Fingrid's current system of separate billing will end at the end of November 2023
- After this, **eSett will bill balancing service providers who are not balance responsible parties for the energy fee**
- The billing period will change from one month to one week, as it is for balance responsible parties
 - The first billing period will be from 1:00 am (EET) on 20 November to 1:00 am (EET) on 27 November 2023
- This change will require balancing service providers to take the following action:
 - Make an agreement with eSett Oy
 - Open a settlement account at a settlement bank approved by eSett, with energy fees as direct debits/settlements
 - Amendment to the balancing energy market agreement between Fingrid and balancing service providers (including balance responsible parties)



Further information on the change is available in the separate announcements and on eSett's [website](#)

FINGRID

Thank you



FINGRID

LUNCH

FINGRID

An aerial photograph of a dense forest with a power line tower and its associated cables running through the center. The trees are a mix of green and brown, suggesting a late summer or autumn setting. The sky is clear and blue. The overall scene is a blend of nature and infrastructure.

Reserve market surveillance

Ekaterina Moiseeva, Manager Market Surveillance, Nord Pool AS

FINGRID

Market surveillance for the reserve market

Ekaterina Moiseeva

Manager Market Surveillance, Nord Pool

Reservimarkkinapäivä – Reserve Market Day

8th June 2023



Market Surveillance Project

**NORD
POOL**

PRIVATE

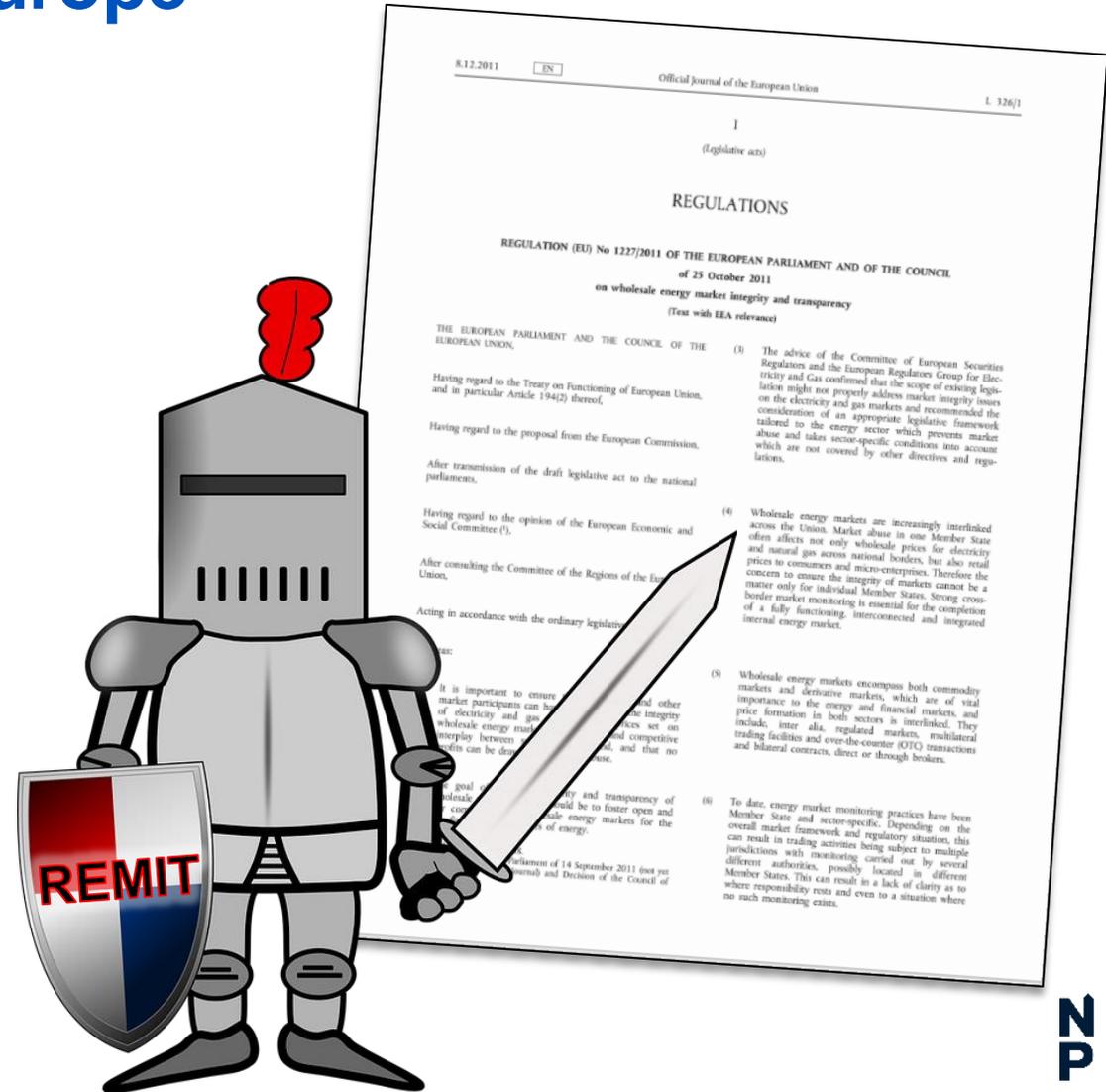
REMIT – the first set of common rules for wholesale energy markets in Europe

REMIT – Regulation on wholesale Energy Market Integrity and Transparency (2011)

Aims to ensure on European level:

- Confidence in the market integrity
- Prices that represent a fair and competitive interplay between supply and demand
- No profits drawn from market abuse

REMIT applies to all wholesale energy markets – including day-ahead, intraday, and balancing markets



Legal background

REMIT Article 15, ACER Guidance

Article 15 of REMIT

Obligations of persons professionally arranging transactions

Any person professionally arranging transactions in wholesale energy products who reasonably suspects that a transaction might breach Article 3 or 5 shall notify the national regulatory authority without further delay.

Persons professionally arranging transactions in wholesale energy products **shall establish and maintain effective arrangements and procedures to identify breaches of Article 3 or 5.**

Based on ACER Guidance, PPATs may outsource some parts of their monitoring activity

Type	Characteristics			Brief description of transactions' arrangement
	Person	Professionally	Arranging transactions	
Energy Exchanges	✓	✓	✓	<ul style="list-style-type: none">• Bringing about transactions by introducing buyer/seller; or• Providing a facility that facilitates the entering into transactions by third parties – Allows placement of orders, matches orders and executes transactions.
Broker platforms/ Brokers	✓	✓	✓	<ul style="list-style-type: none">• Bringing about transactions by introducing buyer/seller; or• Providing a facility that facilitates the entering into transactions by third parties – Allows placement of orders, matches orders and executes transactions.
Cross border capacity exchanges/ platforms	✓	✓	✓	<ul style="list-style-type: none">• Bringing about transactions by introducing buyer/seller; or• Providing a facility that facilitates the entering into transactions by third parties – Allows placement of orders, matches orders and executes transactions.
Secondary capacity allocation platforms	✓	✓	✓	<ul style="list-style-type: none">• Bringing about transactions by introducing buyer/seller; or• Providing a facility that facilitates the entering into transactions by third parties – Allows placement of orders, matches orders and executes transactions.
TSOs (or persons acting on their behalf) organising gas trades, energy balancing, capacity trading	✓	✓	✓	<ul style="list-style-type: none">• Bringing about transactions by introducing buyer/seller; or• Providing a facility that facilitates the entering into transactions by third parties – Allows placement of orders, matches orders and executes transactions.

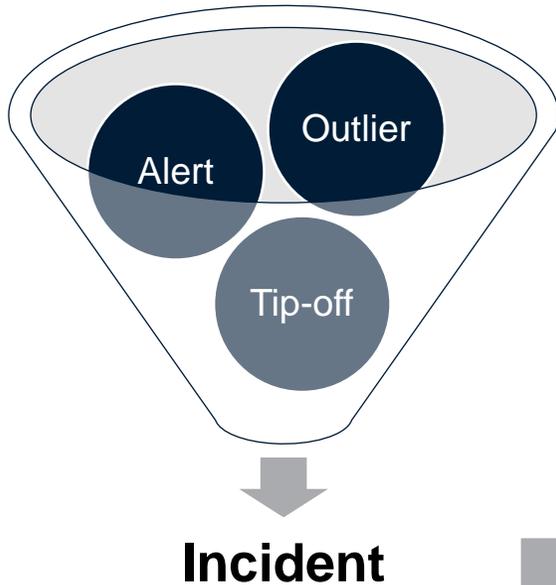
Market Surveillance for the balancing market

Nord Pool works together with Fingrid on establishing efficient arrangements

- Project kicked off in September 2022
- Operation phase to start June 2023
- Nord Pool service:
 - **Documenting** the Market Surveillance setup: MS strategy, Risk Assessment
 - **Designing and implementing automatic alerts** to identify potential breaches
 - Preparing the **monitoring reports and STRs** for Fingrid's review
 - **Other actions** to ensure successful monitoring
 - Training Fingrid's personnel
 - Guidance to stakeholders



Monitoring of the market



Analyst assessment

- Market **fundamentals** analysis: zonal configuration, prices, consumption, supply, imports/exports
- **Behaviour** analysis: type of market participant, historic bidding, unavailability

Need for further information?

Questions to market participants

No reasonable suspicion

Reasonable suspicion of a breach

Draft a **Suspicious Transaction Report** for Fingrid's review and submission to the NRA

Market Surveillance at Nord Pool

- Market Surveillance at Nord Pool has more than 20 years of experience
 - Monitoring the market based on Market Conduct Rules and performing final investigations up to 2015
 - Market Surveillance based on REMIT since 2015
- Strong cooperation with NRAs (Nordic and European) and ACER
 - Meetings twice a year to discuss trading practices
 - Bilateral contacts ad-hoc
- Keeping strong ties to the market
 - REMIT Discussion Group twice a year
 - In 2020 we published a new chapter on ensuring REMIT compliance when using algorithmic trading
 - Latest project “Threshold for publication of inside information” – qualitative and quantitative (statistical) study to find a set threshold for publication of inside information
 - Regular bilateral contacts related to specific trading practices

REMIT Best Practice

A sector review on how to comply with REMIT related to inside information and market abuse.

2nd Edition

Updated: 15 January 2020

NORD
POOL

UPM

NAET

VATTENFALL

fortum

Eidsiva

dc
Danish
Commodities

Ørsted

Statkraft

centrica

Skagerak
Energi

agder energi

NORD
POOL

NORD
POOL

Publications by Market Surveillance

Market Surveillance wishes to share knowledge and be transparent

Quarterly newsletter

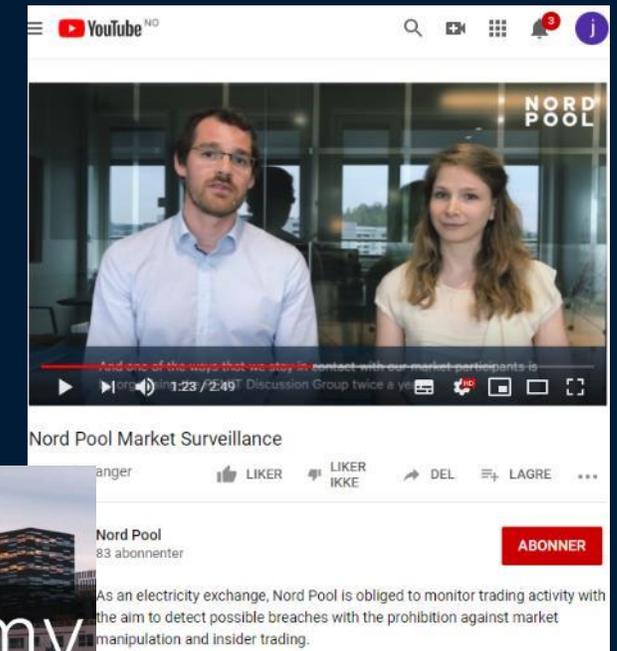
- Discusses relevant developments in market and regulations
- Gives insight into how our work is performed

YouTube-videos

- Introduction to Market Surveillance
- Capacity hoarding

Courses and presentations

**NORD
POOL**



[Link to newsletter](#)
[Link to YouTube](#)



Application of REMIT to the mFRR market

Approach for monitoring the mFRR market

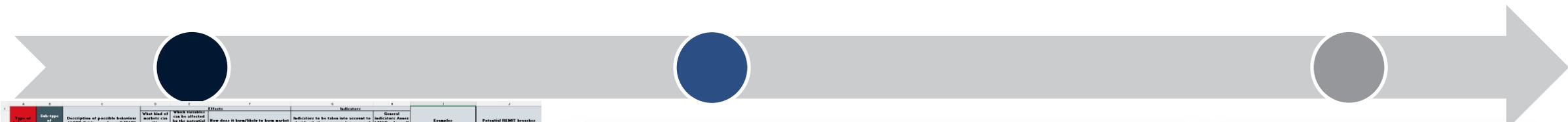
Starts with a **risk assessment** of different types of market manipulation and evaluation of effective arrangements

Based on the risk assessment we have created a **Market Surveillance Strategy**:

- Routines for monitoring
- Routines for internal training
- Governance model
- Handling of conflicts of interest etc.

Monitoring documentation:

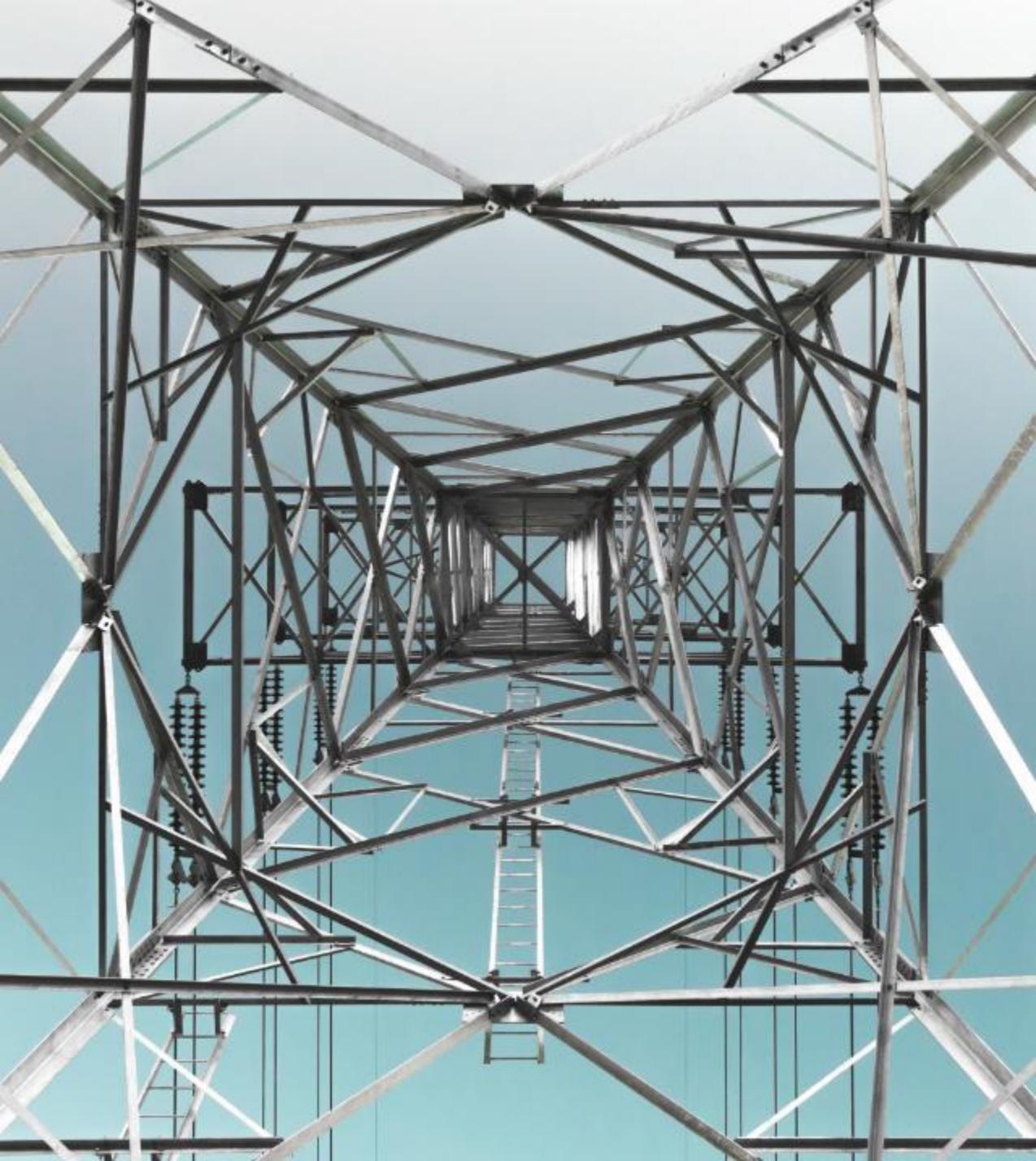
- Alerts with associated guidelines
- Thresholds for when to investigate further



Type of behavior	Sub-type of behavior	Description of possible behavior (ACSR Guidance - Annex II MAF)	What kind of markets can this behavior affect?	What indicators can be used to detect this behavior?	Effects	Indicators to be taken into account to decide whether a person has engaged in market abuse	General indicators Annex I MAF - Annex II MAF - general indicators	Examples	Potential REMIT Breach
Trading based on inside information	•	The practice of a person who possesses inside information in relation to a financial instrument or product of value that intentionally or negligently discloses or attempts to disclose the content of that information to a third party, other than by a directly, indirectly or otherwise	• Confidence • Action	• Price level • Price volatility • Volume level	• It increases market risk for others and decreases the willingness of participants in the market, hence reducing liquidity • It creates an uneven playing field • It distorts the price in the market mechanism, affecting the efficiency of the price formation in a particular market • It reduces the overall welfare in the functioning of the market, which could be lost if other market participants provide information to the market • It reduces the overall welfare in the functioning of the market, which could be lost if other market participants provide information to the market	• If the decision to deal was made before the disclosure of the inside information • If the market participant acted in a way that is not justified by market fundamental public information at that point in time • If the market participant acted in a way that is not justified by market fundamental public information at that point in time • If the market participant acted in a way that is not justified by market fundamental public information at that point in time	No indicators in MAF	Before a publicly available inside information regarding an instrument or product of value is published, the Market Participant has exclusively possessed the information in the period of disclosure in preparation due to an information advantage over the market The market participant discloses the information in the period of disclosure through an	Art.3(1)
Front running	•	The practice of a legal natural person or associated person to trade on the basis of an order to buy or sell a VEP when the person or associated person causing the order to buy or sell has not yet been executed in the market Information concerning an order to buy or sell a VEP is not yet publicly available or is not yet publicly available in the market Information concerning an order to buy or sell a VEP is not yet publicly available or is not yet publicly available in the market Information concerning an order to buy or sell a VEP is not yet publicly available or is not yet publicly available in the market (Source: FFRB's front running as approved by SEC in 04/08/2010 referred to the VEM RAL-5210)	• Confidence • Action	• Price level • Price volatility • Volume level	• It creates an uneven playing field • It distorts the price in the market mechanism, affecting the efficiency of the price formation in a particular market • It reduces the overall welfare in the functioning of the market, which could be lost if other market participants provide information to the market	• If the order to buy or sell a VEP is not yet publicly available or is not yet publicly available in the market • If the market participant acted in a way that is not justified by market fundamental public information at that point in time • If the market participant acted in a way that is not justified by market fundamental public information at that point in time • If the market participant acted in a way that is not justified by market fundamental public information at that point in time	No indicators in MAF	The market participant signed a tip sheet contract and acted in a way that is not justified by market fundamental public information at that point in time The market participant acted in a way that is not justified by market fundamental public information at that point in time The market participant acted in a way that is not justified by market fundamental public information at that point in time The market participant acted in a way that is not justified by market fundamental public information at that point in time	Art.3(1)
	•	The practice of a legal natural person or associated person to trade on the basis of an order to buy or sell a VEP when the person or associated person causing the order to buy or sell has not yet been executed in the market Information concerning an order to buy or sell a VEP is not yet publicly available or is not yet publicly available in the market Information concerning an order to buy or sell a VEP is not yet publicly available or is not yet publicly available in the market Information concerning an order to buy or sell a VEP is not yet publicly available or is not yet publicly available in the market (Source: FFRB's front running as approved by SEC in 04/08/2010 referred to the VEM RAL-5210)	• Confidence • Action	• Price level • Price volatility • Volume level	• It creates an uneven playing field • It distorts the price in the market mechanism, affecting the efficiency of the price formation in a particular market • It reduces the overall welfare in the functioning of the market, which could be lost if other market participants provide information to the market	• If the order to buy or sell a VEP is not yet publicly available or is not yet publicly available in the market • If the market participant acted in a way that is not justified by market fundamental public information at that point in time • If the market participant acted in a way that is not justified by market fundamental public information at that point in time • If the market participant acted in a way that is not justified by market fundamental public information at that point in time	No indicators in MAF	• If there is evidence of communications between the parties involved in the market • If the market participant acted in a way that is not justified by market fundamental public information at that point in time • If the market participant acted in a way that is not justified by market fundamental public information at that point in time • If the market participant acted in a way that is not justified by market fundamental public information at that point in time	Art.3(1)

FINGRID
Strategy for Market Surveillance in market for manual frequency restoration reserves (mFRR)

FINGRID
mFRR Market Monitoring
Monitoring tools Guide and Thresholds



Highlights of the highest-risk areas in the mFRR market

- Capacity withholding
 - Economic withholding
 - Physical withholding
- Market cornering
- Trading based on inside information

Capacity withholding

Based on ACER's guidance:

Electricity generation capacity withholding refers to the practice of keeping available generation capacity from being competitively offered on wholesale electricity market, even though offering it competitively would lead to profitable transactions at the prevailing market prices



Physical withholding

When capacity is not offered at any price

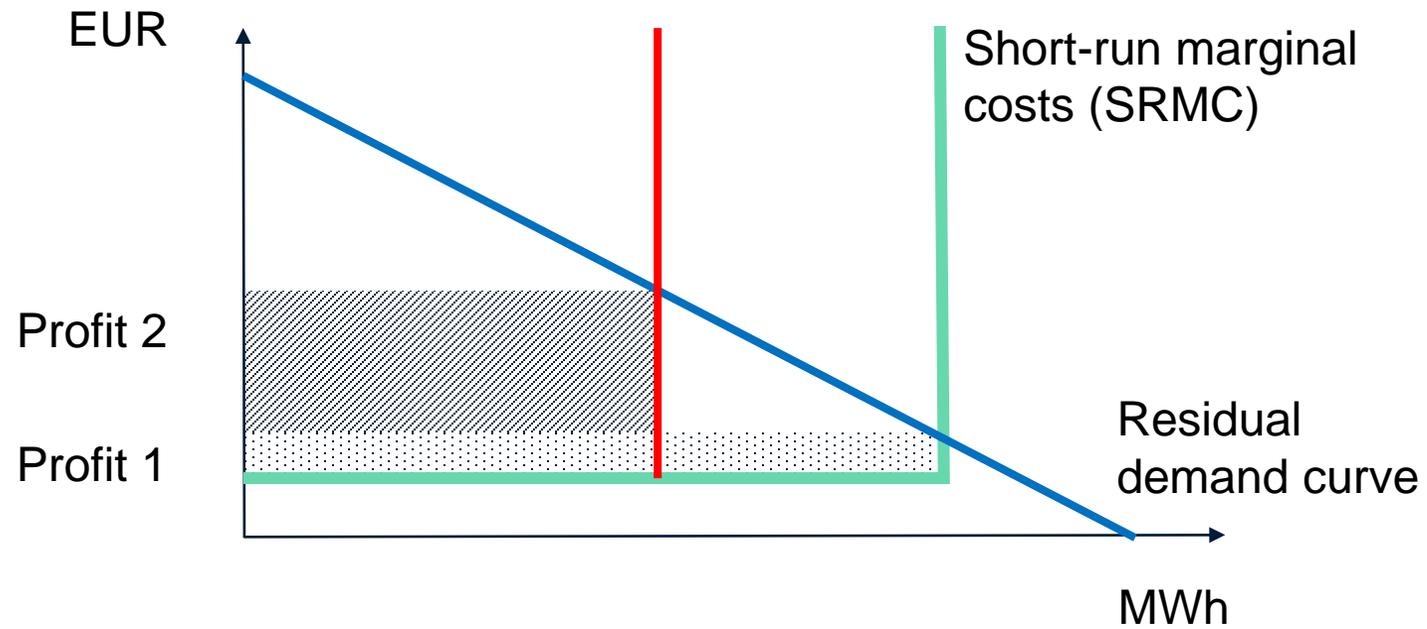


Economic withholding

When capacity is offered above the market price and the bid does not reflect the marginal cost (including opportunity cost)

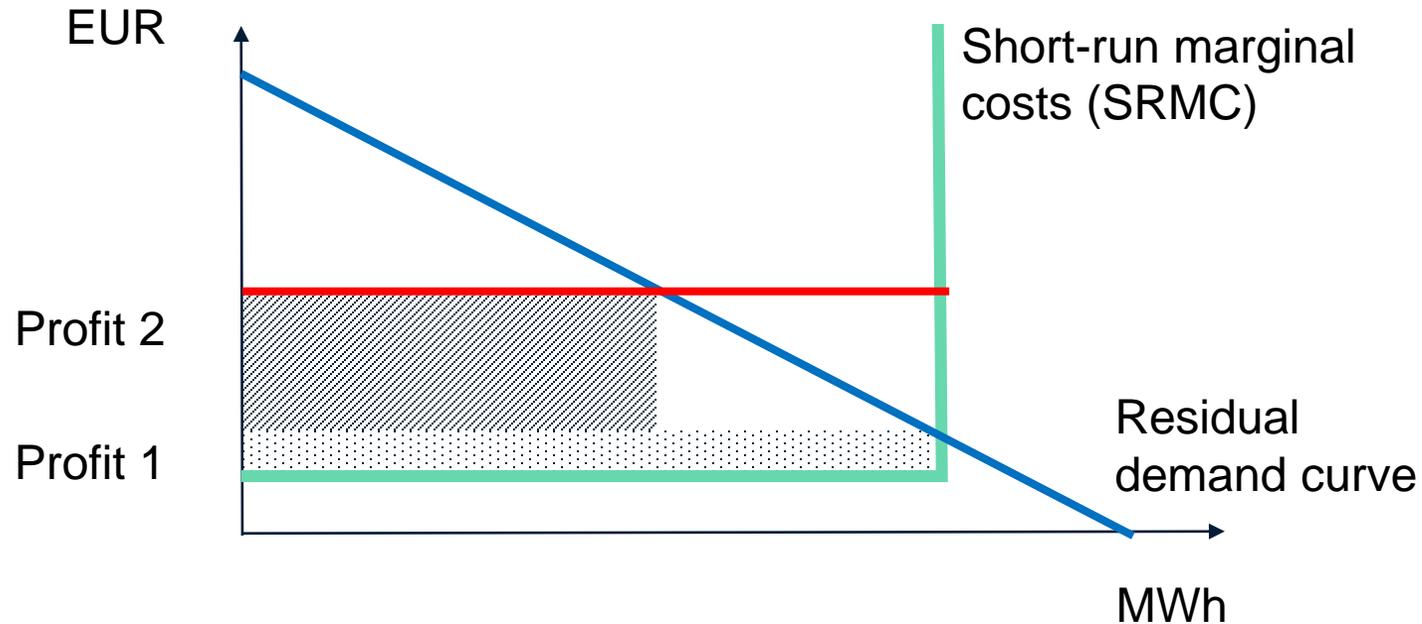
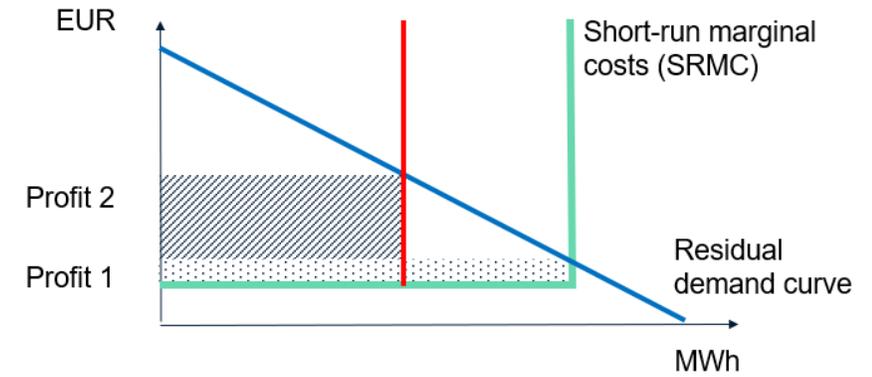
Capacity withholding

Physical withholding



Capacity withholding

Economic withholding



Withholding of physical capacity = **physical withholding**
Pricing up the existing capacity = **economic withholding**

Capacity withholding

When is it market manipulation?

Based on ACER's Guidance, there is a 2-step approach for determining if bidding can qualify as capacity withholding:

1. Is the market participant able to **influence the price** or the interplay by its behaviour in the case-specific circumstances?
2. Does the market participant have **no** legitimate **technical, regulatory and/or economic justification** when it does not offer its generation capacity or has offered it above marginal costs?

Important:

Legitimate economic reason – expectation of opportunity costs, expected value of producing at a different point in time or in a different market.

Price, at which the energy was purchased, is a sunk cost.

[Link](#)

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Economic and physical withholding

Price of the mFRR bid shall only be higher than marginal costs in case there is a legitimate technical, economical (opportunity cost), or regulatory reason for that

While the market is voluntary, it is still expected that market participants normally offer their **available volumes – for up-regulation and down-regulation**

Is there a legitimate justification behind the bid price?

Is the volume of the mFRR bid abnormal?

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HOURLY		10 APR 2023	EUR			
EUR/MWh						
10-04-2023	Price up	Price down	Dominating direction	Imbalance price	Volume up	Volume down
00 - 01	37,77	37,77	-	37,77	0	0
01 - 02	37,19	37,19	-	37,19	0	0
02 - 03	38,51	38,51	-	38,51	0	0
03 - 04	39,97	39,97	-	39,97	0	0
04 - 05	41,67	41,67	-	41,67	0	0
05 - 06	45,65	45,65	-	45,65	0	0
06 - 07	48,74	48,74	-	48,74	0	0
07 - 08	48,37	48,37	-	48,37	0	0
08 - 09	49,90	37,00	D	37,00	0	-10
09 - 10	48,13	24,00	D	24,00	0	-93
10 - 11	27,45	6,50	D	6,50	0	-42
11 - 12	13,52	-45,00	D	-45,00	0	-115
12 - 13	13,21	-100,00	D	-100,00	0	-306
13 - 14	9,99	-2 200,00	D	-2 200,00	0	-140
14 - 15	1,76	-2 200,00	D	-2 200,00	0	-253
15 - 16	2,21	-81,60	D	-81,60	0	-35
16 - 17	4,18	-0,34	D	-0,34	0	-24
17 - 18	25,54	7,00	D	7,00	0	-20
18 - 19	38,53	38,53	-	38,53	0	0
19 - 20	44,74	44,74	-	44,74	0	0
20 - 21	36,12	25,00	D	25,00	0	-4
21 - 22	26,18	6,00	D	6,00	0	-37
22 - 23	14,98	-7,00	D	-7,00	0	-45
23 - 00	3,00	-10,19	D	-10,19	0	-26
Min	1,76	-2 200,00		-2 200,00	0	-306
Max	49,90	48,74		48,74	0	0
Avg / Total	29,05	-171,56		-171,56	0,0	-1 150,0
10-04-2023	Price up	Price down	Dominating direction	Imbalance price	Volume up	Volume down

Market cornering

Large market participant with a **unilateral influence** shall have a legitimate justification for the price and volume of the bid

Market Surveillance will seek to understand the justification and determine if it is reasonable

Is there a legitimate justification behind the bid price?

Is the volume of the mFRR bid abnormal?



Trading based on inside information: Outages



Gets inside information about
e.g. outage

Article 4

Obligation to publish inside information



UMM has to be
published

**NORD
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Trader can react on the
information

Article 3

Prohibition of insider trading

- In an effective and timely manner
- Regarding facilities owned/controlled, or for whose operational matters is responsible

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Trading based on inside information: Activations



Control room receives the information about the mFRR activations from Fingrid's operator



Information about the activations becomes public

FINGRID



Trader can react on the information

Article 3

Prohibition of insider trading

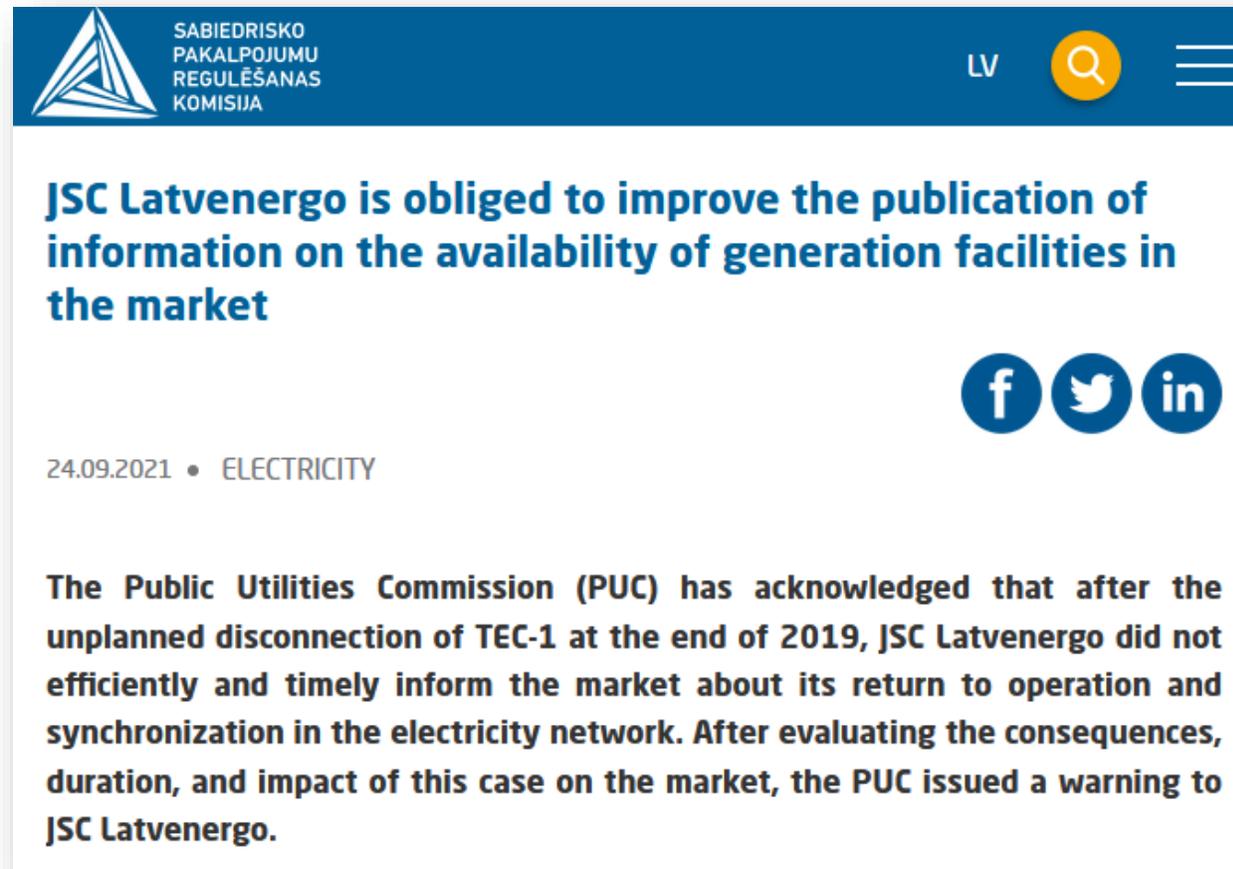
Trading based on inside information

- Market participants are not allowed to place/amend bids to the mFRR, while in possession of inside information
- Inside information can be:
 - Related to the unavailability or changes in unavailability (earlier return of a power plant)
 - Related to activations in the balancing market

What was the reason for the bid amendment?

Was the inside information spread only on the “need-to-know” basis?

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SABIEDRISKO
PAKALPOJUMU
REGULĒŠANAS
KOMISIJA

LV

JSC Latvenergo is obliged to improve the publication of information on the availability of generation facilities in the market

24.09.2021 • ELECTRICITY

The Public Utilities Commission (PUC) has acknowledged that after the unplanned disconnection of TEC-1 at the end of 2019, JSC Latvenergo did not efficiently and timely inform the market about its return to operation and synchronization in the electricity network. After evaluating the consequences, duration, and impact of this case on the market, the PUC issued a warning to JSC Latvenergo.

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Thank you!

market.surveillance@fingrid.fi



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An aerial photograph of a dense forest with a power line tower and its associated cables running through the center. The trees are lush green, and the sky is clear. The image is framed by white diagonal lines in the corners.

Review of reserve purchases and the principles for purchasing reserves in 2023

Jukka Kakkonen, Expert, Fingrid Oyj

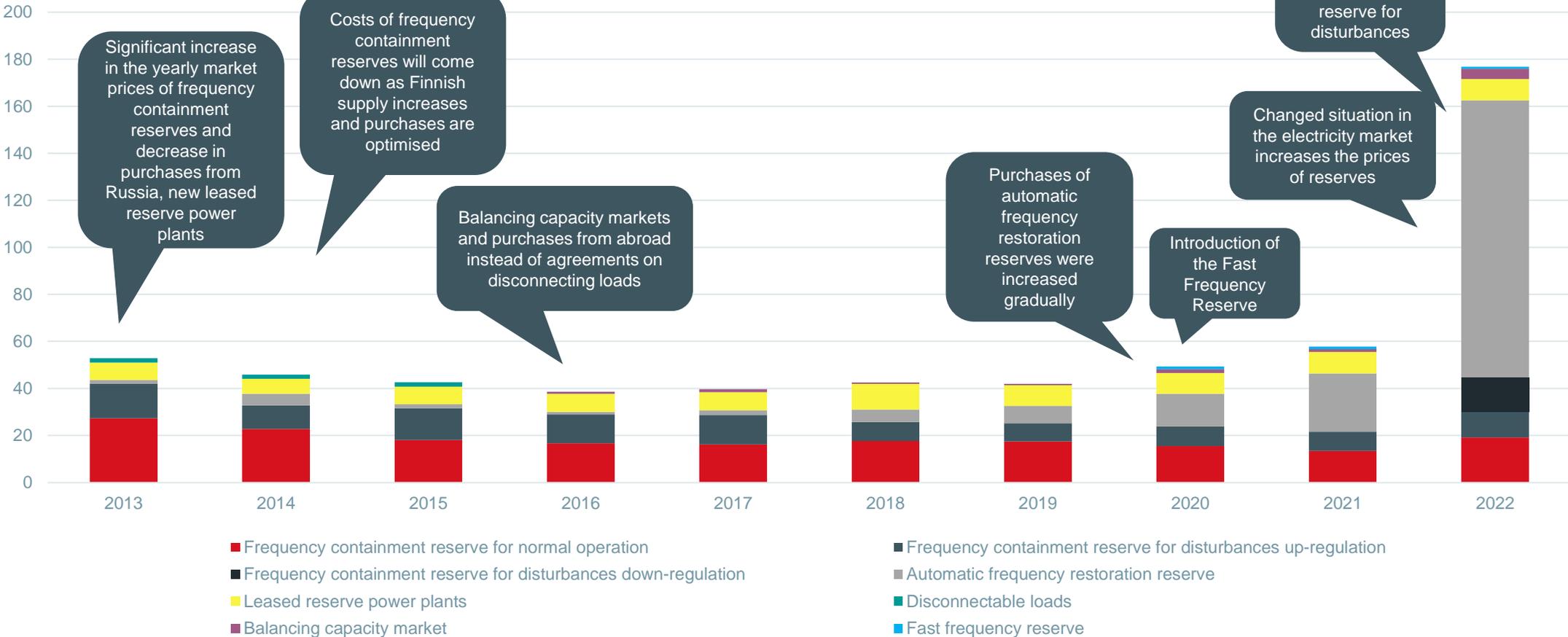
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Reserve procurement

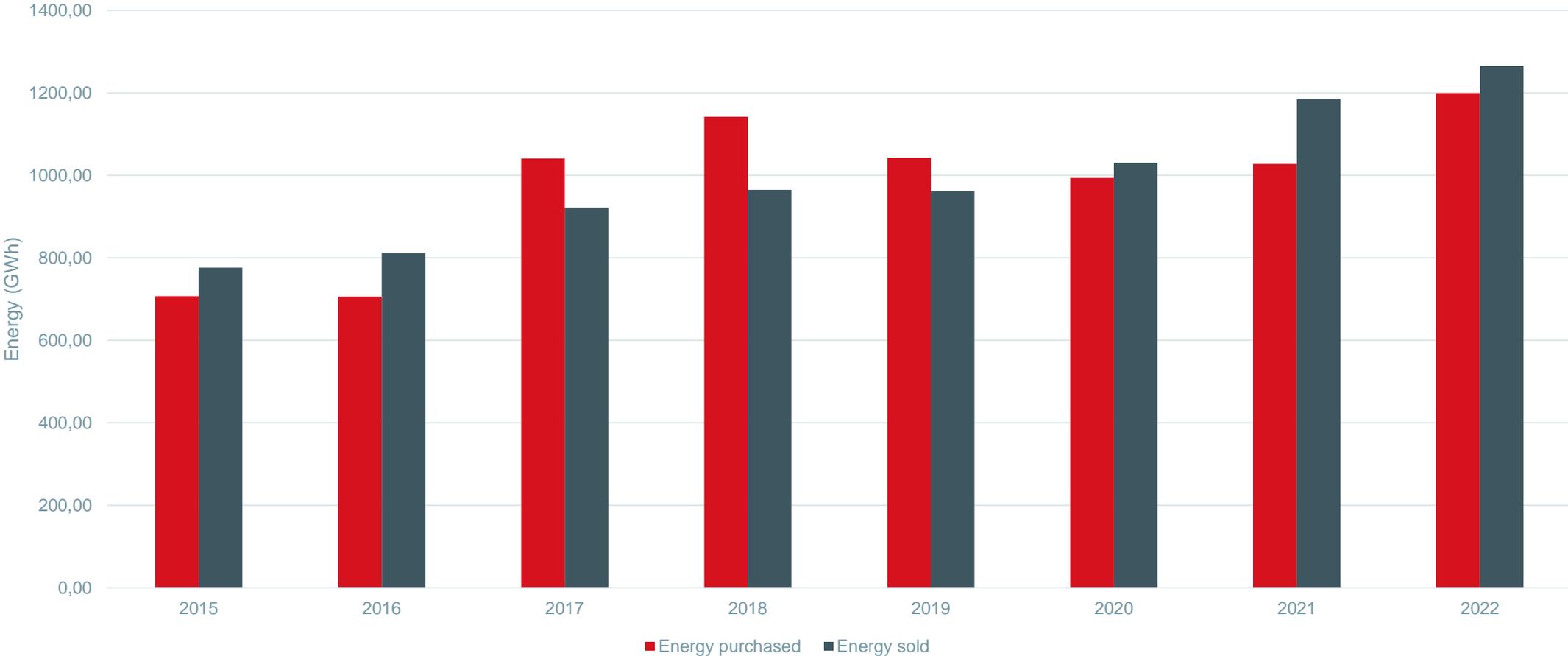
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Reserve capacity costs 2013–2022



Also: reserve energy markets!

Intraday market volumes in Finland

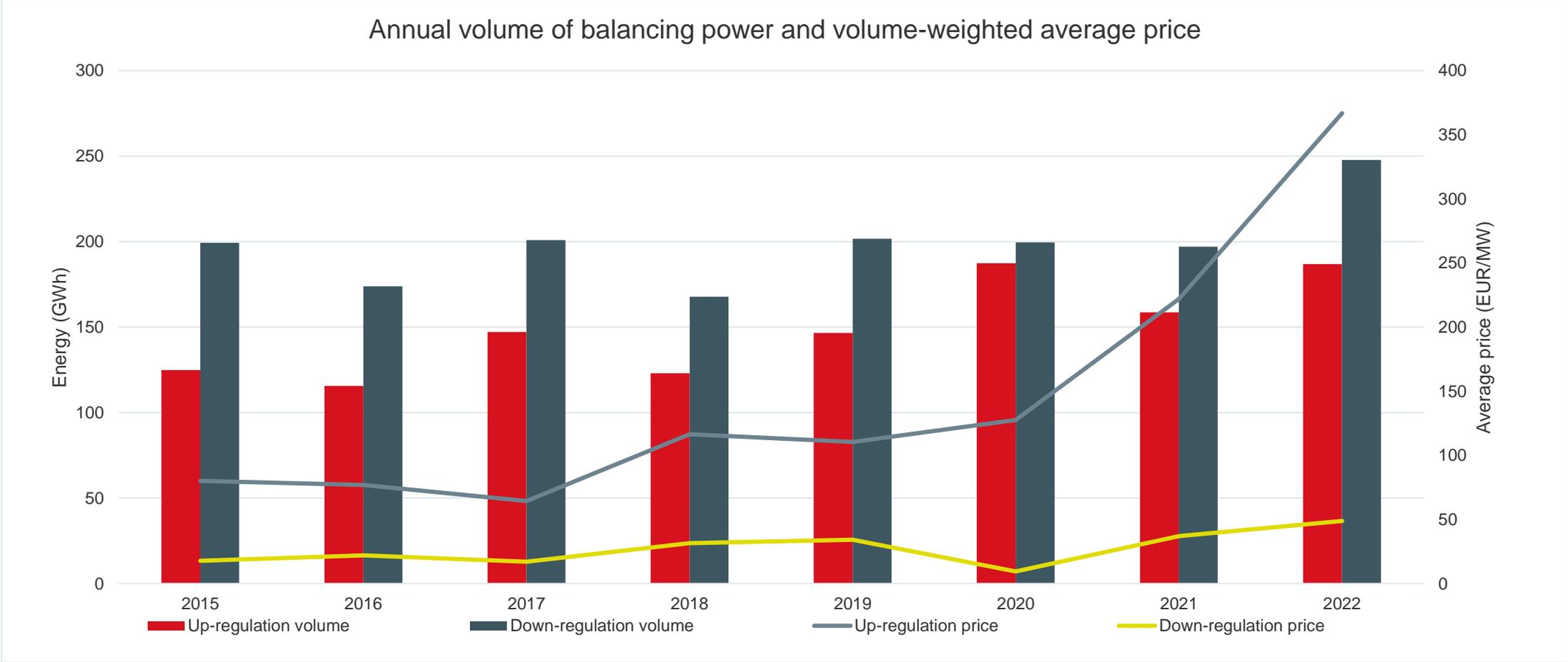


Total balancing power in the Nordic countries 2015–2022

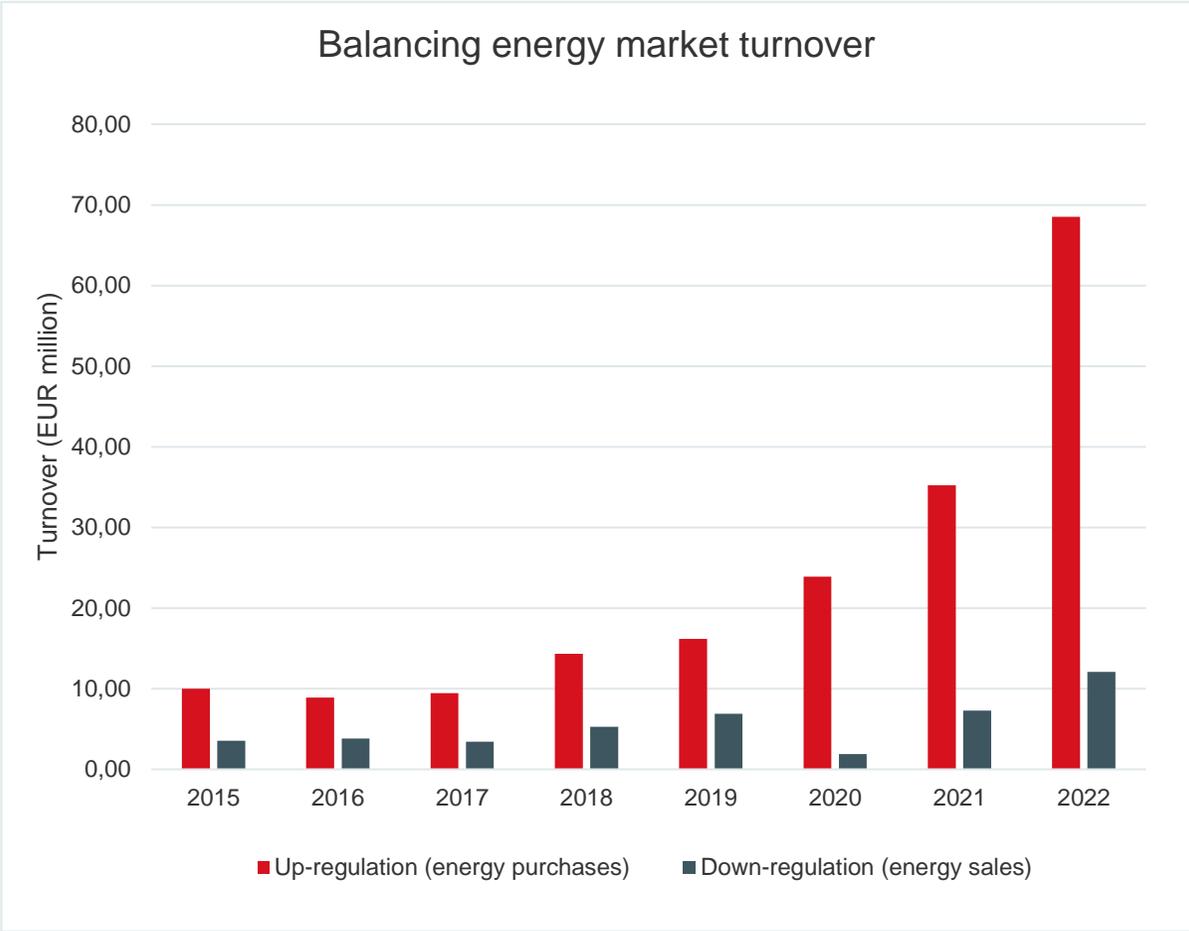
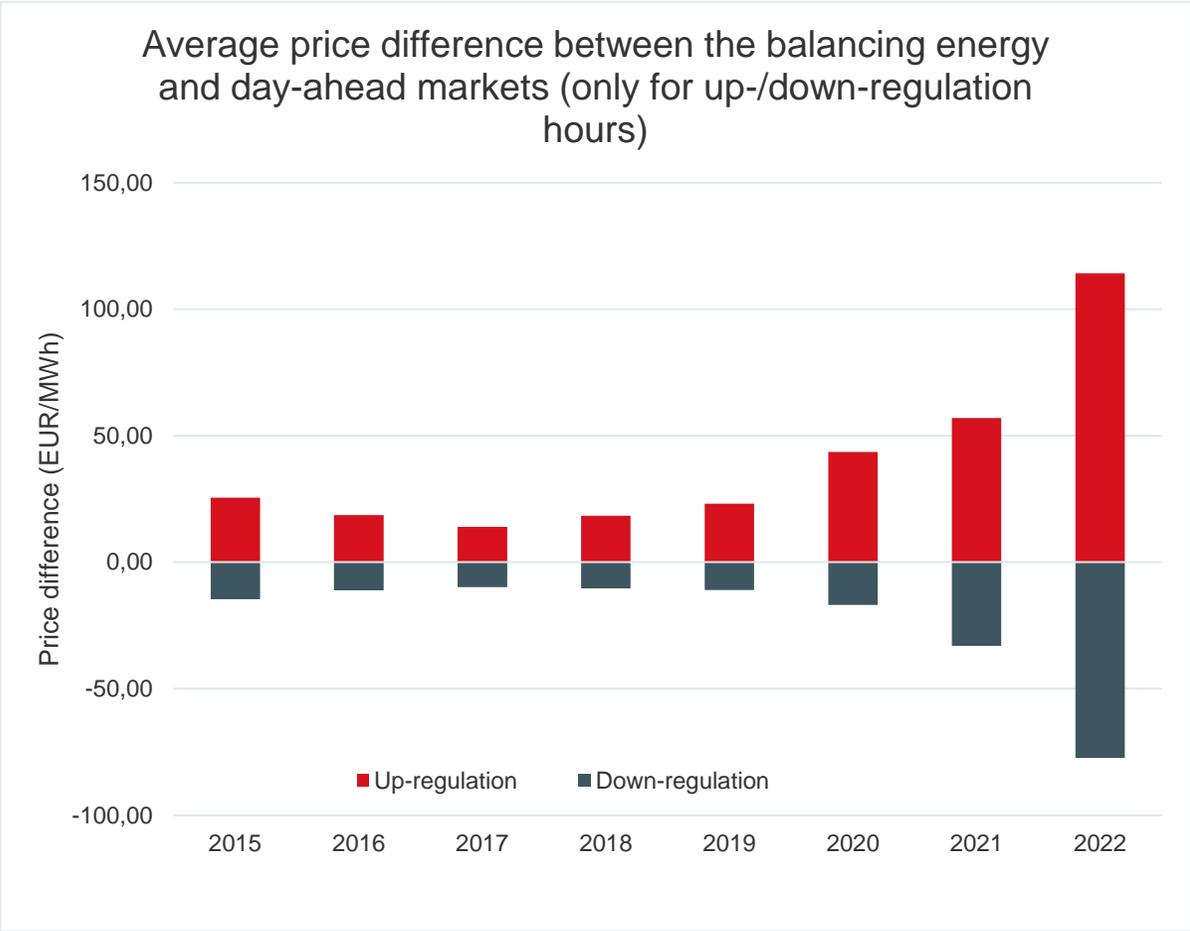
Volume of balancing power in the Nordic shared operation system



Balancing power (mFRR) in Finland



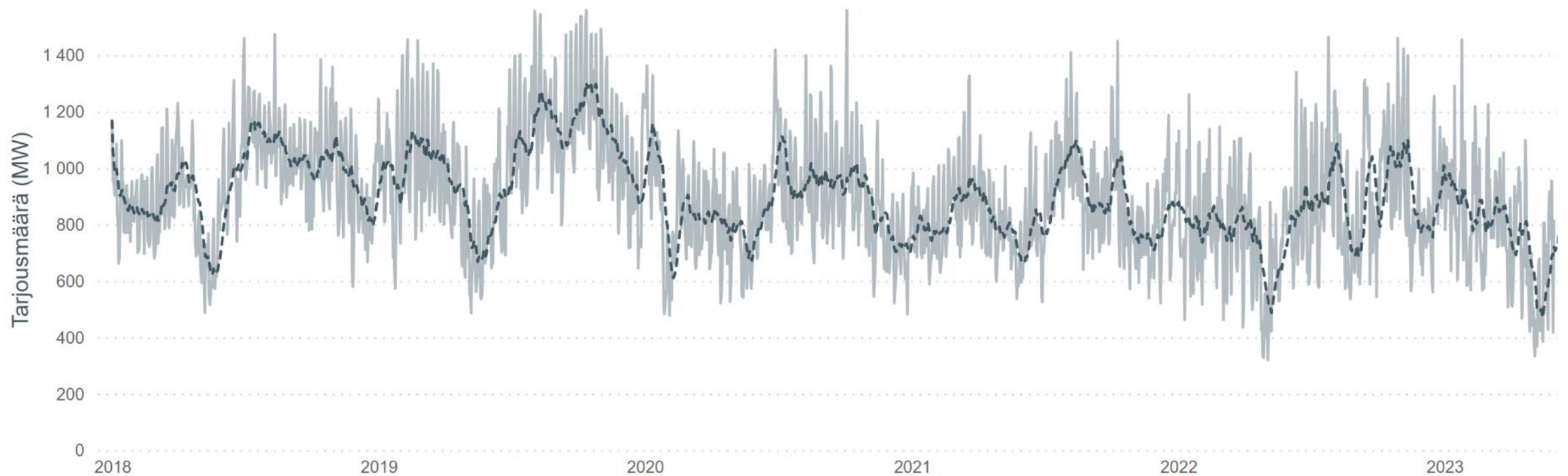
Balancing power (mFRR) in Finland



Balancing power up-regulation bids (mFRR) in Finland

mFRR ylössäätötarjousten määrä

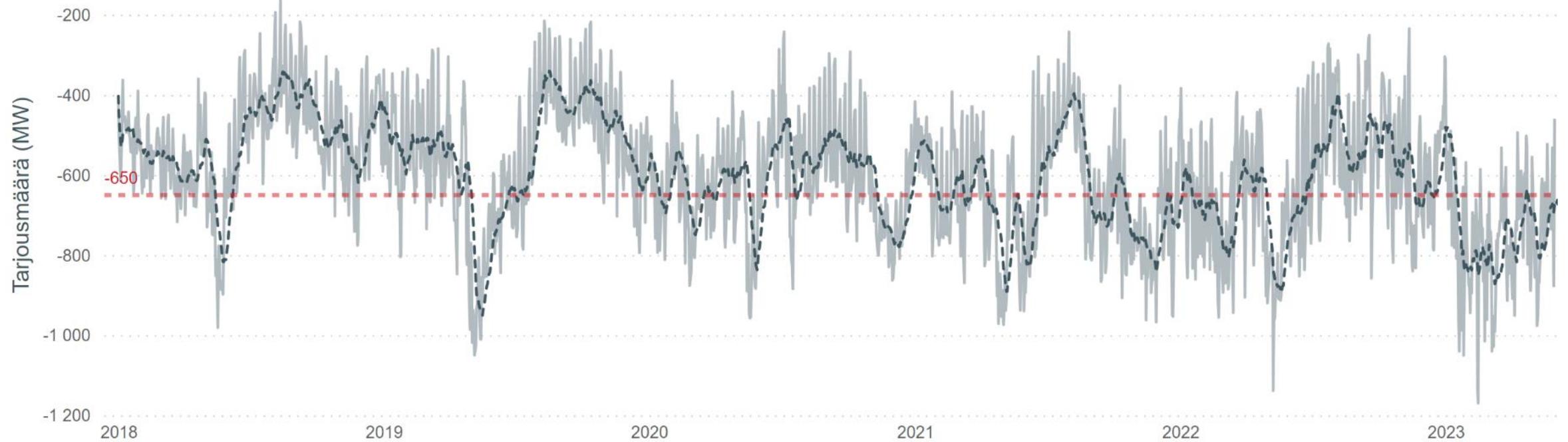
● Päiväkeskiarvo ● 14 päivän liukuva keskiarvo



Balancing power down-regulation bids (mFRR) in Finland

mFRR alasäättötarjousten määrä

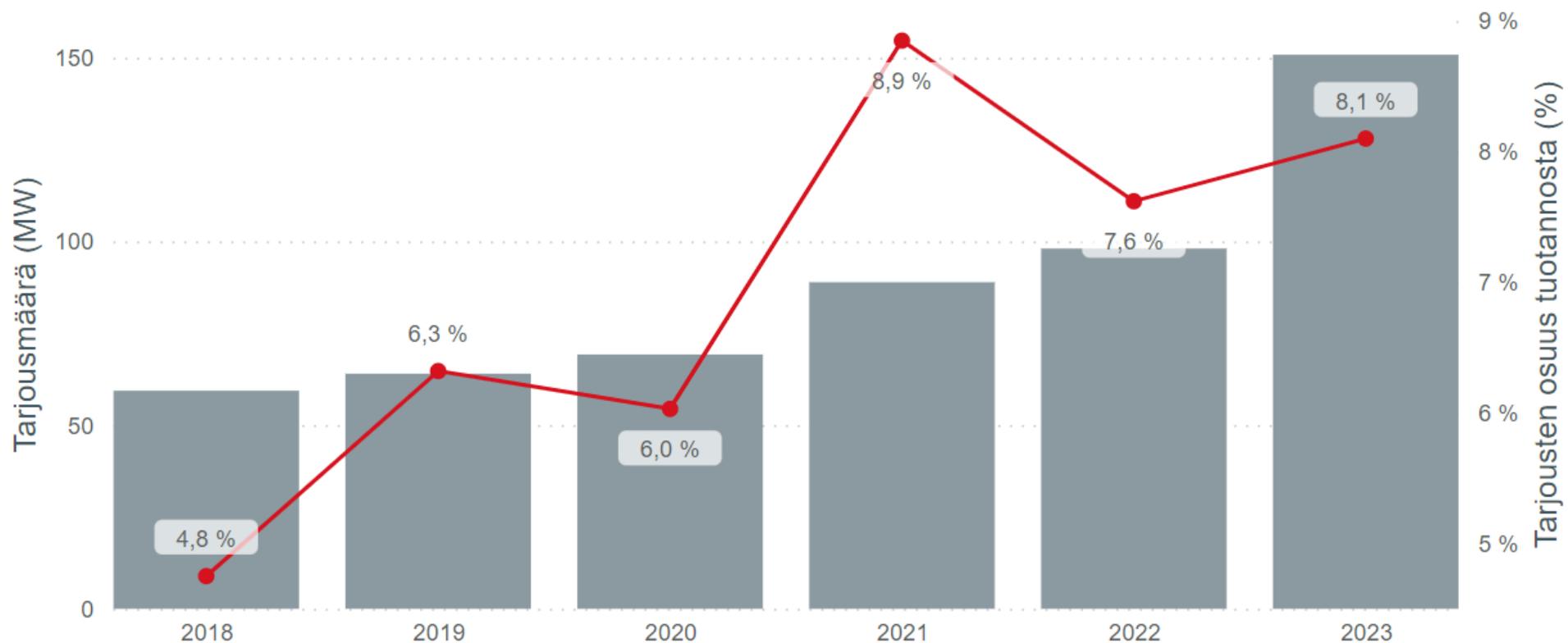
● Päiväkeskiarvo ● 14 päivän liukuva keskiarvo



Wind power down-regulation bids in Finland

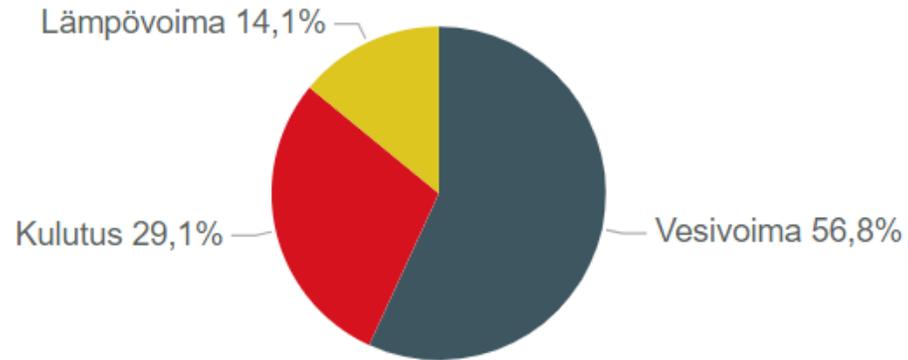
Tuulivoiman alassäätötarjoukset ja tarjousten osuus tuotannosta (tuntika.)

● Tarjousmäärä (MW) ● Tarjousten osuus tuotannosta

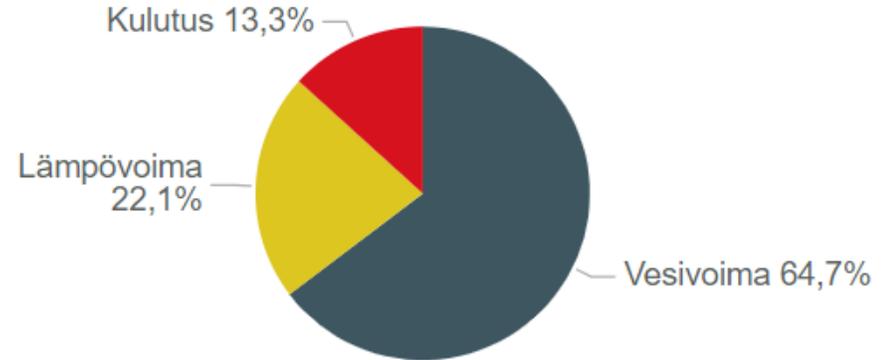


Balancing energy market resources in 2022

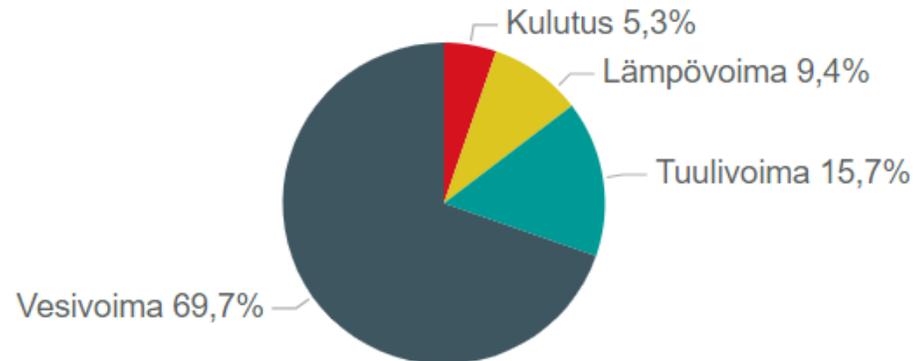
Manuaalisen taajuudenpalautusreservin (mFRR) ylössäätötarjoukset 2022



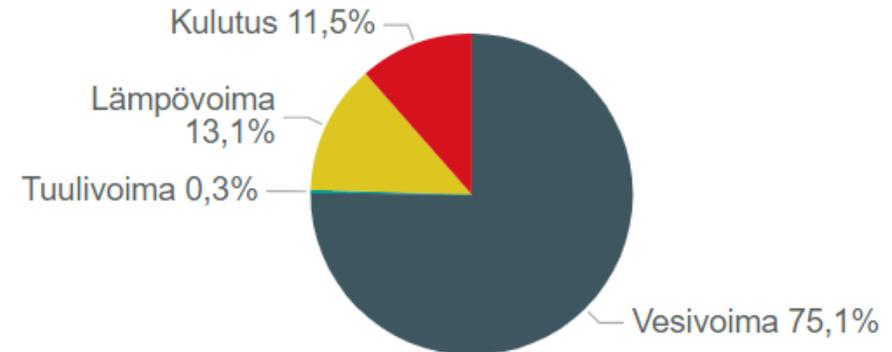
Manuaalisen taajuudenpalautusreservin (mFRR) ylössäätökaupat 2022



Manuaalisen taajuudenpalautusreservin (mFRR) alassäätötarjoukset 2022

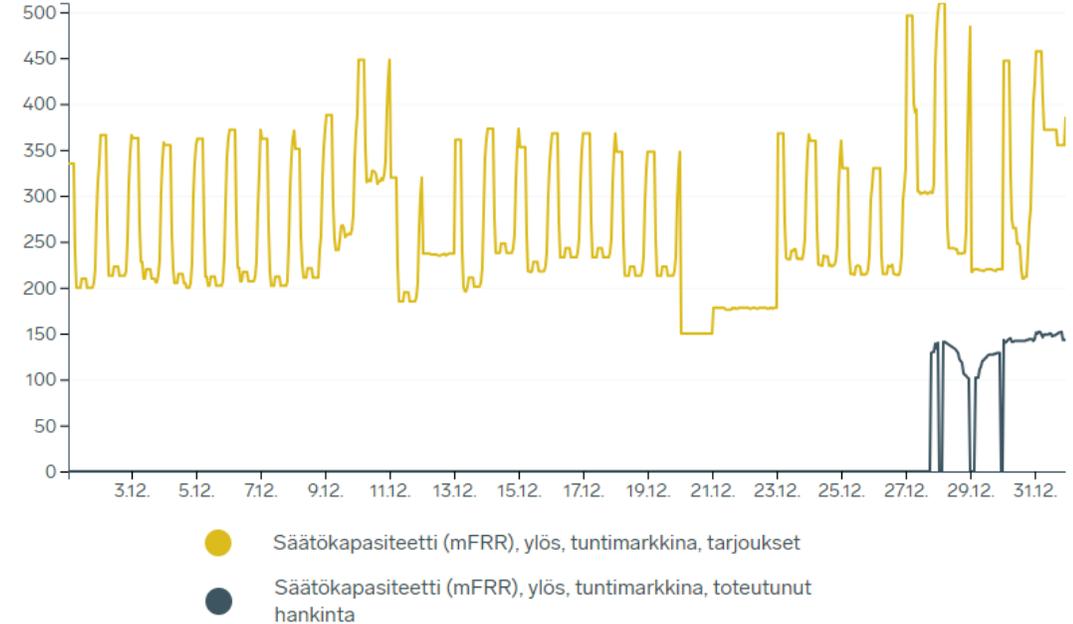
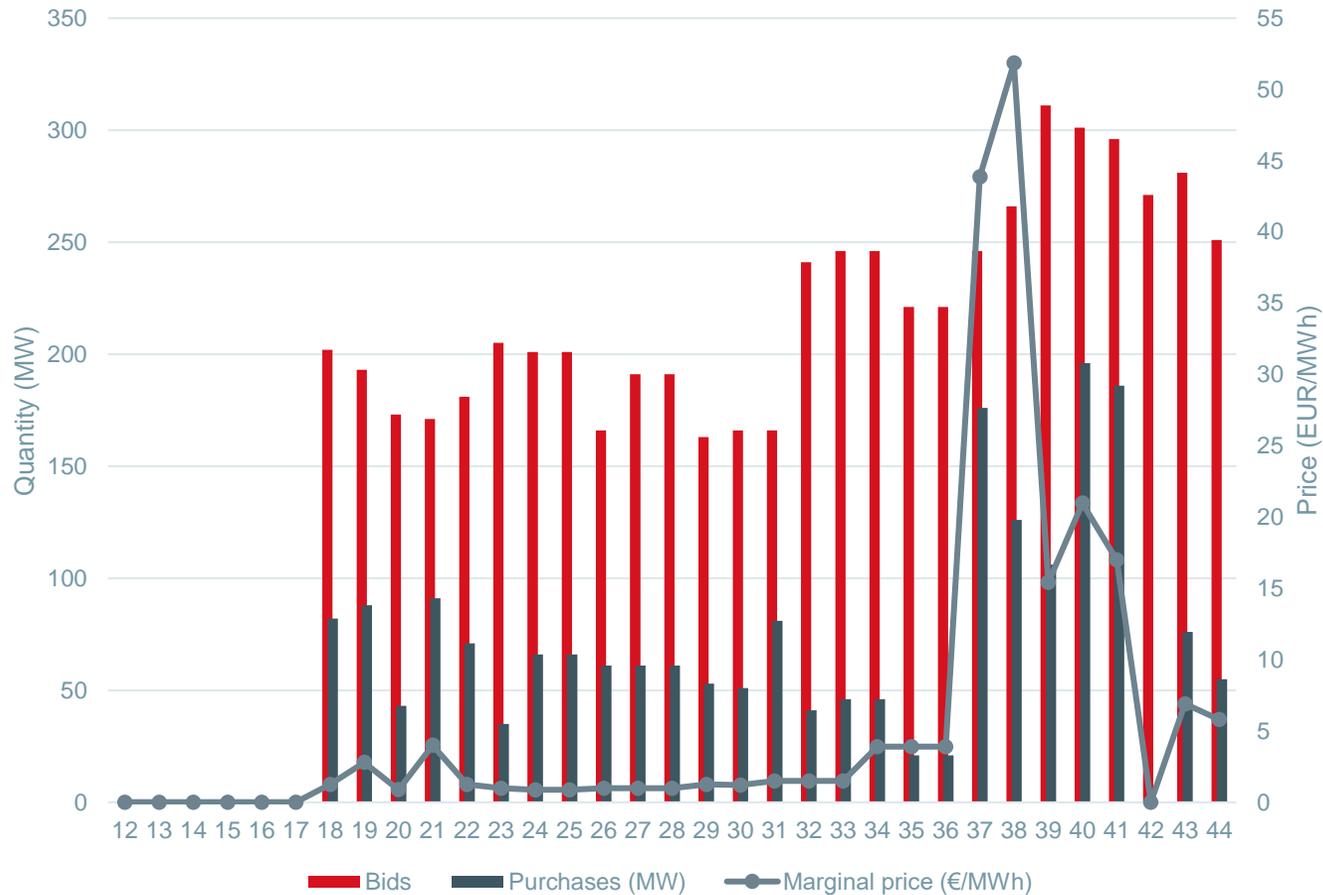


Manuaalisen taajuudenpalautusreservin (mFRR) alassäätökaupat 2022



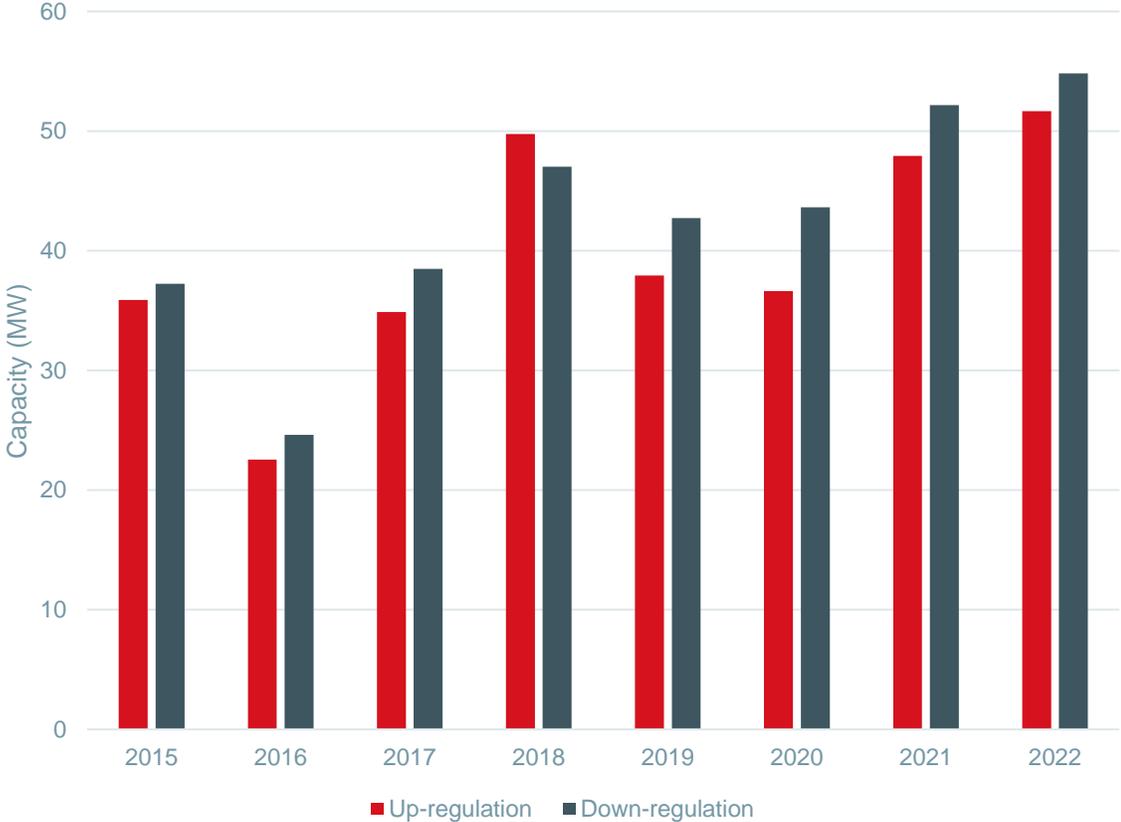
Balancing capacity market up

The market resolution changed from one week to one hour on 1 December

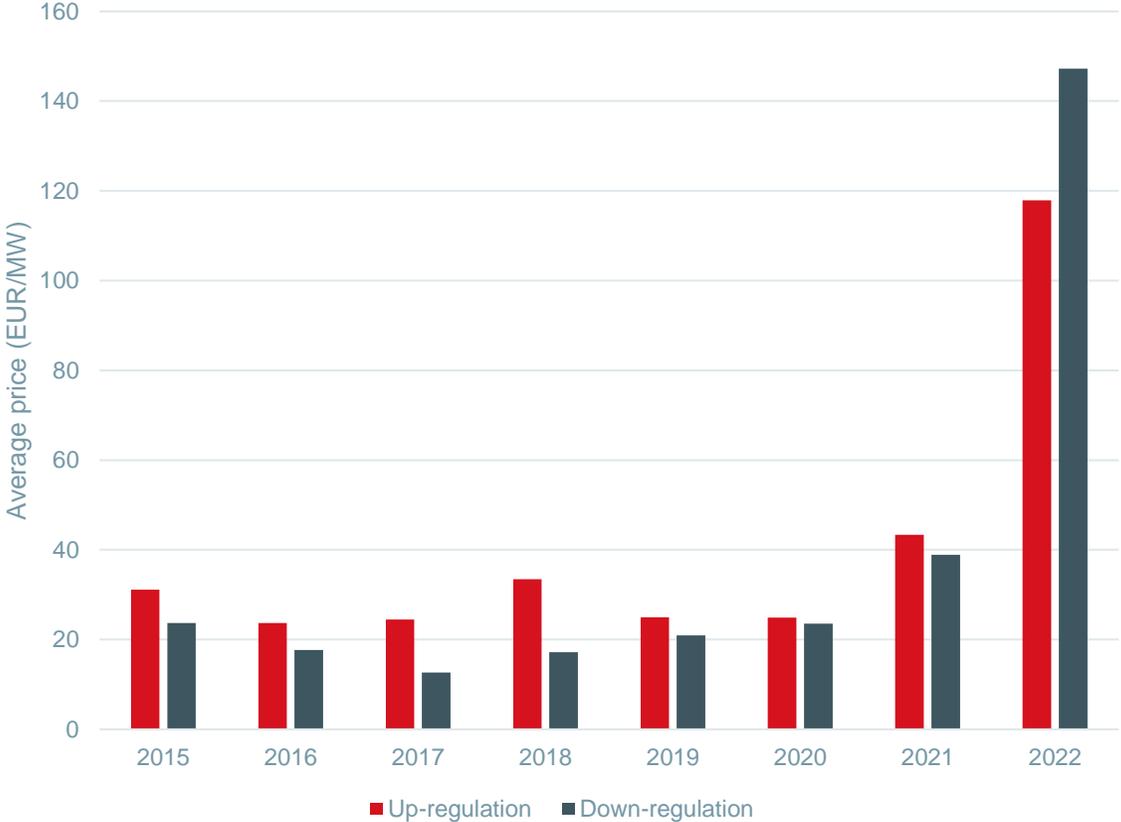


Automatic frequency restoration reserve (aFRR)

Average aFRR purchases per purchased hour

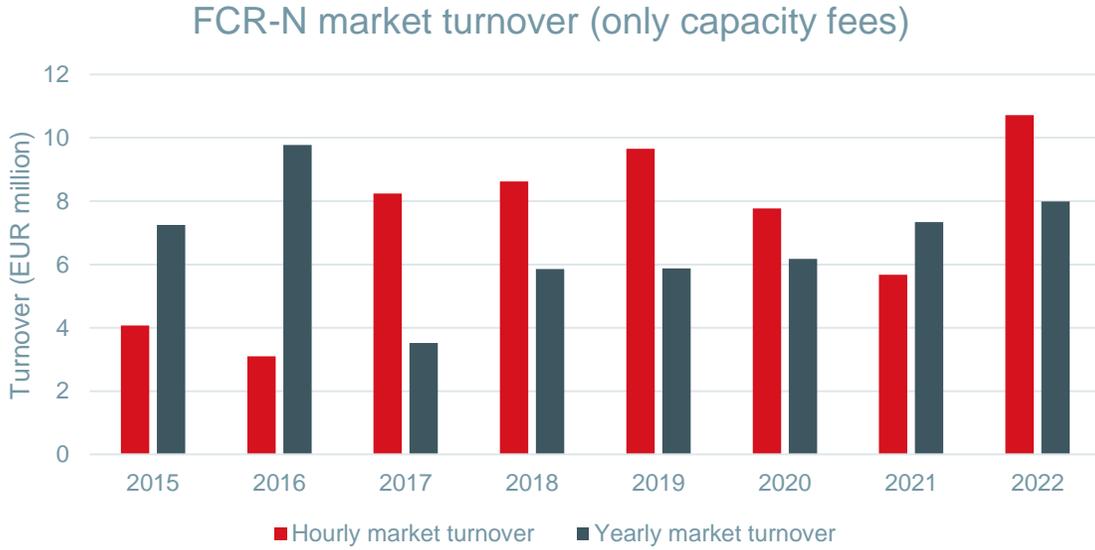
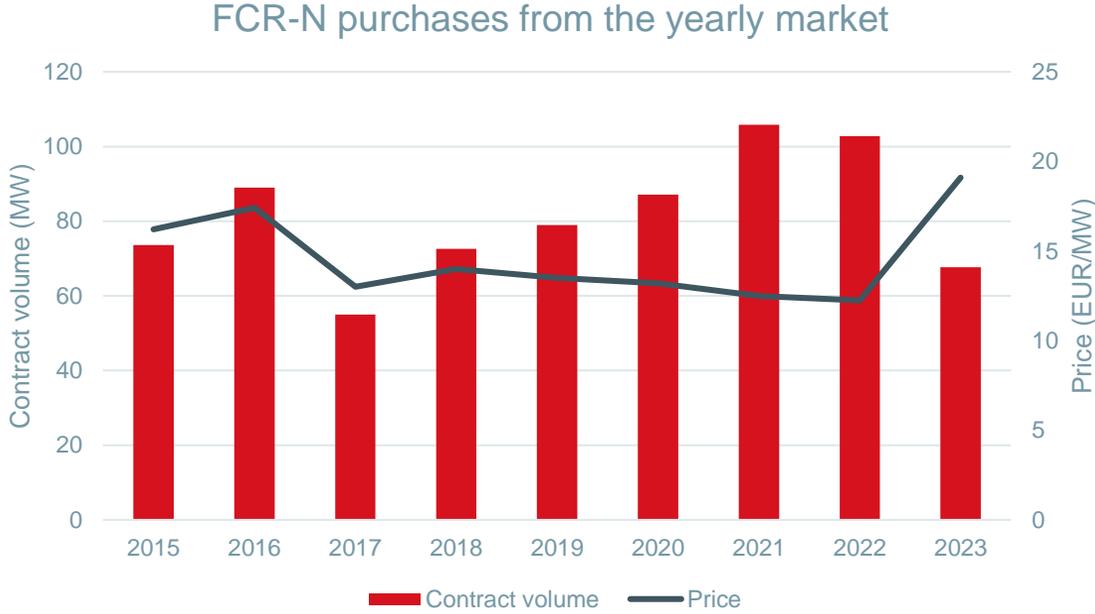
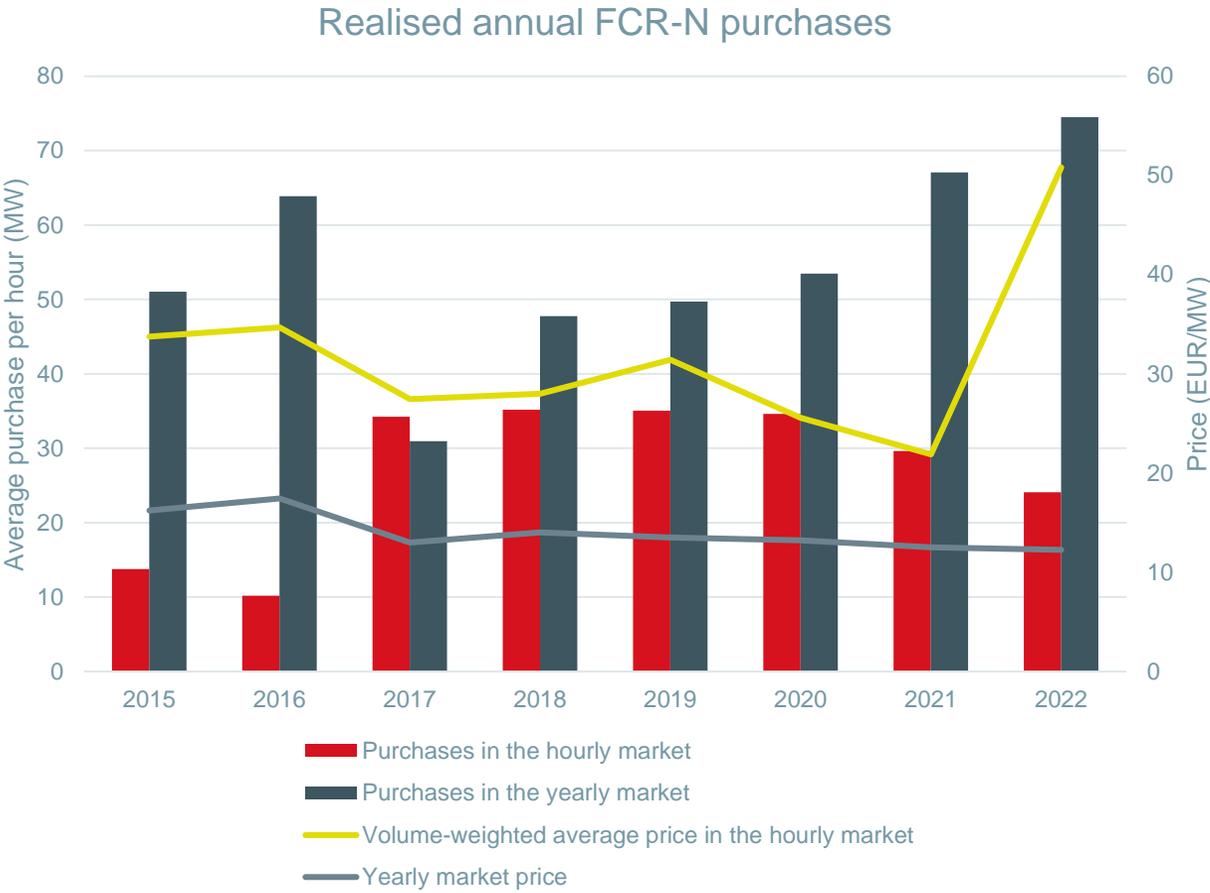


Average price of aFRR capacity per purchased hour

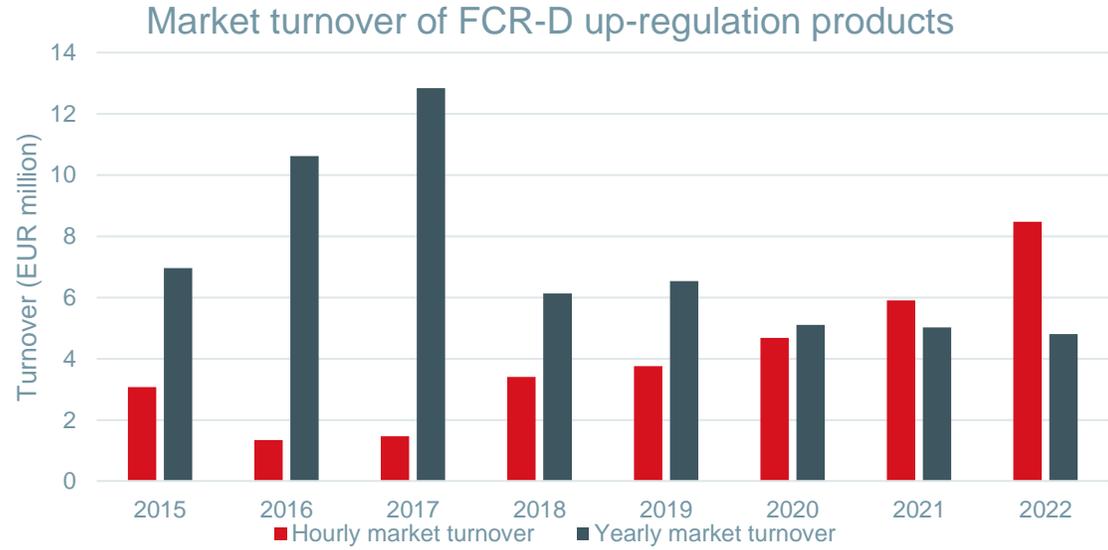
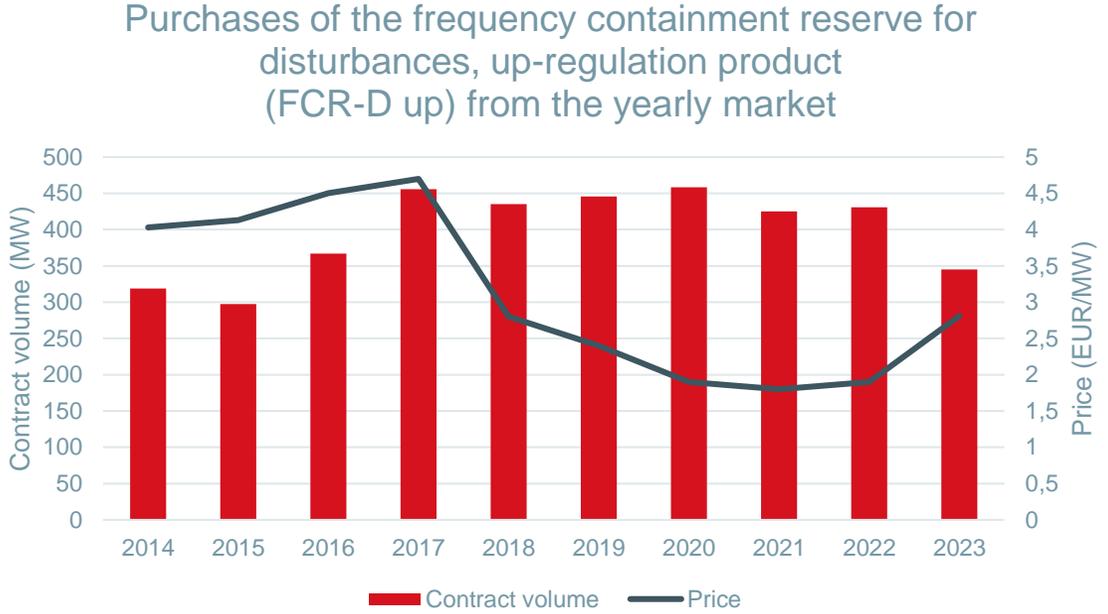
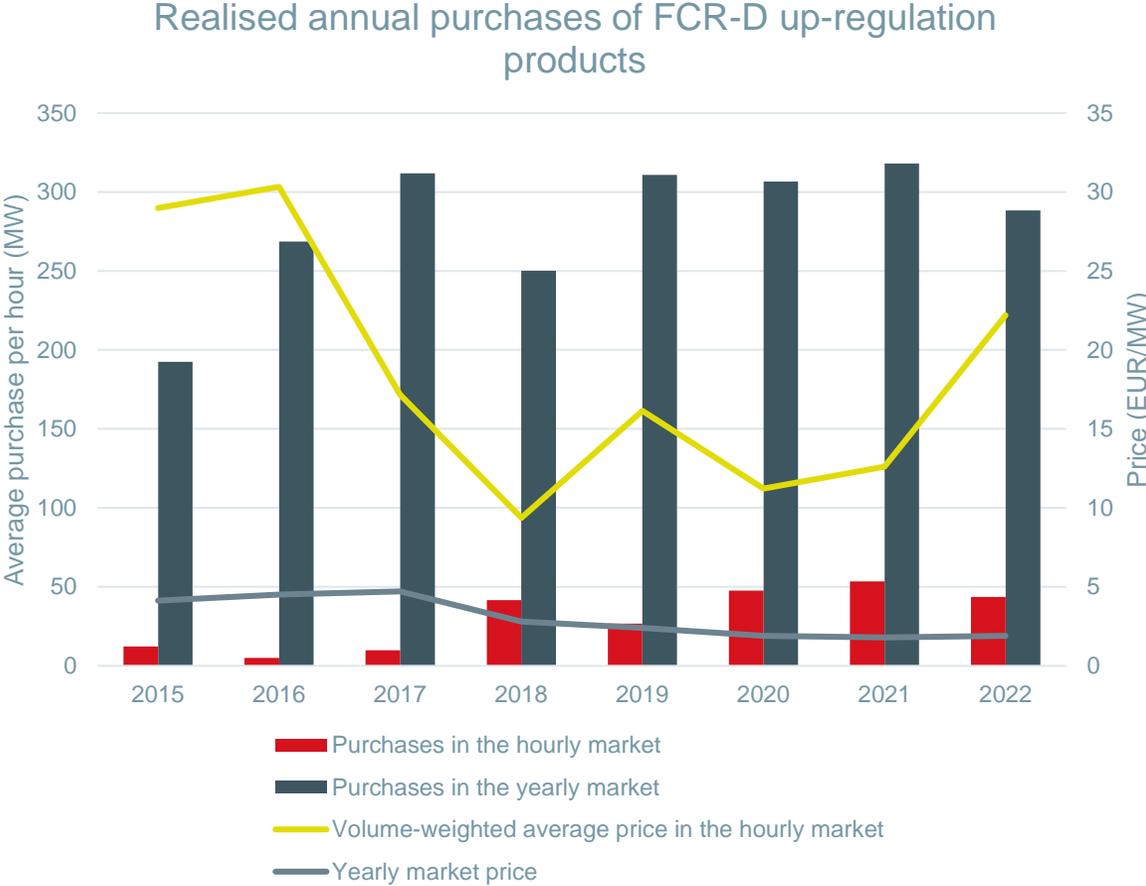


The verified aFRR capability in 5/2023 is approx. 230 MW in both directions.

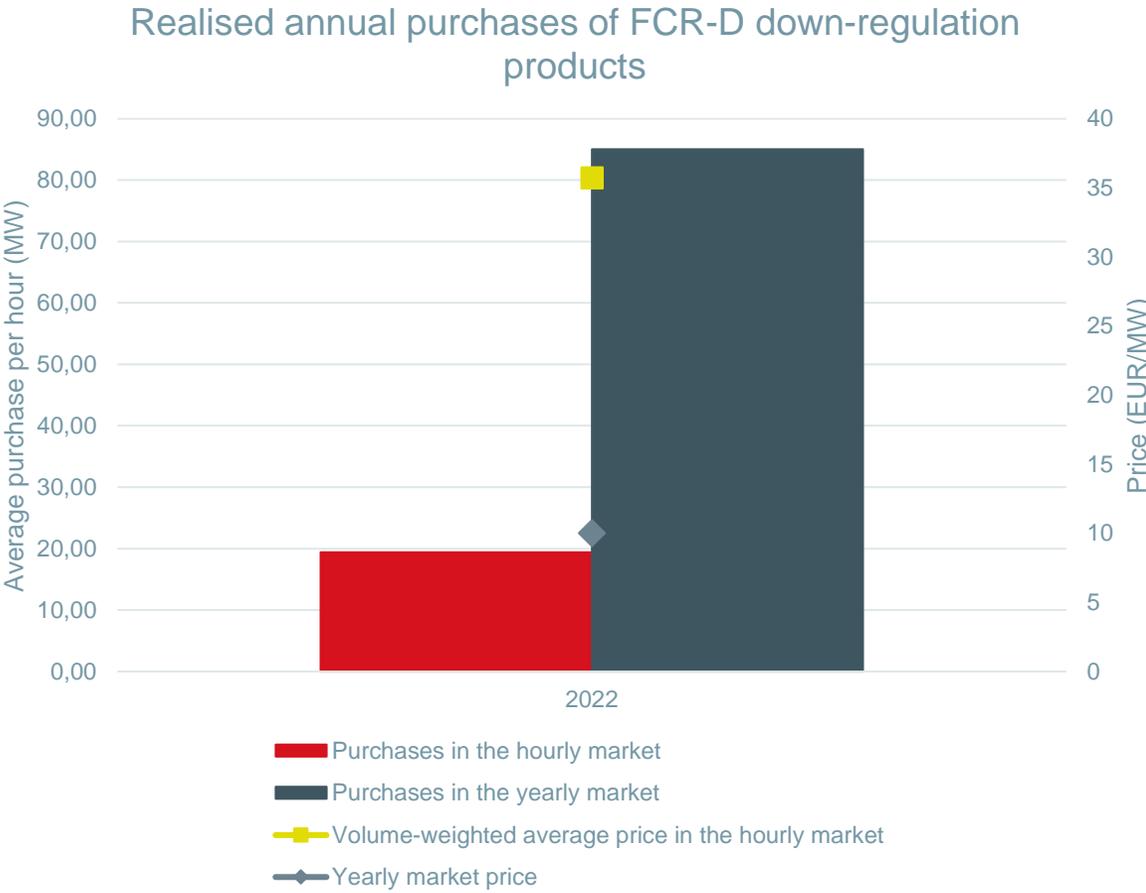
Frequency containment reserve for normal operation (FCR-N)



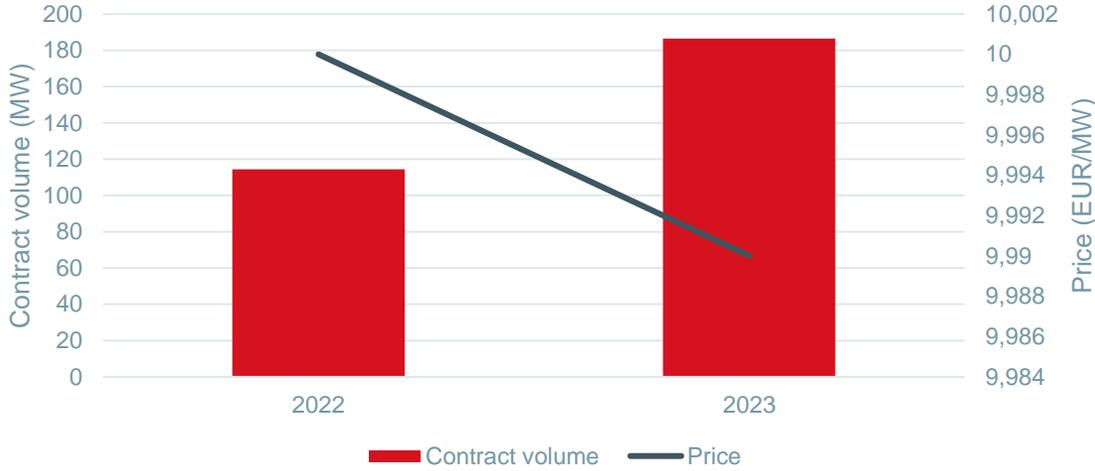
Frequency containment reserve for disturbances, up-regulation product (FCR-D up)



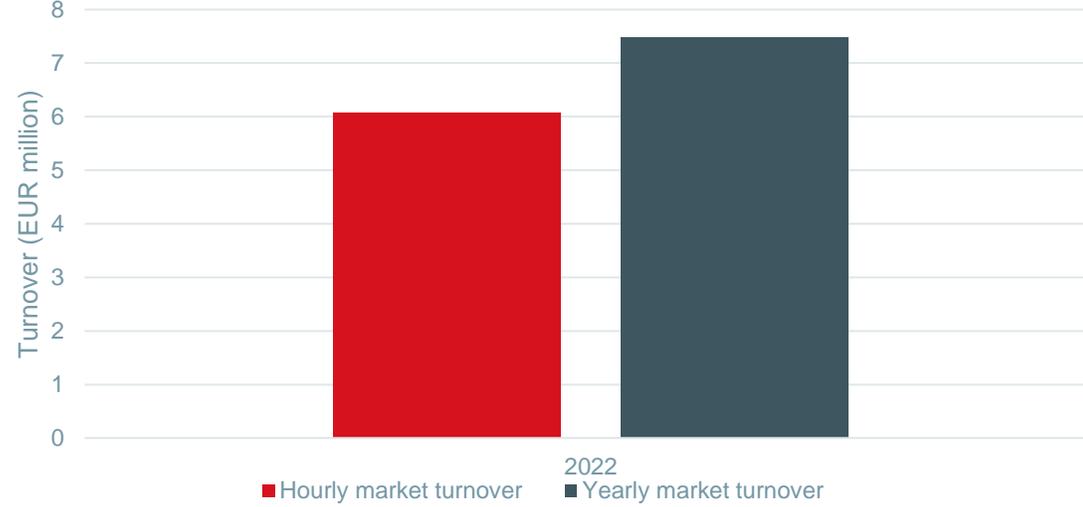
Frequency containment reserve for disturbances, down-regulation product (FCR-D down)



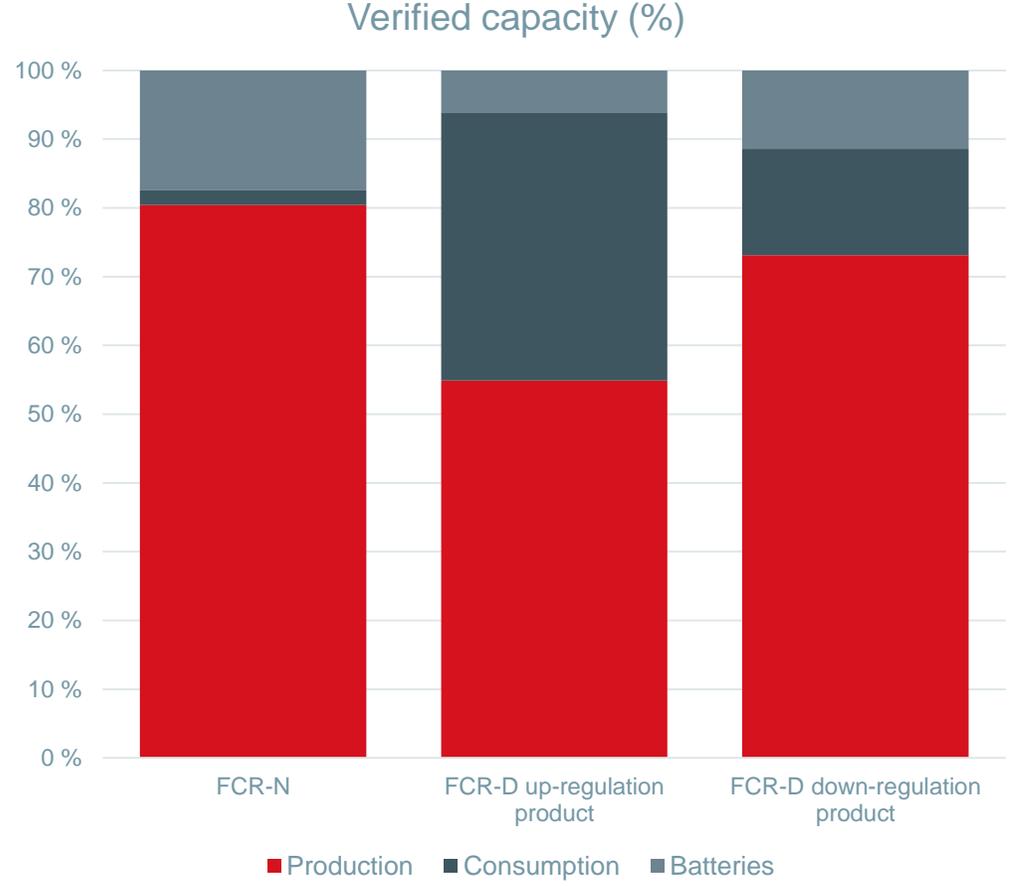
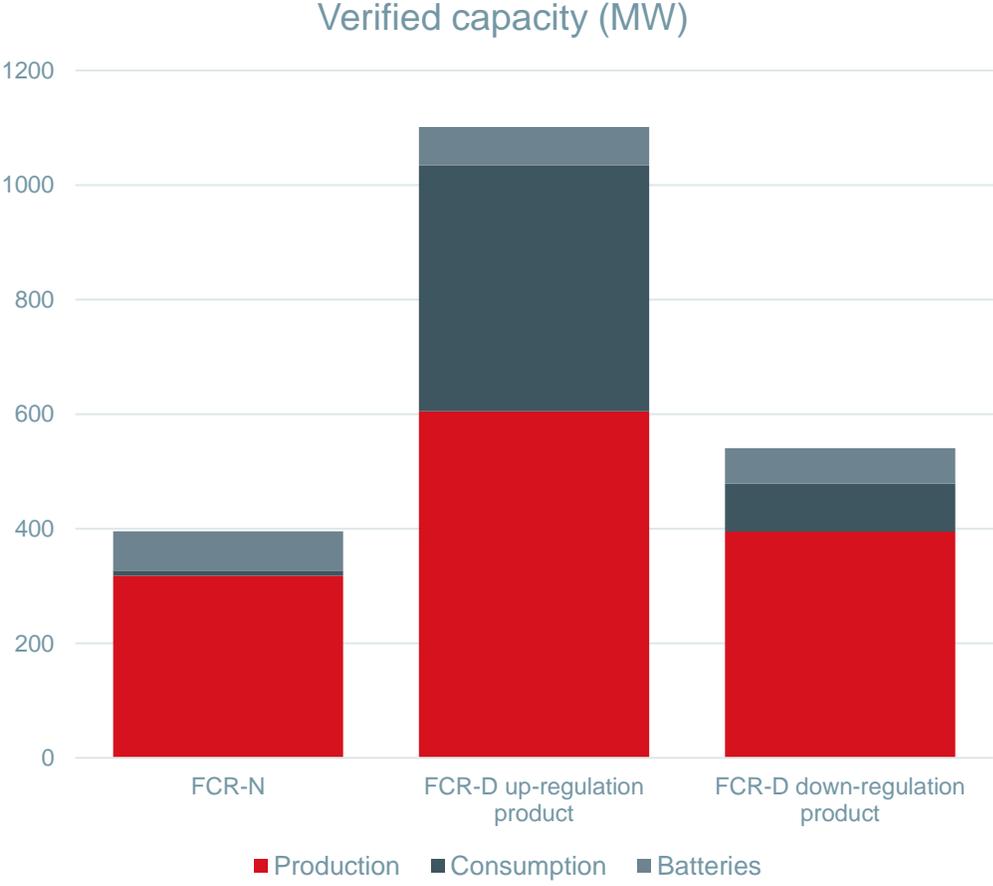
Purchases of the frequency containment reserve for disturbances, up-regulation product (FCR-D up) from the yearly market



Market turnover of FCR-D down-regulation products

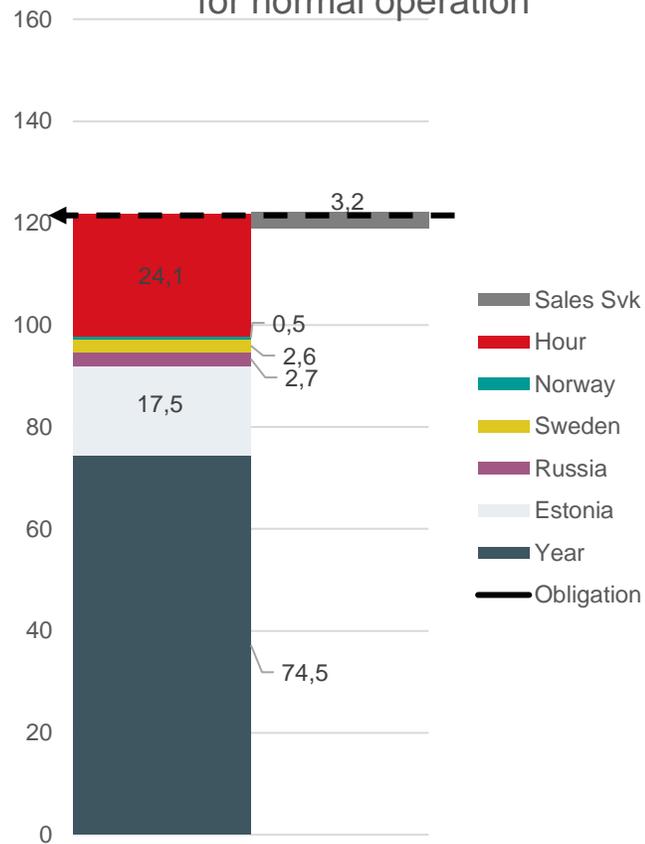


Verified FCR-N and FCR-D capacity (status in 5/2023)

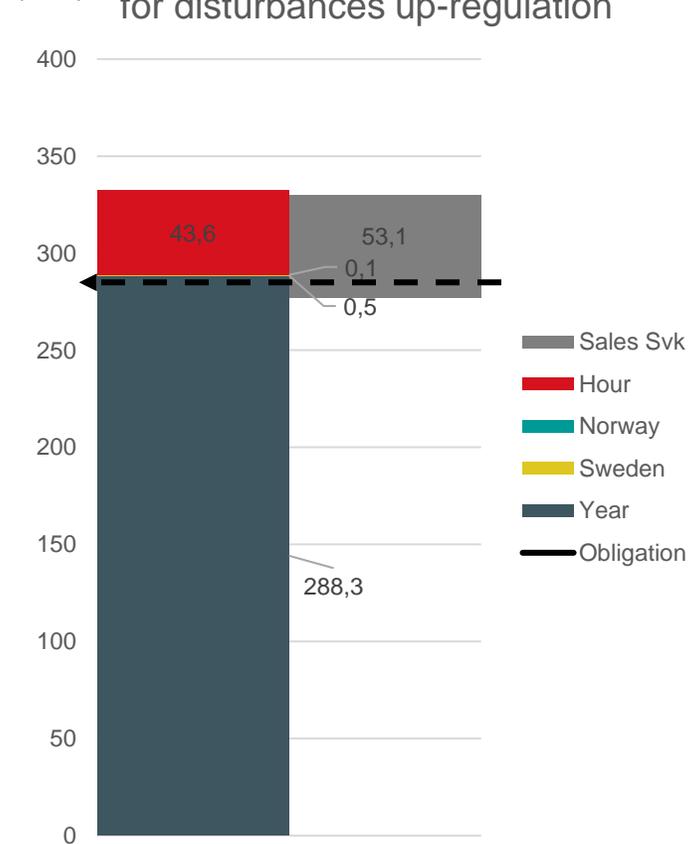


Average purchases of frequency containment reserves in 2022

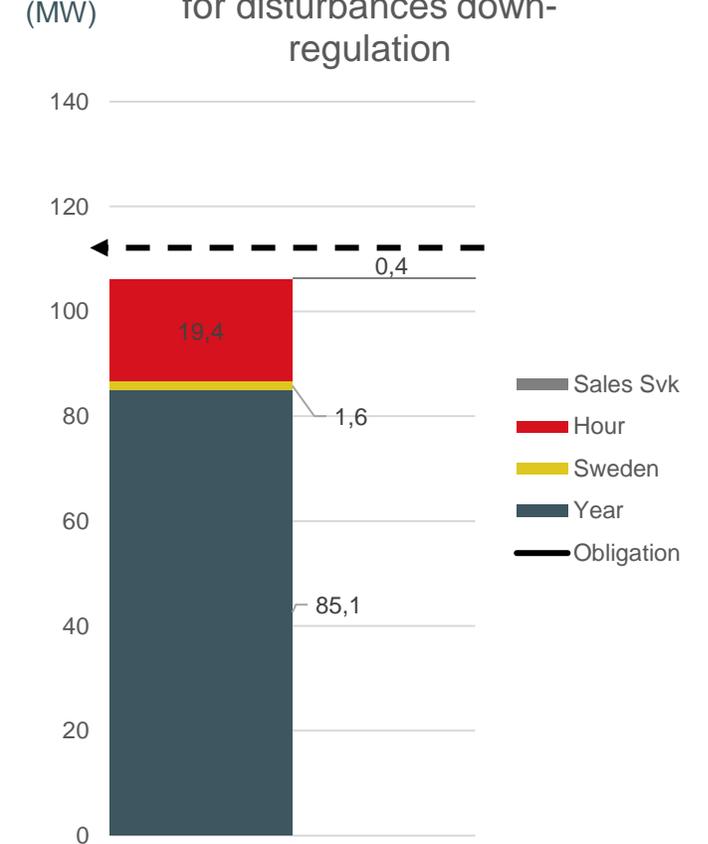
(MW) Frequency containment reserve for normal operation



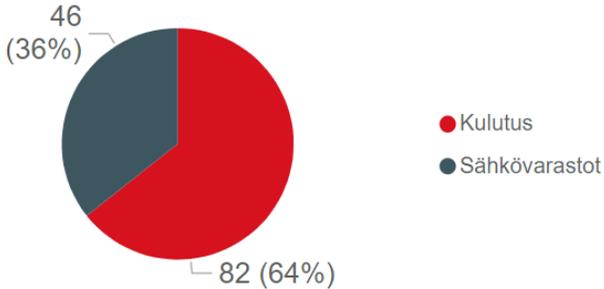
(MW) Frequency containment reserve for disturbances up-regulation



(MW) Frequency containment reserve for disturbances down-regulation



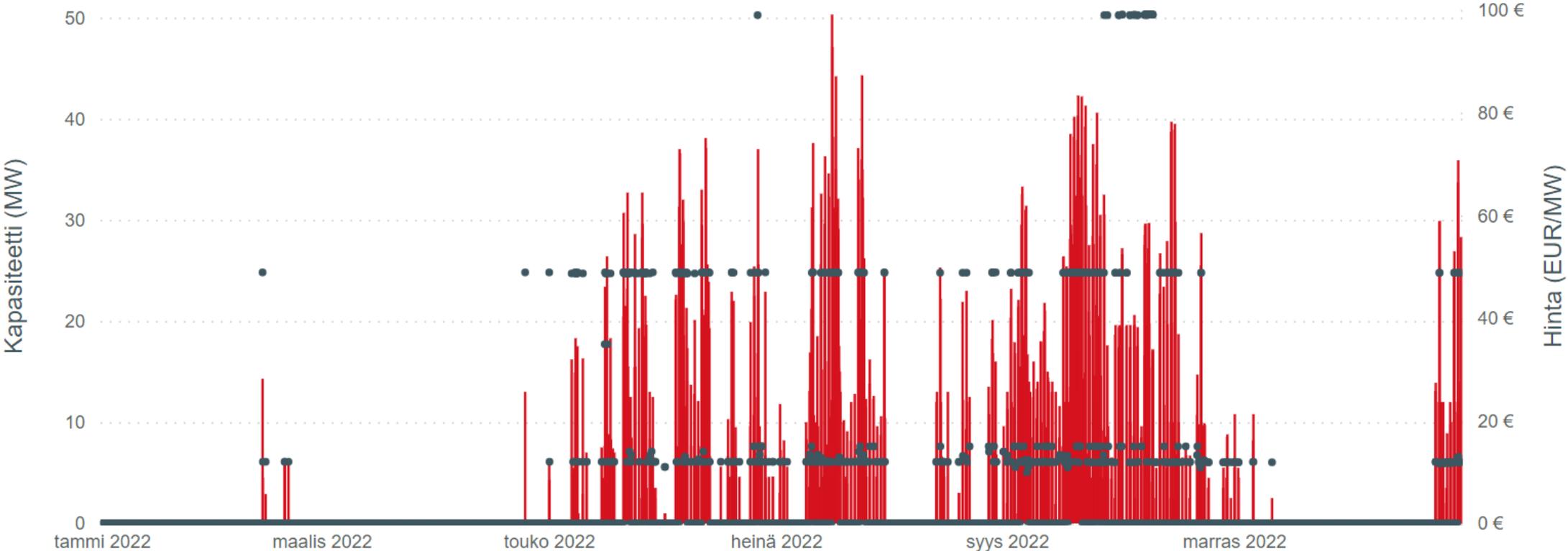
Sertifioitu FFR-kapasiteetti 5/2023 (yht. 127,8 MW)



Fast Frequency Reserve (FFR)

FFR kapasiteettihankinta

● Hankintamäärä (MW) ● Hankintahinta (EUR/MW)





Principles for reserve procurement

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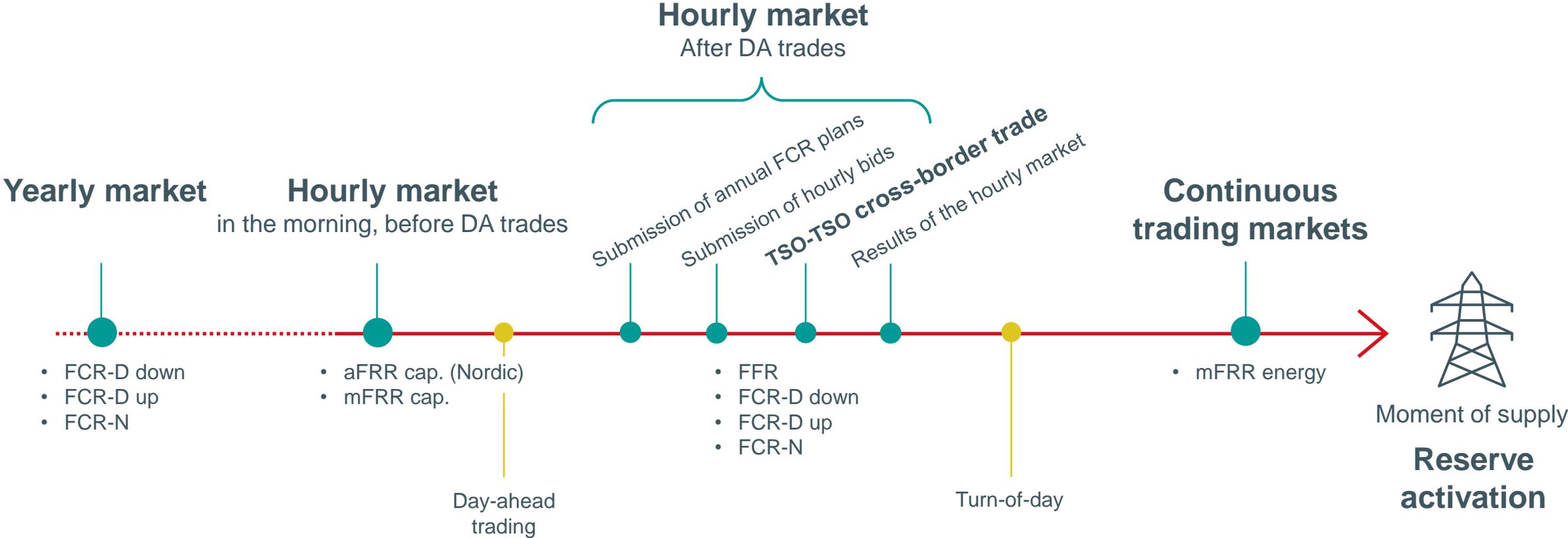
Reserves are procured in the volume necessary to safeguard the stable operation of the power system. Purchases are market-based.

Reserves are purchased to cover obligations

- The need for reserves stems from legislation and the maintenance of the selected level of system security. The need applies to the entire power system. The distribution of reserve obligations between different areas is agreed upon in the Nordic countries.
- **Under exceptional circumstances, Fingrid may accept a minor shortfall in an obligation** if it does not degrade system security in the synchronous area.
 - *Low supply, insufficient competition and significant increases in prices/costs due to small additional purchase volumes.*
 - *Practices will be reassessed when it becomes apparent that exceptional circumstances arise more often than before.*
- The reserve obligation is fulfilled with purchases from Finland or abroad.

Reserve market timeline

Different products are purchased at different times



The yearly market (FCR) brings predictability and stability for balancing service providers and Fingrid

Market

- Balancing service providers submit bids to Fingrid in the autumn
- The autumn round of purchases sets the price and maximum volume of reserves. The bids accepted in the yearly market are not binding on balancing service providers. However, undersupply prevents the operator from participating in the hourly market for the hour concerned.

Purchases

- The optimisation principle is to minimise the overall purchasing costs. No fixed annual purchase volume. Annual purchases depend on bids and forecasts of the reserve supply in the following year.

Annual plan

- Balancing service providers can decide the day before how much of the reserves they have sold to the yearly market to maintain. Annual plans are submitted to Fingrid before hourly trading.

Reserves are purchased from the TSOs of neighbouring countries and Nordic marketplaces

FCR (trading between TSOs)

- Fingrid can trade FCR capacity with Svk and Statnett for the hours of the following day.
 1. *Fingrid receives the annual plans and hourly bids. It then makes buy or sell bids in the transmission system operators' systems.*
 2. *When TSO-TSO trades are confirmed, Fingrid makes purchases in the Finnish hourly market.*
- FCR-N capacity is purchased from Elering in Estonia. Normally 35 MW if the commercial transmission capacity is available at the time of purchase.
- **Purchases aim for cost-efficiency.**
2/3 of the capacity must be in Finland. Reserves supplied via the connection to Estonia are counted as Finnish.

mFRR capacity

- mFRR capacity is purchased from Finnish providers and those in Estonia. Elering's purchases of reserve power capacity are published in Open Data.

aFRR capacity

- Nordic market. For the time being, transmission capacity can be allocated in the Finland-to-Sweden direction.
- Elering can offer aFRR up capacity in the market from Estonian operators.

Purchases of FCR-N and aFRR reserves from Russia ended in summer 2022.

The hourly markets are the final round of purchases before the moment of supply

- Purchases made in the hourly market before day-ahead trading
 - aFRR capacity
 - mFRR capacity
- Purchases made in the hourly market after day-ahead trading
 - FFR
 - FCR-N, FCR-D down, FCR-D up
- mFRR energy bids are submitted in the **continuous trading marketplace**
- The necessary volumes of reserves are purchased in the hourly market in price order. Marginal pricing is also used in the hourly market.

Sometimes purchase volumes are different from usual

Frequency containment reserves from Estonia

- FFR, FCR-D capacity and more FCR-N capacity can be purchased from Estonia if reserves are in short supply.
- This is not directly visible in the published time series, but it has the effect of reducing the obligation.

Flexibility in the 2/3 rule

- It is possible to be flexible in the 2/3 Finnish source rule, subject to agreement with the other transmission system operators.

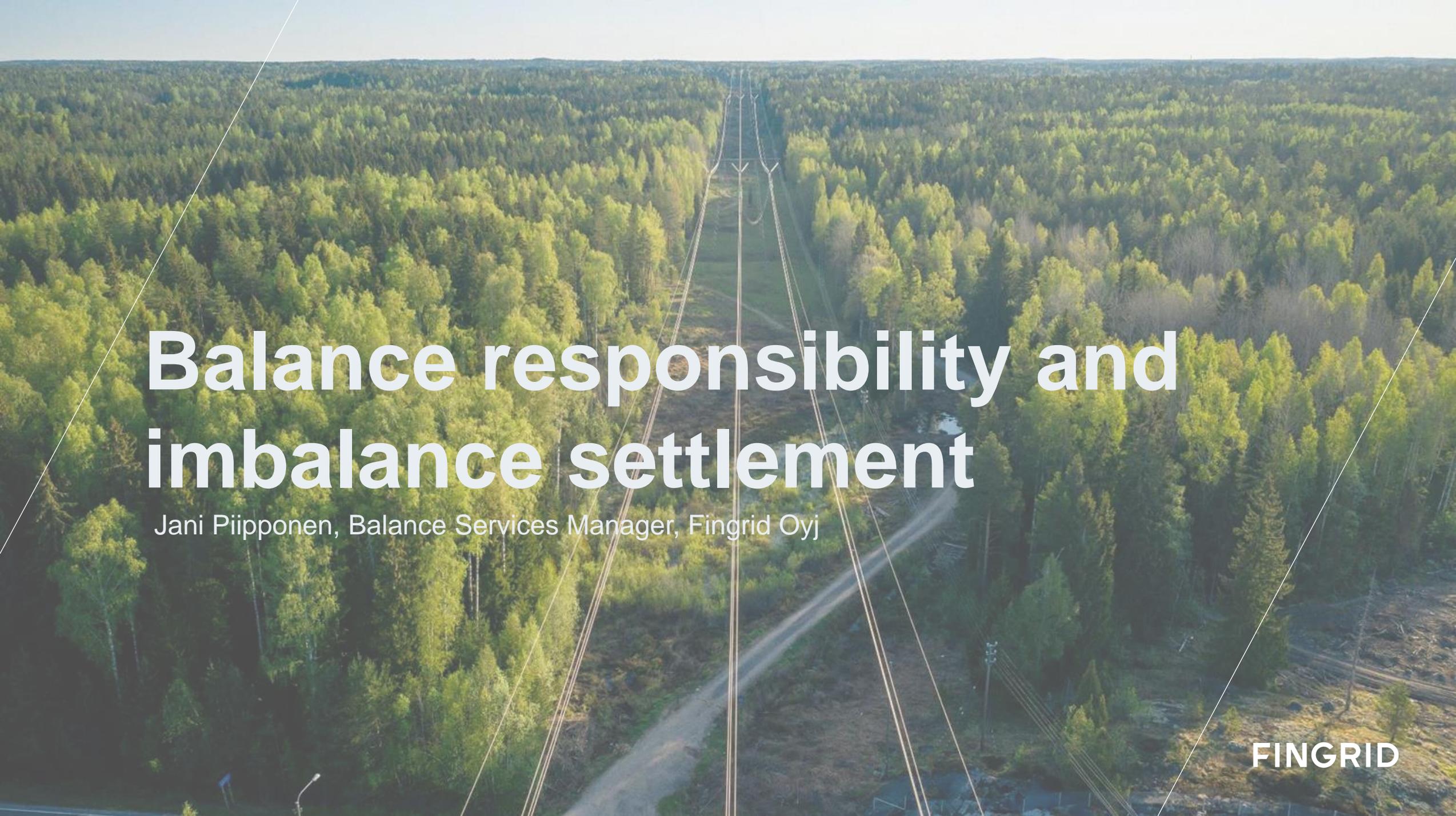
Manual regulation

- Special regulation can be ordered for other transmission system operators from Finnish operators
- Bilateral trading enables Fingrid to purchase production/consumption from Finnish operators for several hours at a time or the operation or reduction of production at a specific plant according to the grid's needs

Thank you



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An aerial photograph of a dense forest with a network of power lines and towers stretching across it. The trees are mostly green, suggesting a summer or early autumn setting. The power lines are a prominent feature, running from the foreground towards the horizon. The sky is clear and blue.

Balance responsibility and imbalance settlement

Jani Piipponen, Balance Services Manager, Fingrid Oyj

FINGRID

Electricity Market Act

- **Chapter 11, section 73: Balance responsibility**
 - Electricity market parties are responsible for ensuring that their electricity production and electricity purchase agreements cover the electricity they consume and supply during each imbalance settlement period (*balance responsibility*).

Parties must ensure a balance between purchases/production and sales/consumption with, for

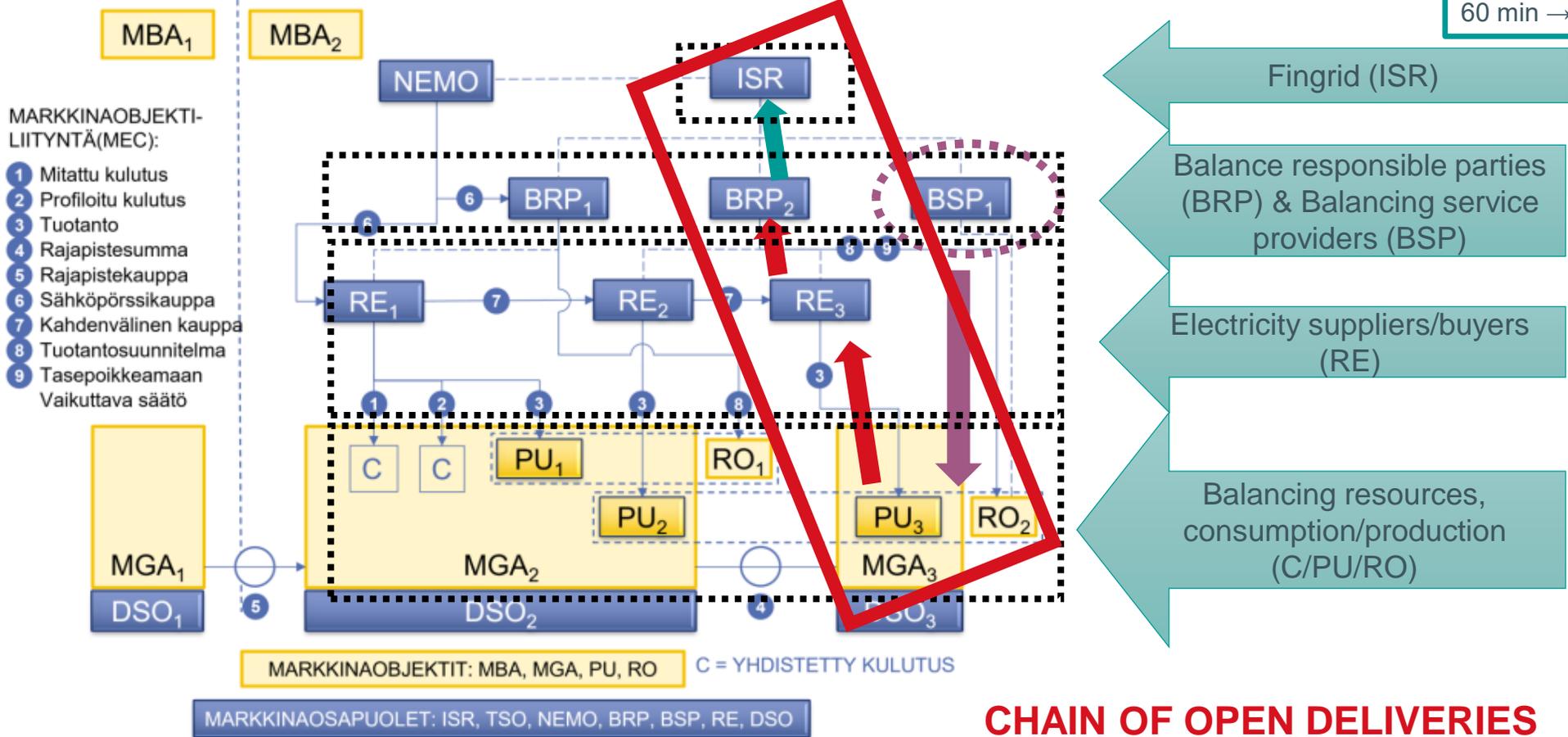
- The Government Decree includes more detailed provisions on the balance responsibility and the procedures related to fulfilling the balance responsibility. See *Government Decree on the Settlement and Metering of Electricity Deliveries, [767/2021](#), valid from 1 November 2021.*

Government Decree on the Settlement and Metering of Electricity Deliveries, 767/2021

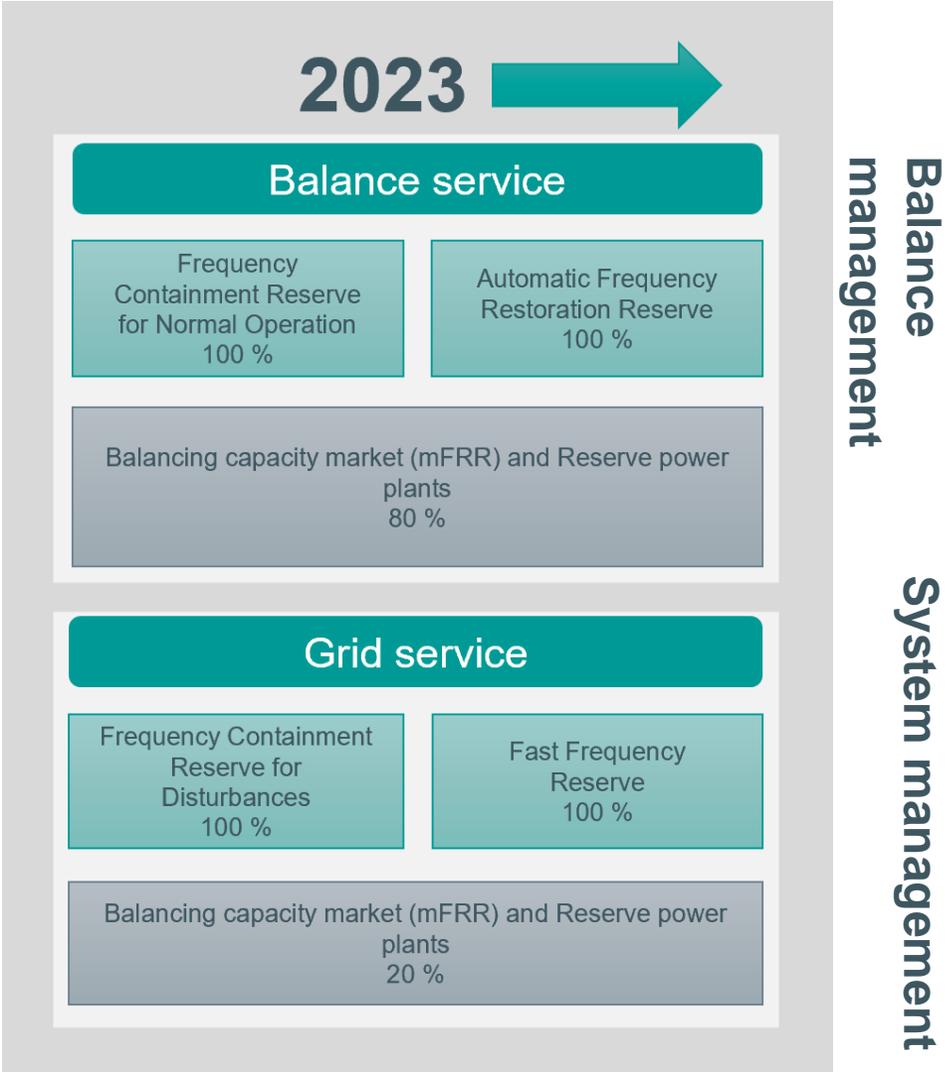
- **Chapter 2, section 1: General provisions concerning balance responsibility**
 - *“For any completed open delivery to an electricity market party, the open supplier shall assign a balance responsible party who, via the said open delivery or via an unbroken chain of open deliveries extending to it, balances the electricity generation and procurement, as well as electricity consumption and delivery, based on the said open delivery to the party.”* **Suppliers must have balance responsible parties**
- **Chapter 2, section 2: Organisation of balance responsibility at the electricity consumption point**
 - *“An electricity consumer must have one open supplier to use electricity at each electricity consumption point connected to the power grid.”*
 - *“An electricity producer that feeds electricity into the power grid for transmission in the grid shall have one open supplier for the electricity production at each electricity consumption point connected to the power grid and the associated electricity consumption.”* **A consumption/production point must have an electricity supplier**

Imbalance settlement, open supply, balance responsibility

22 May 2023
 Imbalance settlement period
 60 min → 15 min



Covering reserve costs



Fingrid covers the maintenance and energy costs by charging balance service fees and grid service fees.

Thank you



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Coffee break

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Outlook for the electricity market and procurement of reserves

Taneli Leiskamo, Specialist, Marina Nordström, Expert,
and Mikko Kuivaniemi, Unit Manager, Fingrid Oyj

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Outlook for the electricity market and purchases of reserves in 2023

- I. Power system and reserves in the 2020s
- II. Electricity and reserve markets in the 2020s
- III. Reserve needs in the 2020s



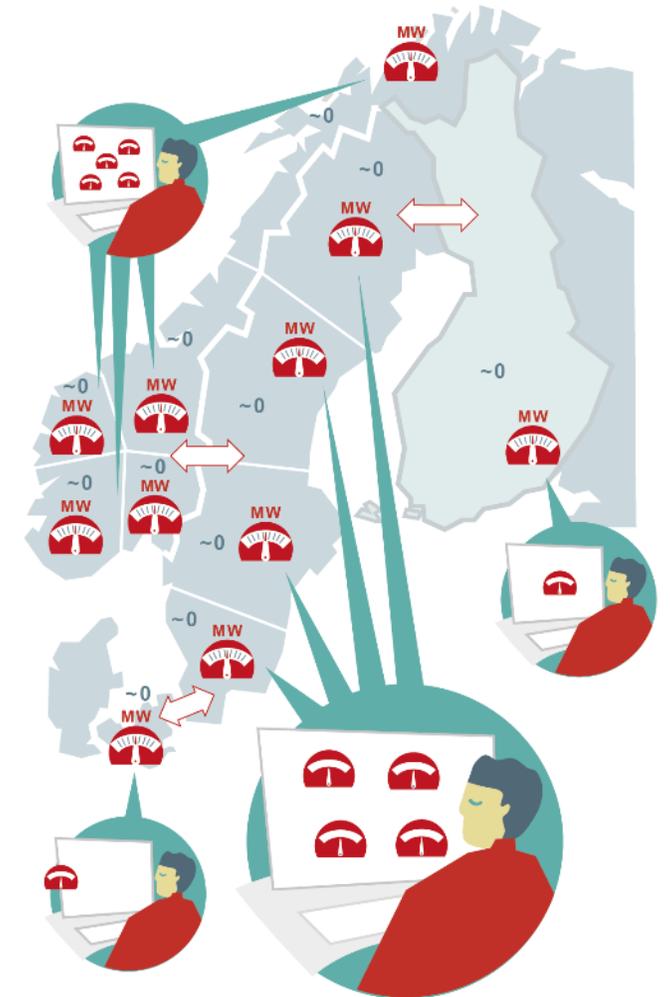
The power system and reserves in the 2020s

Fingrid is preparing for a dramatic shift in the structure of consumption and production in the power system

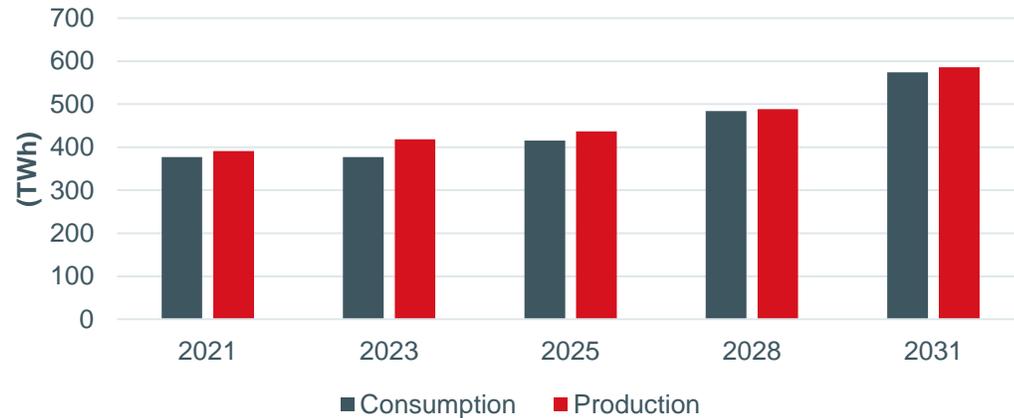
- The estimated reserve volumes and necessary developments in practices were based on Fingrid's forecast

Assumptions (including current practice):

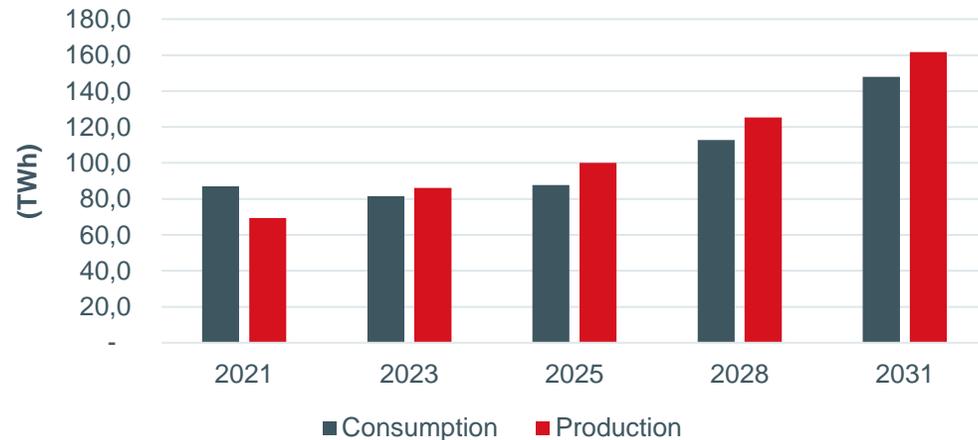
- Fingrid purchases reserves to maintain the power balance as part of the Nordic shared operation system for electricity (Finland, Sweden, Norway and Eastern Denmark).
- The volume of reserves in the area is dimensioned to enable the maintenance of the power balance and the maximum possible individual fault (N-1). However, sufficient reserves are maintained in each area to ensure system security in the event of any disturbance or isolated operation situation.
- Fingrid maintains the reserve market and purchases reserves based on standardised reserve products. Balancing service providers supply reserves, and power system users and balance responsible parties cover the related costs. The technical requirements and purchasing principles for reserves are maintained to satisfy the wishes of Fingrid's customers and the requirements of power balance management.



Electricity production and consumption in the Nordic synchronous area 2021–2031*



Finland's electricity production and consumption 2021–2031*



The power system is growing

According to Fingrid's forecast*:

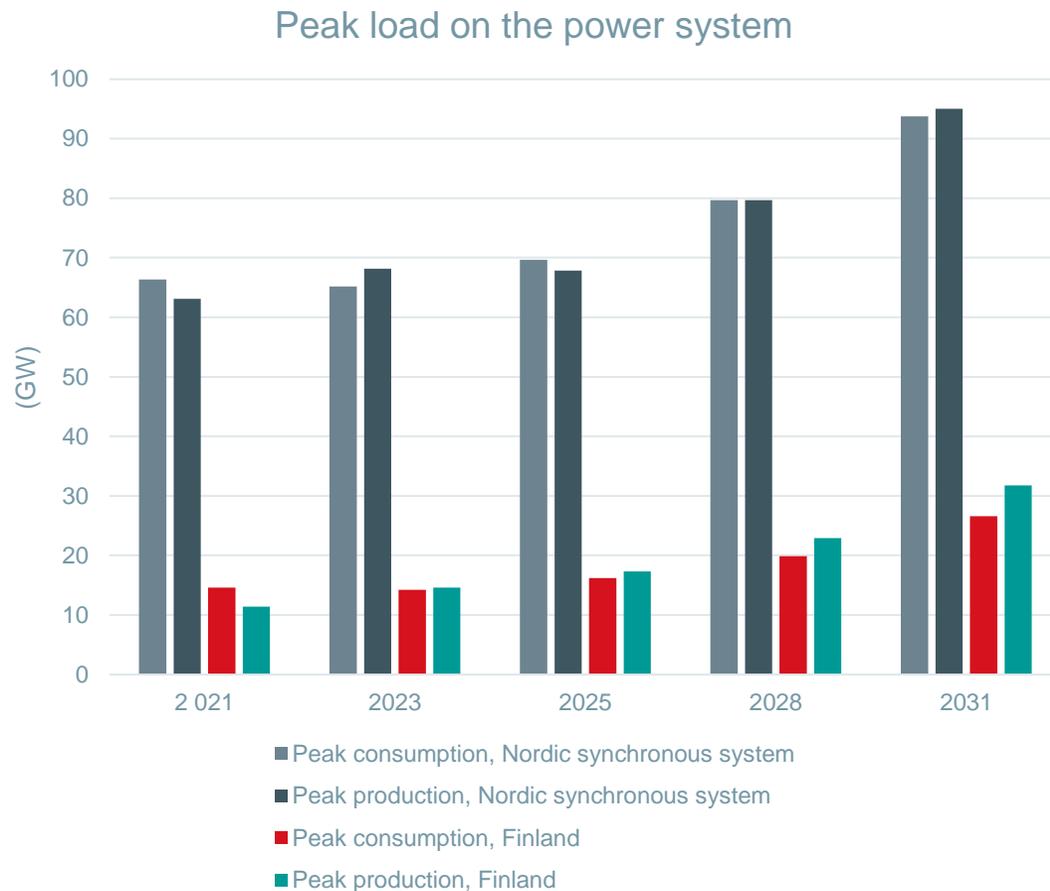
- Electricity consumption and production will increase in the Nordic synchronous area in the 2020s. The Nordic surplus (net exports to points outside the synchronous area) will decrease.
- Finland's share of Nordic production and consumption will increase, thereby raising Fingrid's share of the reserve obligations in the synchronous area.
- Finland is changing from an annual net importer to a net exporter. In combination with the growing cross-border transmission capacity (the Aurora Line), this will reduce bottlenecks in the electricity and reserve markets.
- The average load on the system will rise significantly, which may increase the number and magnitude of imbalances if consumption or production capacity deviations are not decreased or fully netted.

→ **The importance of the FCR-N, aFRR and mFRR will increase further.**

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* Realised figures for 2021, modelled projections for 2023–2031 (non-binding).

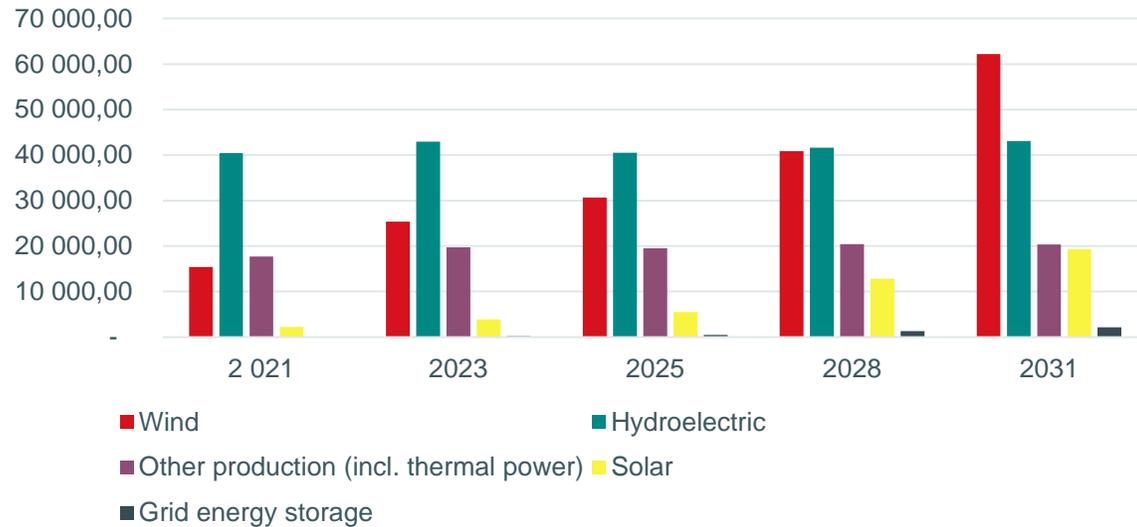
Electricity consumption in the 2020s



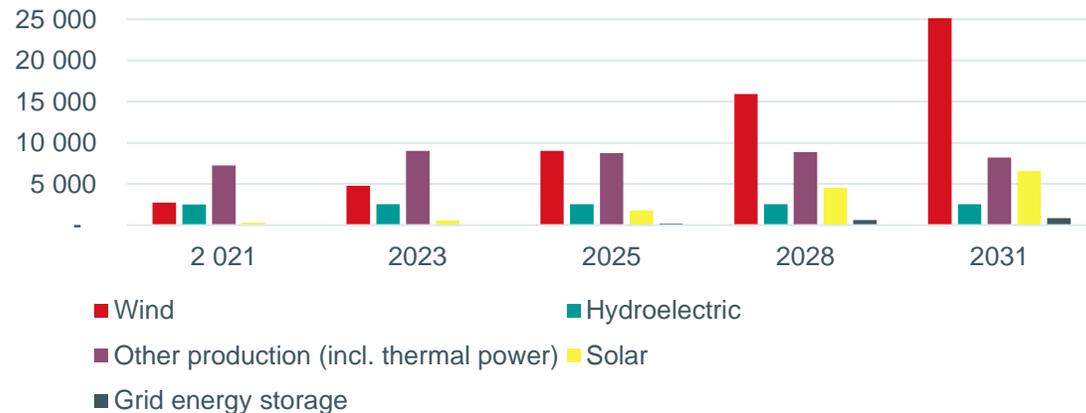
- According to Fingrid's forecast*:
 - Peak loads will increase substantially, especially towards the end of the decade. The forecasted consumption increasingly follows the electricity price, so the timing of loads may differ from before.
 - Consumption is forecasted to grow, especially in industry. Thanks to planned and partially adjustable production processes, the number and magnitude of consumption imbalances will increase more slowly than the rise in average/peak consumption.
 - The maximum size of the largest possible individual disturbances (**and the FCR-D reserve**) will remain unchanged:
 - Over-frequency: DC cable (export)/largest consumption unit. 2023: 1,400 MW.
 - Under-frequency: Largest production unit/DC cable(export). 2023: 1,450 MW.

Electricity production in the 2020s

Nordic peak production by type of production (MW)



Finland's peak production by type of production (MW)



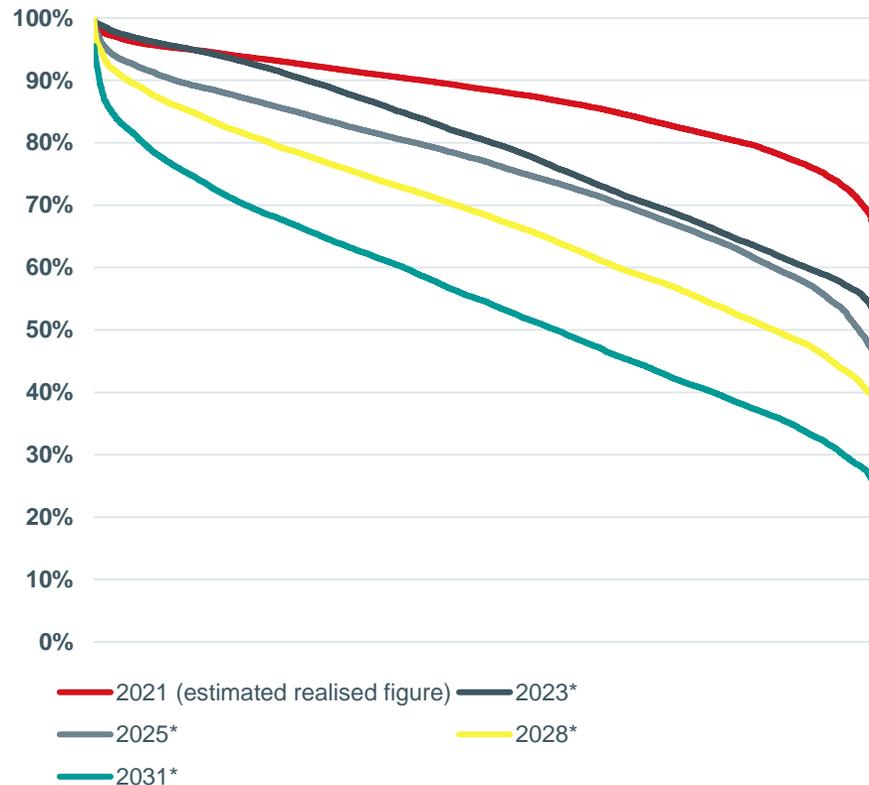
• According to Fingrid's forecast*:

- The hydroelectric power capacity will remain unchanged, but the regulation of hydroelectric power will increase further as consumption and other forms of production vary.
- The amount of nuclear power will remain at the current level. The capacity of other forms of thermal power – and, especially, the average output and operating hours – will decrease.
- The number of grid energy storage facilities in the system will increase, but they will play a limited role in the wholesale electricity market in the coming years.
- The weather-dependent electricity production capacity will rise significantly in the Nordic synchronous system, especially in Finland. **Without substantial development, imbalances in production will increase in tandem with the wind and solar power capacity.**

* Realised figures for 2021, modelled projections for 2023–2031 (non-binding).

Low-inertia frequency management will become more common

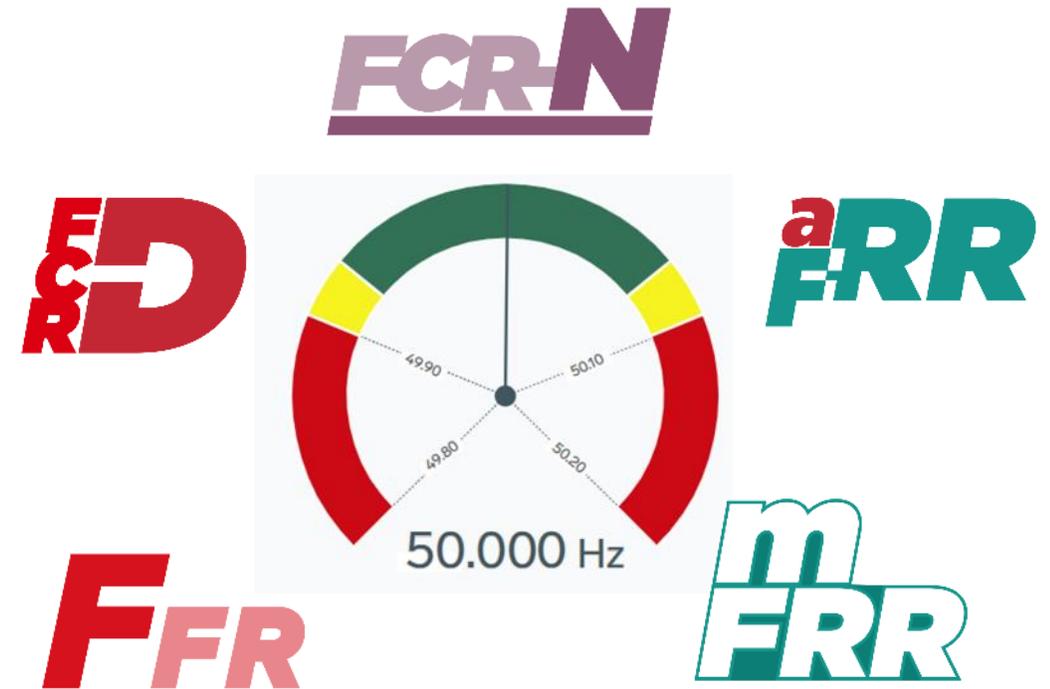
Share of synchronous machine production in Nordic electricity production



- The amount of kinetic energy stored in rotating masses in the power system will decrease as the equipment deployed in the power system changes in the 2020s*. Production, storage and consumption facilities (and transmission using DC cables) will be increasingly based on power electronics.
- The Nordic transmission system operators will purchase fast frequency reserves (FFRs) to prevent any momentary changes in frequency caused by faults from becoming too large (in low-inertia situations). **The decrease in inertia will increase the volume of FFR purchases** and raise the rate of change in the frequency.
- In addition to reserves for managing the power balance, Fingrid is studying network investments and methods for maintaining system security in the future. These include the adequacy of electricity and system services that do not affect the frequency (such as a reactive power reserve, short-circuit power and transmission management).

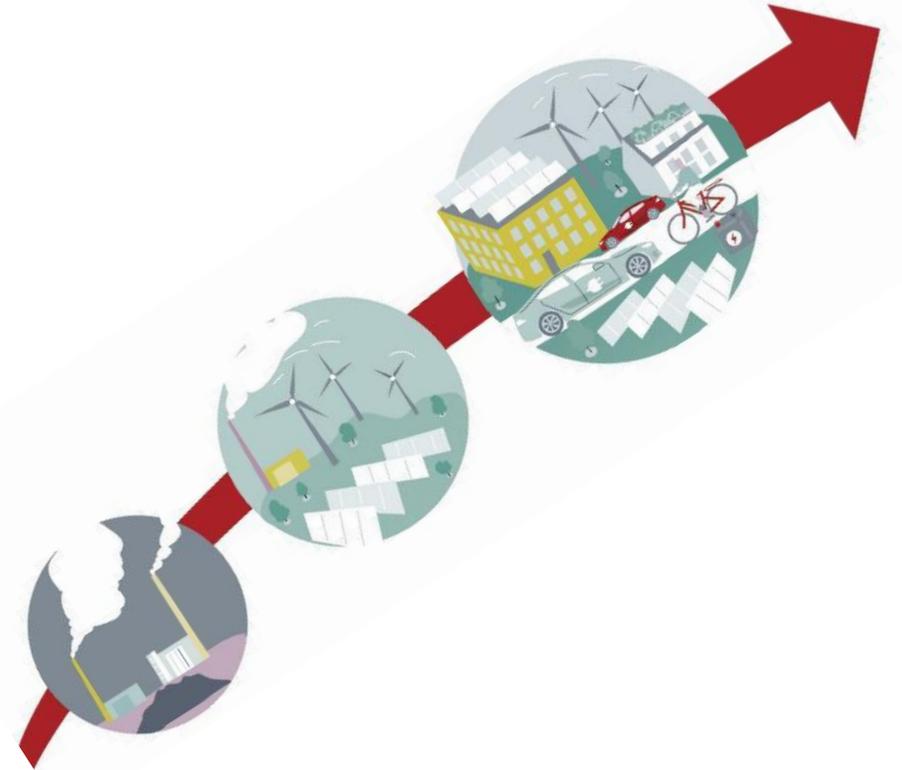
The parties and reserve units in the reserve market will change in the 2020s

- The facilities connected to the power system are changing (old plants are being demolished and new ones are being connected to the grid).
- The behaviour of the facilities connected to the power system is changing due to technological development and the electricity and reserve markets.
- The stricter technical requirements for reserves will affect the number of plants offering balancing services
- Transmission system operators are changing how the system is balanced, affecting the locations of activated reserve facilities.



Conclusions based on the forecasts for the 2020s

- The consumption and production structure in the power system will change at the technical level. The number of devices connected to the power system and their combined average and peak power will increase, raising the probability of power balance deviations and disturbances.
- Netting the fluctuations in an expanding power system and using shorter time units in electricity and reserve markets will improve the balance. However, these measures are unlikely to fully offset the impact of the aforementioned factors on the maintenance of the power balance in the power system.
- → **The amount of inertia will decrease, and the number of imbalances will increase. This calls for stricter technical requirements for the maintained reserves and a greater number of reserves in order to maintain system security in the future.**



Electricity and reserve markets in the 2020s

Reserve markets as part of the electricity market



Reserve markets expand to the Nordic countries and elsewhere in Europe

Reserve product	Now (2023)	Future
FFR	National hourly market maintained by Fingrid.	Nordic market.
FCR-D up/down, FCR-N	Yearly and hourly markets maintained by Fingrid. In addition, Fingrid purchases reserves from its neighbouring countries and may sell Finnish reserves to its neighbouring countries.	Nordic markets.
aFRR capacity up	Nordic hourly market. No separate energy market.	Nordic market.
aFRR capacity down		
aFRR energy up		European 15-minute market (PICASSO project)
aFRR energy down		
mFRR capacity up	National hourly market maintained by Fingrid.	Nordic market.
mFRR capacity down		
mFRR energy up	Nordic hourly energy market.	Nordic market, followed by the European 15-minute market (MARI project).
mFRR energy down		

Future changes in the electricity market

1

Flow-based* for day-ahead markets in the Nordic countries

- Flow-based was introduced in Central Europe in 06/2022.

2

15-minute resolution in the day-ahead market

- Joint European go-live planned for early 2025.
- In Fingrid's view, the 15-minute resolution will reduce the need for regulation, facilitating the energy revolution.

3

15-minute resolution in the intraday market

- Finland's internal market was opened on 22 May 2023

4

Three intraday auctions (IDA)

* Flow-based is a new capacity calculation method

Electricity market projects are interconnected – if one is delayed, it causes problems for the others

- The transition of the balancing power (mFRR EAM) to a 15-minute resolution is significantly delayed – and there is still no detailed schedule.
- The delay to mFRR EAM will affect
 - the introduction of 15-minute trading in the day-ahead market
 - 15-minute imbalance pricing
 - The connection to European market platforms (MARI and PICASSO)
- The Nordic project is trying to resolve the situation. Fingrid is aiming for a solution that
 - preserves the common energy market
 - does not delay the 15-minute day-ahead market from the European schedule

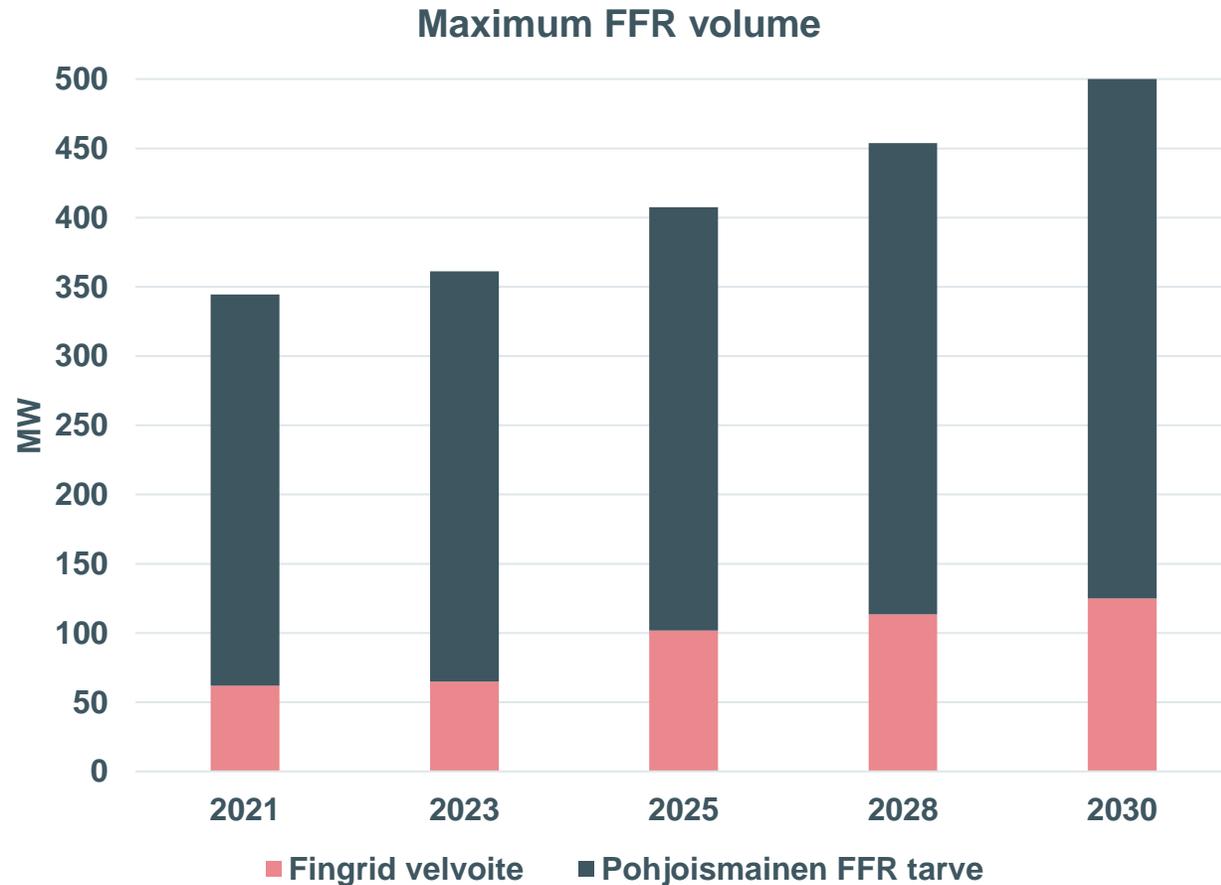


Reserve needs in the 2020s

Fast frequency reserve

- Fast frequency reserves are purchased for managing small-scale inertia events. The need is determined daily, for each hour of the day, based on the forecasted inertia and the dimensioning fault.
- The technical requirements are under development, which may affect the number of reserves needed. The need for the FFR also depends on the properties of the FCR-D reserve (introduction of new technical requirements) and other features of the power system, such as the natural interdependence between consumption and frequency.
- Inertia trends have the greatest influence on trends in the need for FFRs
 - In the future, low-inertia events are expected to become more common. They will also occur in the winter. Reserves will need to be purchased more often than before and in greater quantities.
 - Investments in synchronous compensators and power converters that create networks may reduce the need for FFRs.

Purchase forecast



The forecast indicates that the need for FFRs will increase dramatically in the 2020s as low-inertia events become more common

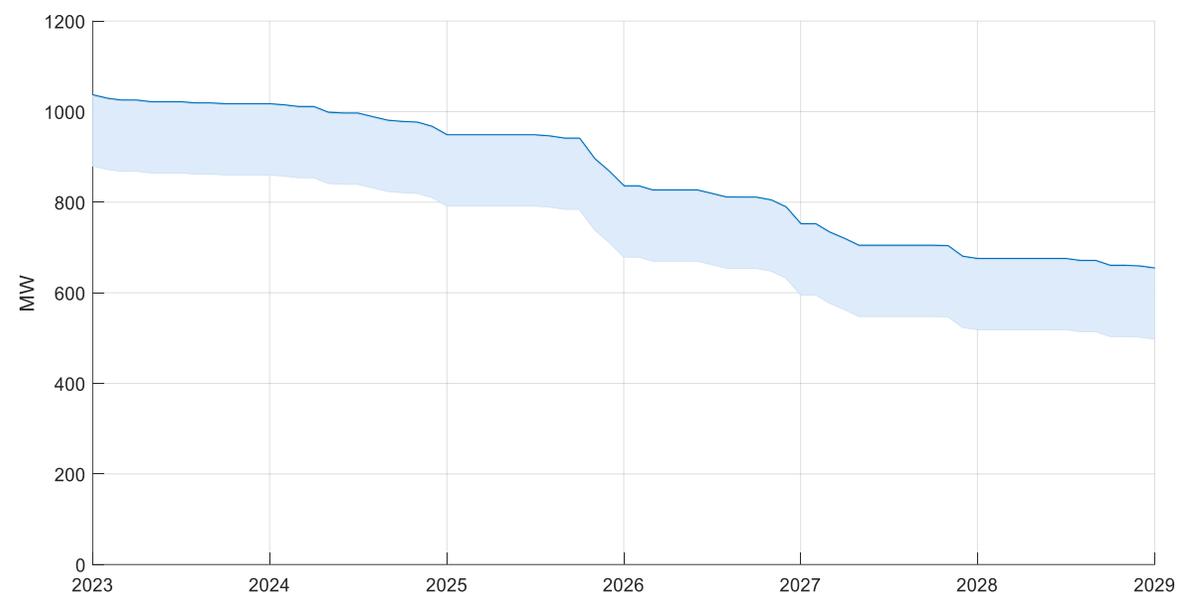
- The maximum need will increase, especially towards the end of the decade
- The average purchase price and number of purchased hours will approximately double compared with the current situation
- Fingrid’s share of the Nordic reserve requirement may change from the assumed share
- The weather and the timing of annual maintenance at nuclear power plants substantially affect the purchases necessary in an individual year

* Realised figures for 2021. Figures for 2023–2030 are based on electricity market modelling (non-binding).

Frequency containment reserve for disturbances

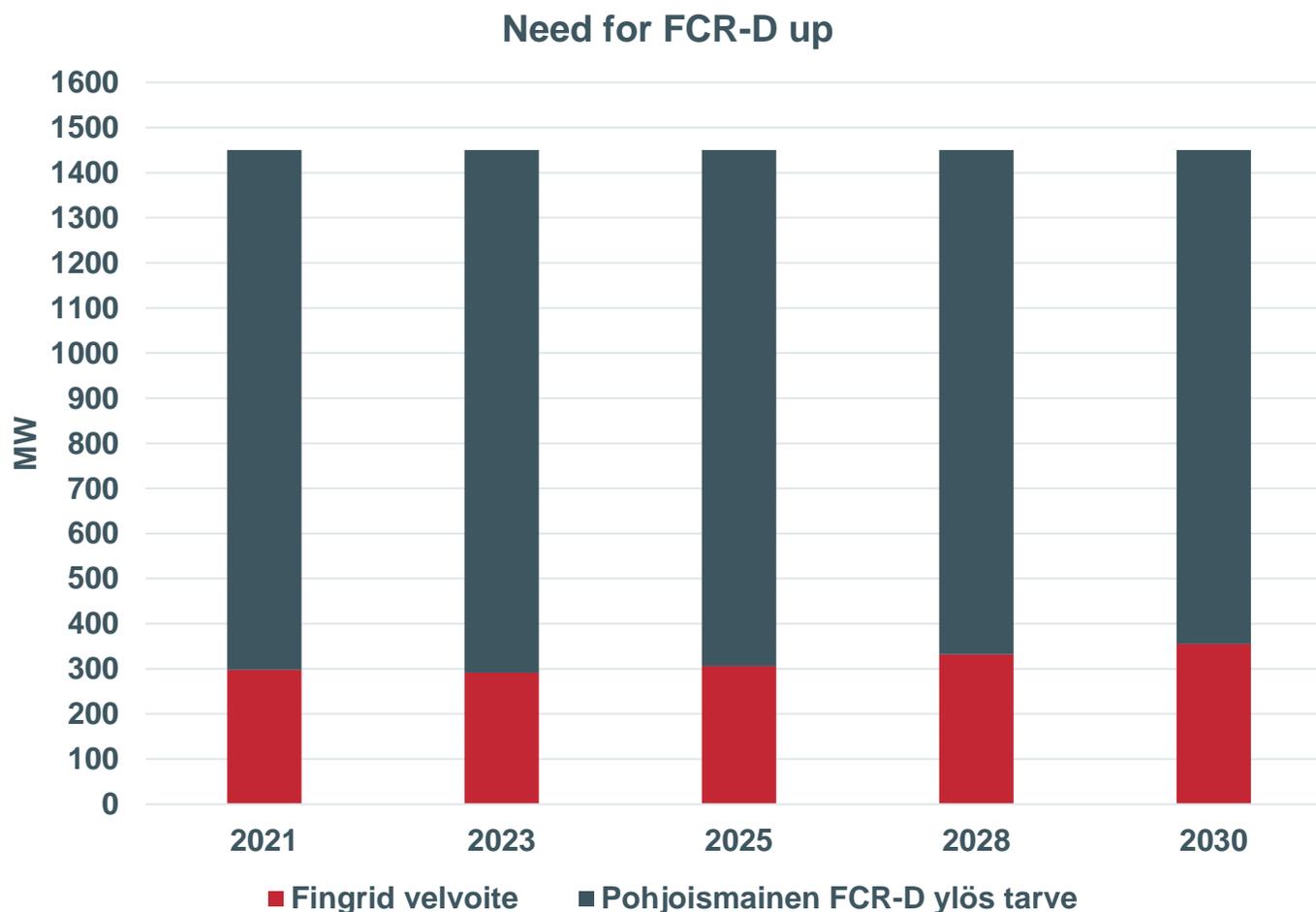
- The frequency containment reserve for disturbances is maintained in a volume corresponding to the dimensioning fault (the largest production unit or HVDC transmission link). The reserve is dimensioned separately for up- and down-regulation products.
- The purchased volumes of FCR-D down will be raised gradually as the offering develops, bringing them in line with the dimensioning fault.
- It will become necessary to specify a minimum volume depending on inertia for the share of the FCR-D reserve using the dynamic control method.
- When the new technical requirements take effect on 1 September 2023, they will reduce the current number of reserve units

Effect of the new requirements on Finland's FCR-D down capacity



Only current units are considered

Purchase forecast



The forecast indicates that Fingrid’s share of the Nordic reserve requirement will increase

- The Nordic FCR-D need will remain unchanged
 - FCR-D up: 1,450 MW
 - FCR-D down: 1,400 MW
- The purchased quantity depends on changes in the magnitude of the dimensioning fault, usually very close to the maximum quantity.

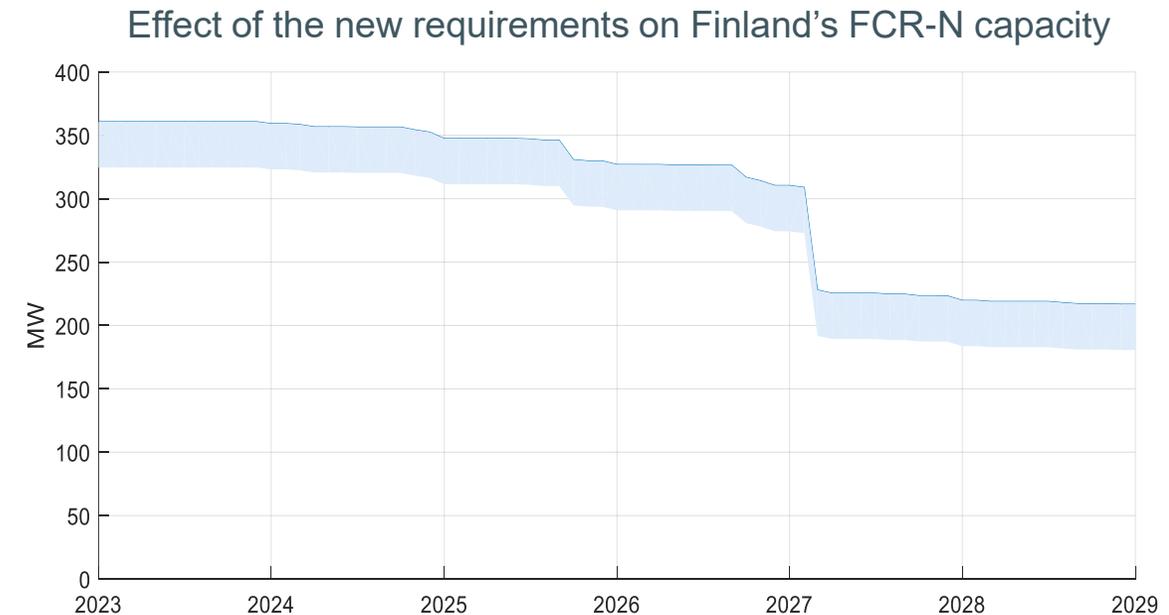
* Realised figures for 2021. Figures for 2023–2030 are based on electricity market modelling (non-binding).

** The purchase trends for FCR-D down reserves in the 2020s will be similar to those for FCR-D up reserves, except that purchases have increased since 2022, and the maximum quantity is 50 MW lower.

Frequency containment reserve for normal operation

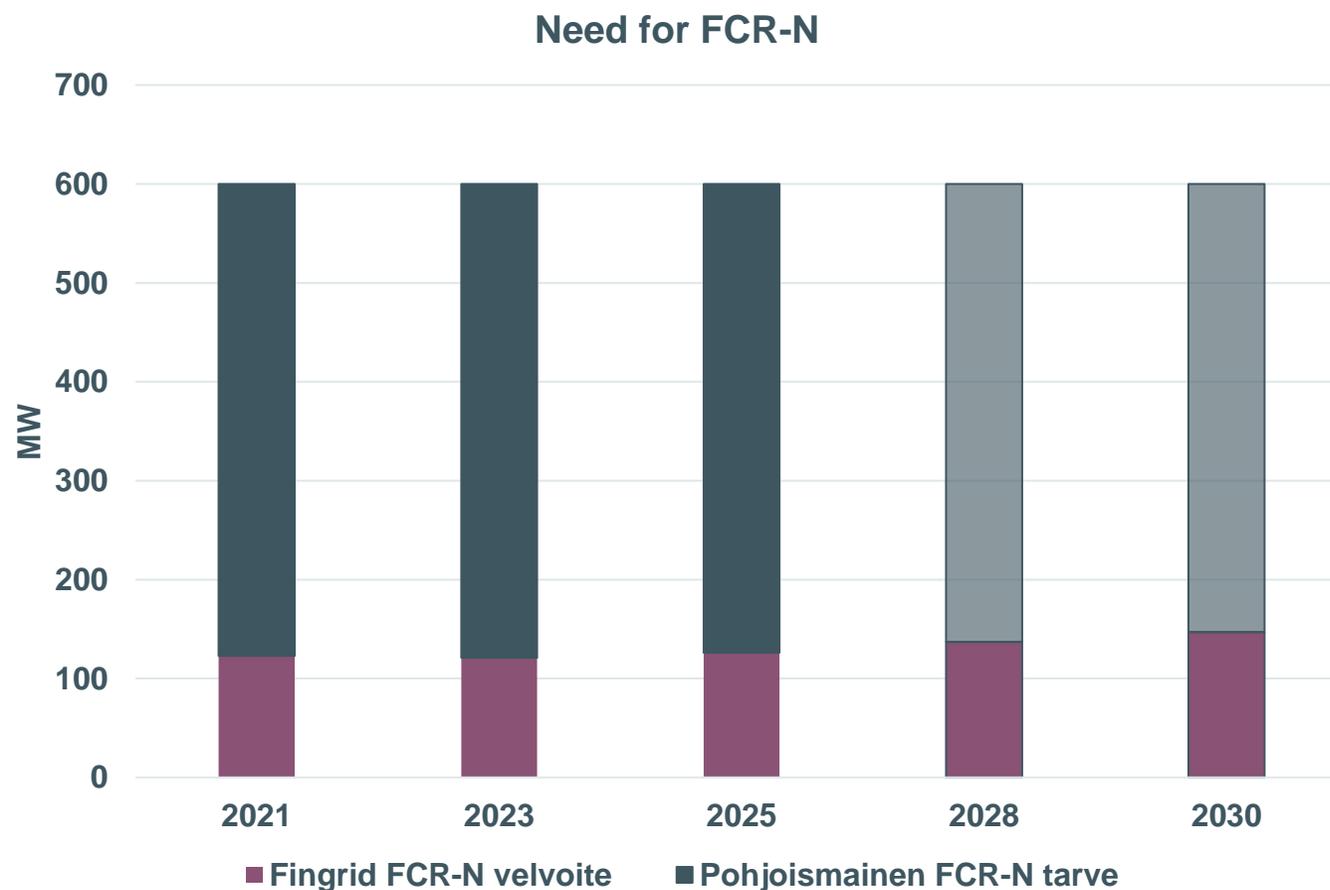


- The Nordic countries maintain a 600 MW frequency containment reserve for normal operation to enable frequency regulation under normal operating conditions. The amount is based on historical assumptions about consumption fluctuations.
- The volume of FCR-N needed in the future will be reviewed after the parties have gained experience with the balance management model based on regional imbalances. The assumption is that the volume of FCR-N could be reduced as the aFRR volume grows.
- When the new technical requirements take effect on 1 September 2023, they will reduce the current number of reserve units



Only current units are considered

Purchase forecast



The forecast indicates that Fingrid’s share of the Nordic reserve requirement will increase

- The Nordic FCR-N need will remain unchanged in the coming years

* Realised figures for 2021. Figures for 2023–2030 are based on electricity market modelling (non-binding).

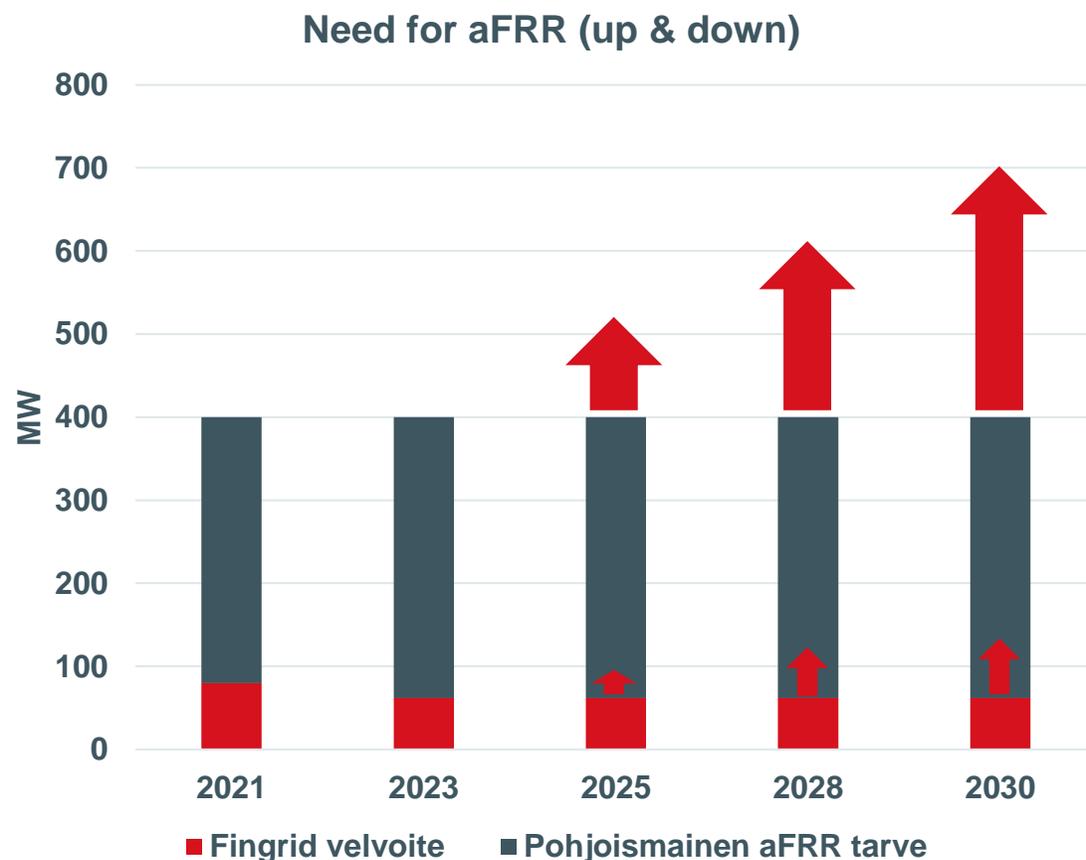
** The introduction of a balance management model based on imbalances may affect the FCR-N need from 2028 to 2030.

Automatic frequency restoration reserve



- The automatic frequency restoration reserve is maintained to restore the frequency to the nominal value. Capacity is purchased in varying quantities for almost every hour of the day. The necessary capacity is specified quarterly based on frequency quality trends.
- In the future, capacity will be purchased for every hour of the day for regional balance deviation management. aFRR activation will occur from the energy market.
- The necessary capacity will be determined based on the ordinary and short-term imbalances of balance responsible parties.
 - Future capacity needs are very difficult to estimate due to future changes in the electricity market and production structure.
- The aim is to determine the required capacity daily for each hour of the day. The forecasted operating state and, potentially, the number of voluntary energy bids influence the need.

Purchase forecast



According to the forecast, the need for aFRRs in the system will increase significantly due to changes in the electricity production structure and the introduction of a new balance management model

- The number of purchase hours will increase in the future.
- The required reserve volumes will increase in the future.
- In the future, the reserve will be activated from the energy market. Trends in the magnitude of imbalances will affect the need for activation.

* Realised figures for 2021. Figures for 2023–2030 are based on forecasts (non-binding).

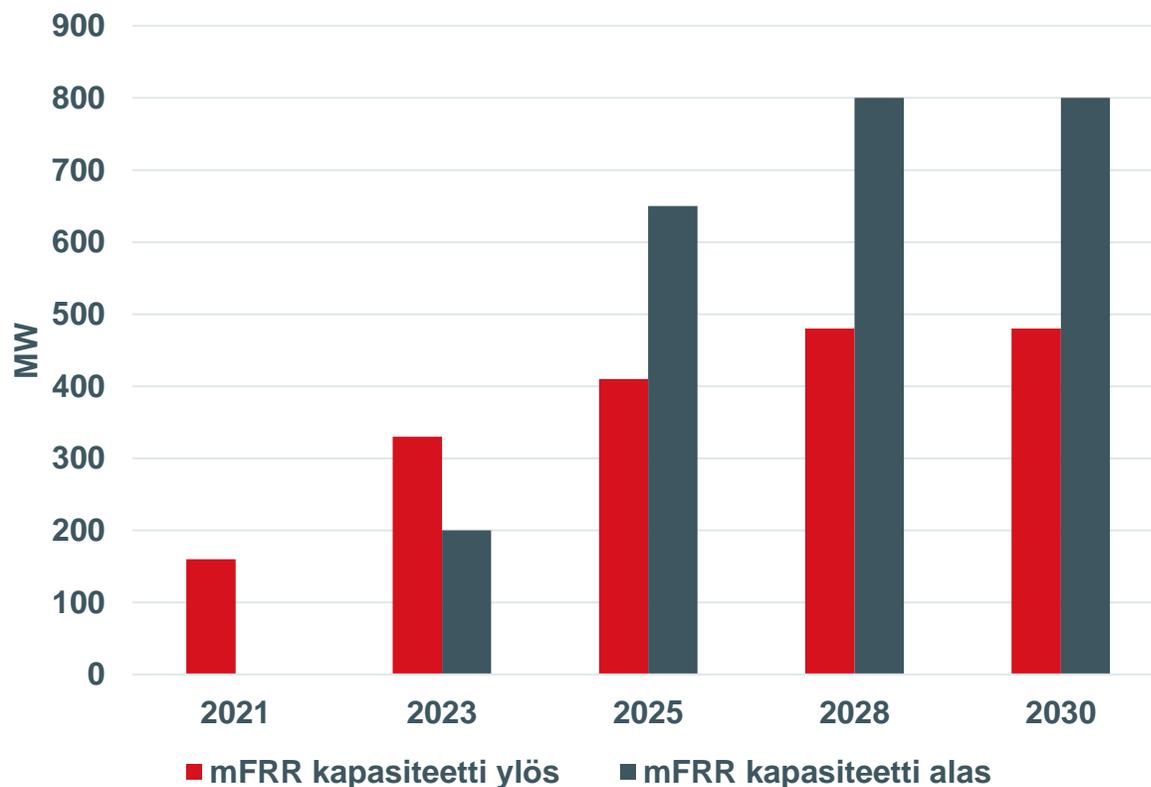


Manual frequency restoration reserve

- Manual frequency restoration reserve capacity is purchased to ensure the transmission system operator has enough reserves to manage a dimensioning fault in its area.
 - Reserve power plants provide some of the up-regulation capacity.
 - The purchased volumes of mFRR down will be raised gradually to bring them in line with the dimensioning fault.
- In the future, the necessary capacity will be determined based on the ordinary and longer-term imbalances of balance responsible parties and the dimensioning fault in the area.
 - As regards imbalances, the future capacity needs are very difficult to estimate due to future changes in the electricity market and production structure.
- The aim is to determine the required capacity daily for each hour of the day.
 - The forecasted operating state and, potentially, the estimated number of voluntary energy bids influence the required capacity.
 - Transmission system operators may share the reserves used to manage dimensioning faults.

Purchase forecast

Fingrid's mFRR need from the capacity market (not including reserve power plants)



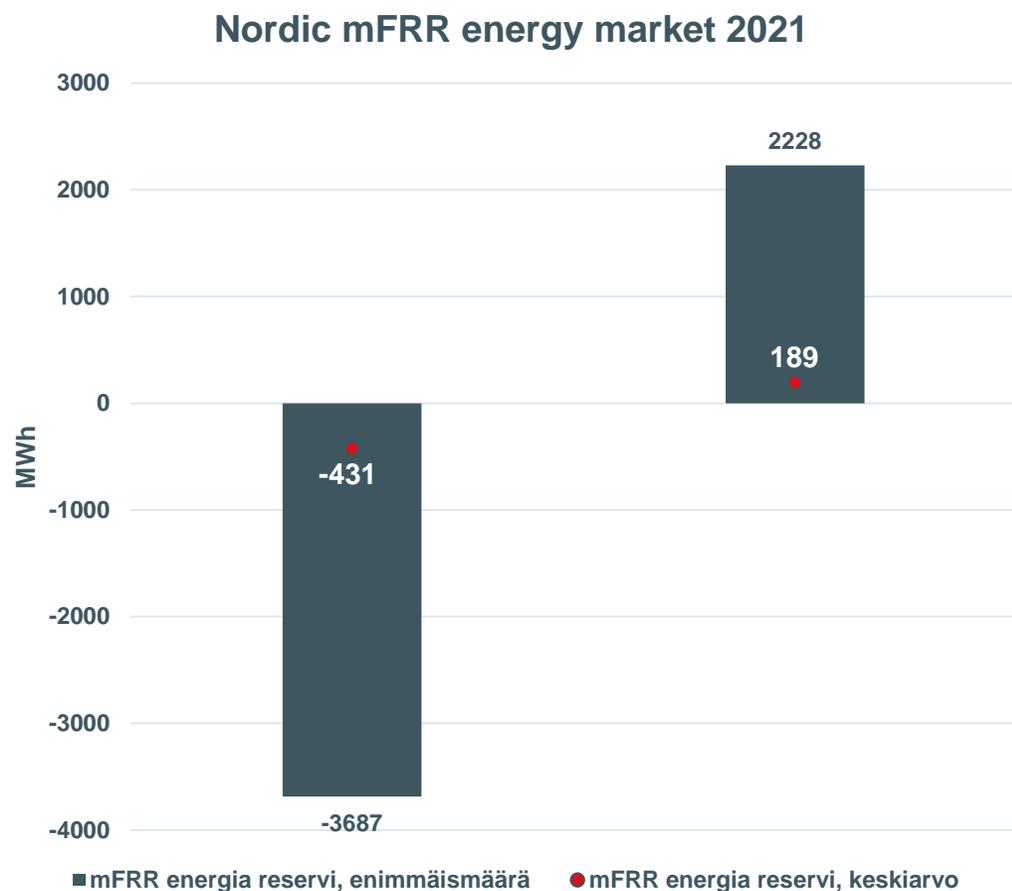
The forecast indicates that the purchased mFRR capacity volumes will increase substantially

- Down-regulation: Preparations will be made for the failure of transmission links in exports.
- Up-regulation: The agreements concerning right-of-use plants will expire.
- Purchases will become continuous.
- Upcoming changes in the capacity market will enable cross-border trading.
- The need for reserves is likely to increase by more than indicated due to preparations for imbalances

* Realised figures for 2021. Figures for 2023–2030 are based on forecasts (non-binding).

** In 2023, the purchased volume of mFRR down-regulation capacity will be reviewed quarterly according to the supply and necessary purchases.

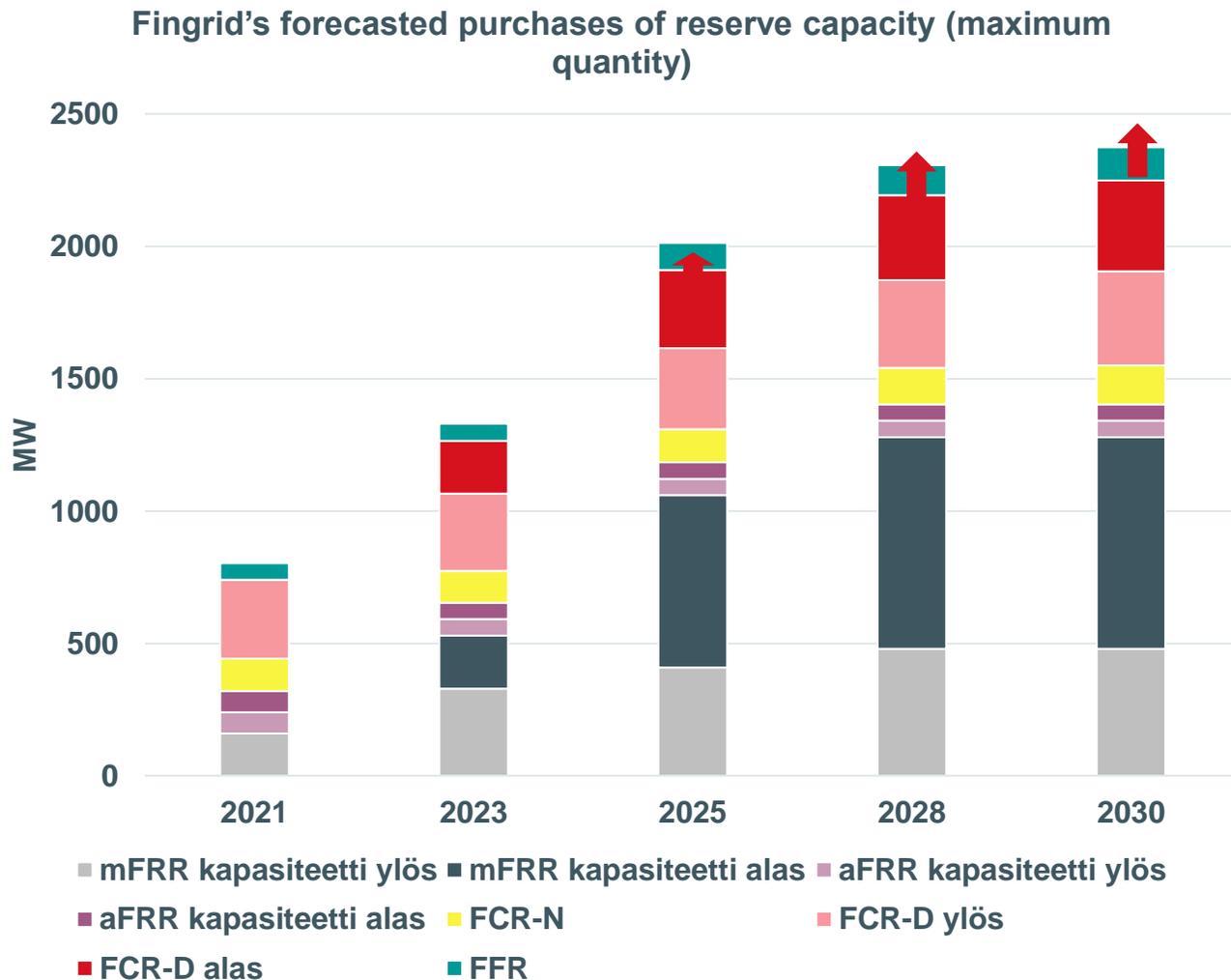
Purchase forecast



The forecast indicates that the regulation volumes ordered in the mFRR energy market may remain significantly higher than the quantities secured from the capacity market

- The share of regulation volumes ordered from Finland in the Nordic mFRR reserve is occasionally large (competitive bids/need to regulate the local area) but, on average, limited (5–20%).
- The upcoming changes to the balance management model, electricity market and production structure make it highly challenging to estimate the need for regulation.
- Resources will also be used increasingly to satisfy regional regulation needs.

Summary



- In addition to capacity purchases, regulation is ordered from the mFRR and aFRR reserves as needed. The need to balance the Nordic power system may be larger than the purchased capacity (see the previous slide).
- The balancing volumes in energy markets are expected to increase.
- The need for reserve capacity is likely to increase by more than indicated due to preparations for imbalances.
- In the future, transmission system operators may share the mFRR capacity they buy to manage disturbances.
- Balancing service providers may also sell their resources to other transmission system operators via Fingrid
- The volumes of reserves needed will be reviewed regularly to maintain system security.

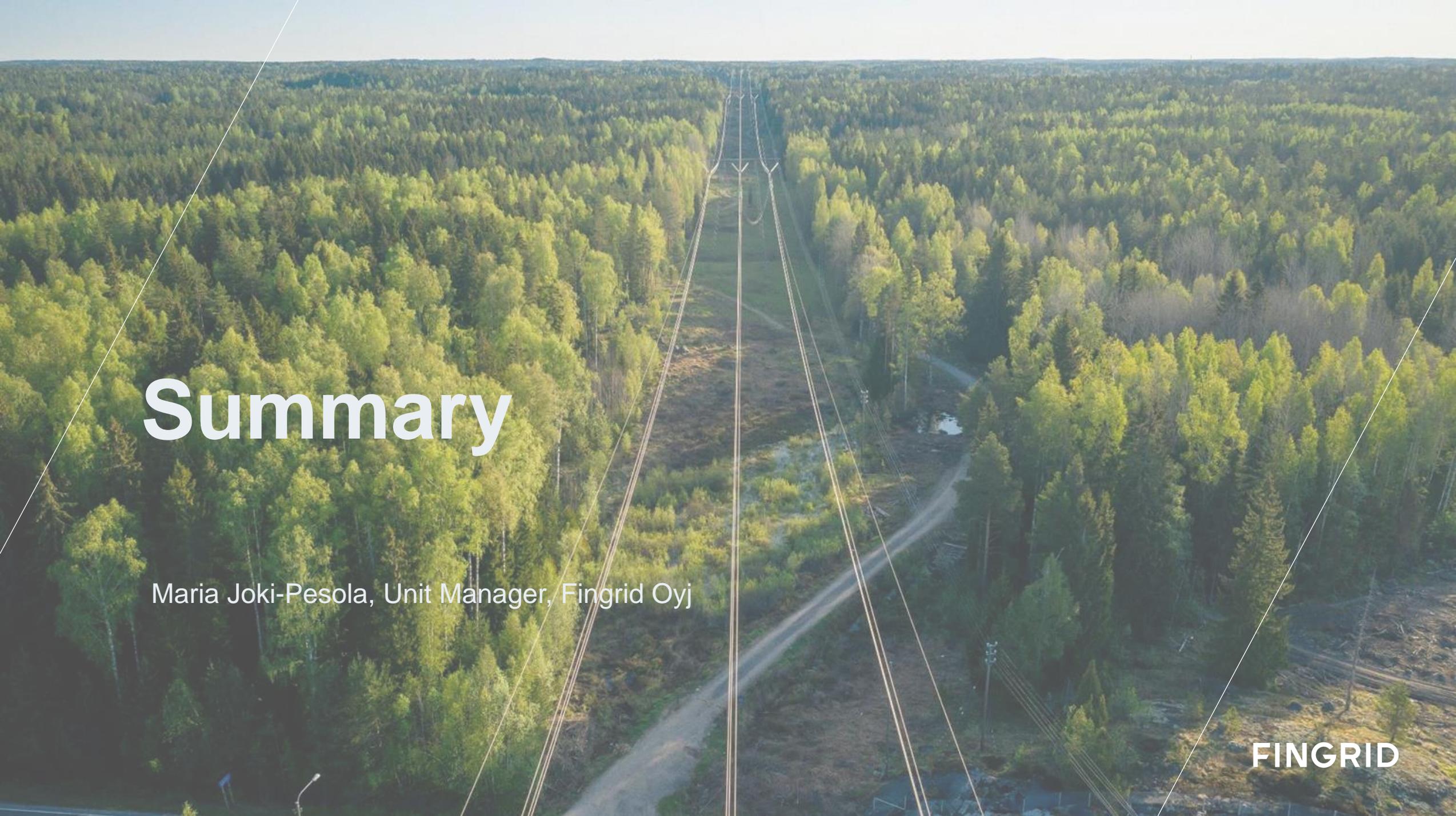
Principles for dimensioning reserve capacity purchases

Reserve product	Now (2023)	Future (latter half of the 2020s)
FFR	Fast frequency reserves (FFRs) are purchased for managing small-scale inertia events. The need is determined daily, for each hour of the day, based on the forecasted inertia and the dimensioning fault.	The technical requirements are under development, which may affect the number of reserves needed. The need for the FFR also depends on the properties of the FCR-D reserve (introduction of new technical requirements) and the frequency dependence of consumption.
FCR-D up	The frequency containment reserve for disturbances (FCR-D) is maintained in a volume corresponding to the dimensioning fault (the largest production unit or HVDC transmission link). The reserve is dimensioned separately for up- and down-regulation products.	It will become necessary to specify a minimum volume depending on inertia for the share of the FCR-D reserve using the dynamic control method.
FCR-D down	The purchased volumes of FCR-D down will be raised gradually as the offering develops, bringing them in line with the dimensioning fault.	The FCR-D down reserve is purchased in a quantity corresponding to the dimensioning fault.
FCR-N	The Nordic countries maintain a 600 MW frequency containment reserve for normal operation (FCR-N) to enable frequency regulation under normal operating conditions. The amount is based on historical assumptions about consumption fluctuations.	The volume of FCR-N needed will be reviewed after the parties have gained experience with the balance management model based on regional imbalances. The assumption is that the volume of FCR-N could be reduced as the aFRR volume grows.
aFRR up	The automatic frequency restoration reserve (aFRR) is maintained to restore the frequency to the nominal value. Capacity is purchased in varying quantities for almost every hour. The necessary capacity is specified quarterly based on frequency quality trends.	Capacity is purchased to manage regional imbalances in every hour of the day. The necessary capacity will be determined based on the ordinary and short-term imbalances of balance responsible parties. The aim is to determine the required capacity daily for each hour of the day. The forecasted operating state and the estimated number of voluntary energy bids may influence the amount of capacity purchased.
aFRR down		
mFRR capacity up	Manual frequency restoration reserve (mFRR) capacity is purchased to ensure the transmission system operator has enough reserves to manage a dimensioning fault in its area.	The necessary capacity will be determined based on the ordinary and longer-term imbalances of balance responsible parties and the dimensioning fault in the area. The aim is to determine the required capacity daily for each hour of the day. Transmission system operators may share the reserves they use to manage dimensioning faults. The forecasted operating state and the estimated number of voluntary energy bids may influence the amount of capacity purchased.
mFRR capacity down	The purchased volumes of mFRR down will be raised gradually to bring them in line with the dimensioning fault.	

Thank you



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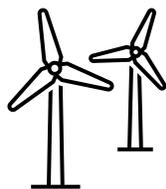
An aerial photograph of a dense forest with a dirt road and power lines running through it. The trees are mostly green, with some brown patches. The power lines are a prominent feature, running vertically through the center of the image. The sky is clear and blue.

Summary

Maria Joki-Pesola, Unit Manager, Fingrid Oyj

FINGRID

An era of change will be challenging for us all



Accelerating transformation
of the production structure



Society's dependence on
electricity



Extensive electricity markets

The importance of reserve markets will increase. All possible flexibility is needed in the market.

Market-orientation, openness, communication, cooperation



We operate in a market-oriented way because functional markets lead to the best and most innovative solutions



We promote the operation of the entire market impartially and work in strong cooperation and open interaction with market participants and all stakeholders

Thank you!

Fingrid Oyj

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