
FINGRID
Reserve Market and Balance Service Days 2026
Reserve Market Day
28.4.2026
Unofficial translation


OPENING OF THE EVENT
FINGRID

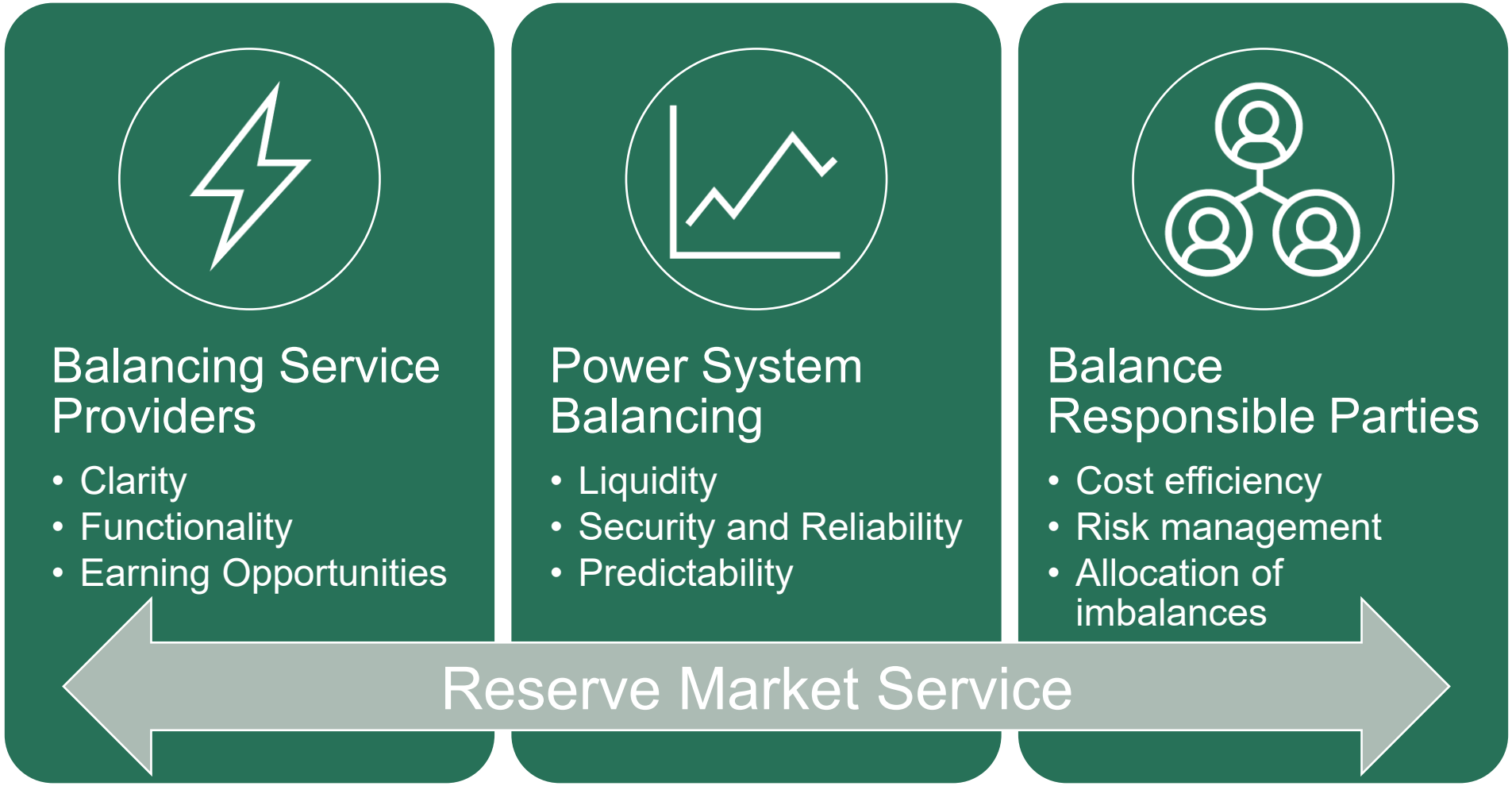
28.4.2026

Tuomas Mattila, Fingrid Oyj

Welcome to the Reserve Market Day!

fingrid.screen.io/reservit26

FINGRID


Balancing Service Providers
• Clarity
• Functionality
• Earning Opportunities
Power System Balancing
• Liquidity
• Security and Reliability
• Predictability
Balance Responsible Parties
• Cost efficiency
• Risk management
• Allocation of imbalances
Reserve Market Service

FINGRID


Contact details always up to date!
The service is developed based on customer feedback
Reliability and security as key themes
FINGRID

Agenda for the Day

Opening of the Event

9:00–9:15 Welcome to the Reserve Market Day!
Tuomas Mattila, Senior Expert, Fingrid Oyj

9:15–9:45 Cybersecurity of the Power System
Jyrki Pennanen, Unit Manager of Information Security, Fingrid Oyj

Overview of the Past Year and Changes in the Reserve Markets

9:45–10:00 Highlights from the Reserve Markets in 2025–2026
Eero Ilomäki, Business Information Owner, Fingrid Oyj

10:00–10:25 Operational Reliability Perspective in Reserve Market Development
Taneli Leiskamo, Expert, Fingrid Oyj

10:25–10:45 First Year in the 15-minute mFRR Energy Market
Otso-Ville Rinne, Expert, Fingrid Oyj

10:45–11:00 From PICASSO Accession to Area Control Error Based aFRR Activation
Joonas Muikku, Expert, Fingrid Oyj

11:00–12:00 Lunch Break

Reliable Operation in the Reserve Markets

12:00–12:25 Market Surveillance in Changing Markets
Juha Teirilä, Economist, Energy Authority

12:25–12:50 Cybersecurity Act Supervision in the Energy Sector
Joonas Kari, Network Engineer, Energy Authority

12:50–13:15 Energy Management of Energy Storage Systems
Elisa Alanen, Specialist, Fingrid Oyj

13:15–14:00 Panel Discussion – Reliability from the Perspective of Market Participants
Tuomas Mattila, Senior Specialist, Fingrid Oyj
Henri Taskinen, CEO, Capalo AI Oy
Petri Vihavainen, Project Director, Kemijoki Oy
Juha Hietaoja, Senior Specialist, Gasum Oyj

14:00–14:45 Coffee Break

Future Development in the Reserve Markets

14:45–15:00 MARI and the New Market Platform MIMOSA
Ilkka Hulkko, Specialist, Fingrid Oyj

15:00–15:20 Future Prospects of Capacity Markets
Timo Halttunen, Specialist, Fingrid Oyj

15:20–15:45 Procurement Costs and Development of Reserve Procurement Volumes
Mikko Kuivaniemi, Unit Manager, Fingrid Oyj

15:45–16:00 Summary of the Day
Maria Joki-Pesola, Unit Manager, Fingrid Oyj

16:00–18:00 Afterwork

fingrid.screen.io/reservit26 FINGRID


It’s time to start the day!
FINGRID

28.4.2026

Jyrki Pennanen, Fingrid Oyj

Keynote – Cybersecurity of the Power System

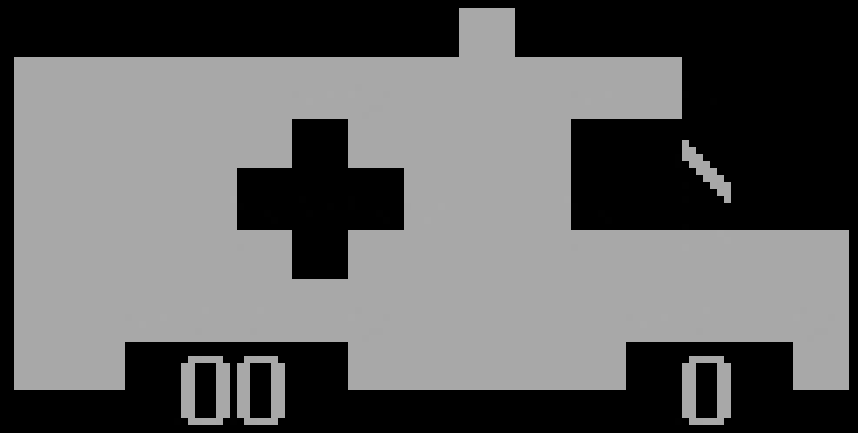
fingrid.screen.io/reservit26

FINGRID

Two stories and their three points

FINGRID


"Time that has passed never returns"
FINGRID



FINGRID

Three points

FINGRID


Antivirus
Updates
Firewall
FINGRID


"The Present"
FINGRID

ELECTRUM: Cyber Attack on Poland's Electric System 2025

- A late-December cyberattack that nearly caused a major blackout in Poland has been attributed to Electrum, a Russian state-linked hacking group associated with Sandworm and past power grid attacks in Ukraine.
- The operation marked the first known large-scale cyberattack focused on distributed energy resources, compromising operational technology at combined heat and power plants and renewable energy management systems without causing outages.
- Polish authorities warn the threat remains severe, noting hundreds of thousands could have lost heating, and are moving forward with stricter cybersecurity regulations and new tools to protect critical energy infrastructure.

FINGRID

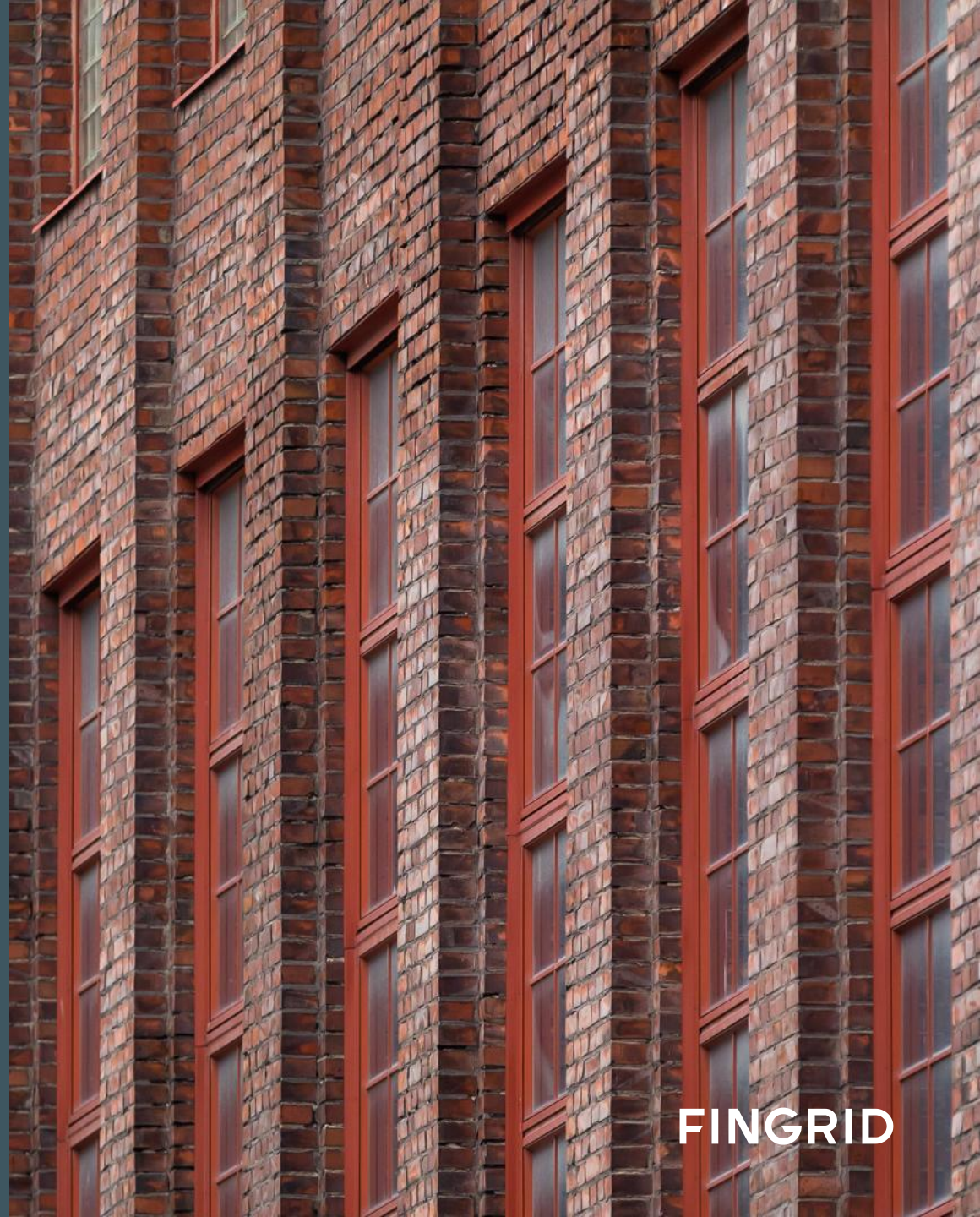
Three points

FINGRID

Regulation

- Cybersecurity Act, NIS2
- CER, CRA, NCCS…

- Regulation is a good thing, ensuring that security is considered, for example, by management in NIS2
- Ensures a certain level of cybersecurity for all operators
- On the other hand, the risk is having too many actors and assessments (at Fingrid in 2025, there were eight different surveys/audits)
- Survey from the Energy Authority about their survey – extremely commendable!




Human is the strongest link
FINGRID

- The weakest link in thinking is completely wrong
- The correct actions of people are key to overall information security
- Information security awareness and training
- Mistakes must be (dared to be) reported

Collaboration

FINGRID

- The bad cooperate, so must the good
- Open exchange of information about both good and bad practices and lessons learnt
- E-ISAC as an example
- **Trust!**

Thank you

FINGRID

OVERVIEW OF THE PAST YEAR AND CHANGES IN THE RESERVE MARKETS

FINGRID

28.4.2026

Eero Ilomäki, Fingrid Oyj

Highlights from the Reserve Markets in 2025–2026

fingrid.screen.io/reservit26

FINGRID

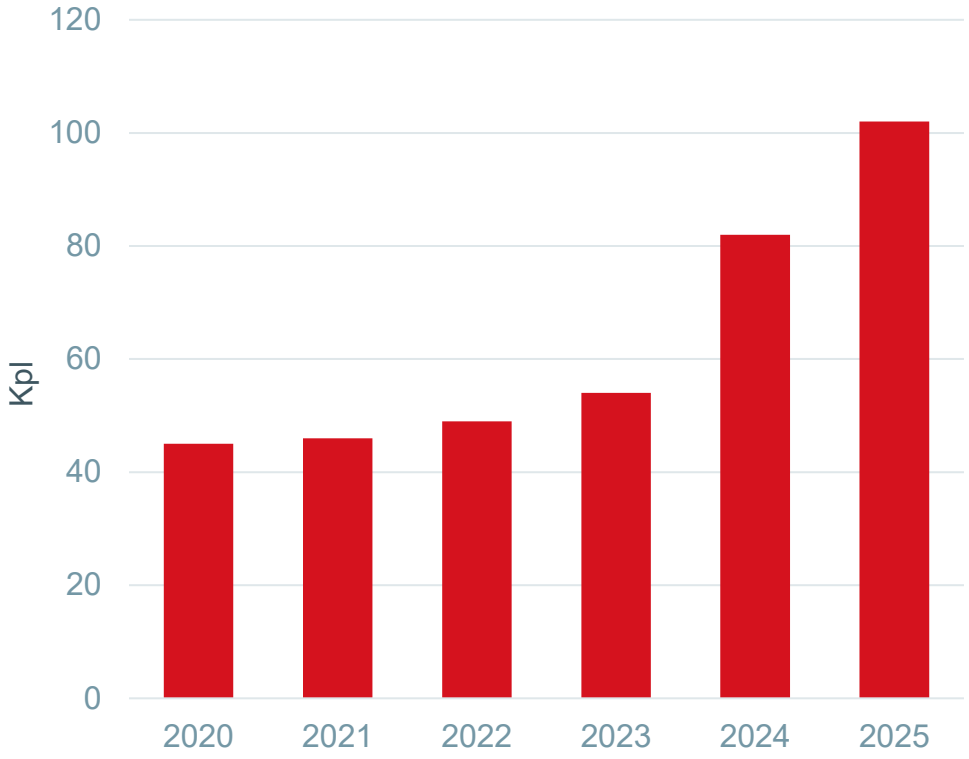
Highlights from market developments

5.6.2025	Independent aggregator model go-live on aFRR market
1.10.2025	15 minute market time unit go-live on the day-ahead electricity markets
3.11.2025	Greater share of FCR procurement allocated to the hourly markets
13.11.2025	Aurora Line go-live
25.11.2025	mFRR energy market algorithm change to avoid the spread of illogical prices
17.12.2025	Real time publishing of mFRR energy market prices began

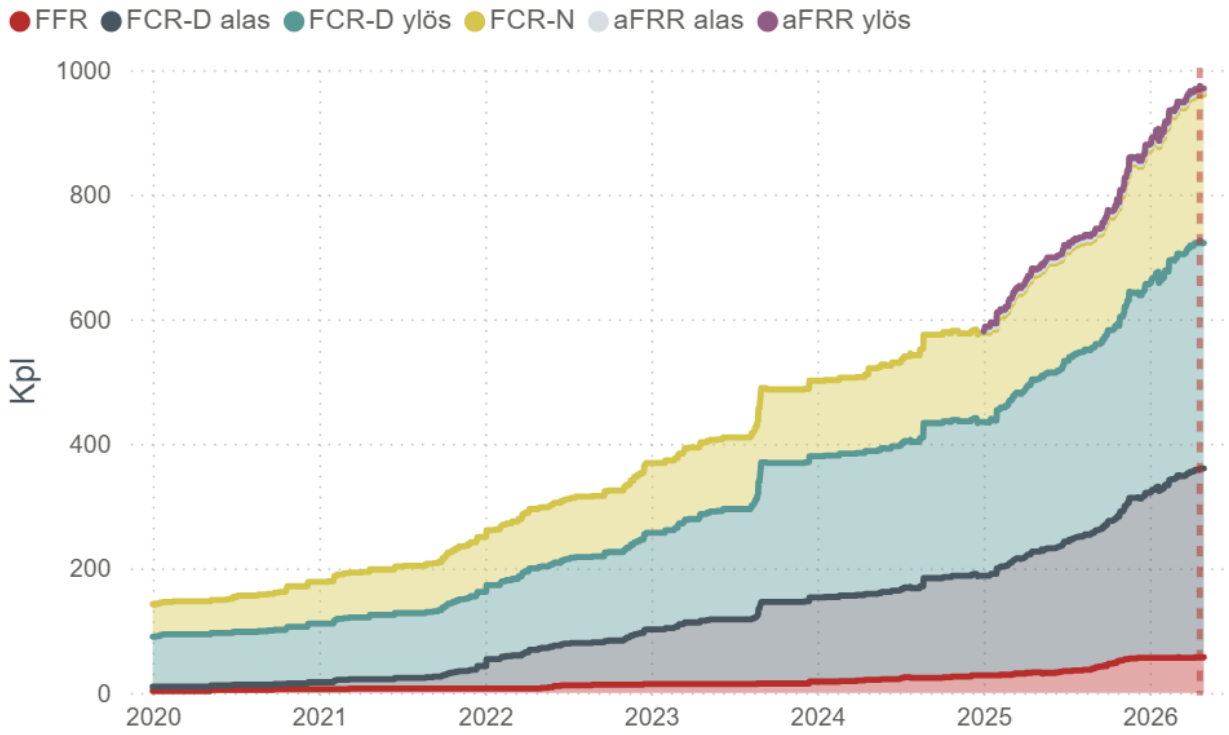
FINGRID

Increased reserve supply has met the power system's growing needs

Number of balance service providers



Number of reserve assets by reserve product

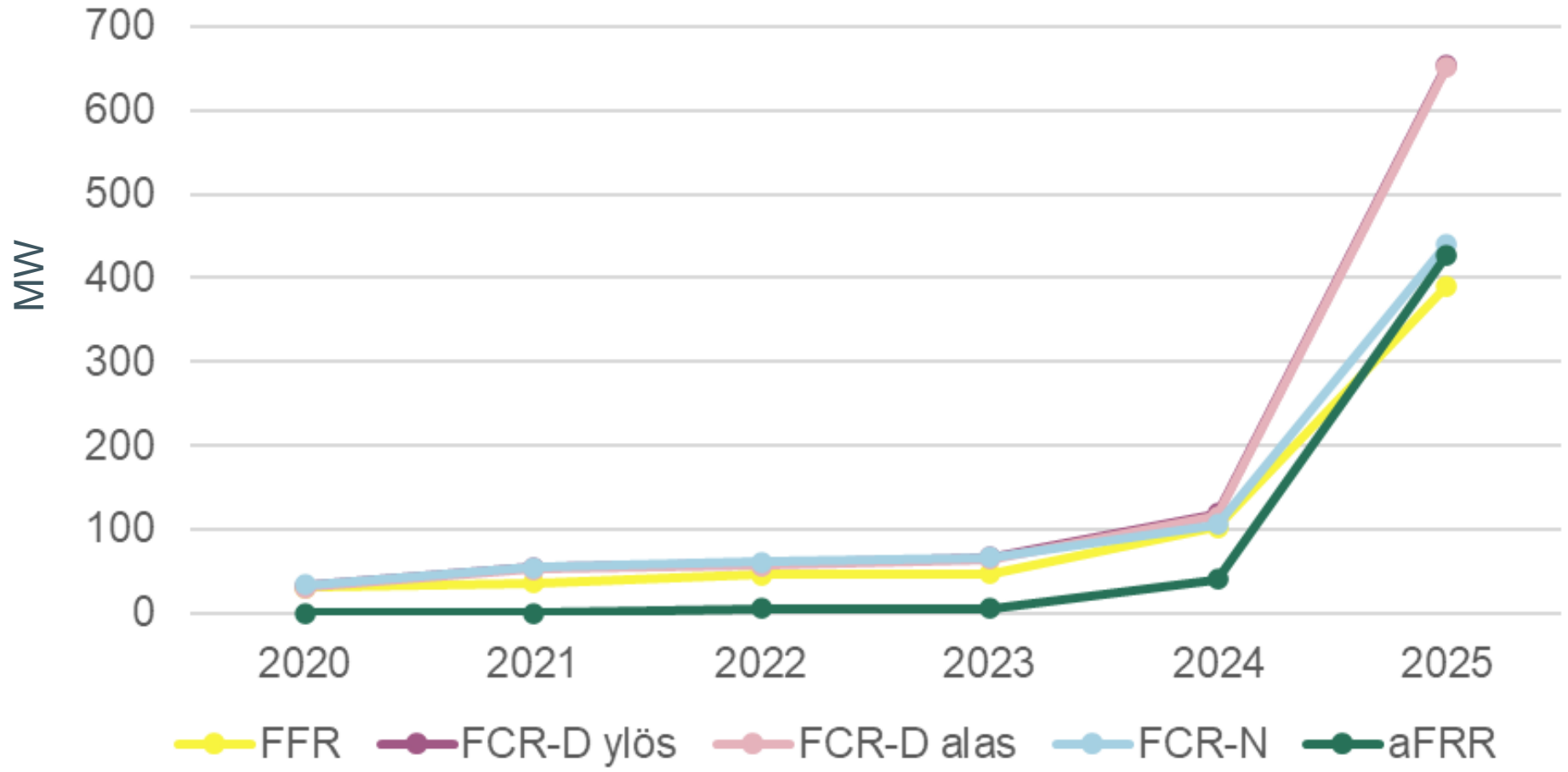


FINGRID

Energy storage capacity has increased in reserve markets

Same energy storages approved for multiple products

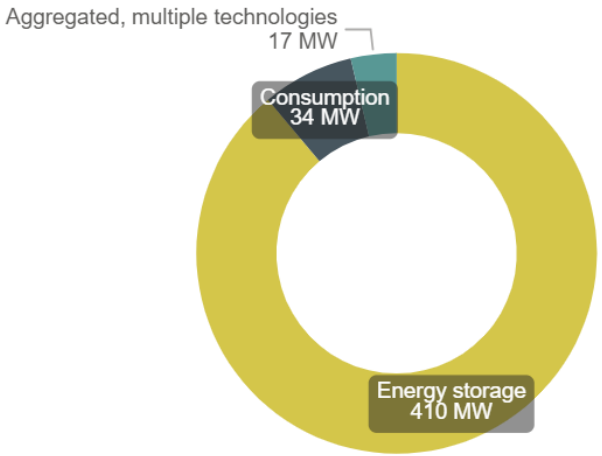
Prequalified reserve capacity from energy storage, by reserve product



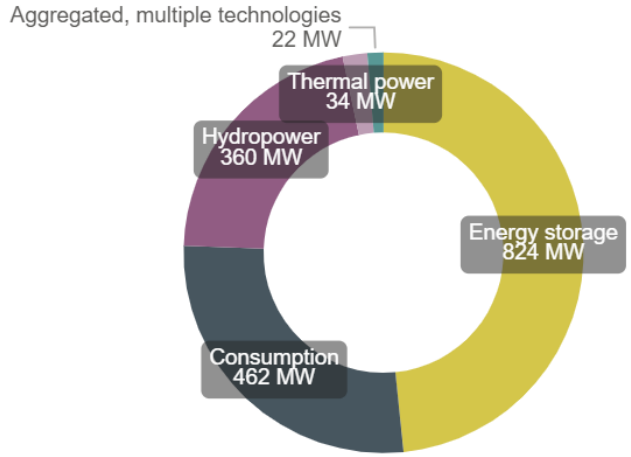
FINGRID

Reserve capacity is distributed across a wide range of technologies

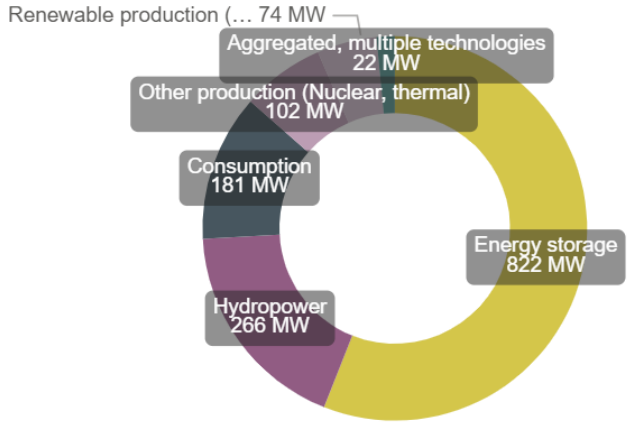
FFR



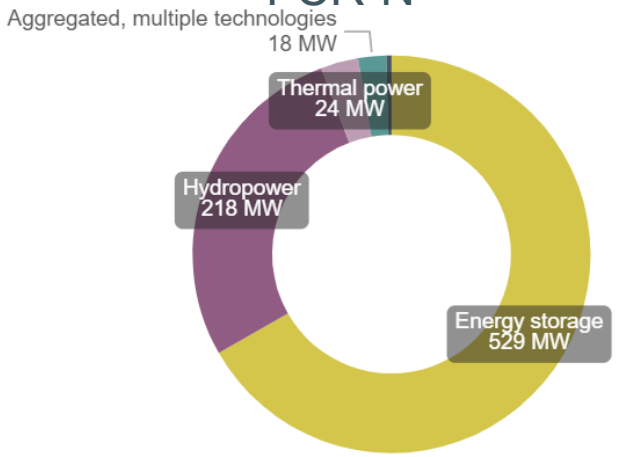
FCR-D up



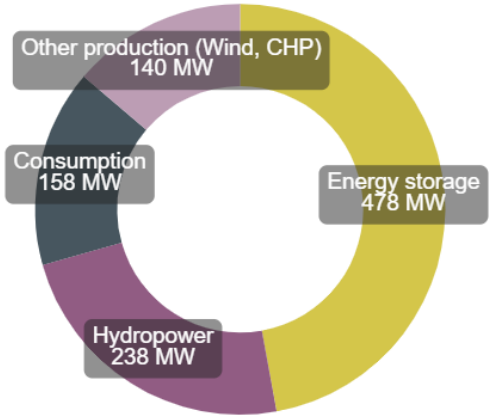
FCR-D down



FCR-N



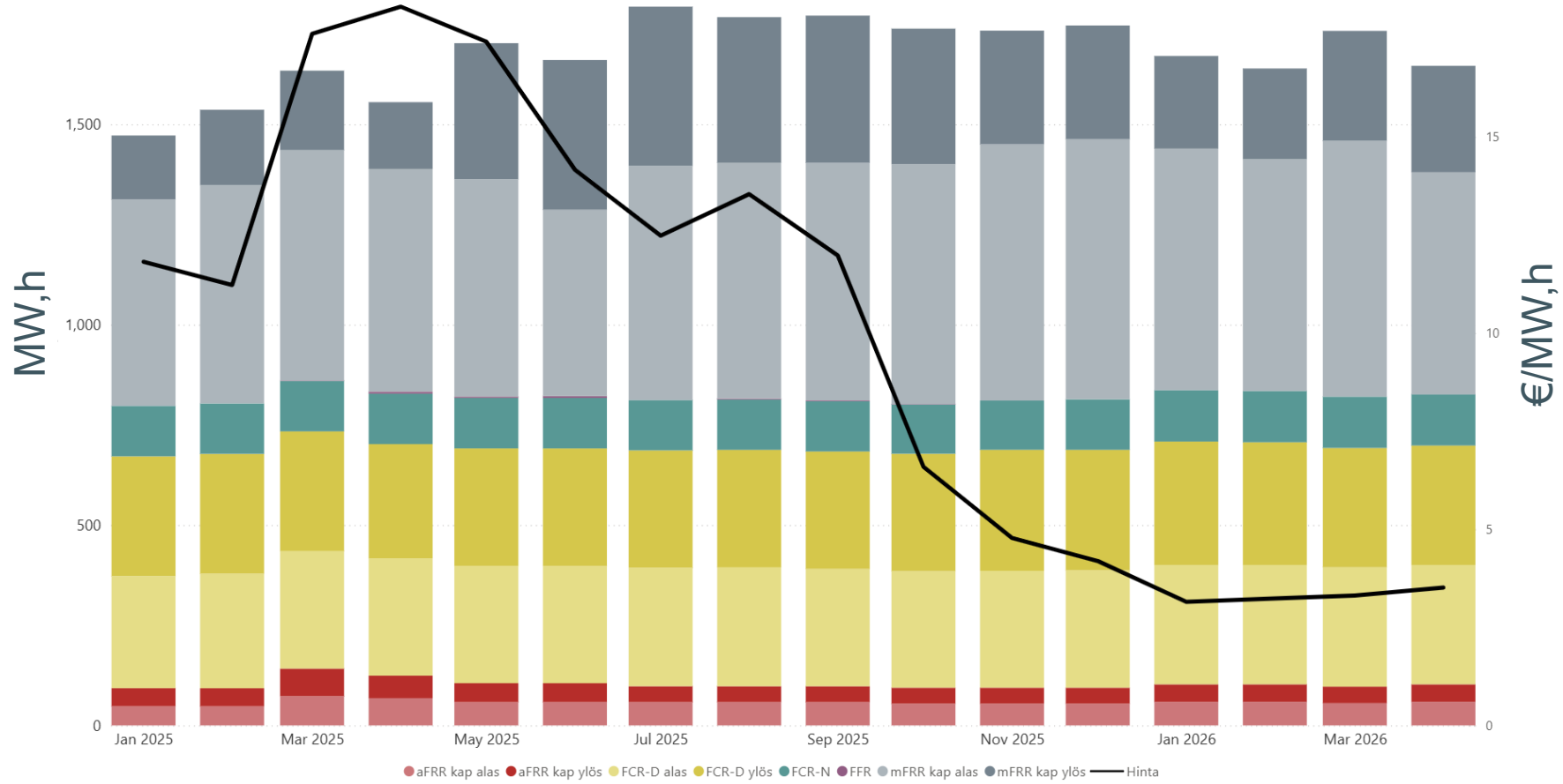
aFRR



FINGRID

Average reserve capacity prices have declined as supply has developed

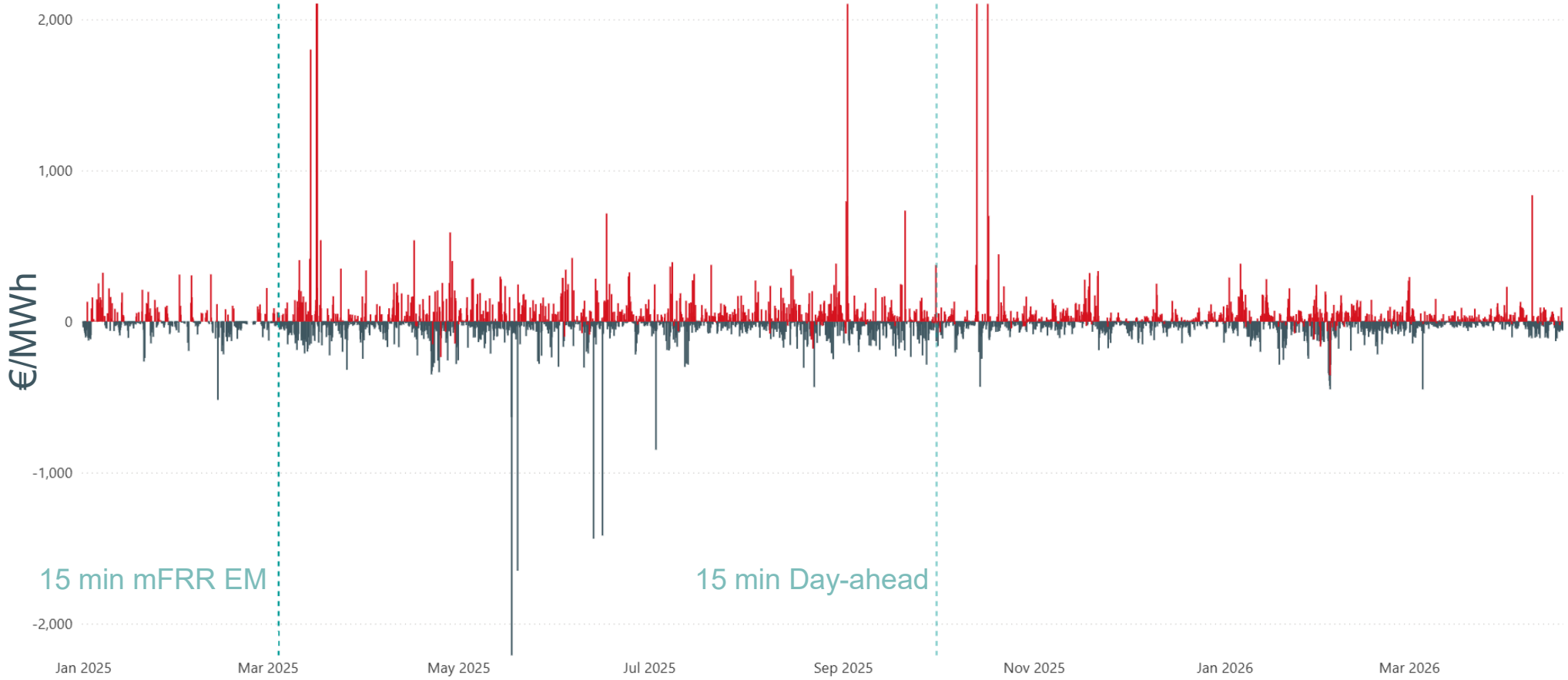
Average reserve capacity procurement by product and volume-weighted monthly price



FINGRID

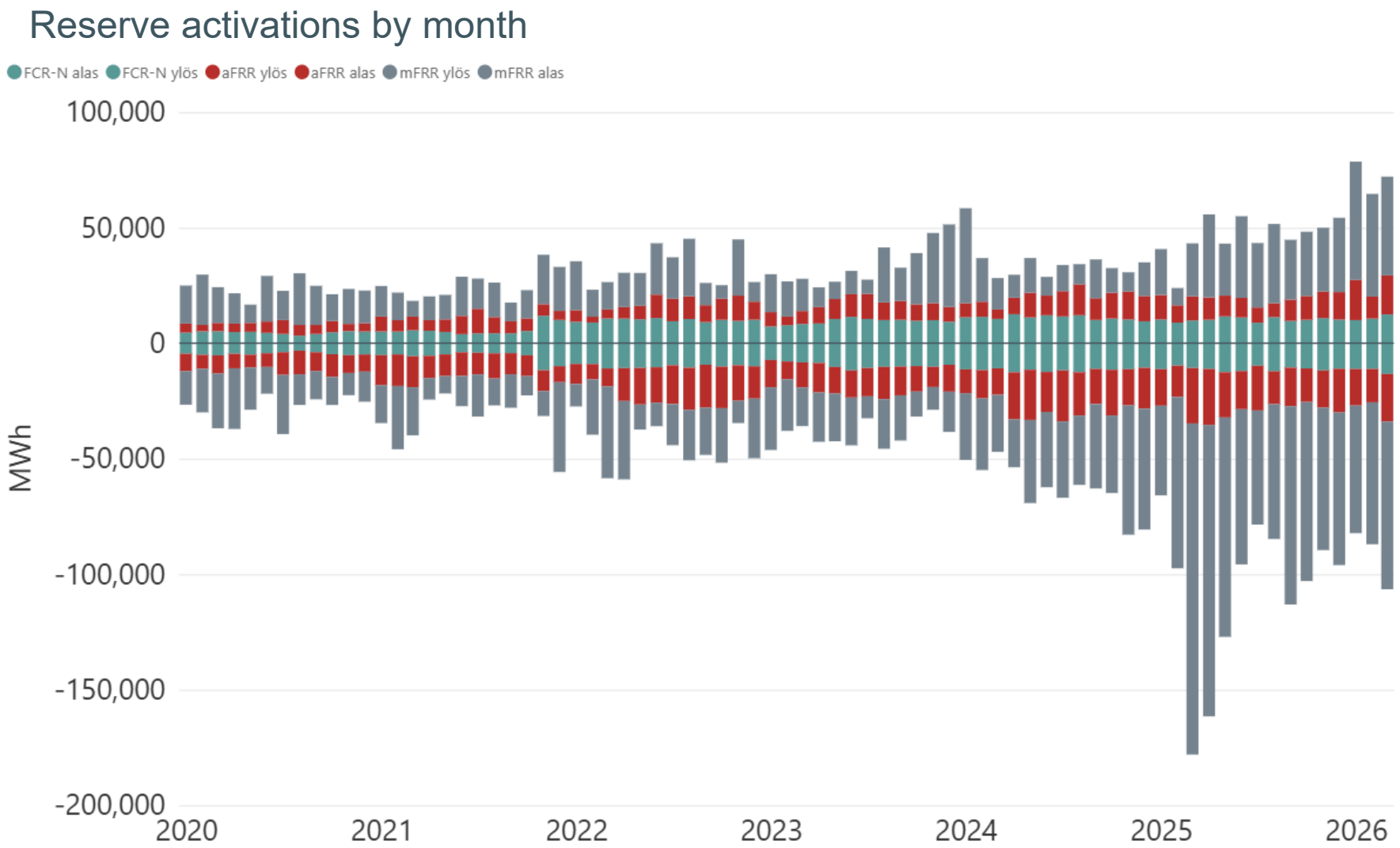
Price volatility has decreased in the aFRR and mFRR energy markets

Directional difference between imbalance price and Day-ahead price



FINGRID

mFRR activations increasing in up-regulation and stabilizing in down-regulation



FINGRID

Thank you

FINGRID

28.4.2026

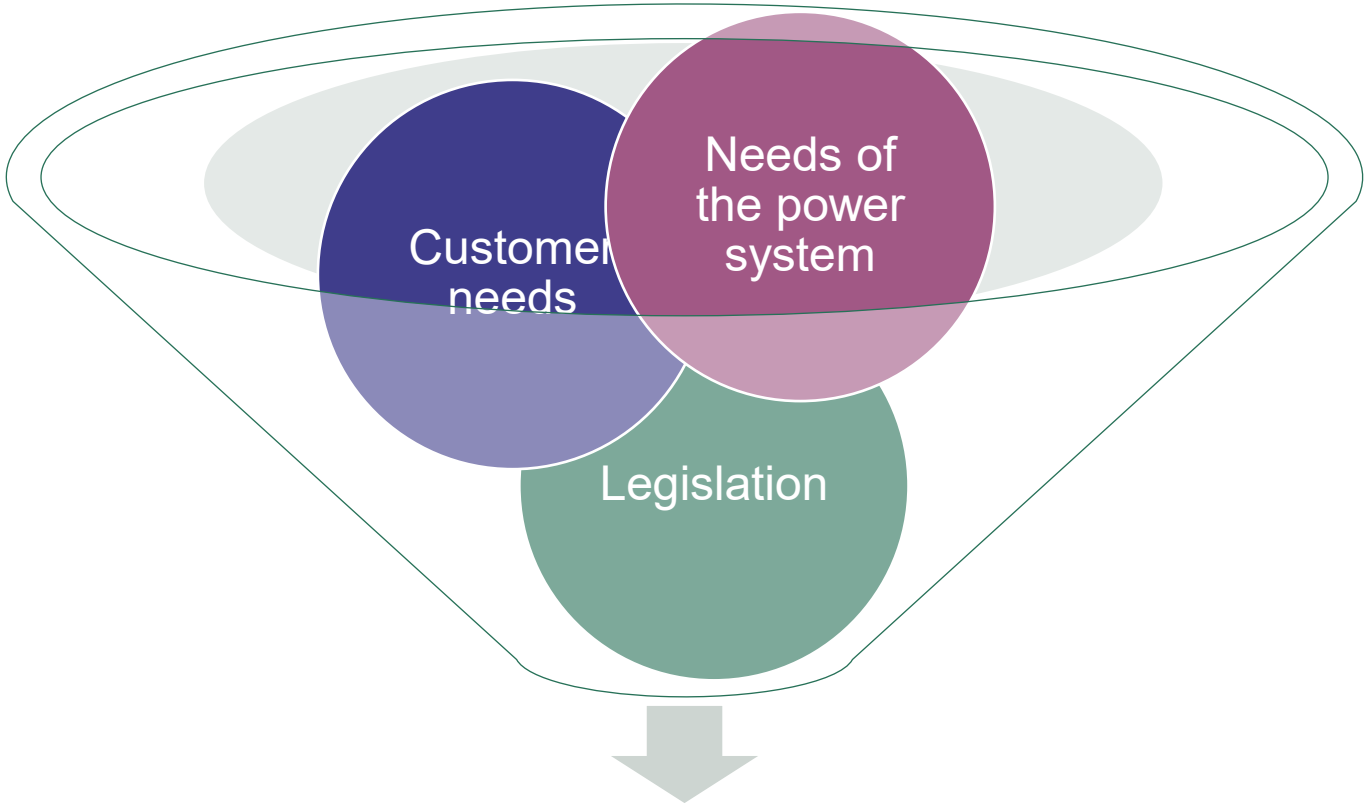
Taneli Leiskamo, Fingrid Oyj

Operational Reliability Perspective in Reserve Market Development

fingrid.screen.io/reservit26

FINGRID

Operational security is considered in the development of the reserve market



Terms and conditions for balancing service providers and balance responsible parties

FINGRID

Security of supply requirements for reserves to be confirmed by the Energy Authority

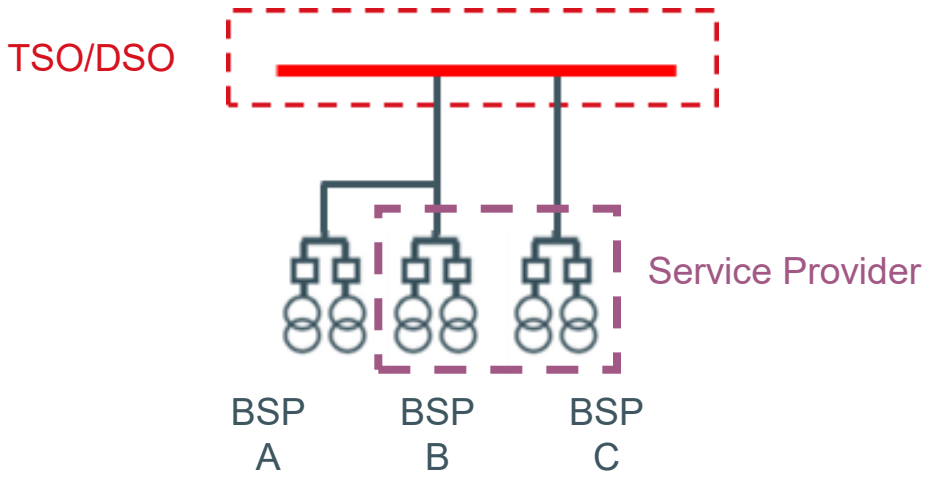
- **Background**: As part of the "Mega Package" package of amendments to the terms and conditions launched in May 2025, Fingrid proposed the introduction of the Requirements for Security of Supply of Reserves appendix as part of the requirements for balancing service providers
- **Objective**: Update and compile requirements relevant to maintaining operational security, in particular taking into account the simultaneous supply of multiple reserves and the utilization of service providers
- **Status**: Document to be confirmed by the Energy Authority, commissioning schedule proposed by Fingrid in September 2026

FINGRID

The security of supply requirements for reserves aim to maintain system security

Limits on the maximum amount of reserve per fault

- Frequently Asked Questions:
  - *"What do we need to double?"*
  - *"Several operators in same connection?"*
  - *" Existing connections"?*
  - *"TSO/DSO faults?"*



Balancing service providers are responsible for their service providers

- Frequently Asked Questions:
  - *"Whose responsibility is it to take care of the situation of service providers?"*
  - *"How do we ensure service providers, taking into account, among other things, the confidentiality of market information?"*

Fingrid: *"Balancing service provider is responsible for the compliance of its equipment, information systems and service providers"*

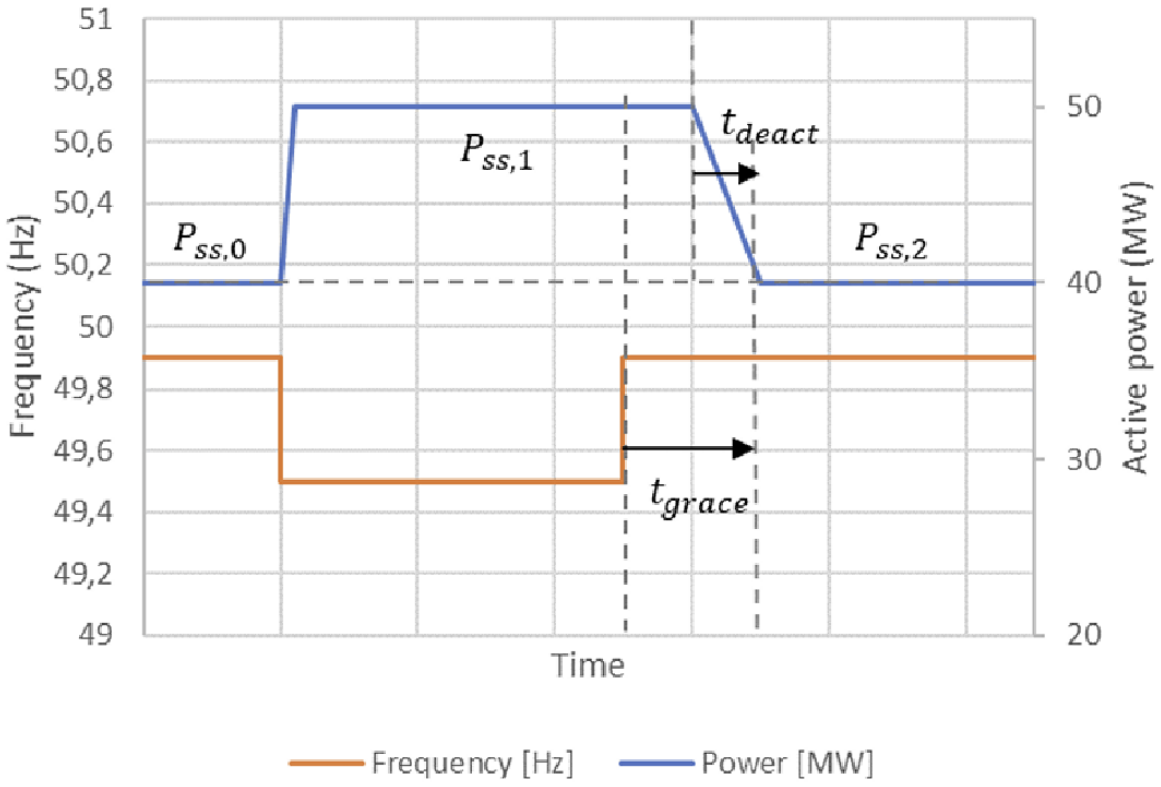
FINGRID

Reserve units must pass grid code specifications

- Fingrid ensures that the grid code technical requirements and grid service conditions are met when a reserve unit enters the markets after reserve prequalification tests
- At the moment
  - aFRR, FCR and FFR are allowed when the grid code specifications have been passed and the network service conditions are met
  - mFRR allowed when the connecting TSO/DSO of the reserve unit has granted interim operational notification
- Possible changes (under review, entry into force will be announced separately):
  - mFRR units' equivalent requirements for grid code tests as for other reserves
  - Updated grid code technical requirements for consumption (KJV2026), target schedule from entry into force Q2/2027

Introduction of limitations for static FCR-D reserve units from autumn 2026

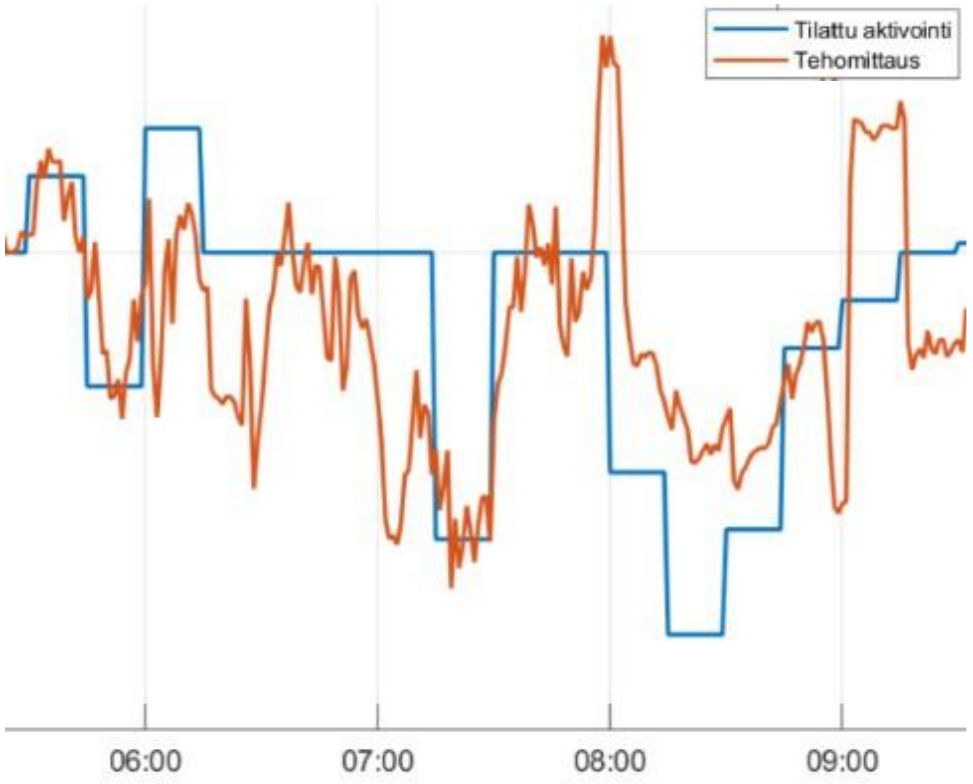
- **In September 2026, the Nordic TSOs will start restrictions on the amount of static reserve in the procurement of the FCR-D up-balancing product for system security reasons**
- Later also for the FCR-D down-regulation product
- The restriction of static FCR-D is implemented in the bid selection process
- The deployment will not cause any significant changes to the practices or operational activities of existing Finnish balancing service providers



FINGRID

Fingrid has noticed room for improvement in the supervision and control of reserve activations by balancing service providers

- Room for improvement, especially in relation to
  - For the simultaneous maintenance of several reserve products
  - mFRR activations
- Based on the gap-analysis, Fingrid assesses possible changes:
  - technical requirements for the mFRR product and its verification
  - Real-time data requirements related to reserve maintenance
- Fingrid continues monitoring, possible changes will be consulted before commissioning



FINGRID

Balancing service provider must notify Fingrid of undelivered reserves

- **Recap:** If an obstacle restricts or interrupts the maintenance of the reserve completely, the BSP must notify Fingrid without delay
- **Change:** Fingrid has updated the Reserve Trading and Information Exchange Guidelines, and any reserves that have not been delivered as of 1 May 2026 at the latest must be reported using the updated notification form
- **Change:** A notification of force majeure must be submitted **no later than 30 minutes** within the start of the fault, if it is to be taken into account in the invoicing of capacity compensation.

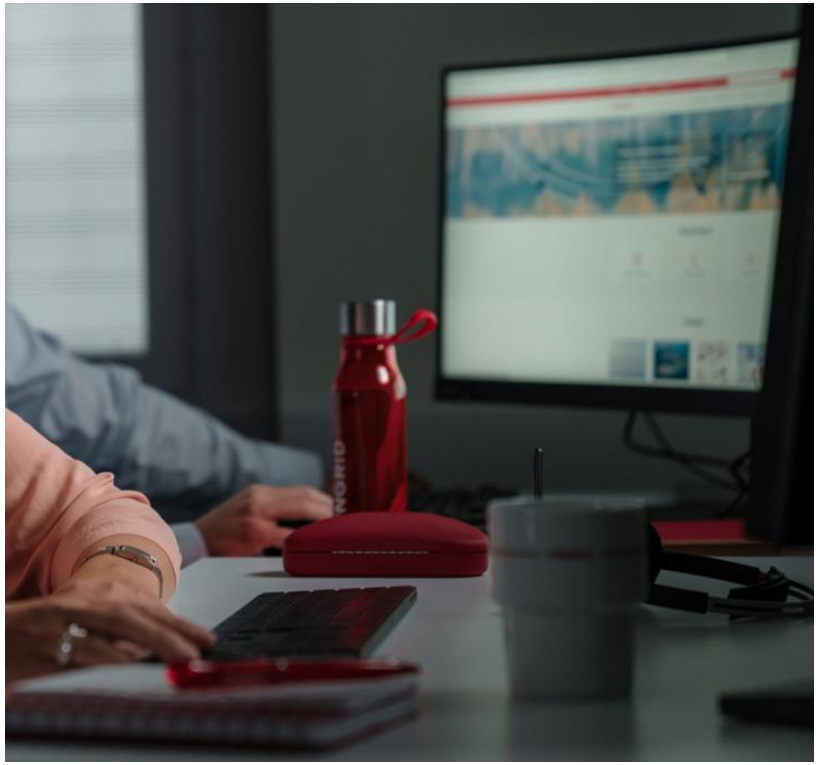
Toimittamatta jääneen reservin ilmoituslomake

Osapuoli					
Reservikohde					
Ylläpidetyt reservituotteet (ylös / alas)	mFRR:	aFRR:	FCR-N:	FCR-D:	FFR:
Ylläpitämättömän reservin määrä (ylös/alas) (MW)	mFRR:	aFRR:	FCR-N:	FCR-D:	FFR:
Häiriötilanteen alkamishetki					
Arvioitu päättymishetki					
Todellinen päättymishetki					
Häiriön syy, sekä kuvaus häiriöstä					
Ylivoimainen este (kyllä/ei)					
Yhteystiedot					
Lisätiedot					

FINGRID

Balancing service providers must be able to ensure reliable reserve delivery

- × **Problem**: The balancing service provider does not notice errors in activations
  - ✓ **Solution**: Balancing service provider invests in the development of its own surveillance
- × **Problem**: Fingrid notices deviations, but cannot reach the balancing service provider
  - ✓ **Solution**: The reserve supplier will provide Fingrid with up-to-date 24-hour contact information
- × **Problem**: Balancing service provider can't fix the problem at all or it's slow
  - ✓ **Solution**: Balancing service provider updates its arrangements and tests for disruptions



Deviations will result in sanctions in accordance with the terms and conditions, and repeated deviations will result in an BSP-specific temporary exclusion from the market.

FINGRID

Thank you

FINGRID

28.4.2026

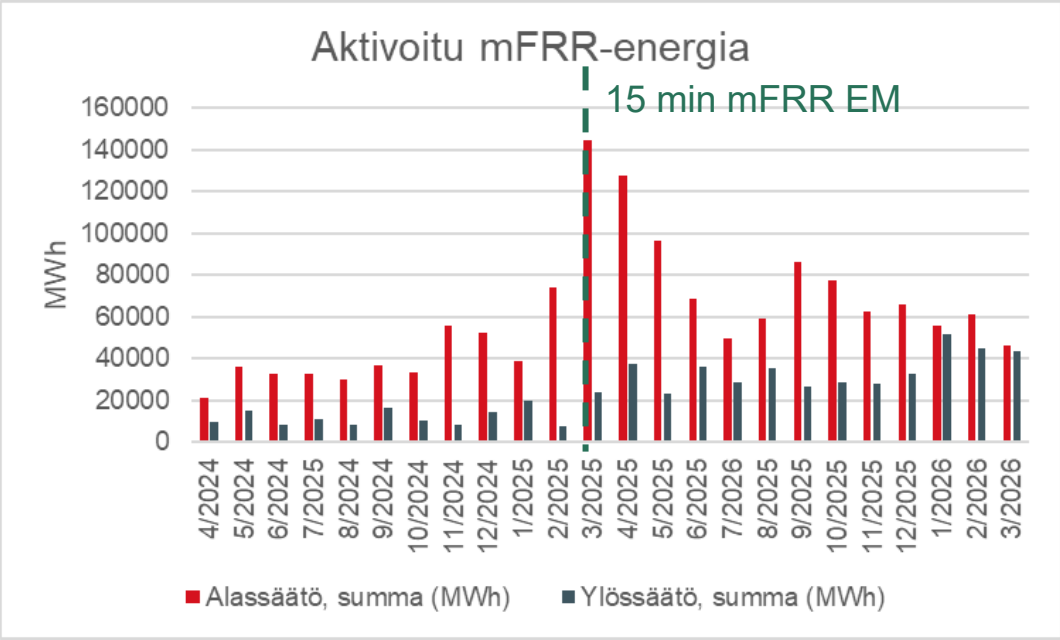
Otso-Ville Rinne, Fingrid Oyj

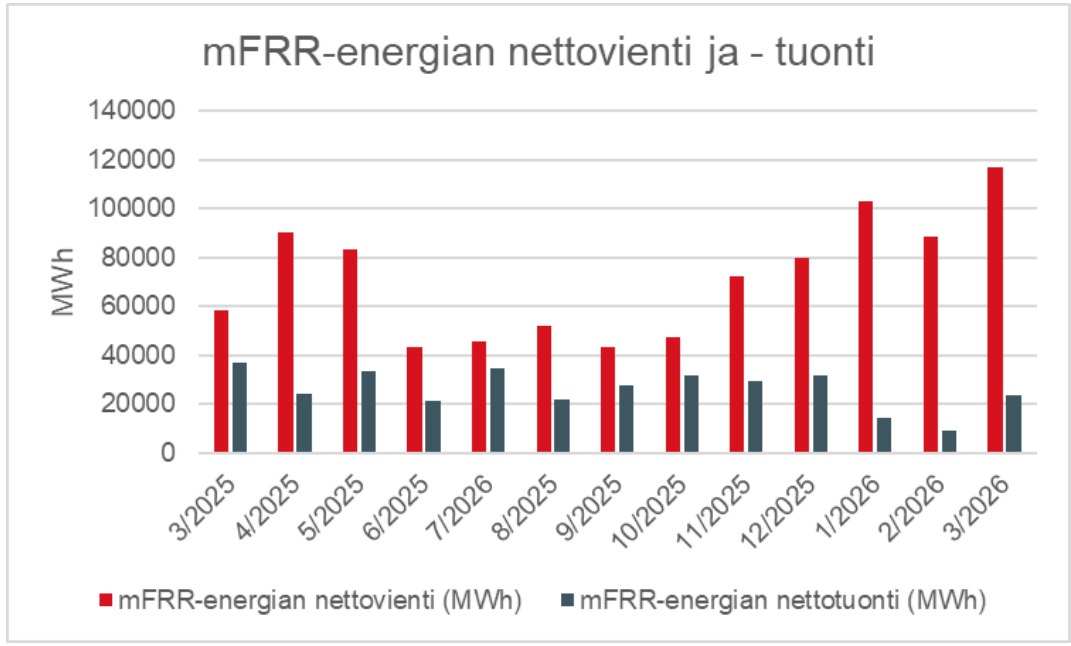
First Year in the 15-minute mFRR Energy Market

fingrid.screen.io/reservit26

FINGRID

mFRR-energy activation volumes for down regulation have evened out

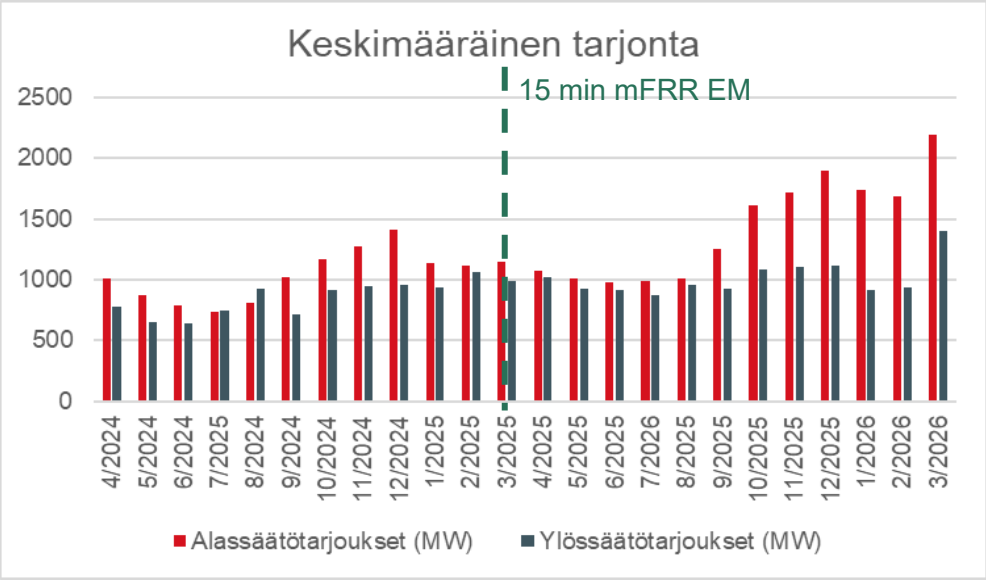


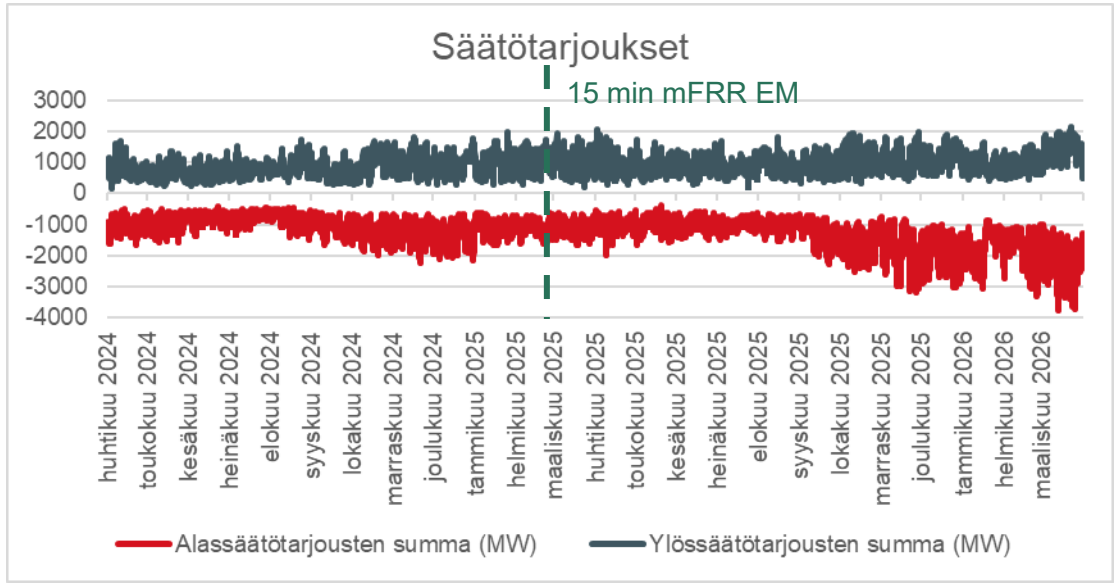


- After mFRR energy market go-live the uptick of down regulation volumes has evened out
- Lately, some upwards movement can be seen in upward regulation volumes
- There's constant activation of reserves both for Finnish and other Nordic TSOs needs
- Cross-border flows to the export direction have increased after the introduction of Aurora line

FINGRID

The supply in the mFRR energy market has increased

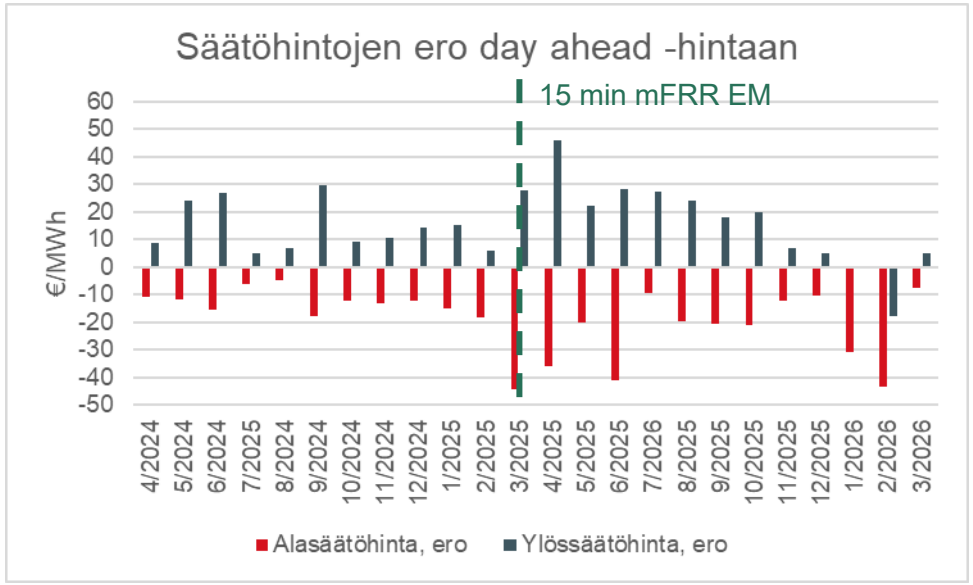


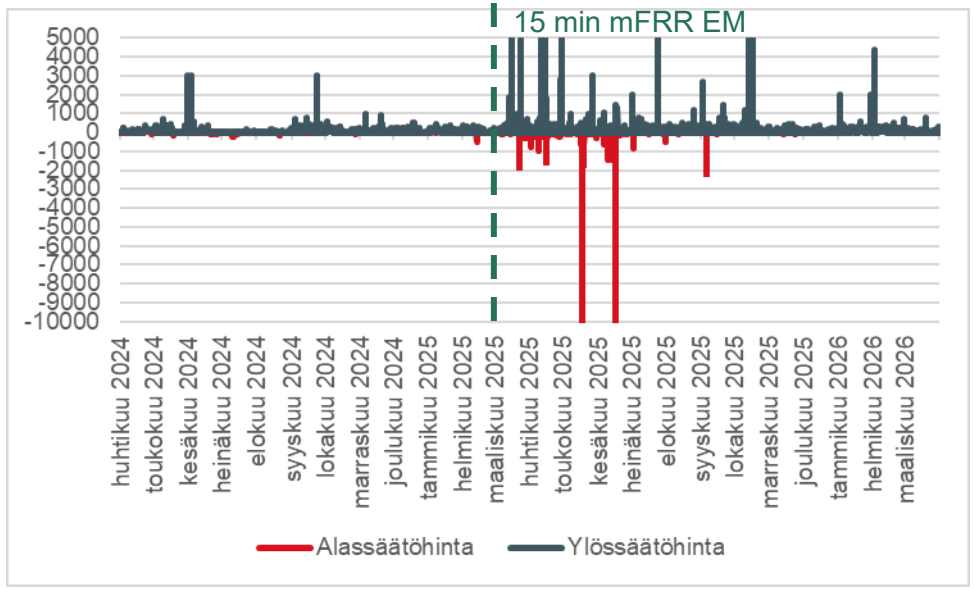


- The supply in the mFRR energy market has seen positive increase since last autumn, especially in downwards regulation
- From time to time, however, there is a scarcity of supply

FINGRID

There are occasional price spikes in the mFRR energy markets



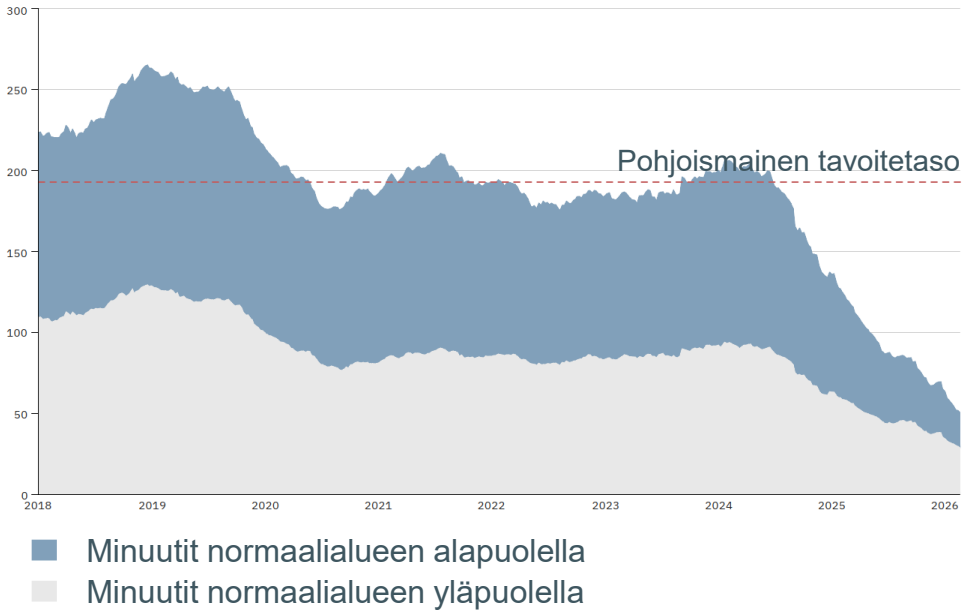


- The average price difference to the Day-ahead price has narrowed since last spring
  - Slightly higher spread is visible in early 2026 due to high Day-ahead prices
  - They have been seen mainly in the upward direction lately

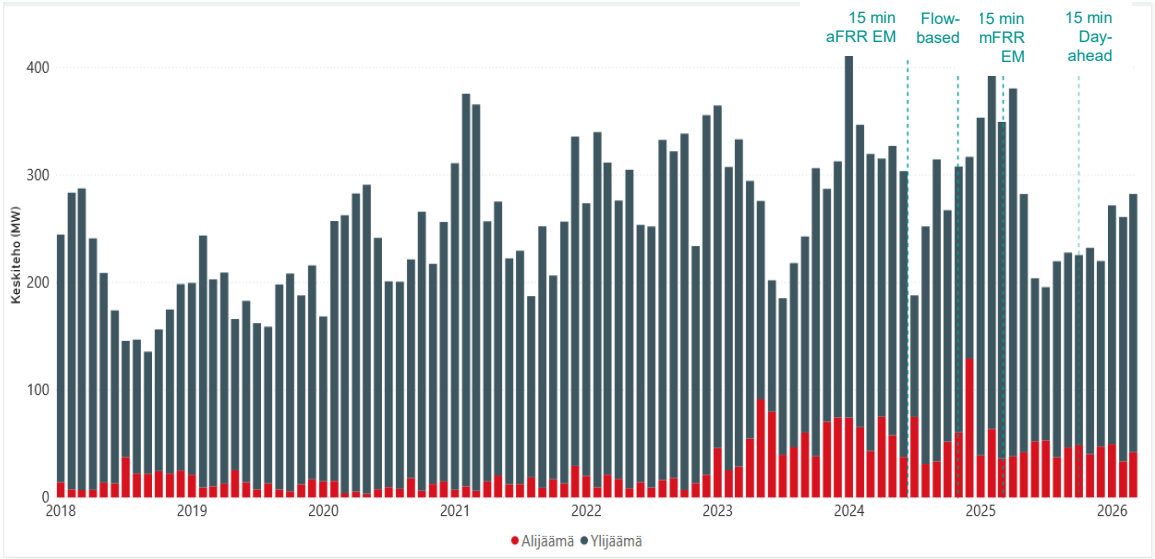
FINGRID

The balance of the Nordic system has improved

Liukuva vuosikeskiarvo taajuuden standardialueen ulkopuolella



Absoluuttinen tasevastaavien nettotasepoikkeama keskitehona (MW)

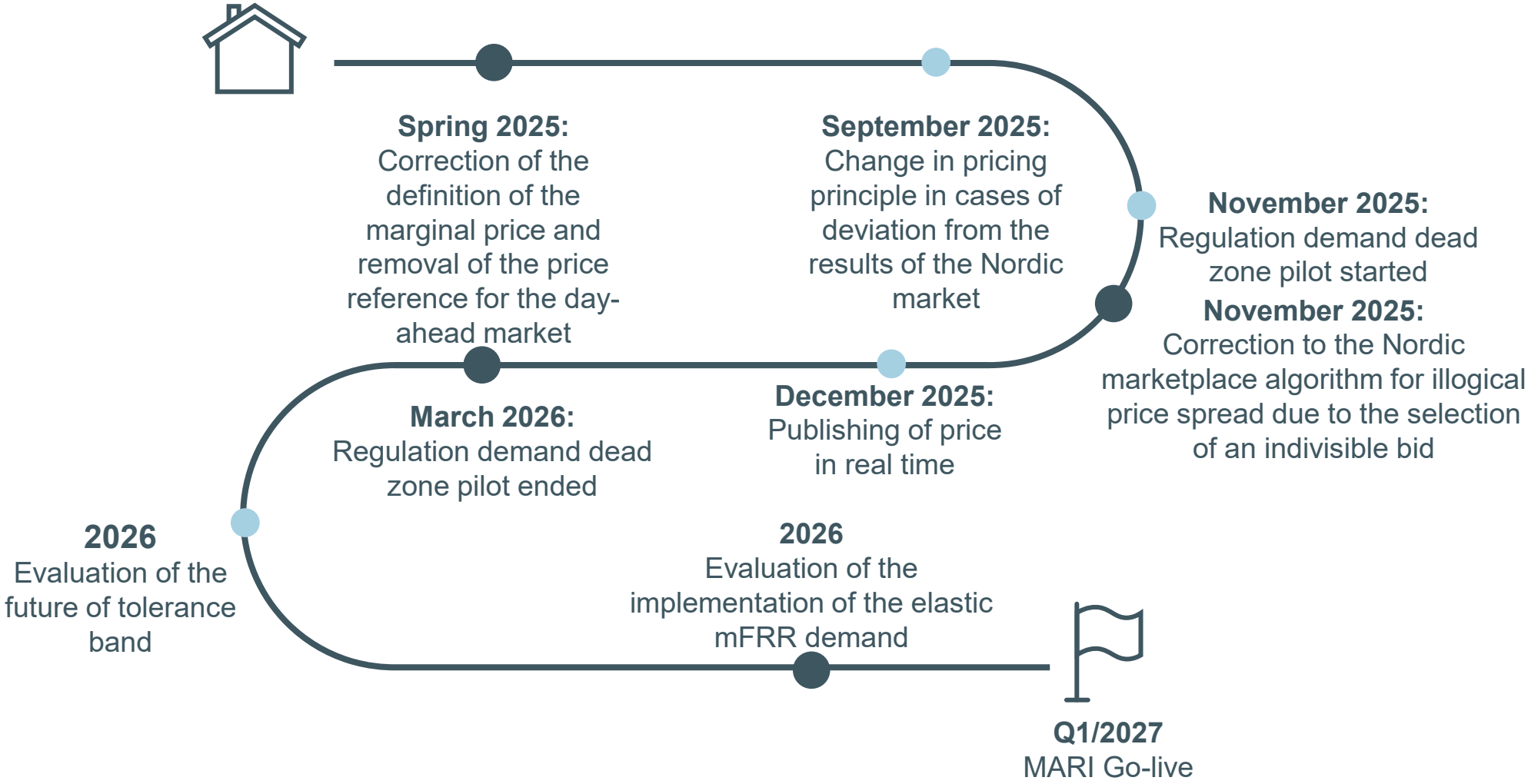


- The improvement in frequency quality, which began at the end of 2024, has continued – The number of minutes outside the normal range is significantly below the target
  - The imbalance in the Nordic countries have been regulated more accurately
  - Multiple reasons can be identified: Flow-based, 15 min market time unit in most of the markets, the increased amount of energy storage, new technical requirements for FCR markets…
- The imbalances in Finland and thus the regulation demand have decreased in comparison to the last few years

FINGRID

Market and IT development

Changes in the mFRR energy market after the implementation



FINGRID

mFRR energy price formation and release may still be challenging from time to time

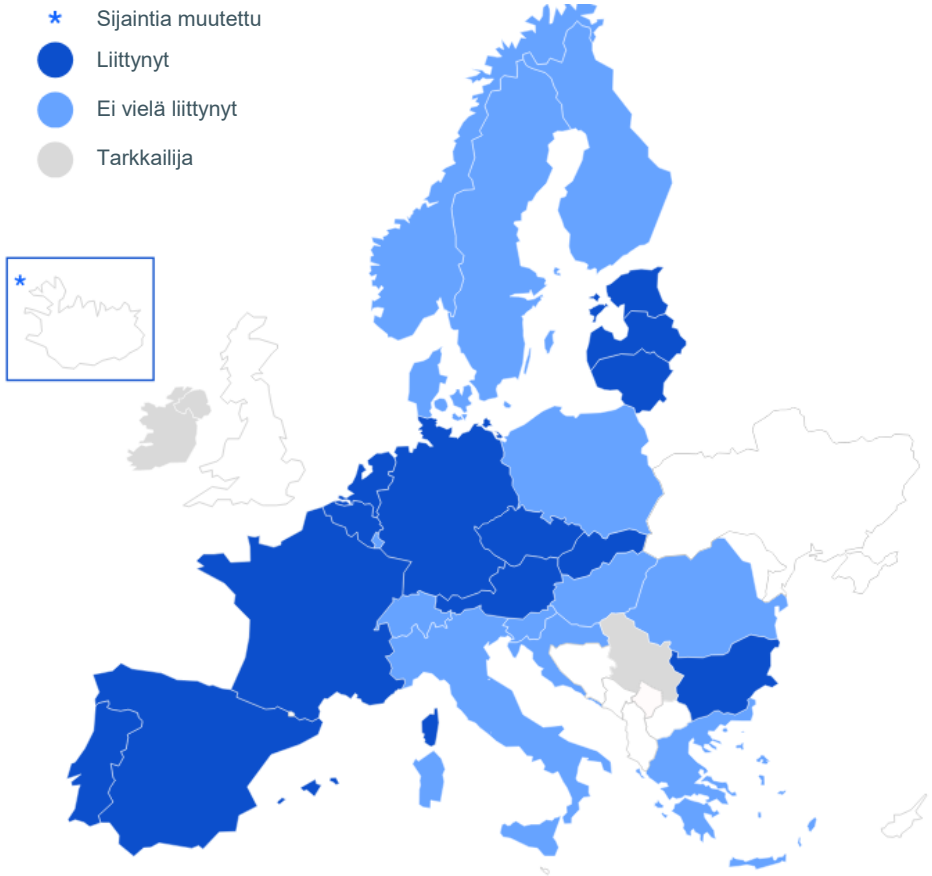
- There were challenges and delays in the publication of mFRR energy market prices after the Go-live
  - Marginal price not according to the last selected bid (corrected 5/2025)
  - Price, day-ahead market price (corrected 4/2025)
  - Illogical spread of the price due to the selection of an indivisible bid (corrected 11/2025)
    - Illogical prices due to performance (multiple fixes)
- The publication of prices has no longer been deliberately delayed after December 2025
  - Still, information system errors in the Nordic countries have caused delays from time to time
- Despite updates aimed at improving the algorithm's performance, illogical prices have occurred this year (those affecting Finland on 9 January and 17 March).
  - The price is not based on the selected offers and the result of the algorithm may not be optimal
  - The development continues, e.g. The impact of tolerance band on algorithm performance is analyzed

FINGRID

Changes to the BSP due to MARI Go-live

When Finland joins the European mFRR energy marketplace together with the other Nordic countries

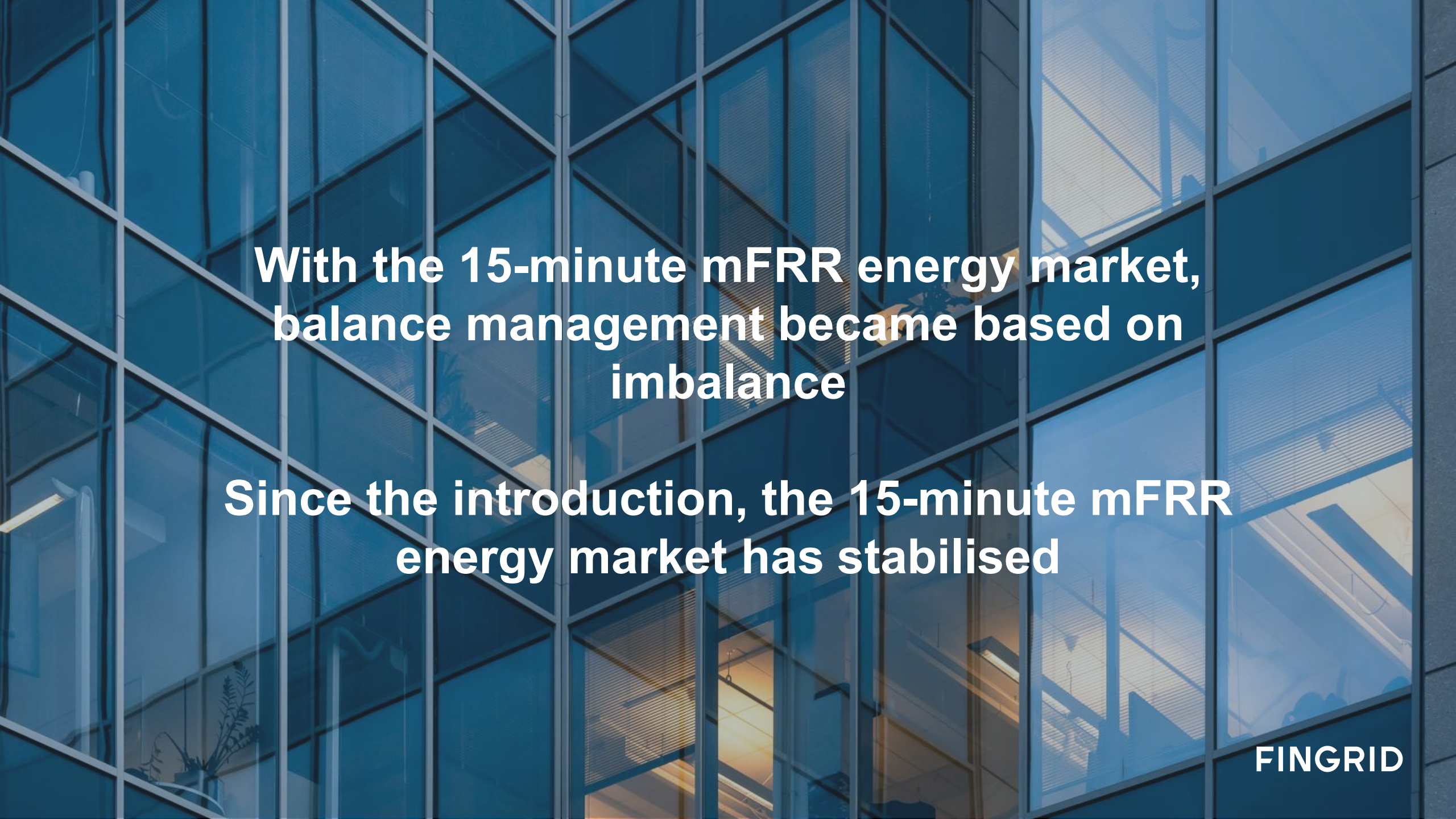
- The submission time of bids is moved closer to the time of use (qh-25 min)
- Separate prices will be introduced for scheduled and direct activation
- mFRR trading with Estlink



MARIin liittyneet maat (huhtikuu 2026)

https://www.entsoe.eu/network_codes/eb/mari/

FINGRID


With the 15-minute mFRR energy market, balance management became based on imbalance
Since the introduction, the 15-minute mFRR energy market has stabilised
FINGRID

Thank you

FINGRID

28.4.2026

Joonas Muikku, Fingrid Oyj

From PICASSO Accession to Area Control Error Based aFRR Activation

fingrid.screen.io/reservit26

FINGRID

Reasons to use Area Control Error based model

- aFRR activations as part of Finnish balance management
- Eliminate opposing aFRR and mFRR activations

FINGRID

Road map towards Area Control Error based aFRR activation

Fingrid aFRR energy market and PICASSO accession

aFRR energy market started 6/2024 and PICASSO accession was done 3/2025

Energinet Full ACE 8/2025

Energinet switched to fully ACE based aFRR activation

Model used currently is planned as an intermediate stage

Fingrid aFRR ACE calculation Q2/2027

Fingrid aims to take into use ACE calculation done by Fingrid LFC, as a basis for Nordic activation

Svenska Kraftnät PICASSO accession Q4/2027

Statnett PICASSO accession Q1/2028

Fingrid Full ACE

Statnett Full ACE

Svenska Kraftnät Full ACE

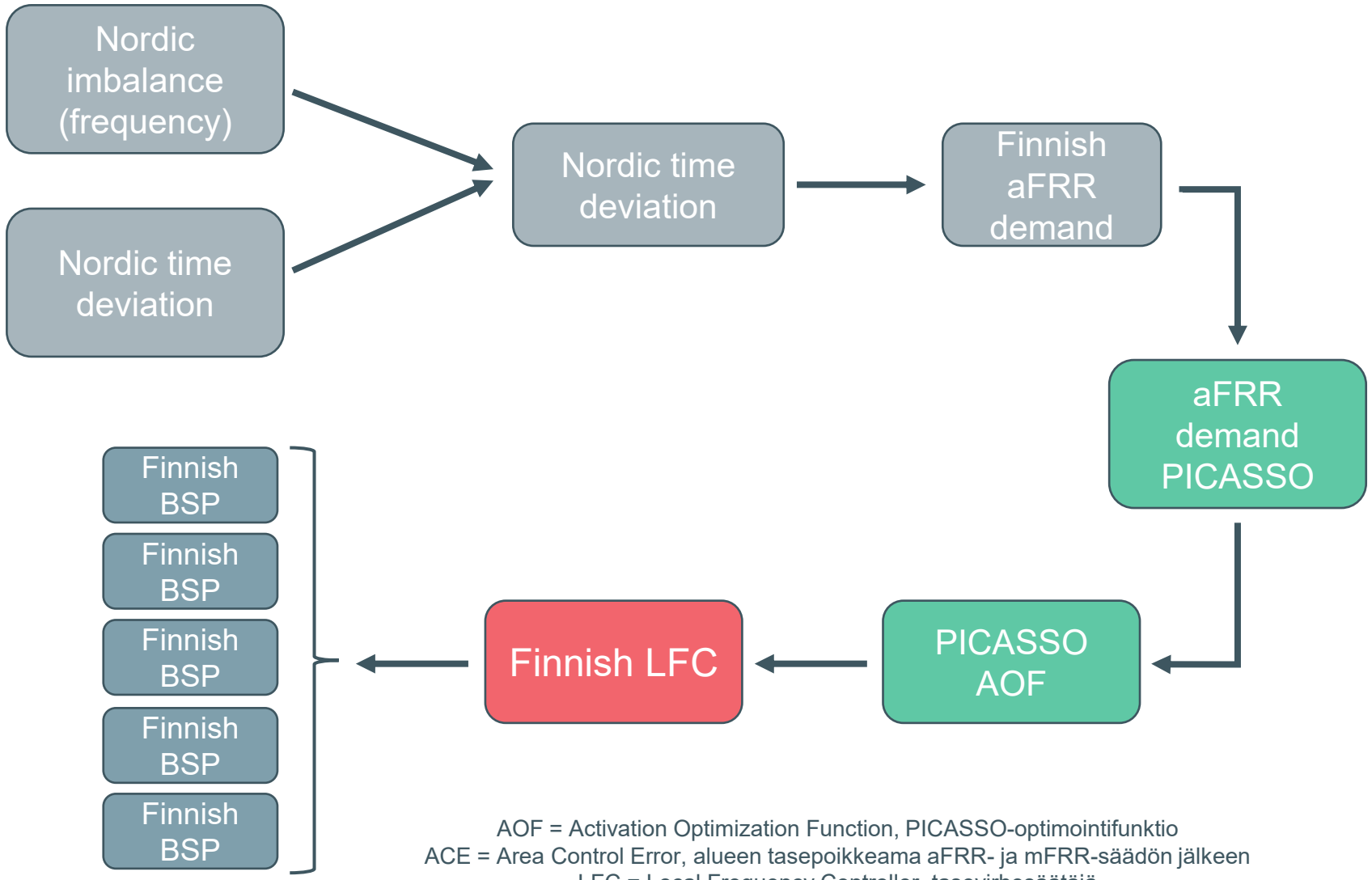
Fingrid, Statnett and Svenska Kraftnät switch one by one to fully ACE based activation

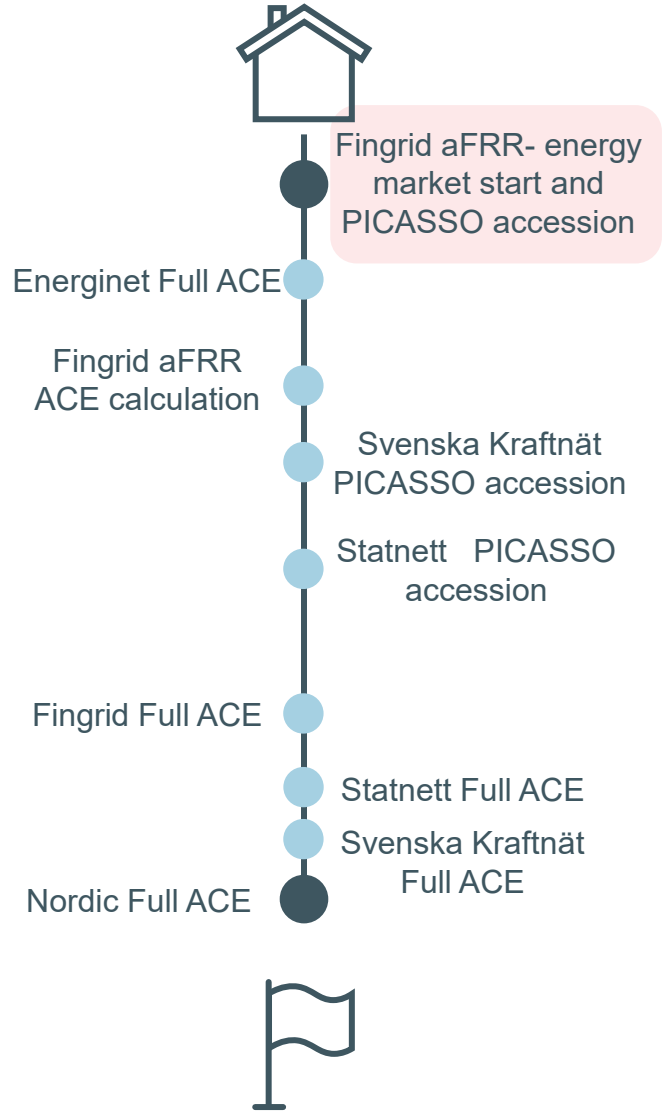
Nordic Full ACE

AOF = Activation Optimization Function
ACE = Area Control Error
LFC = Local Frequency Controller

FINGRID

Nordic aFRR activation in Finland

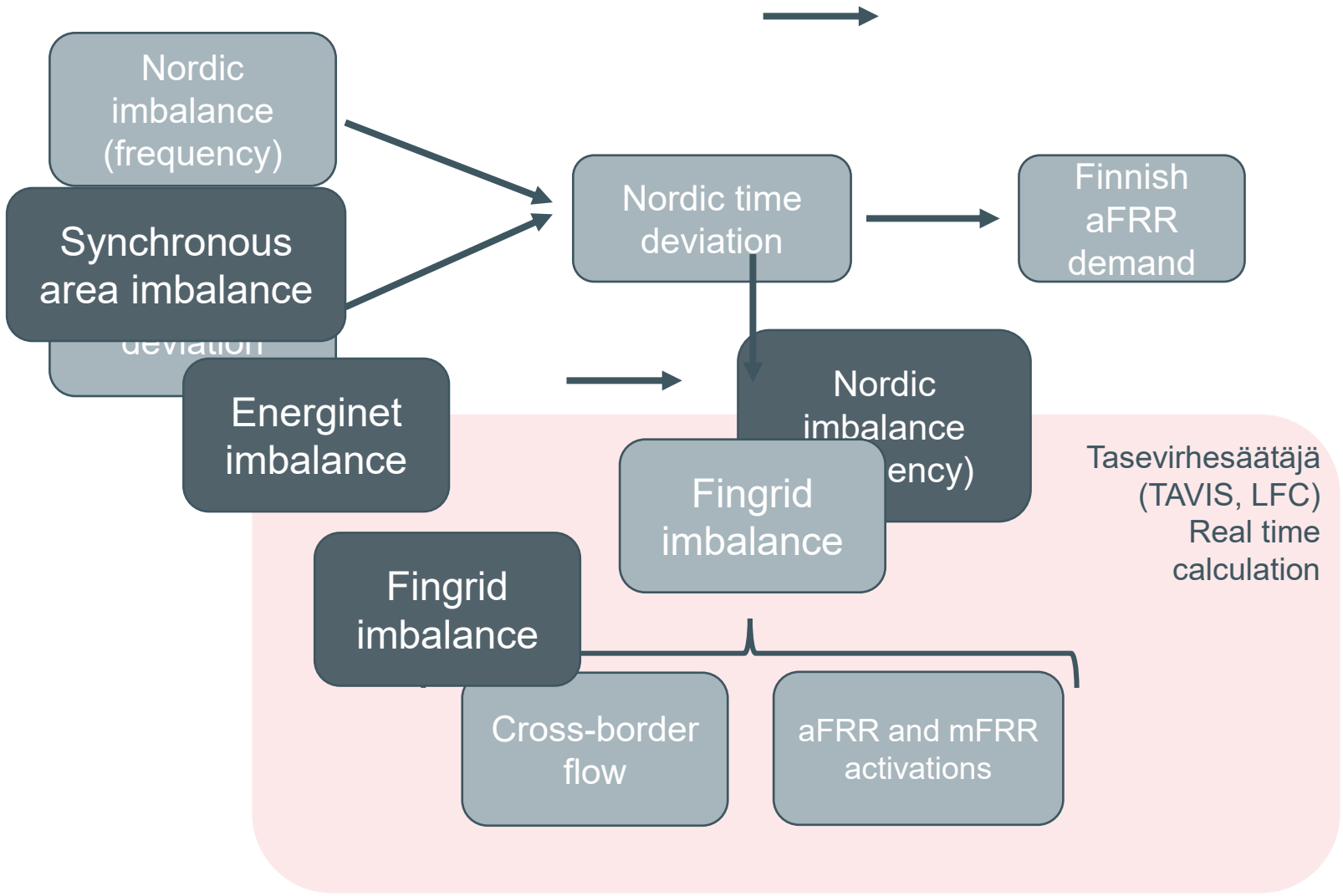


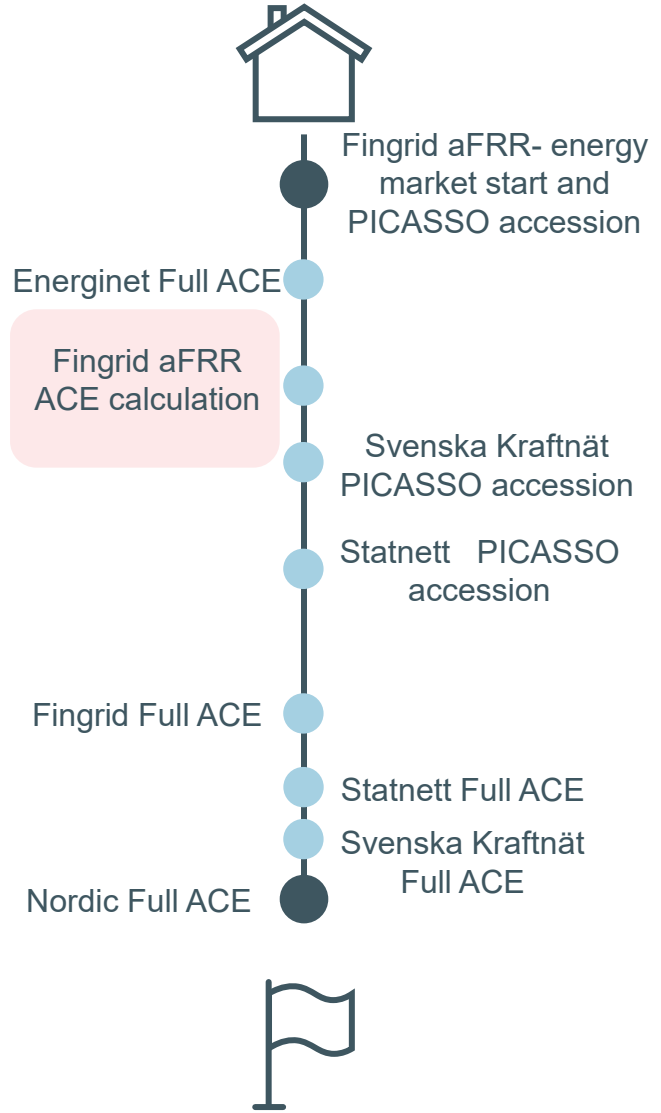


AOF = Activation Optimization Function, PICASSO-optimointifunktio
ACE = Area Control Error, alueen tasepoikkeama aFRR- ja mFRR-säädön jälkeen
LFC = Local Frequency Controller, tasevirhesäätäjä

FINGRID

Calculation of Finnish imbalance

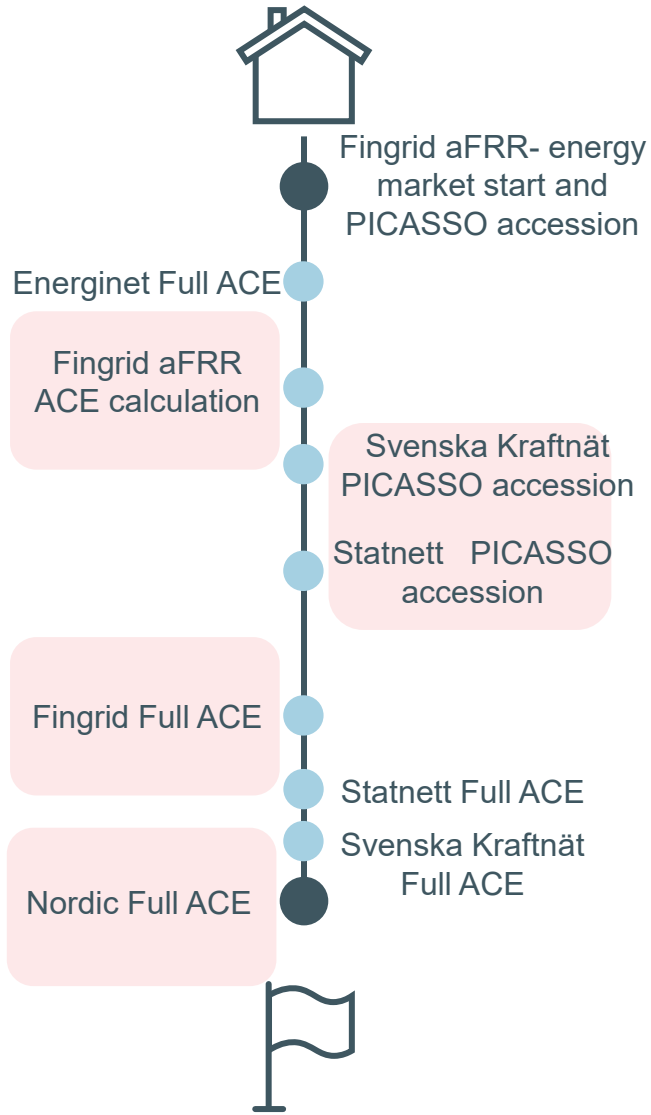




FINGRID

How will the changes be reflected to Balancing Service providers?

1. **Fingrid aFRR ACE calculation**
   - Change is purely technical. Calculation in principle remains the same, but the calculation is done in Fingrid IT system instead of Statnett IT system. No affect on activation volumes or method.
2. **Statnett and Svenska Kraftnät PICASSO accessions**
   - Statnett and Svenska Kraftnät PICASSO accessions enable the exchange of energy market bids, as currently with for example Elering and rest of Europe
3. **Fingrid Full ACE**
   - Fundamental change of aFRR activation method. aFRR activation based on Nordic imbalance, meaning synchronous area frequency, will be changed to activation based on Finnish Area Control Error. aFRR procurement volumes will likely be increased and the activation may become more volatile due to smaller area.
4. **Nordic Full ACE**
   - All Nordic countries switch to Area Control Error based aFRR activation. Opposing direction imbalances can be netted between areas in the PICASSO platform, and energy market bids will be activated based on PICASSO optimization. All areas have to fulfill aFRR dimensioning requirements, which will likely increase aFRR procurement in the Nordics.



FINGRID

Thank you

FINGRID

RELIABLE OPERATION IN THE RESERVE MARKETS

FINGRID

28.4.2026

Juha Teirilä, Energy Authority

Market Surveillance in Changing Markets (in Finnish)

fingrid.screen.io/reservit26

FINGRID

energiavirasto

28.4.2026

Markkinavalvonta muuttuvilla markkinoilla

Juha Teirilä / Energiavirasto

Tukkumarkkinavalvonta (REMIT-asetus)

energiavirasto

Tukkumarkkinavalvonta

kahdenväliset

Energiavirasto:

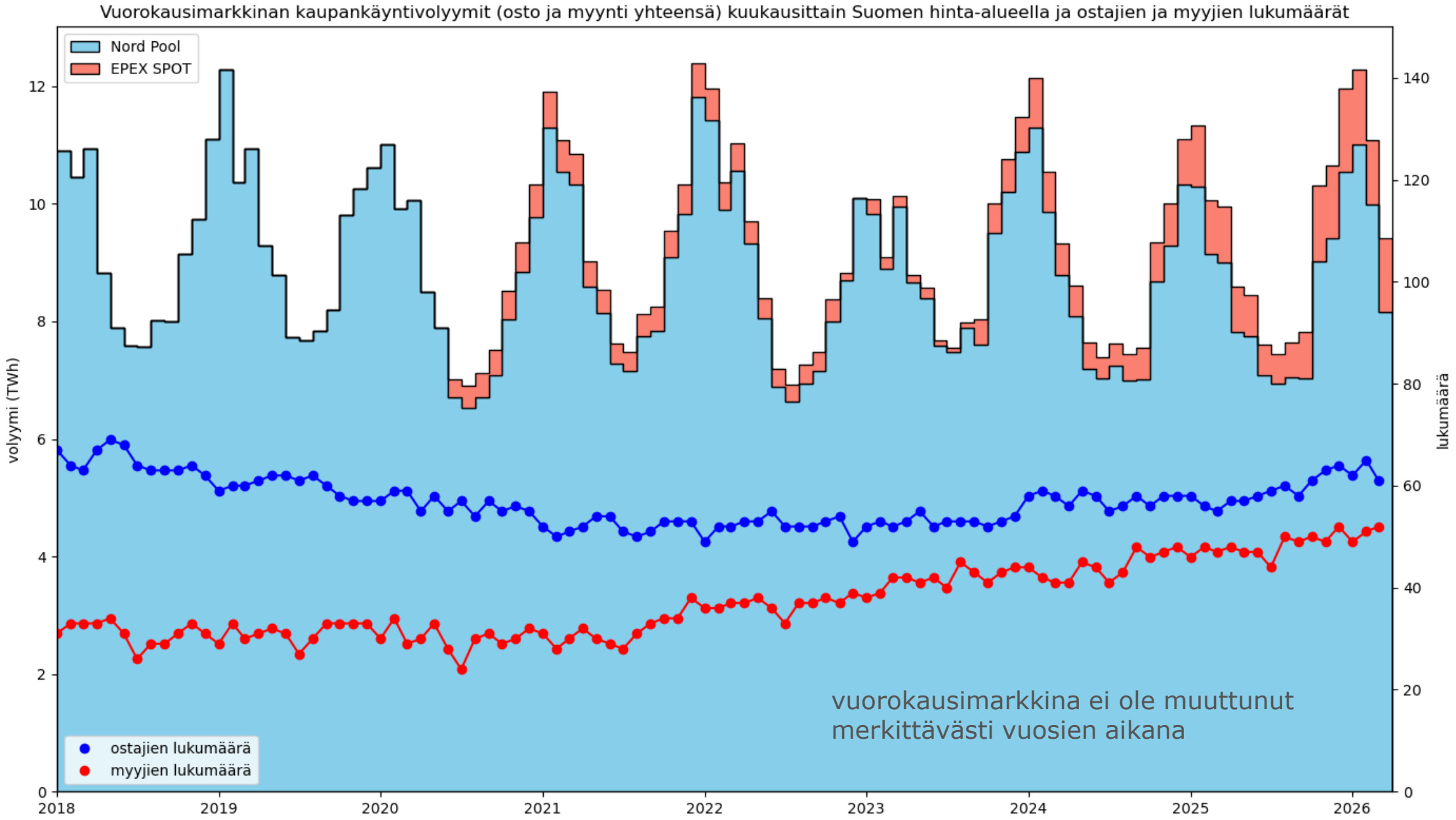
- tutkii mahdolliset REMIT-asetuksen rikkomukset, tekee hallintopäätökset

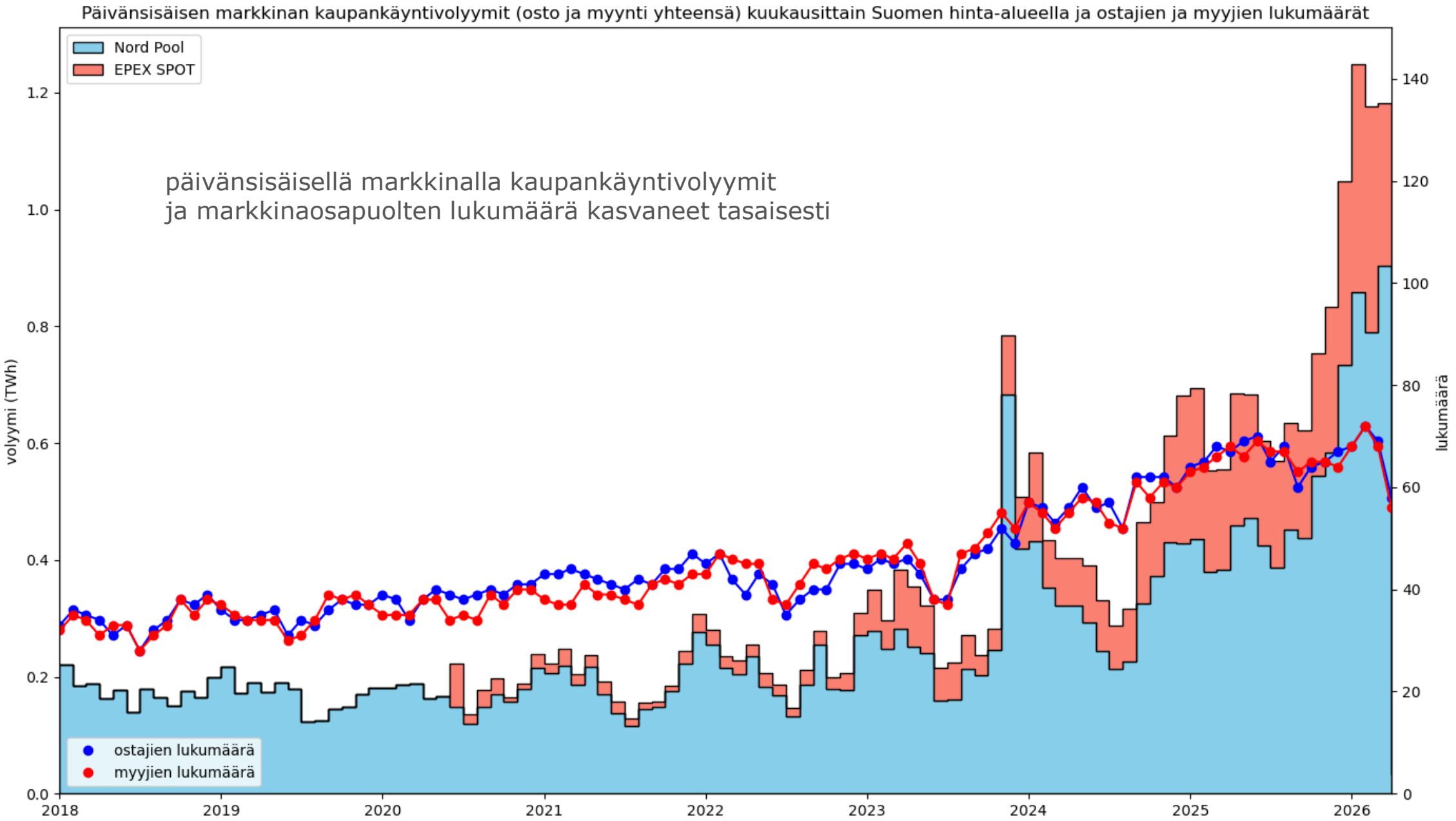
- täyttää mahdollisia valvontakatveita (cross-market, cross-border, jne.)

- tekee pistoselvityksiä eri aiheista (korkeat hinnat, yksi toimija(-ryhmä))

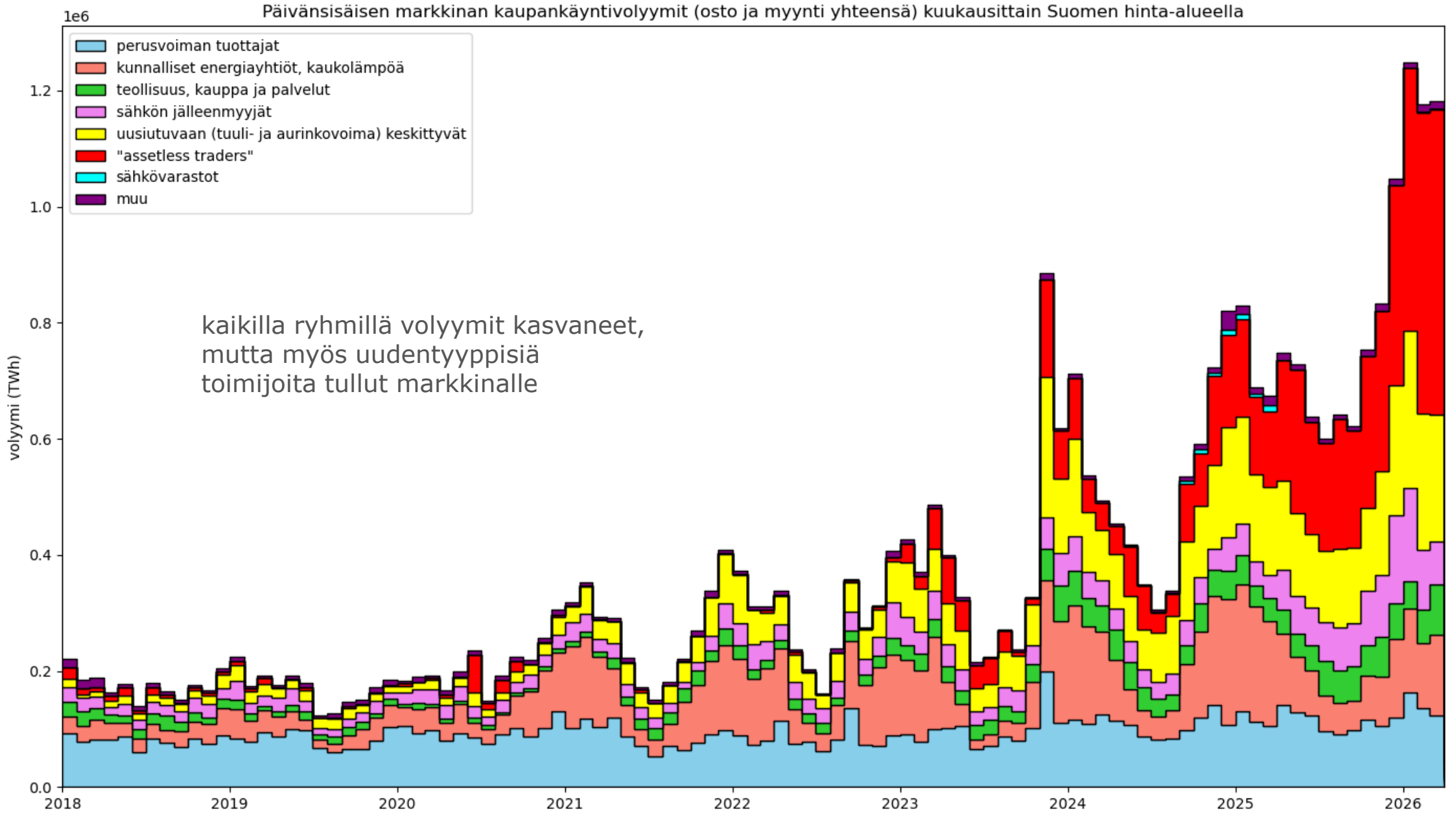
- seuraa markkinan kehitystä ja varmistaa valvonnan kattavuuden (uudentyyppiset toimijat, markkina-muutokset, jne.)

energiavirasto


Vuorokausimarkkinan kaupankäyntivolyymit (osto ja myynti yhteensä) kuukausittain Suomen hinta-alueella ja ostajien ja myyjien lukumäärät
Nord Pool
EPEX SPOT
volyymi (TWh)
lukumäärä
ostajien lukumäärä
myyjien lukumäärä
vuorokausimarkkina ei ole muuttunut
merkittävästi vuosien aikana
0
2
4
6
8
10
12
0
20
40
60
80
100
120
140
2018
2019
2020
2021
2022
2023
2024
2025
2026

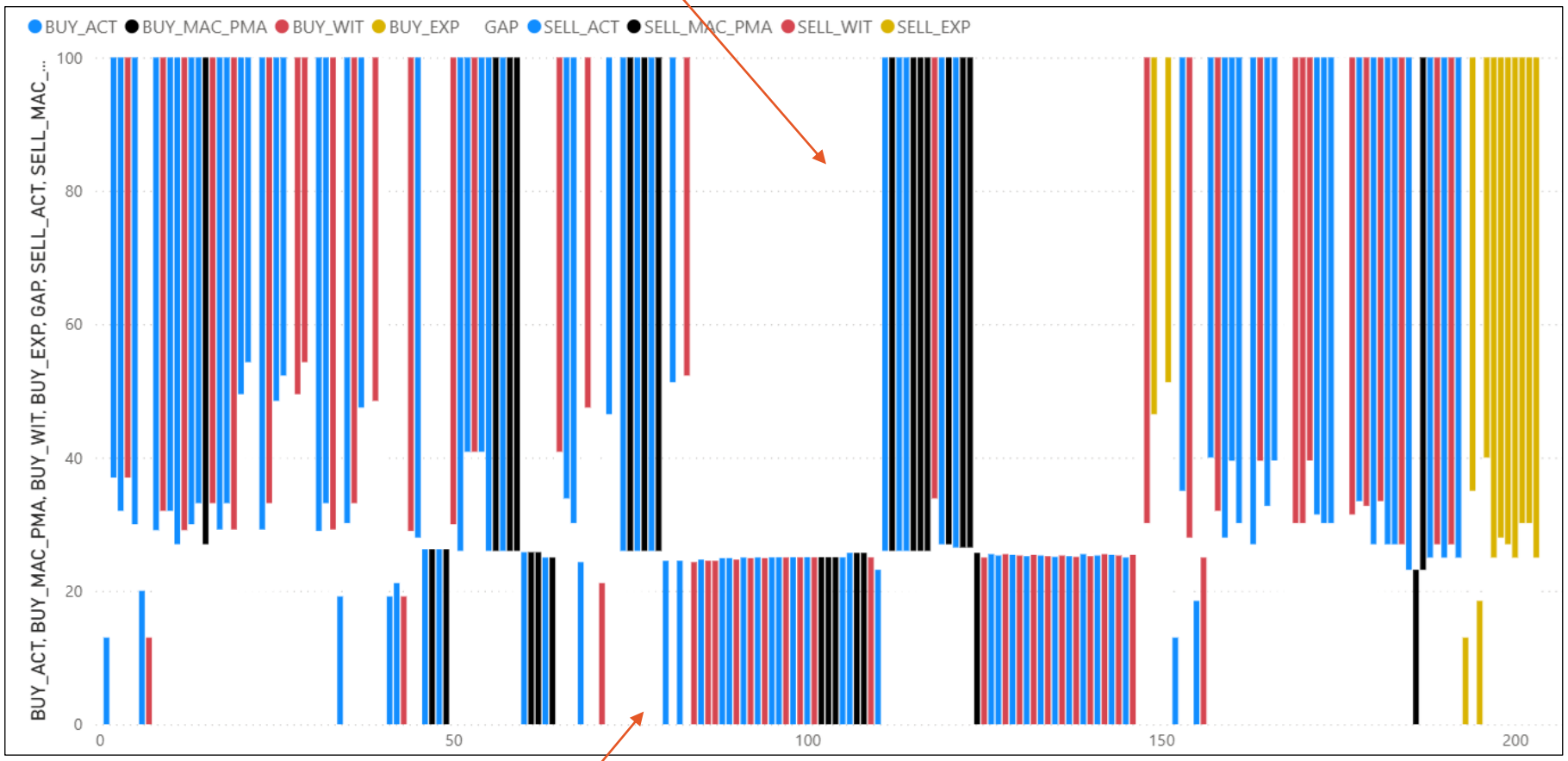

Päivänsisäisen markkinan kaupankäyntivolyymit (osto ja myynti yhteensä) kuukausittain Suomen hinta-alueella ja ostajien ja myyjien lukumäärät
Nord Pool
EPEX SPOT
päivänsisäisellä markkinalla kaupankäyntivolyymit
ja markkinaosapuolten lukumäärä kasvaneet tasaisesti
volyymi (TWh)
lukumäärä
ostajien lukumäärä
myyjien lukumäärä
0.0
0.2
0.4
0.6
0.8
1.0
1.2
0
20
40
60
80
100
120
140
2018
2019
2020
2021
2022
2023
2024
2025
2026

asto


Päivänsisäisen markkinan kaupankäyntivolyymit (osto ja myynti yhteensä) kuukausittain Suomen hinta-alueella
1e6
perusvoiman tuottajat
kunnalliset energiayhtiöt, kaukolämpöä
teollisuus, kauppa ja palvelut
sähkön jälleenmyyjät
uusiutuvaan (tuuli- ja aurinkovoima) keskittyvät
"assetless traders"
sähkövarastot
muu
volyymi (TWh)
0.0
0.2
0.4
0.6
0.8
1.0
1.2
2018
2019
2020
2021
2022
2023
2024
2025
2026
kaikilla ryhmillä volyymit kasvaneet,
mutta myös uudentyyppisiä
toimijoita tullut markkinalle

Intraday, tammikuu 2020 (PH-20200103-11)

myyntitarjoukset

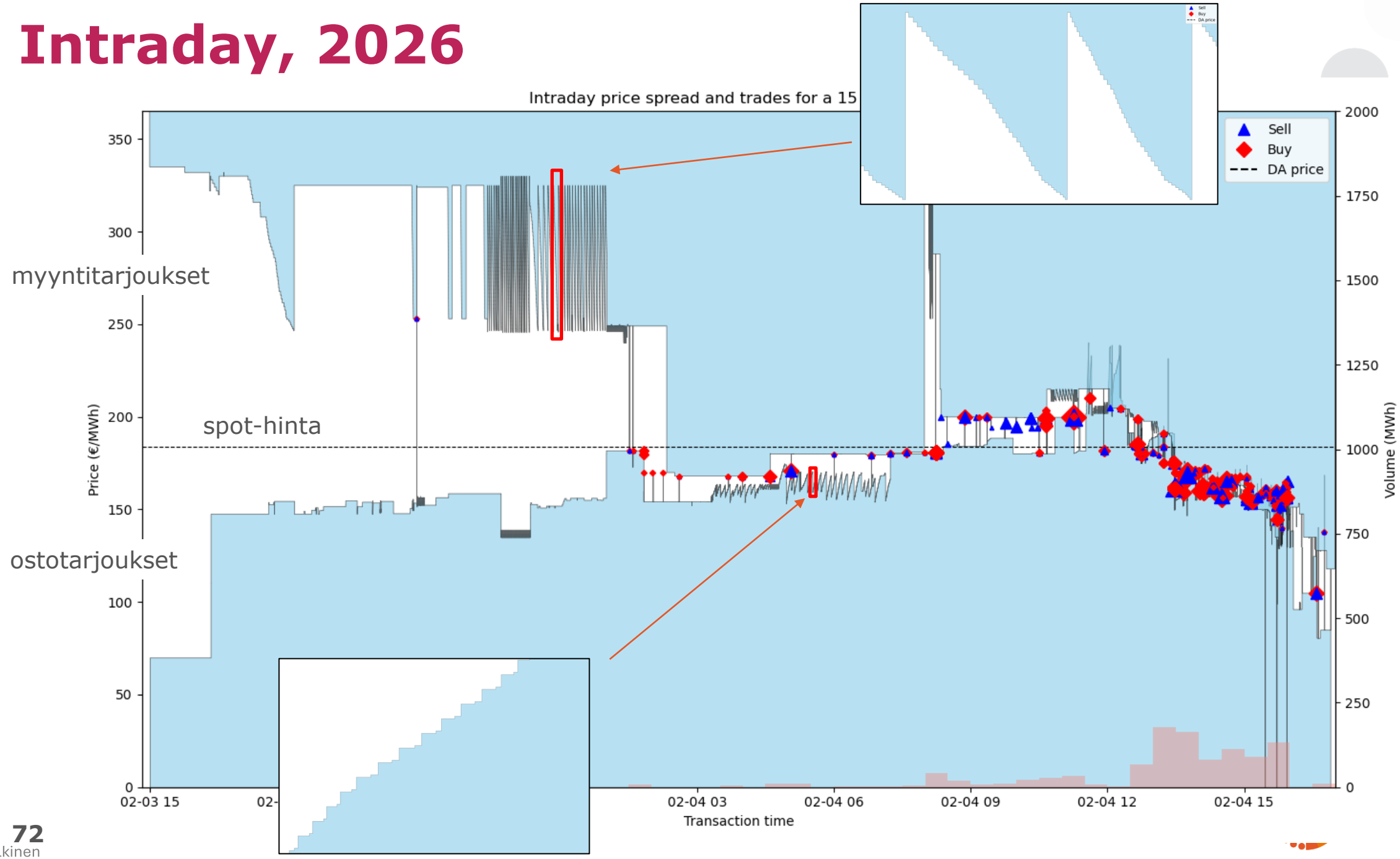


ostotarjoukset

sininen = uusi tarjous
punainen = peruttu tarjous
musta = toteutunut kauppa
keltainen = expiroitunut tarjous

energiavirasto

Intraday, 2026



giavirasto

Algoritmeja koskevat samat säännöt

- Jokaisen tarjouksen tulee perustua aitoon tarpeeseen
  - "price discovery" ok
  - "spoofing" ei ok
  - tasevirheen tahallinen jättäminen ei ok
- Arvioidut kannattavat hintatasot muuttuvat koko ajan
  - vaikea nähdä pelkistä tarjouksista
  - parempi kysyä suoraan algoritmin toiminnasta
- Markkinaosapuolet vastaavat aina itse omista tarjouksistaan
  - joskus myös kaupankävijät henkilökohtaisesti

energiavirasto

Algoritmien kuvaus (REMIT II)

Sen jäsenvaltion, johon markkinaosapuoli on rekisteröitynyt 9 artiklan 1 kohdan mukaisesti, kansallinen sääntelyviranomainen voi pyytää markkinaosapuolta toimittamaan säännöllisesti tai tapauskohtaisesti kuvauksen algoritmisten kaupankäyntistrategioidensa luonteesta, yksityiskohtaiset tiedot kaupankäyntijärjestelmään sovellettavista kaupankäynnin parametreista tai limiiteistä, tiedot keskeisistä vaatimustenmukaisuuden ja riskinhallinnan varmistavista menetelmistä, joita se käyttää varmistaakseen tämän artiklan 1 kohdassa vahvistettujen vaatimusten täyttymisen, sekä kaupankäyntijärjestelmiensä testausta koskevat tiedot.

energiavirasto

Vaihtoehtoiskustannukset sähkövarastoilla

Harkitse valintaasi

Vaihtoehtoiskustannus on hylätyn vaihtoehdon tuottama hyöty. Se on myös ihmiselämän tärkeimpiä käsitteitä, sanoo taloustieteilijä Mika Maliranta. Näin käsitettä voi hyödyntää jokapäiväisessä elämässä.

Tilaajille

Kuuntele juttu

Kyösti Niemelä
6.7.2025 2:00

JOS voisit saada jokaisen suomalaisen ymmärtämään jonkin taloustieteellisen käsitteen tai idean, niin mikä se olisi?

Tällainen kysymys esitettiin viime joulukuussa talousjournalismia käsittelevän paneelikeskustelun osallistujille.

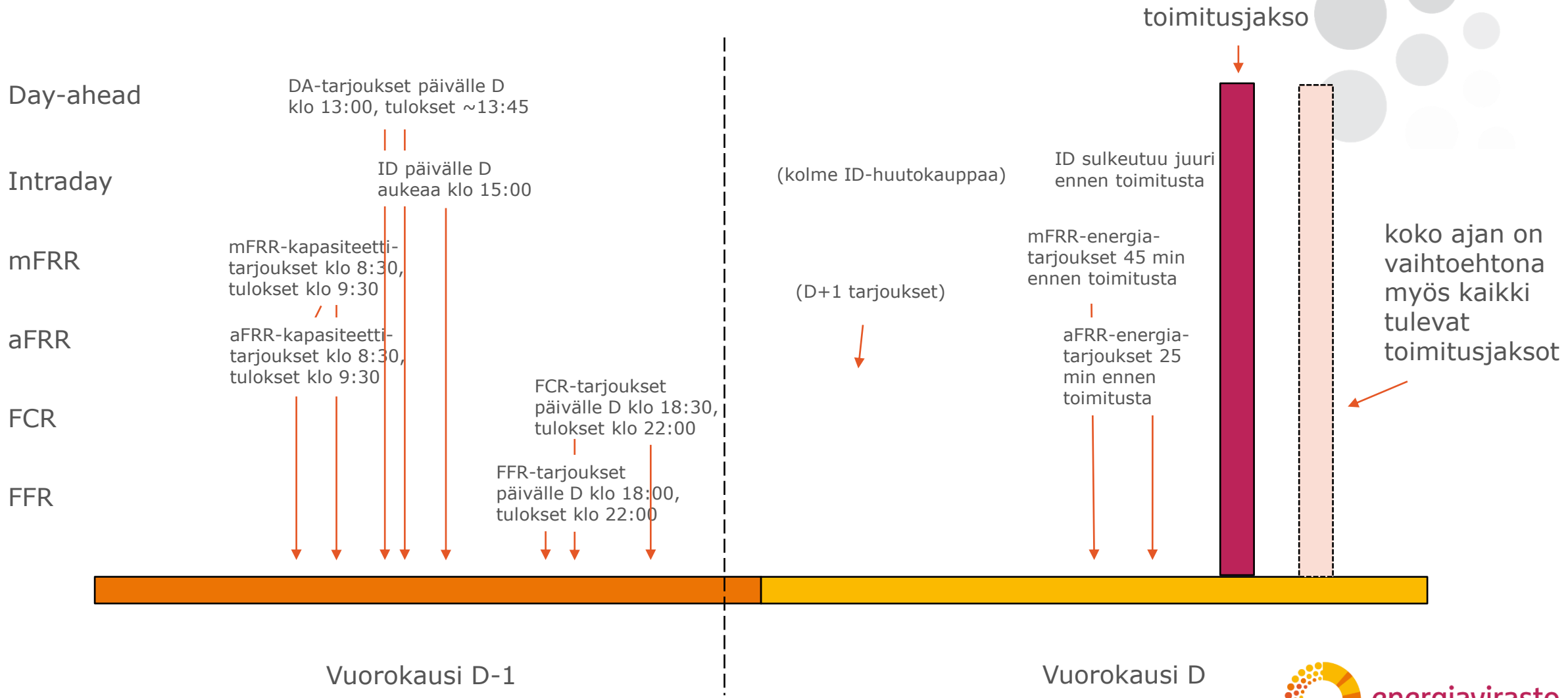
Taloustieteen professori **Mika Malirannalle** vastaus oli selvä: vaihtoehtoiskustannus.

”Se on ihmiselämän tärkeimpiä käsitteitä”, Maliranta sanoi tuolloin.

Helsingin Sanomat, 6.7.2025

energiavirasto

Vaihtoehtoja ajan ja markkinoiden yli



energiavirasto

Vaihtoehtoiskustannuksissa tärkeää

- Vaihtoehdon pitää aina olla aito ja tulevaisuudessa
  - DA-hinta ei voi olla vaihtoehtoiskustannus, kun DA-kauppa on käyty
- Uponneita kustannuksia tai omia preemioita ei voi lisätä tarjoushintaan
  - esim. sähkön ostohinta akun lataukseen on uponnut kustannus
- Hintaennusteiden tulee olla rationaalisia
  - voidaan arvioida jälkikäteen vertaamalla toteumaan

Baltian TSO:t ja Nord Pool:

"Balancing Market Best Practice Guidance Document"

https://elering.ee/sites/default/files/2024-12/20241212%20Best%20Practice%20Guidance.pdf

energiavirasto

Yhteenveto

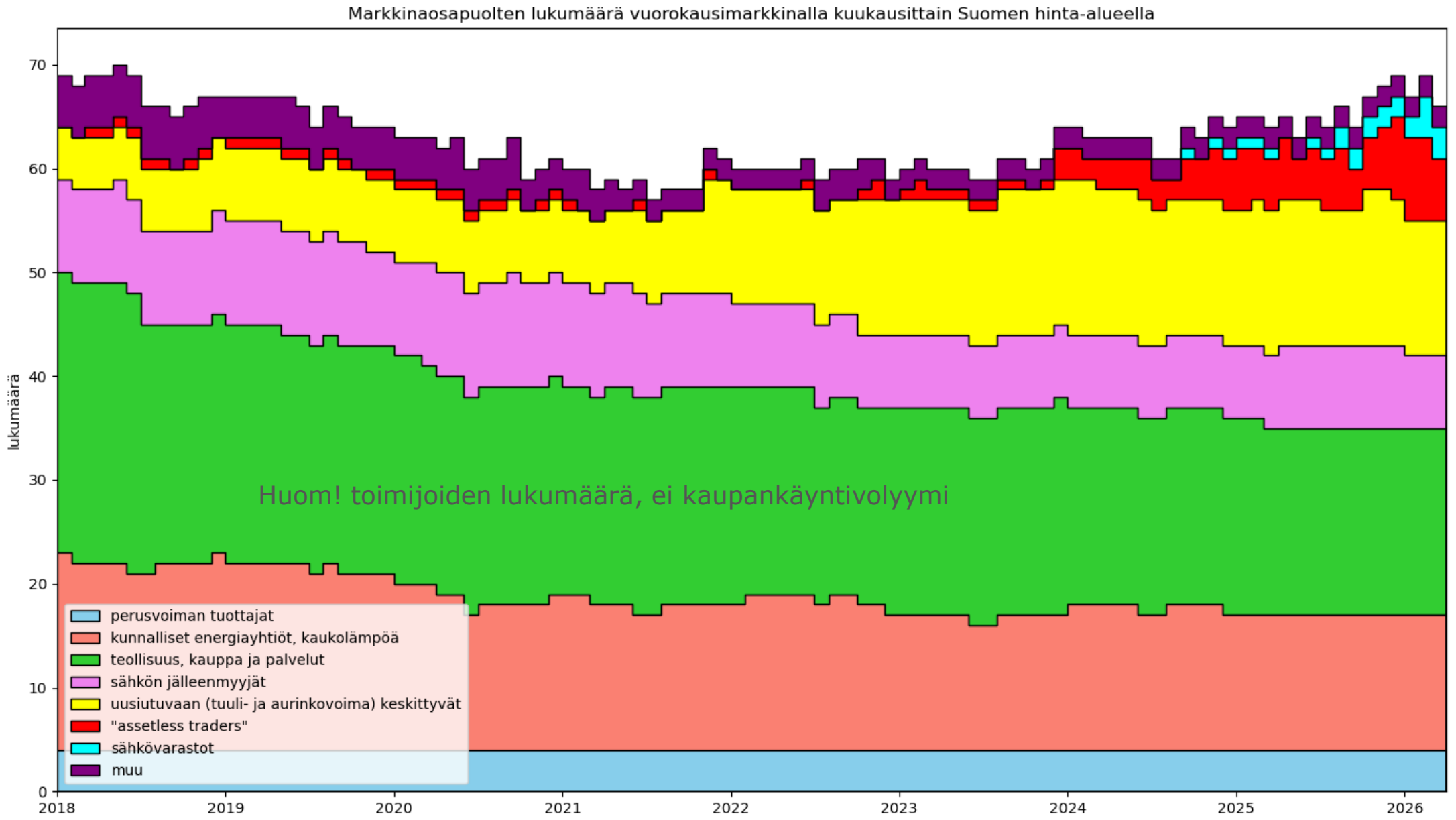
- Markkinat monimutkaistuneet ja nopeutuneet, tarjousten määrä kasvanut
  - koneellista seurantaa
- Riippuvuuksia eri markkinoiden ja markkinapaikkojen välillä, cross-border
  - valvonta hajautettua, tarvitaan koordinointia
- Uudenlaisia toimijoita ja toimintatapoja
  - sähkövarastot (vaihtoehtoiskustannus)
  - assetless traders (algoritmit)
- Valvonta aiempaa enemmän kaupankäyntistrategioita selvittämällä
  - REMIT II mahdollistaa
- **Energiavirastolta voi kysyä oikeasta markkinakäyttäytymisestä etukäteen**

energiavirasto

energiavirasto

Kiitoksia!

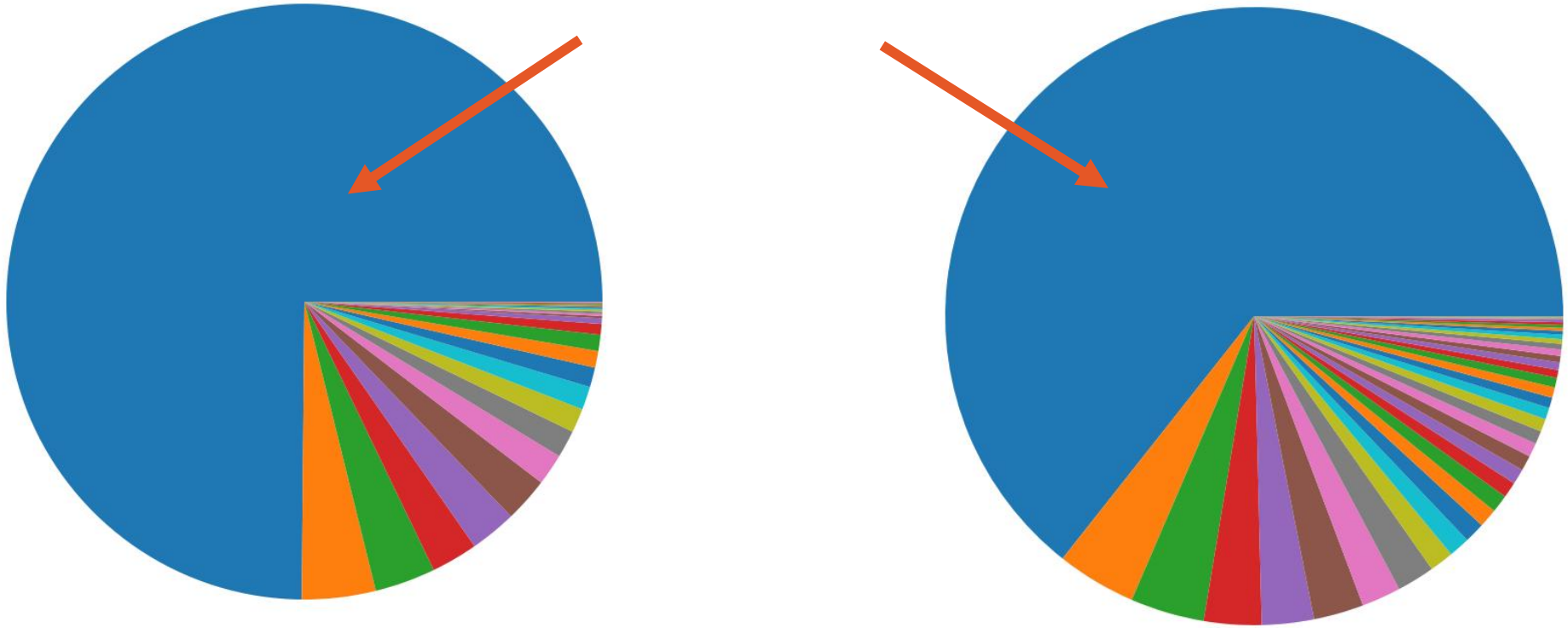
remit@energiavirasto.fi



energiavirasto

Markkinarakenne - myynti FI-alueella (vrk-markkina)

3 suurinta myyjää yhdistettynä



2018

(suurimman osan ajasta kilpailua tulee muilta hinta-alueilta)

2025

energiavirasto

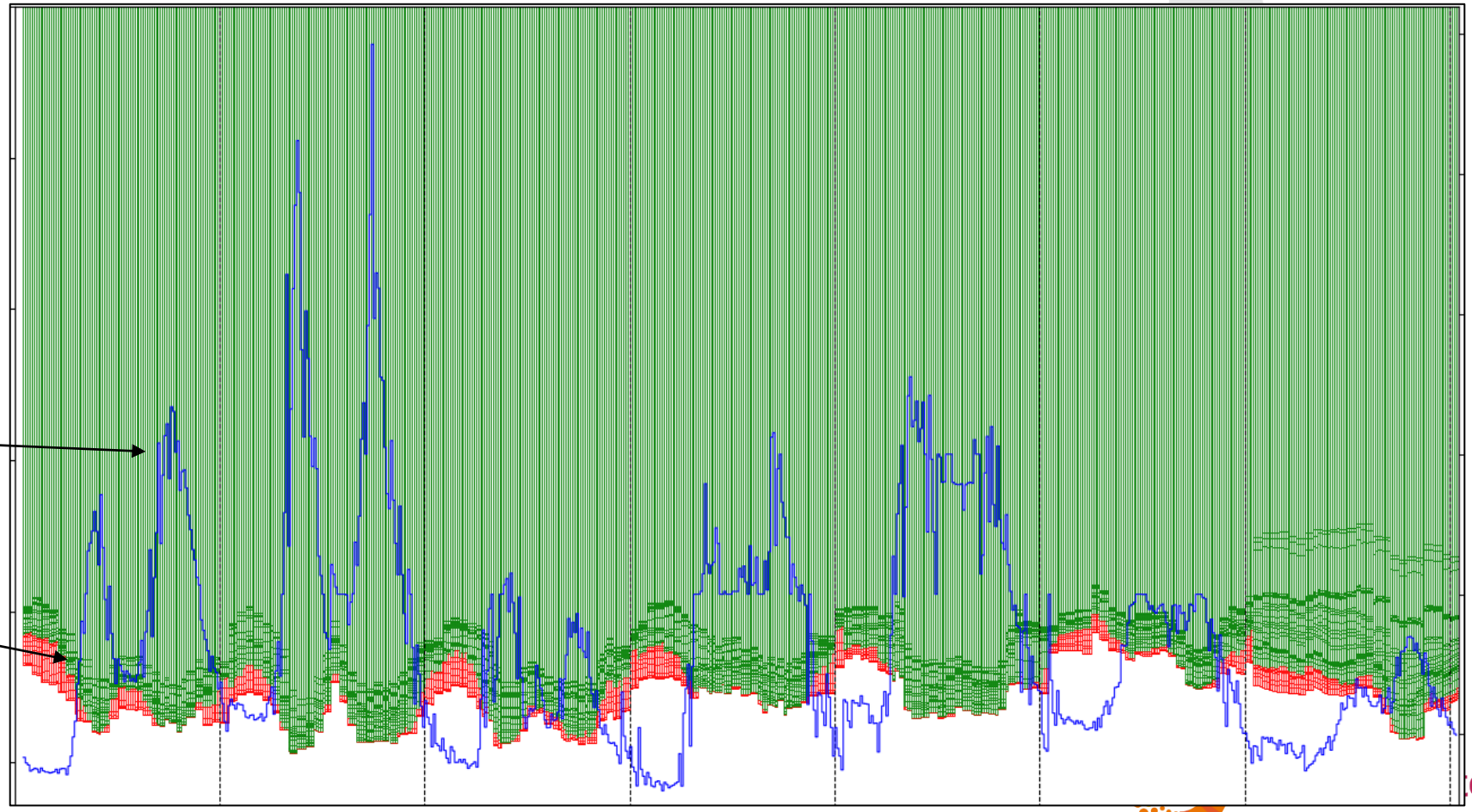
Capacity withholding

- harvoin ja harvoille kannattavaa
- suht. helppo havaita

useiden toimijoiden myyntitarjouksia yhdistettynä (vihreä läpi, punainen ei läpi)

spot-hinta

tarjousten määrä ei muutu + kaikki tarjoukset läpi (vihreä) kun hinnat korkeat



Thank you

FINGRID

28.4.2026

Joonas Kari, Energy Authority

Cybersecurity Act Supervision in the Energy Sector (in Finnish)

fingrid.screen.io/reservit26

FINGRID

energiavirasto

28.4.2026

Kyberturvallisuuslain valvonta energia-alalla

Fingridin Reservimarkkinapäivät

Joonas Kari

Yleistä kyberturvallisuuslaista

- NIS2-direktiivistä on säädetty kansallinen laki: kyberturvallisuuslaki (124/2025, tullut voimaan 8.4.2025).
  - Kaikkia toimialoja koskeva yhteinen yleislaki, jonka piiriin kuuluu myös energia-alan toimijoita.
  - NIS1-direktiivin myötä tehdyt muutokset eli sähkömarkkinalain 29 a § (588/2013) ja maakaasumarkkinalain 34 a § (587/2017) on kumottu.
- Energiaviraston ohje julkaistu verkkosivuilla: www.energiavirasto.fi/kyberturvallisuus
- Energia-alan valvonta on jaettu Energiaviraston ja Turvallisuus- ja kemikaaliviraston (Tukes) kesken.

Soveltamisalaan kuuluminen

Yrityksen koko

- Toimija täyttää tai ylittää keskisuuria yrityksiä koskevat komission suosituksen 2003/361/EY edellytykset ja tarjoaa palvelujaan tai harjoittaa toimintaansa Euroopan unionissa.

Koosta riippumattomat

- Kriteereistä voidaan antaa tarkempia säännöksiä valtioneuvoston asetuksella.
- Valtioneuvoston asetusta tarkemmista säännöksistä ei ole vielä annettu.

CER-direktiivi

- CER-direktiivin nojalla määritetyt kriittiset toimijat
- Kriittisten toimijoiden määrittely valmistuu viimeistään kesällä 2026

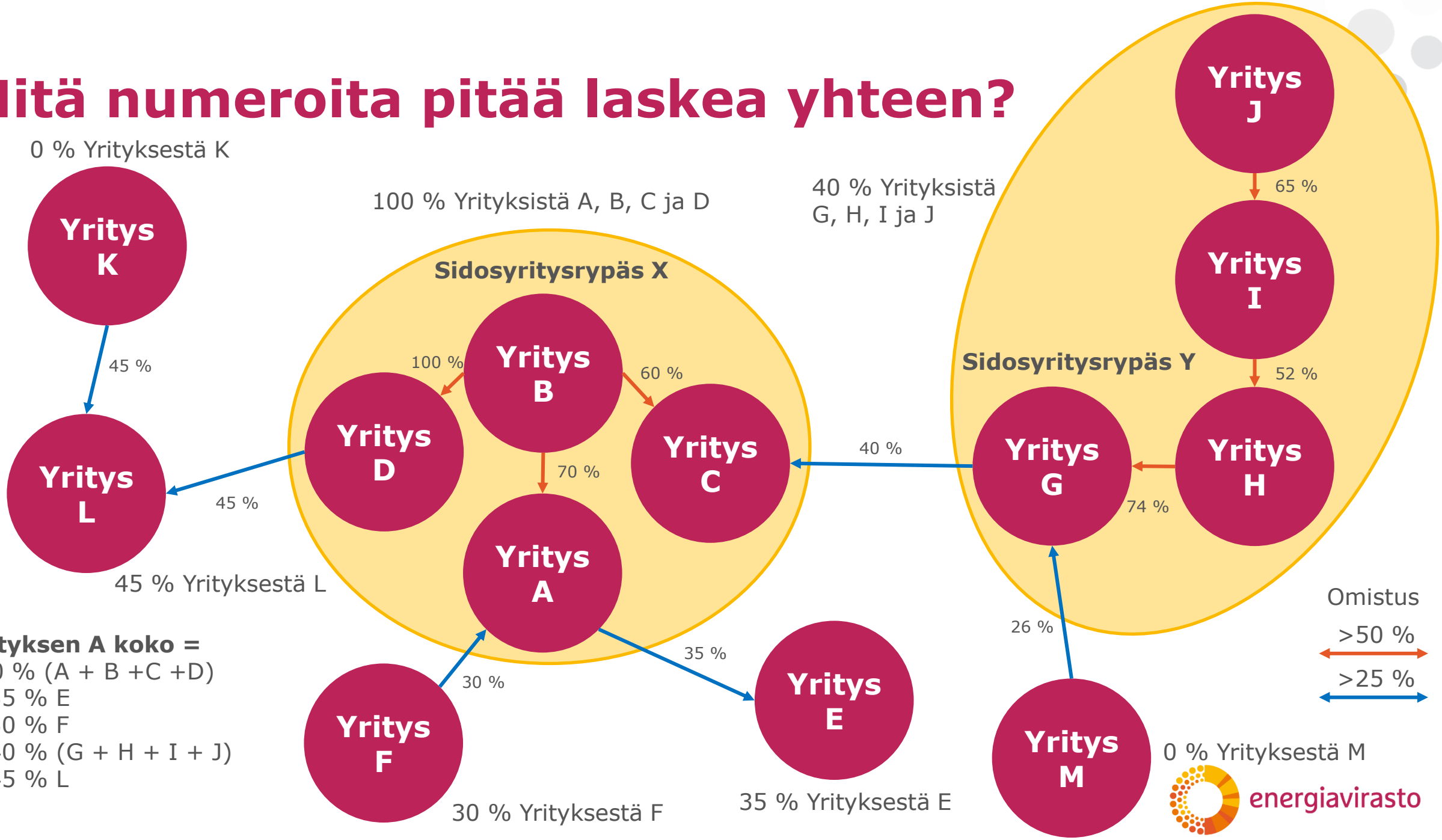
energiavirasto

Ilmoittautuessa huomioitavaa

- Toistaiseksi Energiavirasto ohjeistaa toimijoita ilmoittautumaan ainoastaan kokoperusteisesti
  - Keskisuuri yritys -> Tärkeä
  - Suuryritys -> Keskeinen

Ottakaa huomioon omistusyhteys- ja sidosyritykset kokomäärityksessä!

Mitä numeroita pitää laskea yhteen?



Yrityksen A koko =
100 % (A + B +C +D)
+ 35 % E
+ 30 % F
+ 40 % (G + H + I + J)
+ 45 % L

energiavirasto

Erot toimijaluokituksissa

Keskeinen

- **Ylittää** keskisuuren yrityksen määritelmän tai täyttää jonkun poikkeusehdoista
- Ilmoitusvelvollisuus merkittävistä poikkeamista (NIS2-ilmoitus)
- Kaikki kyberturvallisuuslain velvoitteet riskienhallintaan, toimintamalliin, toimenpiteisiin, ja johdon vastuuseen liittyen
- Valvova viranomainen **kohdistaa ennakoivaa valvontaa**

Tärkeä

- Täyttää mutta **ei ylitä** keskisuuren yrityksen määritelmän
- Ilmoitusvelvollisuus merkittävistä poikkeamista (NIS2-ilmoitus)
- Kaikki kyberturvallisuuslain velvoitteet riskienhallintaan, toimintamalliin, toimenpiteisiin, ja johdon vastuuseen liittyen
- Valvova viranomainen **voi kohdistaa valvontaa** perustellusta syystä

energiavirasto

Valvonnan kohdentamisen periaatteet

- Yrityksen toiminnan laatu ja laajuus
- Tietojärjestelmien tai viestintäverkon merkitys kyseiselle toiminnalle
- Muut kyberturvallisuuslain § 37:ssa tarkoitetut seikat, mm.
  - Väärinkäytösten toistuvuus, vakavuus, tahallisuus
  - Vahingon ehkäisemiseksi tai lieventämiseksi tehdyt toimenpiteet
  - Hyväksyttyjen sertifiointimekanismien noudattaminen
  - Toimijan halukkuus tehdä yhteistyötä valvovan viranomaisen kanssa
- Lisäksi Energiavirasto tulee jossain määrin kohdentamaan valvontaa myös toimialakohtaisesti, siten että esimerkiksi jonain vuonna tarkastellaan enemmän kaukolämpöverkonhaltijoita tai vastaavaa

energiavirasto

Mitä valvontaan kuuluu?

Esitietojen keräys

- Yritysten ja toimialojen välisen riskitason määrittämiseksi ja valvonnan kohdentamiseksi

Perinteistä valvontaa

- Dokumentaation tarkastuksia, haastatteluja

Valvontakäyntejä

- Toimipisteissä haastatteluja, luottamuksellisen dokumentaation tarkastuksia
- Laitosten tietoturvallisuuden tarkastuksia

Teknisiä tarkastuksia

- Joko velvoitettuja yrityksen kustannuksella tai Energiaviraston kustannuksella
- **Oikeus varataan, mutta todennäköisesti käytetään vain poikkeavissa tilanteissa**

energiavirasto

CER

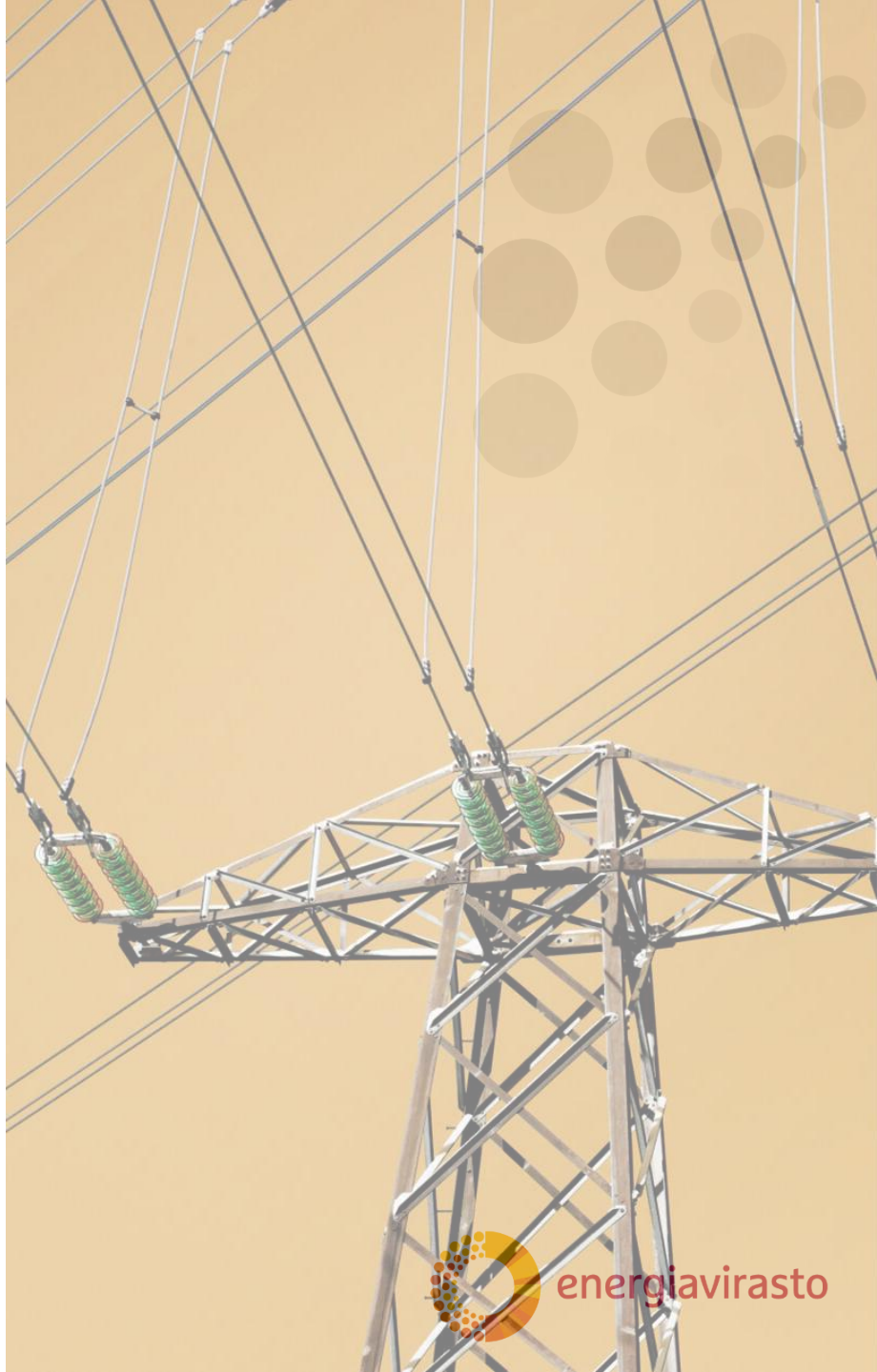
energiavirasto

Yleistä CER-laista

- CER-direktiivistä on säädetty kansallinen laki: Laki yhteiskunnan kriittisen infrastruktuurin suojaamisesta ja häiriönsietokyvyn parantamisesta (310/2025, tullut voimaan 1.7.2025). CER-laki on useita toimialoja koskeva yhteinen yleislaki, jonka piiriin kuuluu myös energia-alan toimijoita.
  - CER-lakiin on viittauksia muualla lainsäädännössä, muun muassa kyberturvallisuuslaissa. CER-kriittiset toimijat ovat kyberturvallisuuslain mukaisia keskeisiä toimijoita.
- Ministeriön päätöksellä määritetään CER-kriittiset toimijat, joita velvoitteet koskevat.
- Energia-alan valvonta on jaettu Energiaviraston ja Turvallisuus- ja kemikaaliviraston (Tukes) kesken.
- Valvonta toteutetaan mahdollisuuksien mukaan muun toimijaan kohdistuvan valvonnan yhteydessä. Käytäntö selviää, kun kriittiset toimijat on tiedossa ja valvontaa käynnistetään.

CER-lain vaatimukset

- Riskiarviointi tarvittaessa tai vähintään kerran neljään vuoteen (ensimmäisen kerran viim. 9 kk päätöksestä)
  - Huomioiden ”…kaikki sellaiset merkitykselliset luonnon ja ihmisen aiheuttamat riskit, jotka voivat johtaa poikkeamaan.”
- Suunnitelma häiriönsietokyvyn varmistamiseksi (viim. 12 kk riskiarviosta)
  - Sisältäen teknisiä, turvallisuuteen liittyviä ja organisatorisia toimenpiteitä
- CER ilmoitus NIS2 ilmoituksen lisäksi
  - 24h aikaraja ilmoittaa ”…merkittävästä poikkeamasta, joka häiritsee tai voi häiritä keskeisten palvelujen tarjoamista.”
  - Tarkempi ilmoituskanava on vielä tässä vaiheessa epäselvä



Vaikutukset yritykselle?

Kyberturvallisuuslain soveltamisalaan kuuluva toimija

- CER tuo yritykselle:
  - Riskienhallinta (fyysiset + hybridiuhat)
  - Konkreettiset suojaustoimet häiriöihin
  - Raportointivelvollisuuden
  - Viranomaisvalvonnan
  - Vastuun myös toimitusketjusta
- Tärkeä toimija nousee ennakoivan valvonnan piiriin

Muu toimija

- CER varautumistoimet
- NIS2 velvoitteet (3 kk päätöksestä)
  - Toimijaluetteloon ilmoittautuminen
  - Poikkeamailmoitukset
  - Johdon vastuu
- NIS2 velvoitteet (9 kk päätöksestä)
  - Riskienhallinta ja toimintamalli (KTL 7-8 §)
  - Toimenpiteet riskien hallitsemiseksi (KTL 9 §)

energiavirasto

energiavirasto

Kiitoksia!

varautuminen@energiavirasto.fi

Energiaviraston verkkosivu:
www.energiavirasto.fi/kyberturvallisuus

Liity Energiaviraston kyberturvallisuus-uutiskirjeen vastaanottajaksi!

Thank you

FINGRID

28.4.2026

Elisa Alanen, Fingrid Oyj

Energy Management of Energy Storage Systems

fingrid.screen.io/reservit26

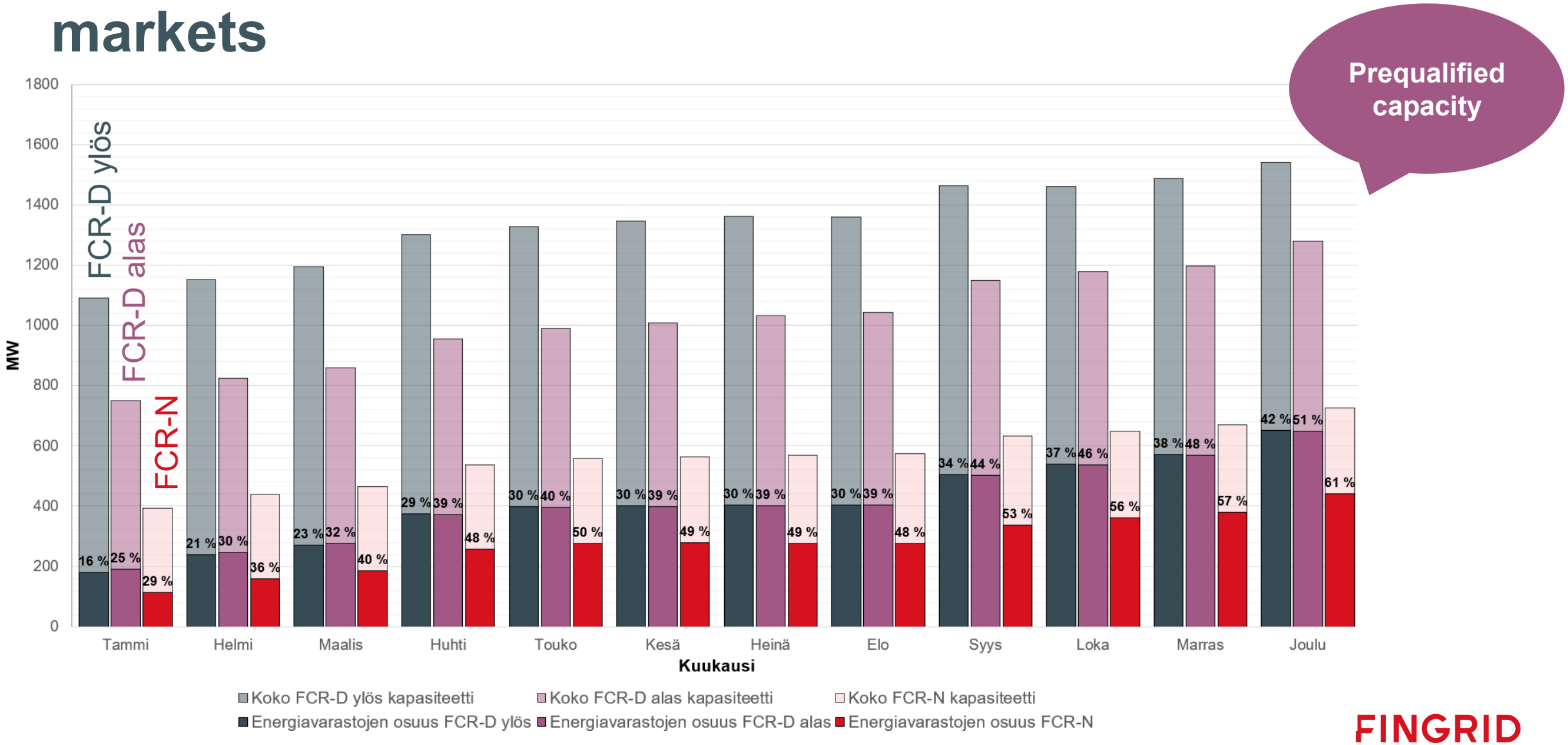
FINGRID

Why energy management is essential in the reserve markets?

- Sufficient energy is a premise for reserve delivery – in all reserve products
- The share energy storages in prequalified capacity has increased considerably recently
- Reserve provider has a responsibility to ensure that energy is sufficient for maintaining or activating the reserve when reserve has been offered/sold

FINGRID

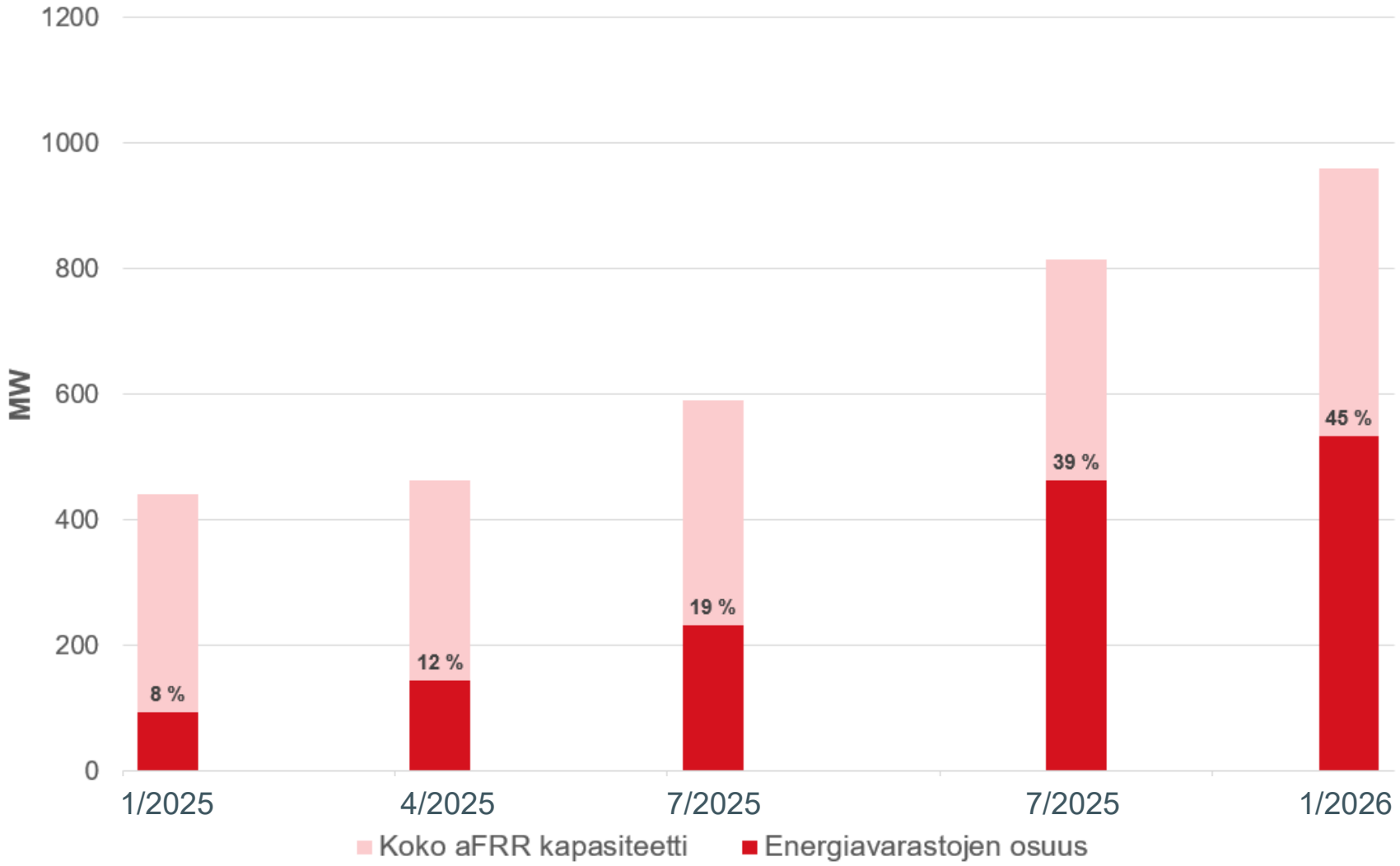
Energy storage capacity has increased in the FCR markets



FINGRID

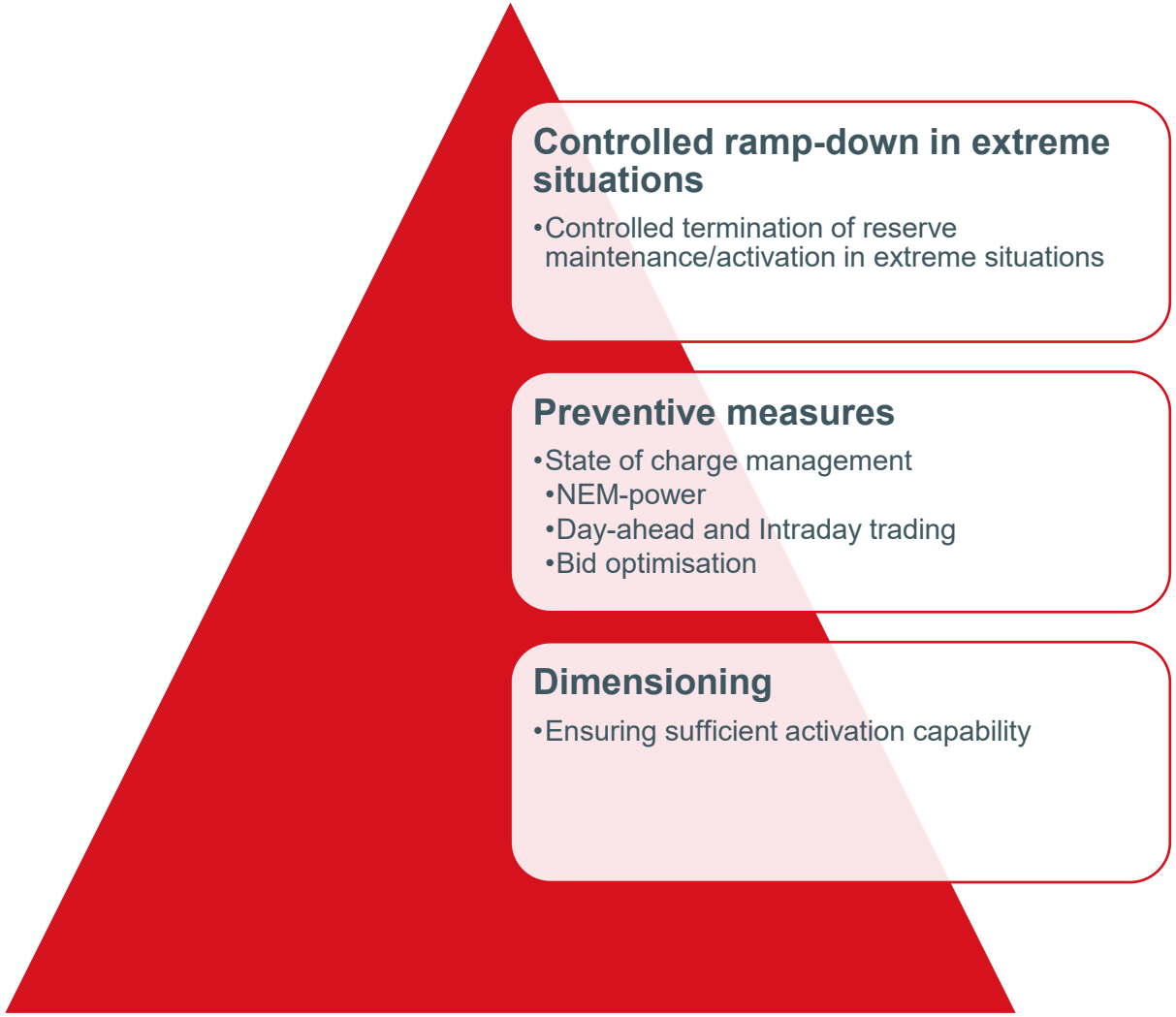
Energy storage capacity has also increased in the aFRR markets

Prequalified capacity



FINGRID

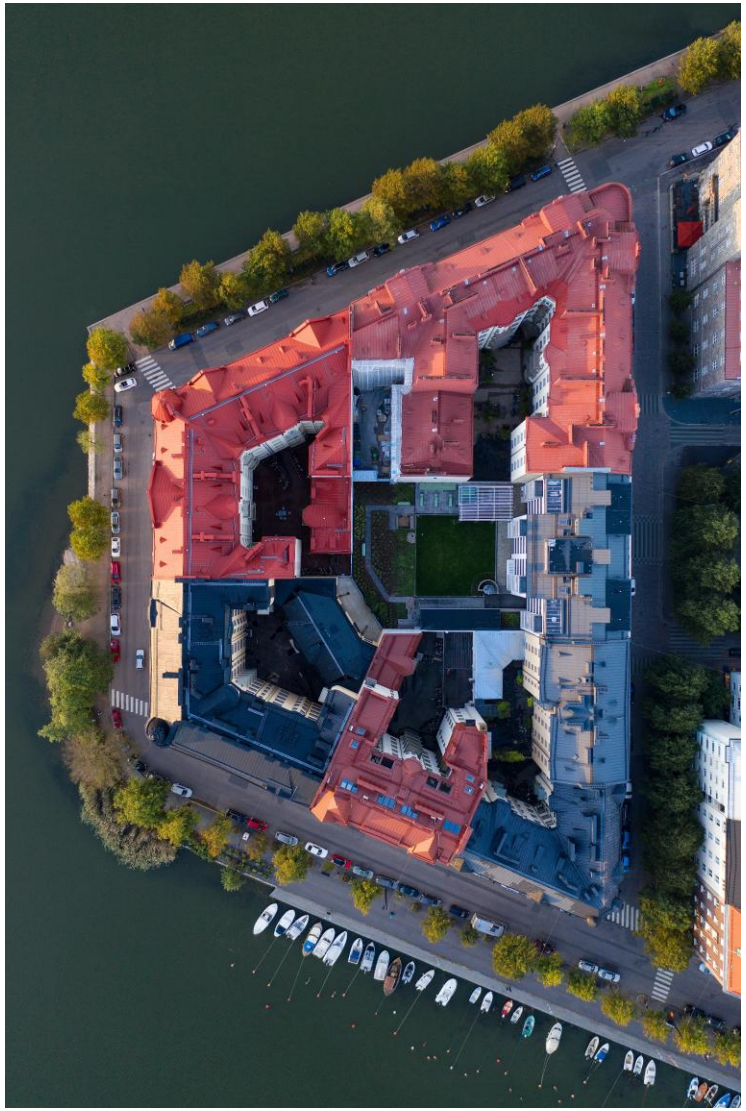
What are the components of energy management?



FINGRID

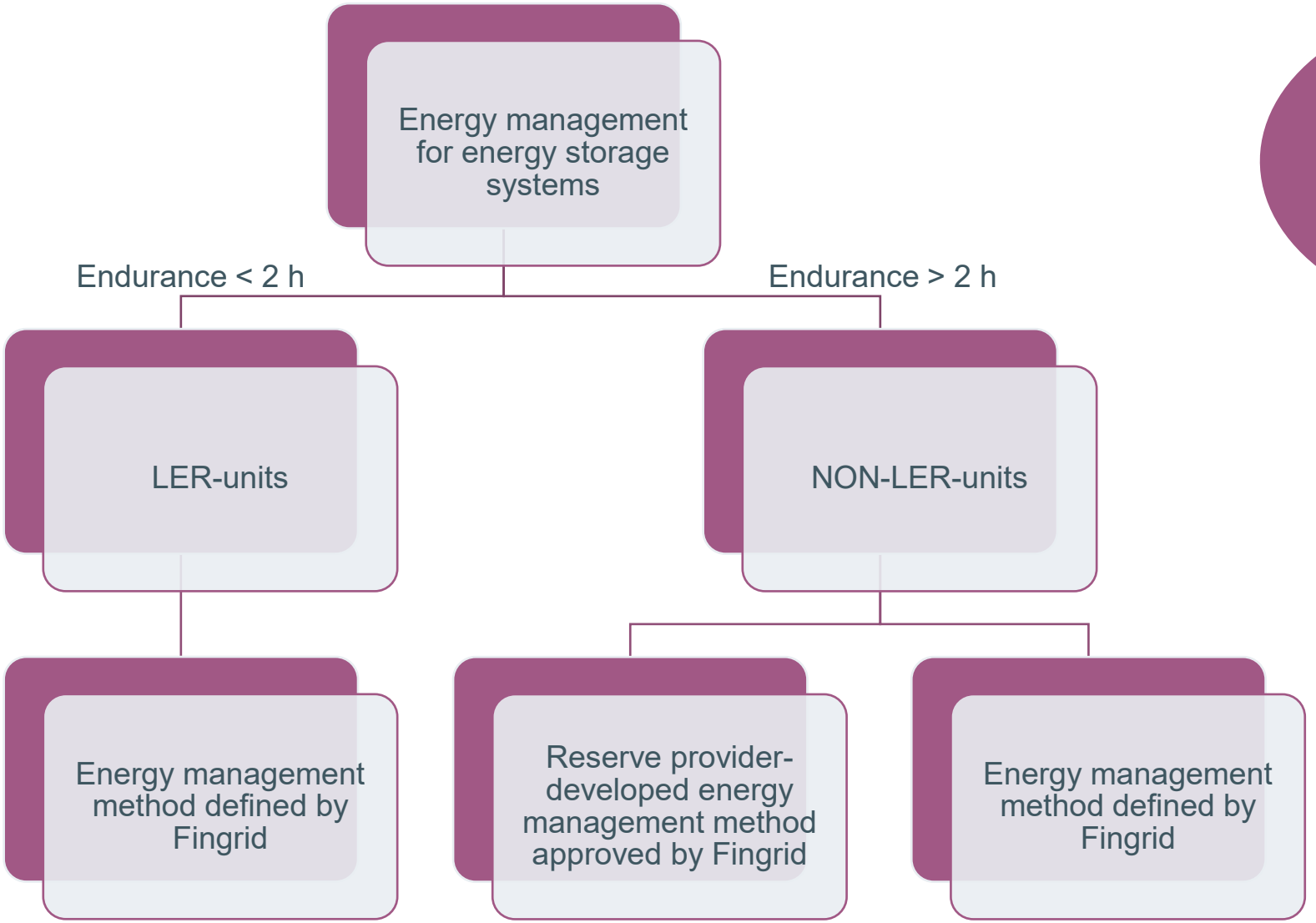
Requirements on endurance

Reserve market	Minimum continuous activation duration
FFR	5–30 seconds
FCR-D	20 minutes
FCR-N	1 hour per direction
aFRR	1 hour
mFRR	1 hour



FINGRID

Energy management in the FCR markets



The unit is either LER or NON-LER, **not both**. The classification is determined during the prequalification process.

FINGRID

Energy management method defined by Fingrid in the FCR markets

NEM – Normal state Energy Management

- Purpose is to **prevent** the state of charge from reaching extreme levels
- Capacity must be reserved for NEM mode, and it may not be used for purposes other than NEM activation

AEM – Alert state Energy Management

- Purpose is to **ramp down** reserve activation in a controlled manner when energy is being depleted
- The reserve is no longer maintained when AEM mode is active

FINGRID

Boundary conditions for energy management in the aFRR and mFRR markets

Allowed

- Energy management using day-ahead and intraday markets
- Compensation of required energy within the operator's own portfolio
- Taking energy management into account in capacity bids

Not allowed

- Energy management using imbalance energy
- Avoiding activation by unjustified pricing when energy is running out
- Energy management based solely on aFRR/mFRR energy bids
- Using reserve capacity for energy management

FINGRID

Summary

FINGRID

Thank you

FINGRID

28.4.2026

Tuomas Mattila, Fingrid Oyj
Henri Taskinen, Capalo AI Oy
Petri Vihavainen, Kemijoki Oy
Juha Hietaoja, Gasum Oyj

Panel Discussion – Reliability from the Perspective of Market Participants

fingrid.screen.io/reservit26

FINGRID


Sanction
Force Majeure
Reporting errors
Trading strategy
Courses and training
Trust
Bidding behaviour
Service provider
Operational reliability
Grid code specifications
Regulation
Coordination
CER
CRA
Risk management
Updates
Cybersecurity
NIS2
Collaboration
Activation audits
Troubleshooting
NCCS
24/7
Audits
Security of supply
Antivirus
Contact details
REMIT
Opportunity cost
Strongest link
Incidents
Market surveillance
Real-time data
REMIT II
Algorithms
Cybersecurity Act
FINGRID
Energy Management
Supply chain
FINGRID
News

Thank you

FINGRID

FUTURE DEVELOPMENT IN THE RESERVE MARKETS

FINGRID

28.4.2026

Ilkka Hulkko, Fingrid Oyj

MARI and the New Market Platform MIMOSA

fingrid.screen.io/reservit26

FINGRID

MIMOSA will replace VAKSI

In the MIMOSA project, the current market platform VAKSI, which has been in use for 18 years, will be replaced. The goal is to respond more efficiently to the rapidly changing operational environment.

Markets

FCR-N

mFRR

aFRR

FFR

FCR-D

Users

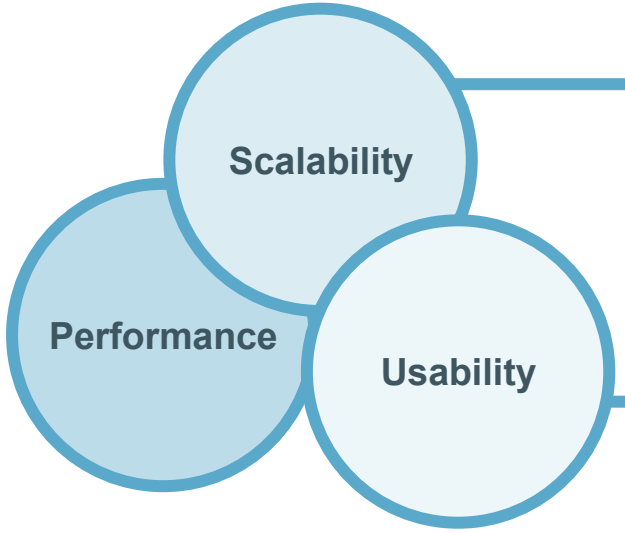
- Operators
- Experts
- Reserve providers

Processes

- Transfer capacity management
- Schedule management
- Activation need adjustment
- Filling the activation need
- Trading

FINGRID

Key objectives for MIMOSA

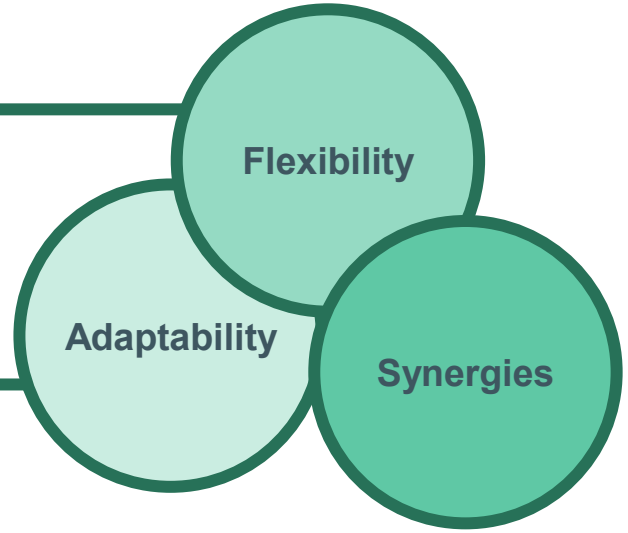


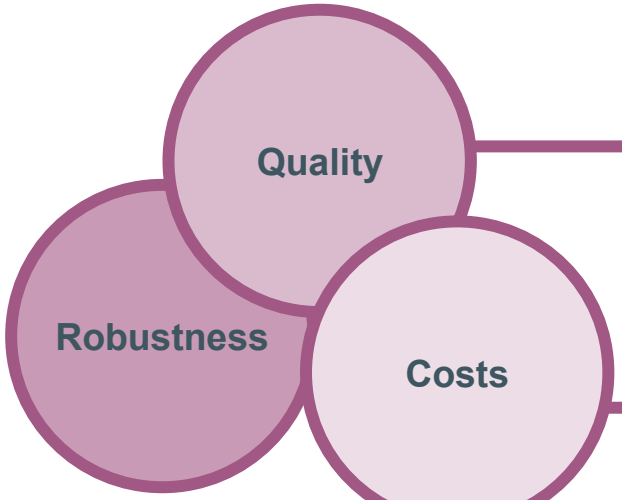
Modern system

An efficient system will be built to meet current and future business needs. The system will be high-performing, scalable, extensible, and user-friendly.

Adaptive system

The system must be able to quickly adapt to market changes and new requirements.





Productized solution

The solution is sustainable, high-quality, and cost-effective throughout its lifecycle.

FINGRID

Key expectations from market participants for MIMOSA

FINGRID

Challenges

- Performance and acknowledgment issues, especially in mFRR energy bids
- Insufficient usability and limited aggregation and reporting views
- No comprehensive API interface → a lot of manual work
- Challenges with bid withdrawal, historical data retrieval, and access rights

Expectations

- Modern and comprehensive API
- Clear aggregation views for mFRR and aFRR bids
- Single login view for multiple BSPs/customers
- Improved performance and reliability even with large bid volumes
- Usability, reporting, audit trail, and role-based access rights
- Heartbeat

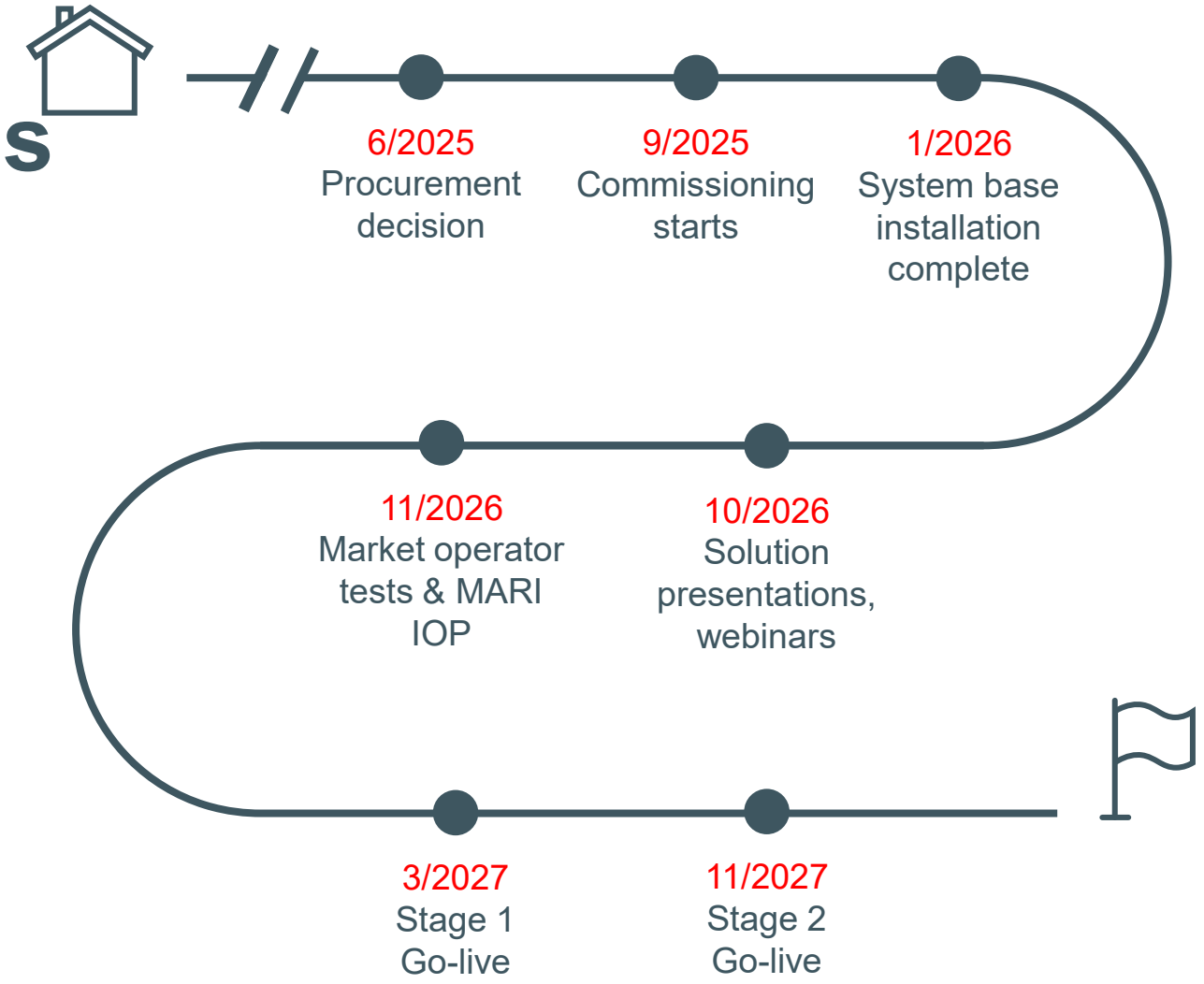
Interaction

- A sufficiently long and high-quality testing period
- Opportunity to influence functionalities already during the implementation phase
- Open and regular communication: email, webinars, demos, newsletters

FINGRID

MIMOSA to be implemented in phases

- The implementation project will proceed in two phases: In the first phase, functionalities for energy markets (MARI & PICASSO) will be introduced, and in the second phase, the capacity markets.
- Market participants' onboarding and testing on the new platform will take place during autumn 2026.
- Communication with market participants will remain unchanged.
- The platform is planned to go live operationally with the MARI integration in Q1/2027.
- For other functionalities, implementation will take place no earlier than the end of 2027.



FINGRID

How to participate?

Webinars

System testing

Meetings

mimosa@fingrid.fi
fingrid.fi/mimosa
developers.fingrid.fi/mimosa

FINGRID

Thank you

FINGRID

28.4.2026

Timo Halttunen, Fingrid Oyj

Future Prospects of Capacity Markets

fingrid.screen.io/reservit26

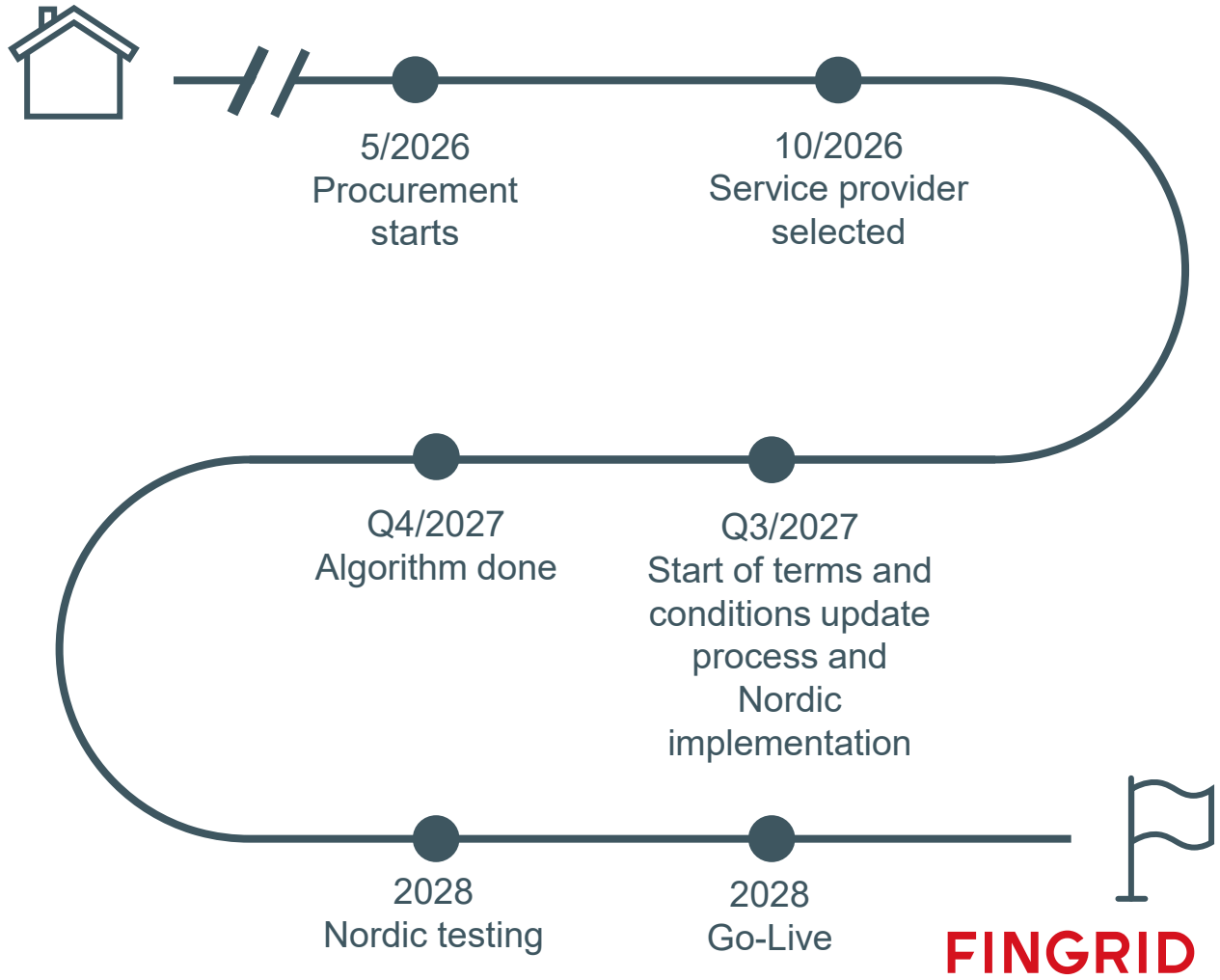
FINGRID

Harmonized cross-zonal capacity allocation optimization function

FINGRID

Development of mFRR- and aFRR cross zonal capacity allocation optimization algorithm is on-going

- **Project is split up to two main phases**
  1. Procurement of the optimization algorithm
  2. Nordic implementation of the algorithm
- **The development needs for market parties is defined later**
  - Terms and conditions process
  - Update of the implementation guide
  - Testing with market parties

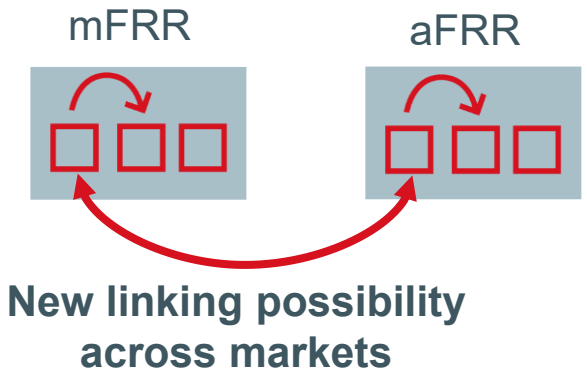


FINGRID

What does the harmonized optimization algorithm change?

Bidding

- Co-optimization of mFRR and aFRR capacity markets allows the market players to link bids across markets
  - The details on the linking possibilities will be known later
- The current linking possibilities within market will stay the same



Cross-zonal capacity allocation

- Usage of flow-based parameters changes basis for the available capacity to be allocated
- Cross-zonal capacity is allocated for the product that yields most socio-economic welfare
- The value of cross-zonal capacity will have a new basis as the current solution is removed

As the basis for the capacity allocation changes, it is foreseen that the amount of allocated capacities change

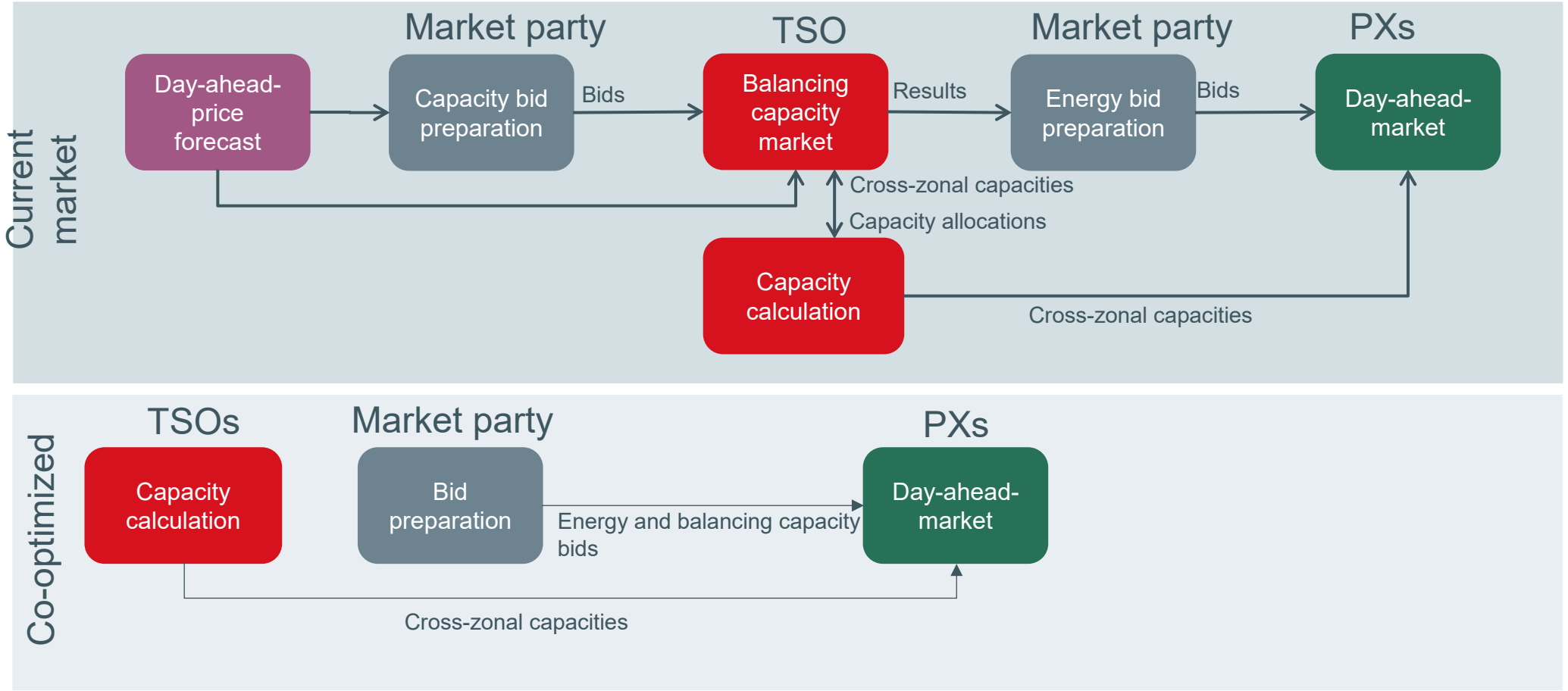
FINGRID

Co-optimization of capacity markets and Day-ahead market

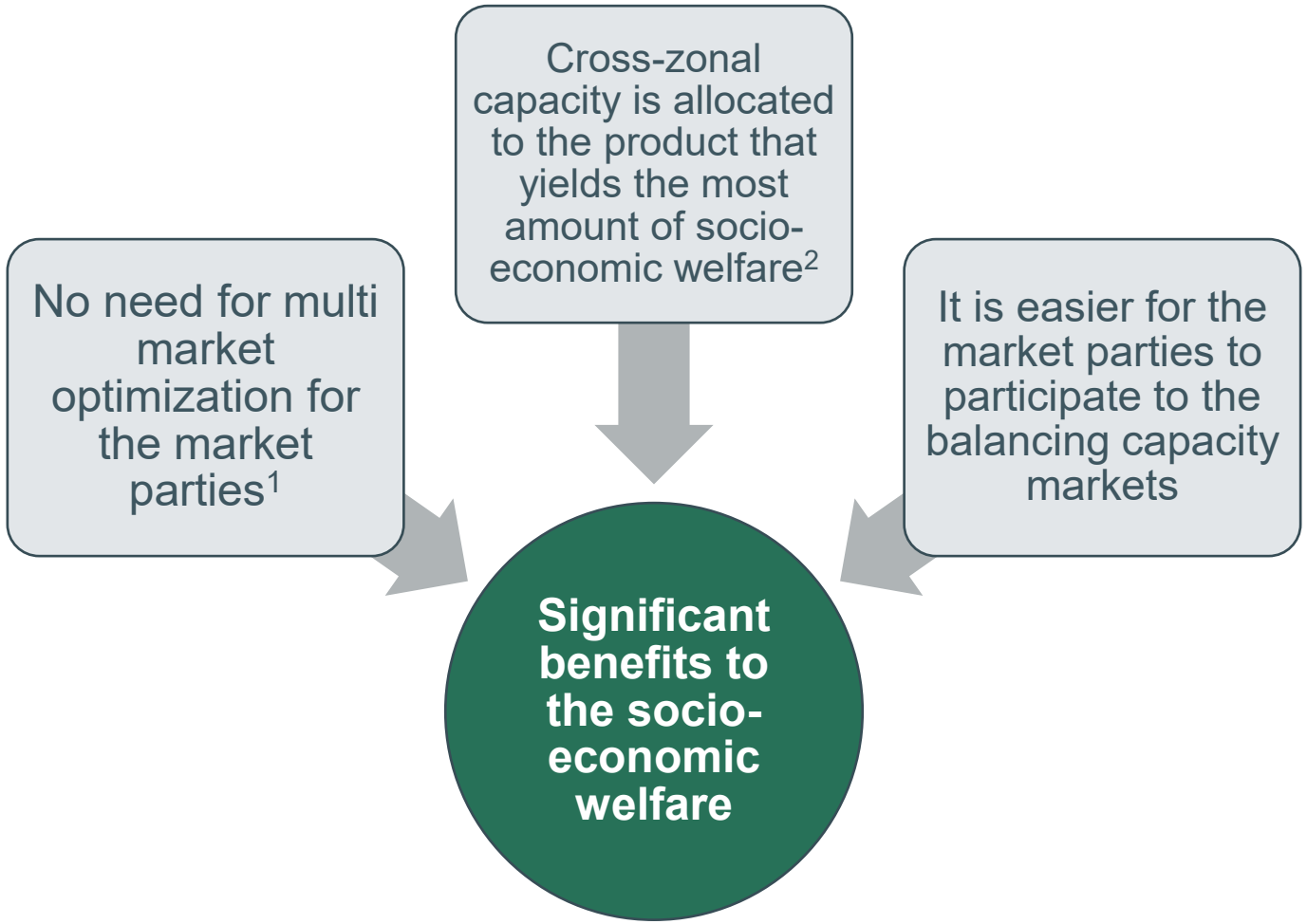
FINGRID

What is co-optimization

- Simultaneous optimization of Day-ahead and aFRR/mFRR capacity markets



Added value of co-optimization



[1] Excludes FCR and FFR markets
[2] Due to flow-based capacity calculation, SDAC (Single Day-Ahead Coupling) is likely to be prioritized due to technical reasons

FINGRID

What happens next?

R&D Reports

- Published so far: R1-report published in November 2025

- The R2 report is currently in the works
  - Consultation on the R2 report for market participants
  - Based on the consultation, the R2 report will be supplemented into an R3 report

Simulations

- The purpose is to verify that co-optimization is theoretically possible
- POC simulations[1] have been completed, i.e. all five markets have been jointly optimized in a limited market area
- Next, simulations of the entire Day-ahead market switching range over a long period of time

[1] POC = Proof of Concept

FINGRID

European research on co-optimisation

Study commissioned by ACER

- Co-optimisation would generate annual economic benefits of approximately EUR 590 million in the Central European region
- The benefits can be explained by inefficient modelling of fixed costs and forecasting errors in opportunity costs, which is why the wrong bids are selected for the capacity market in a market-based procedure

Study commissioned by the German TSOs

- Co-optimisation would generate annual economic benefits of approximately EUR 15–180 million in the Central European region
- Co-optimization was also analyzed qualitatively
  - The qualitative analysis was based on interview studies of two market participants, several TSO representatives and two representatives of the stock exchange (EPEX)
  - Is it cost-effective to implement co-optimization if indirect costs are taken into account?

FINGRID

Thank you

FINGRID

28.4.2026

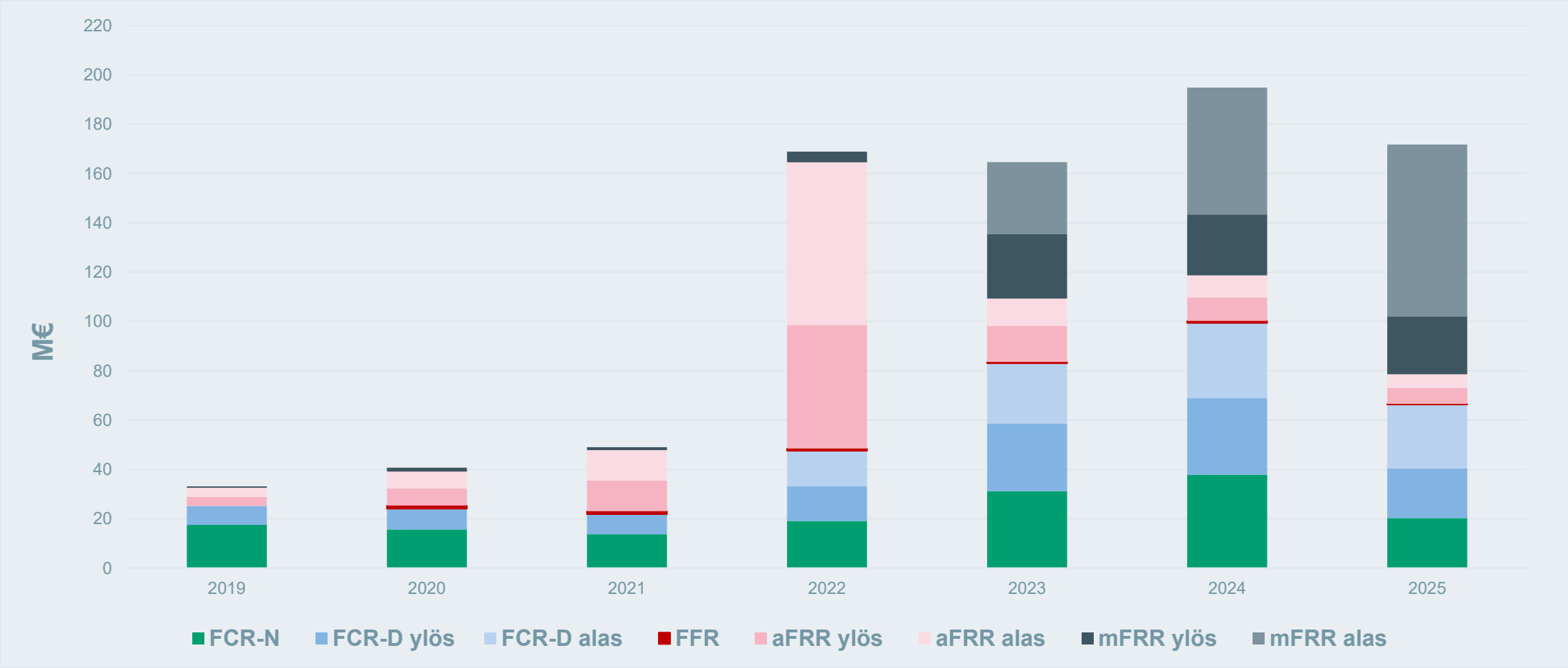
Mikko Kuivaniemi, Fingrid Oyj

Procurement Costs and Development of Reserve Procurement Volumes

fingrid.screen.io/reservit26

FINGRID

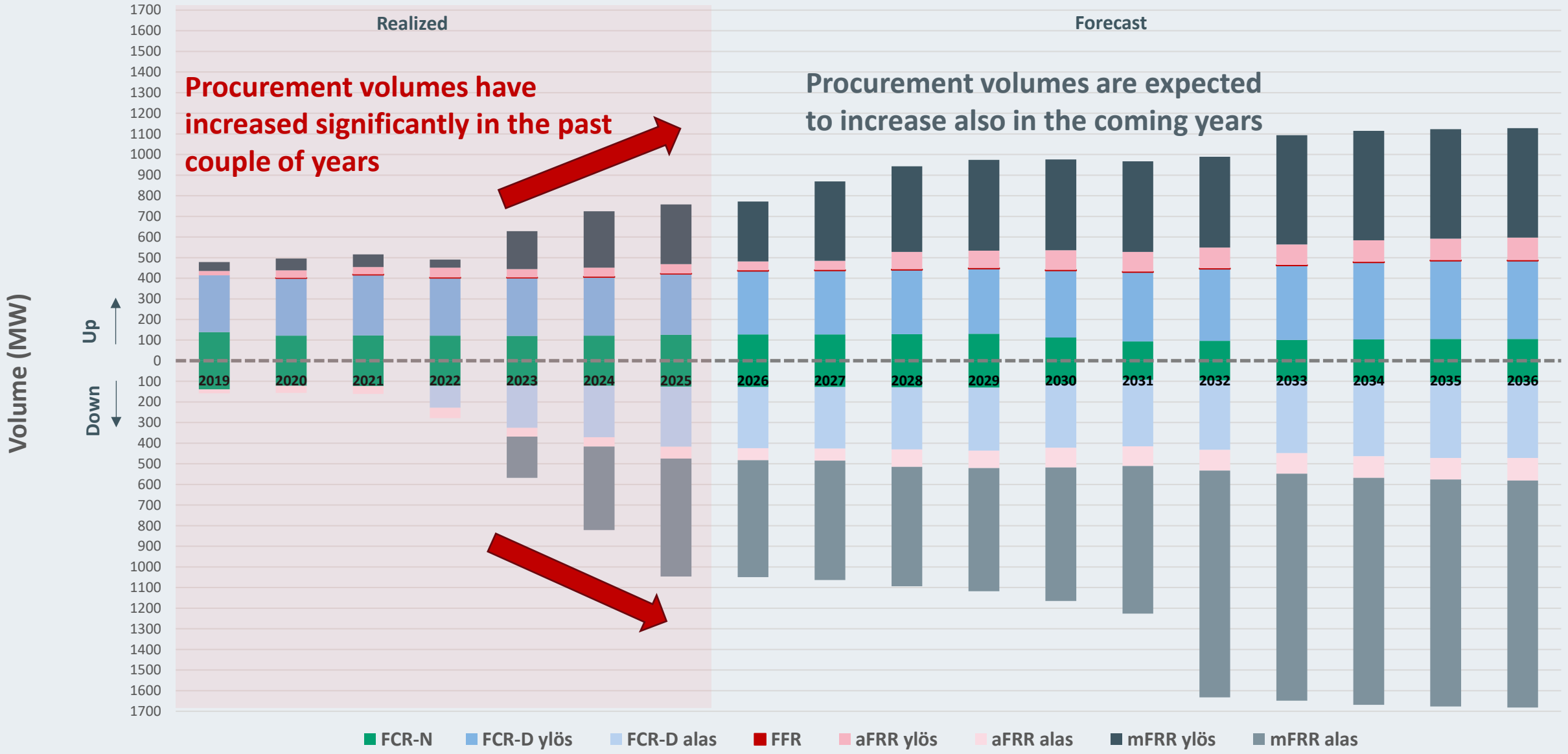
Reserve capacity procurement costs 172 M€ in 2025



FINGRID

Reserve capacity procurement volumes 2019–2036

Base case -scenario



Numerical data available on Fingrid's website

Uncertainties related to the development of procurement volumes

FCR-N

- As the Nordics transition to ACE-based aFRR activation, we will assess the impact of the transition on the required FCR-N volumes

FCR-D

- Procurement volumes will increase if electricity production and consumption in Finland grow faster than in the other Nordic countries

FFR

- The development of the need is determined by how inertia in the power system evolves

aFRR

- The need will be determined based on balance responsible parties' typical and short-term imbalances
- As the Nordics transition to ACE-based activation, the need is expected to increase

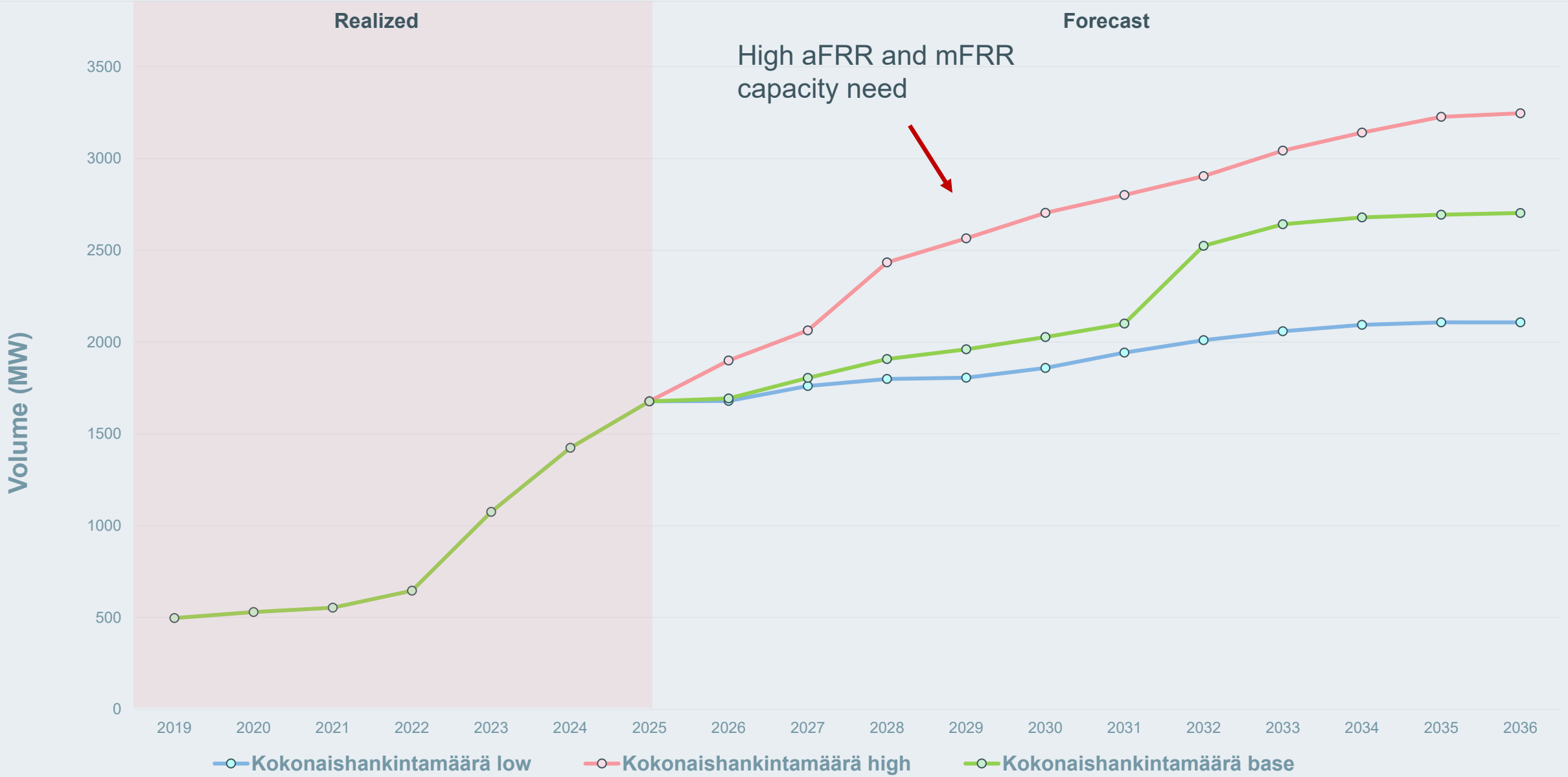
mFRR

- New large consumption units will increase the need for mFRR down capacity
- The need is influenced by the size of the dimensioning incident, in addition to the magnitude of balance responsible parties' typical and longer-term imbalances

aFRR and mFRR capacity procurement needs also depend on voluntary energy bids; dynamic dimensioning supports efficient procurement.

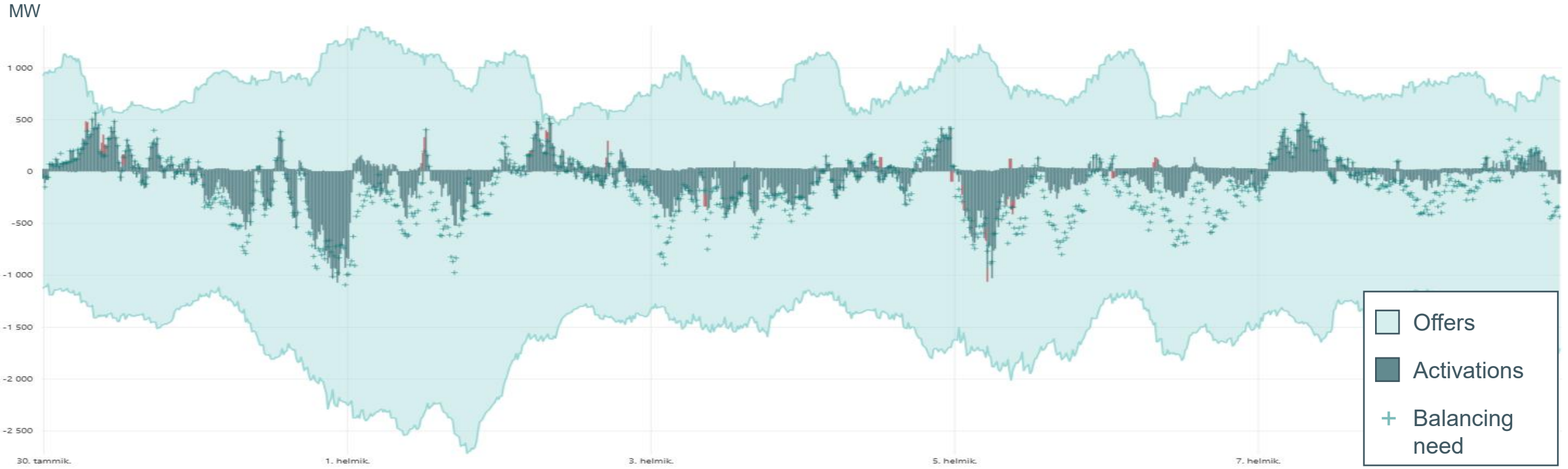
FINGRID

Procurement volumes under different scenarios



Balancing needs are at times considerably higher than reserve capacity procurement volumes

- mFRR- and aFRR activations are carried out in the energy markets
- Balancing needs are at times considerably higher than the previously presented reserve capacity procurement volumes – more energy bids are needed for scarcity situations
- In the long term the aim is to cover a significantly larger share of balancing needs with aFRR instead of mFRR



Development of balancing needs in the future

The development of balancing needs is influenced by balance responsible parties' ability and opportunities to keep their own balance balanced

As the amount of variable production increases, balancing needs are estimated to grow very sharply if operating models remain similar to the current ones

Balancing the power system will increasingly require

- management of uncertainties and own balance
- active participation in the **intraday market** as well as in the **reserve markets**

Thank you

FINGRID

28.4.2026

Maria Joki-Pesola, Fingrid Oyj

Summary of the Day

fingrid.screen.io/reservit26

FINGRID

Reliability and certainty are a shared commitment

Domestic supply in the reserve markets safeguards power system balancing

Cooperation and effective information exchange ensures operational reliability

Clear and fair rules are the foundation for reliable reserve markets

Testing the reliability of systems and processes is increasingly important

Customer feedback guides Fingrid's operations and service development

fingrid.screen.io/reservit26

FINGRID

Thank you

FINGRID