

# Energy Storage Solutions from Integration to Optimization



# Introduction to E energija group

History and Group overview

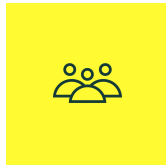


**NordNest** is a dedicated energy storage solution established in 2023 by E energija Group. With over 30 years of experience in delivering complex energy projects, E-Energija has built a strong reputation and maintains excellent relationships with local TSOs and DSOs in Lithuania, the Baltics, and Poland.



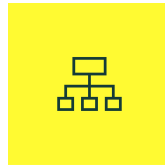
1000 MW

Portfolio of over 1000 MW of wind, solar, and hybrid under development



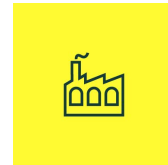
100+

100+ experienced professionals



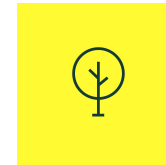
25

25 companies



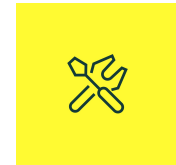
Licensed

Until 2023 been a licensed green district heating producer and operator in Lithuania



2,500 ha

2,500 ha of biomass plantations in Lithuania



EPC solutions

EPC solutions for Energy Storage in Lithuania, Poland and Nordics

# Track record in renewable energy

Management team's track record with development and financing of renewable energy projects

Management team has successfully developed and exited over 500 MW of wind, solar and hybrid energy projects in the Baltics and Poland together with partners, including Enercon and GE Capital.



Wind park of 44 Nordex turbines

ENERGY: wind  
POWER: 300 MW  
YEAR: 2016-2023



Wind park of 2 GE Cypress turbines

ENERGY: wind  
POWER: 9 MW  
YEAR: 2020-2023



Portfolio of biomass boiler plants

ENERGY: biomass  
POWER: 52.5 MWt  
YEAR: 2016-2023



Wind park of 13 GE Cypress turbines

ENERGY: wind  
POWER: 69.3 MW  
YEAR: 2018-2022



Senior debt for a 69.3MW onshore wind

ENERGY: wind  
DEBT: €48.2m  
YEAR: 2021



Senior debt for a 69.3MW onshore wind

ENERGY: wind  
DEBT: €42.9m  
YEAR: 2020



Management team has successfully raised, originated, underwritten and managed numerous public and private debt market transactions.



Portfolio of RTB PV projects

ENERGY: sun  
POWER: 21.9 MWp  
YEAR: 2019-2021



Wind park of 10 Enercon turbines

ENERGY: wind  
POWER: 21.5 MW  
YEAR: 2012-2019



Portfolio of 43 PV projects at COD

ENERGY: sun  
POWER: 42.3 MWp  
YEAR: 2017-2019



Biomass boiler plant

ENERGY: biomass  
POWER: 20 MWt  
YEAR: 2013-2016



Senior debt for a 9 MW onshore wind

ENERGY: wind  
DEBT: €10.5m  
YEAR: 2021



Junior debt for a 69.3 MW onshore wind

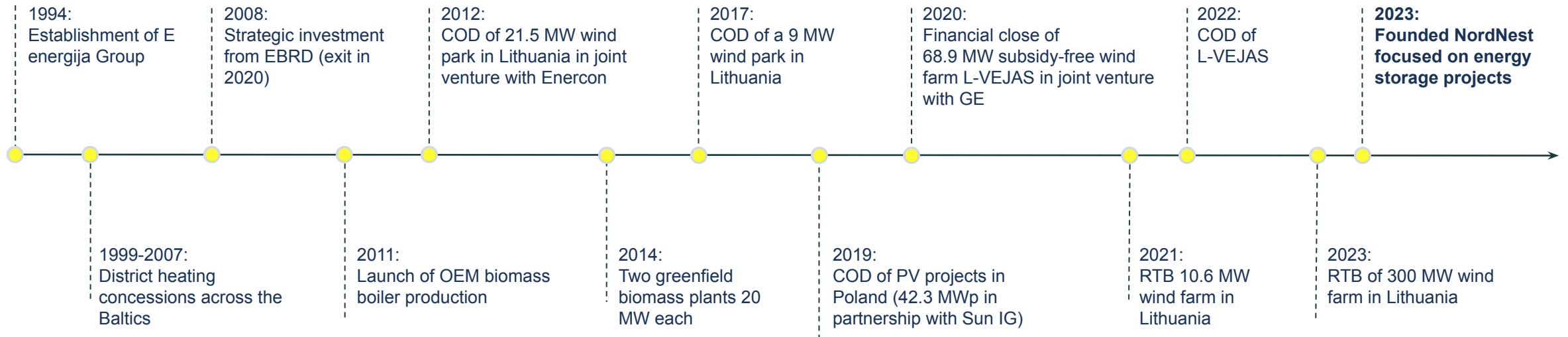
ENERGY: wind  
DEBT: €15.3m  
YEAR: 2020



# E energija Legacy in Renewable Energy

## History and Group overview

- Founded in 1994 as a pioneer within the modernization of heat generation through district heating networks
- E energija Group has over the past 10 years become a reputable developer for greenfield wind and solar projects in Lithuania, Poland, and Ukraine
- Has built a successful track record of partnerships with leading international renewable energy companies





# ↘ NordNest Energy Storage

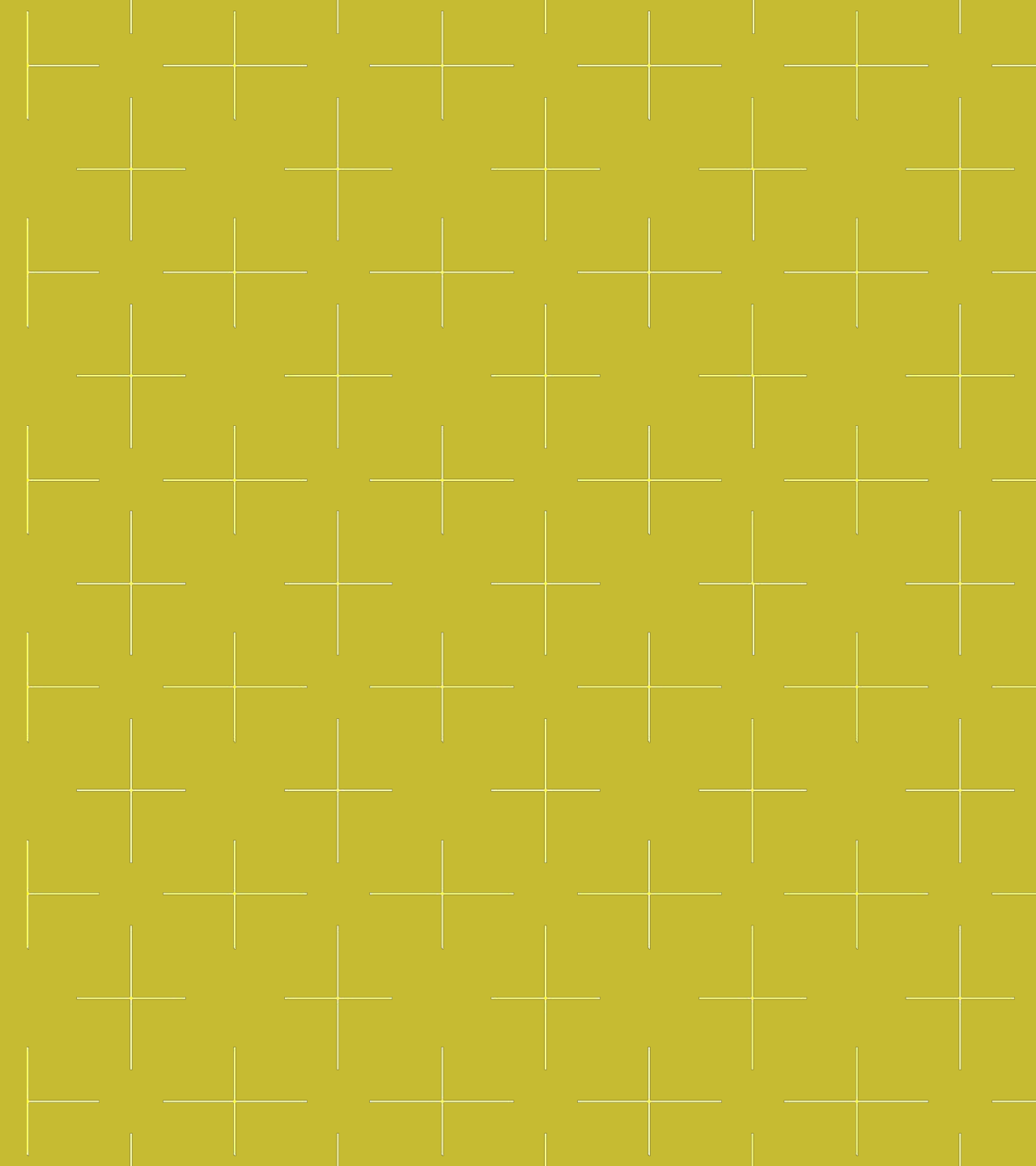


We scope, design, build, integrate, commission, and service utility scale energy storage systems.

As your one-stop solution provider, NordNest manages every detail, from initial consultation to ongoing maintenance and revenue optimization.

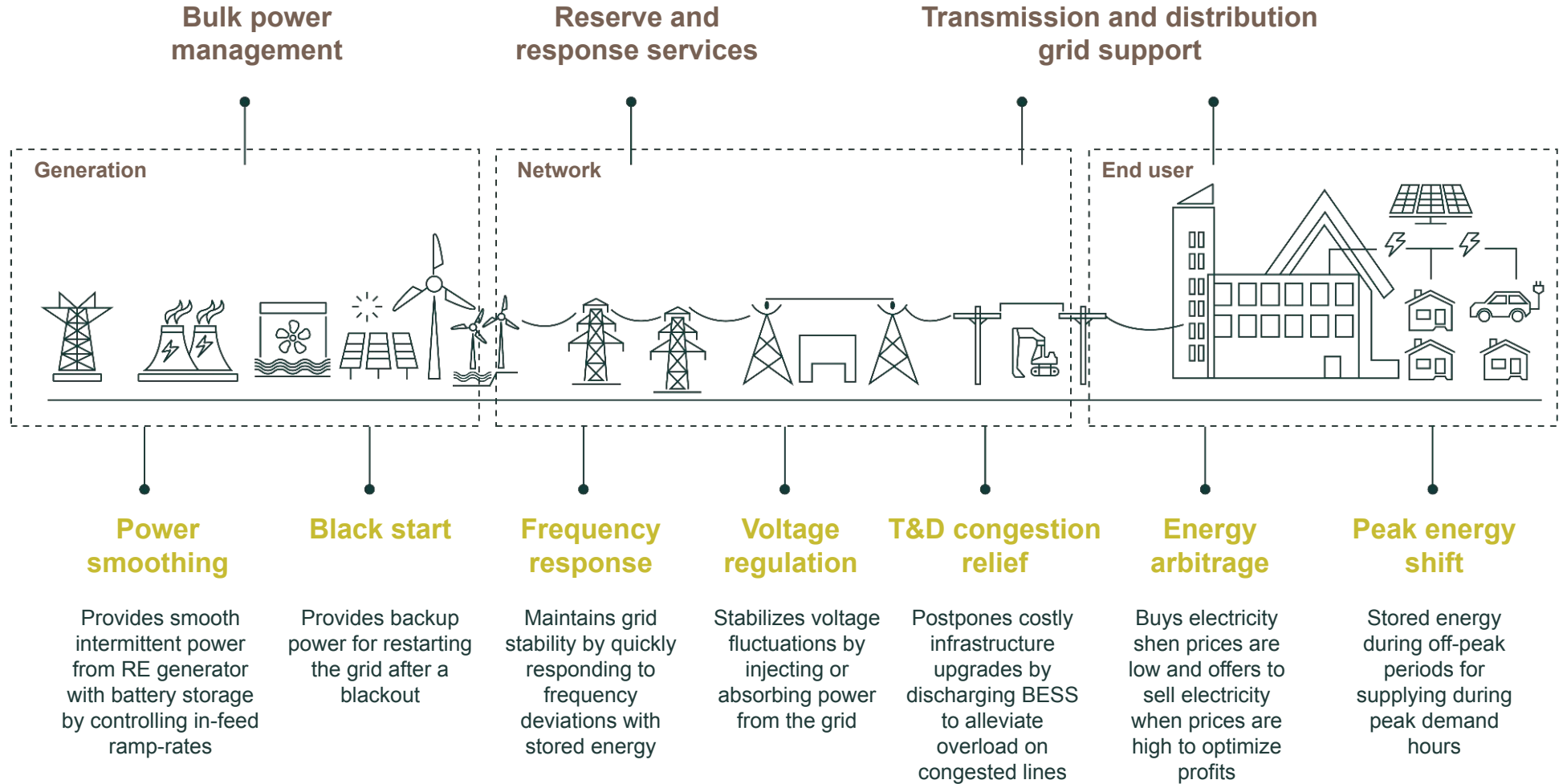


# Key use cases for Battery Energy Storage



# Uses of Battery Storage in Power Systems

Batteries provide essential services at various stages of the power system, enhancing stability, efficiency, and reliability from generation to consumption.





# ↘ Grid-Scale Battery Storage

**Balancing Services (aFRR, mFRR):** Ensure grid stability with automatic and manual frequency restoration reserves, offering reliable capacity and energy payments.

**Capacity Markets (FCR):** Benefit from stable income by participating in Frequency Containment Reserve, providing immediate power to maintain grid frequency.

**Wholesale Markets (Day-Ahead and Intraday):** Maximize returns through strategic energy trading, buying low and selling high in day-ahead and intraday markets





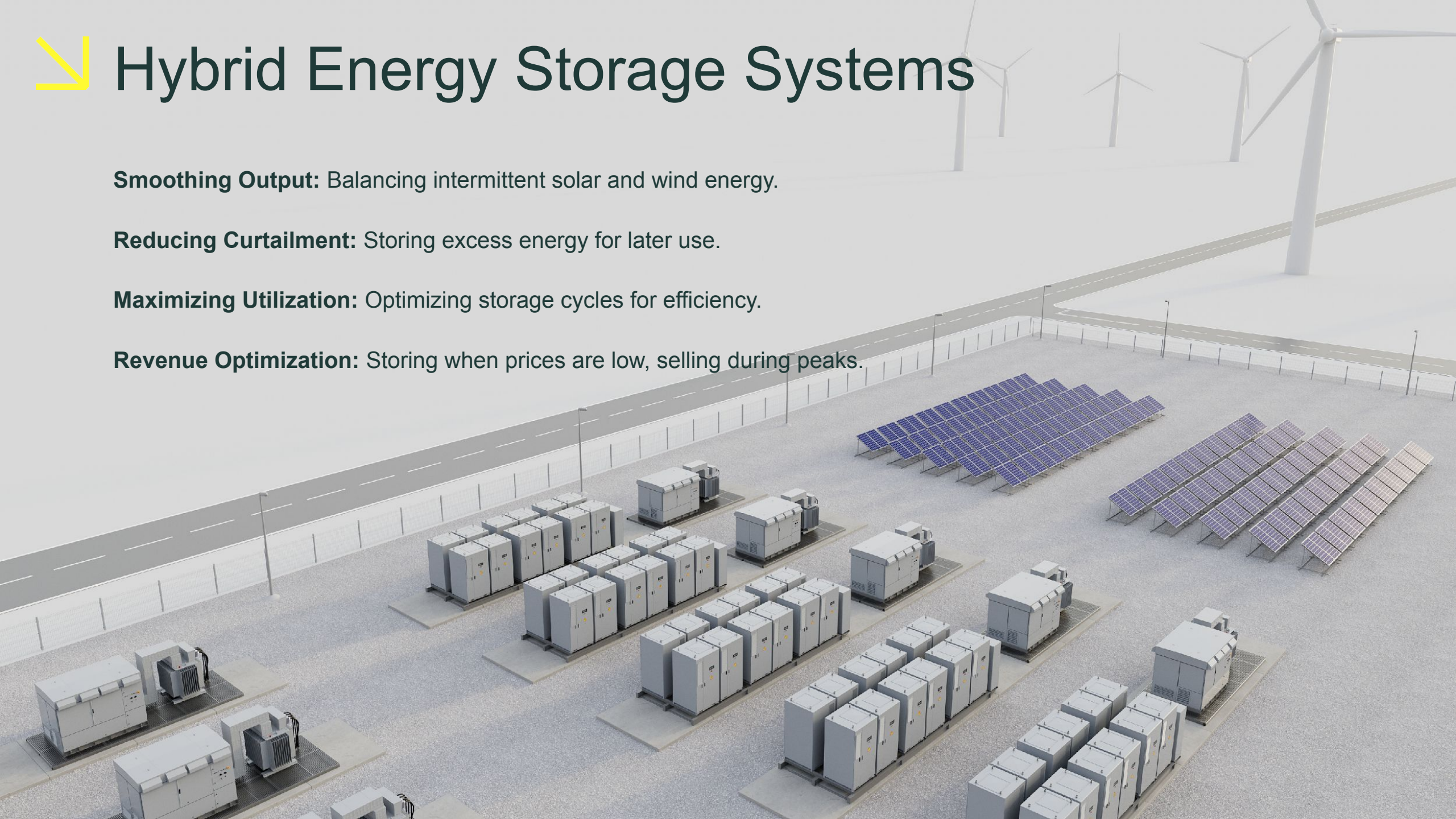
# Hybrid Energy Storage Systems

**Smoothing Output:** Balancing intermittent solar and wind energy.

**Reducing Curtailment:** Storing excess energy for later use.

**Maximizing Utilization:** Optimizing storage cycles for efficiency.

**Revenue Optimization:** Storing when prices are low, selling during peaks.



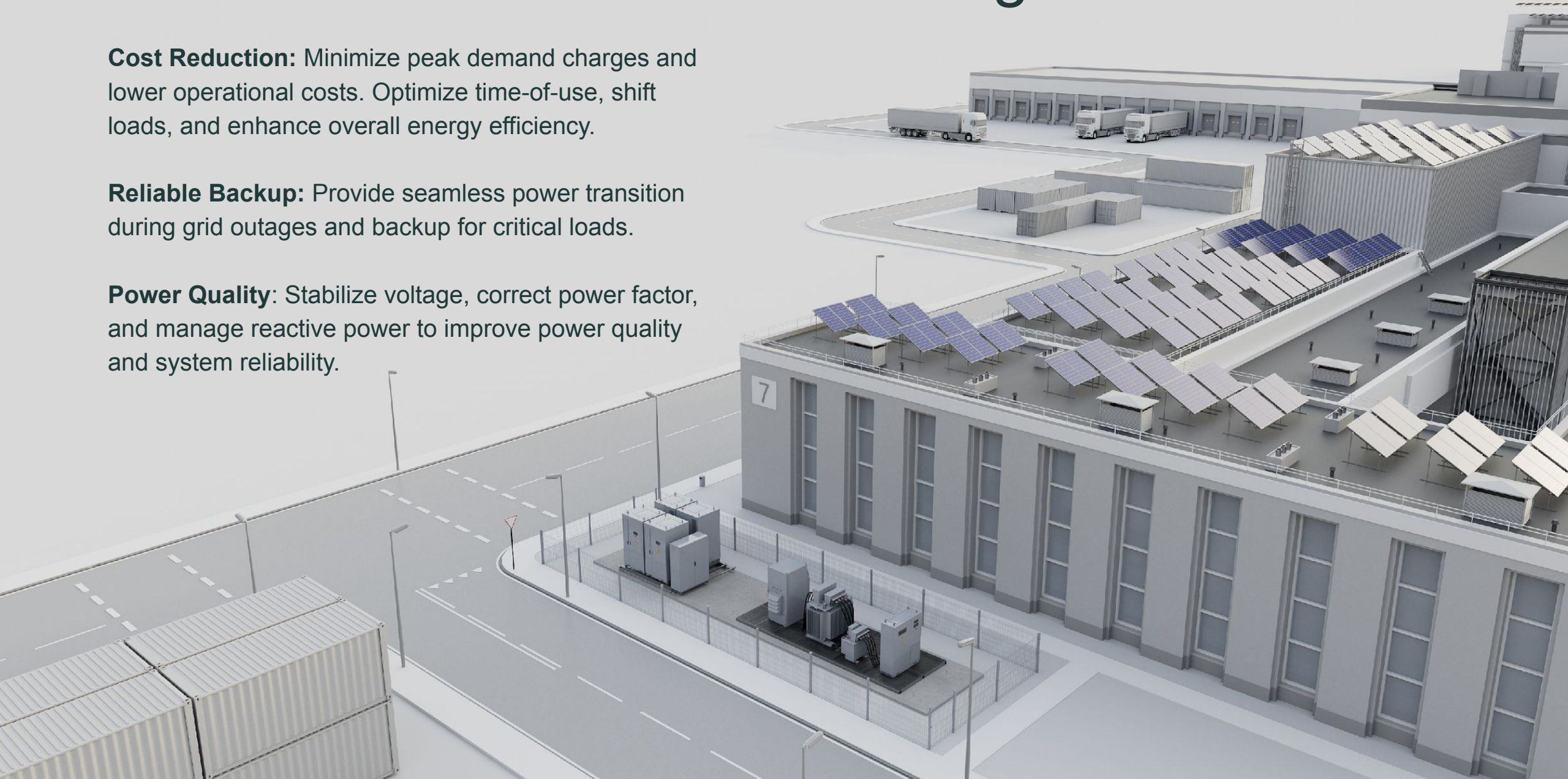


# Commercial & Industrial Microgrid Batteries

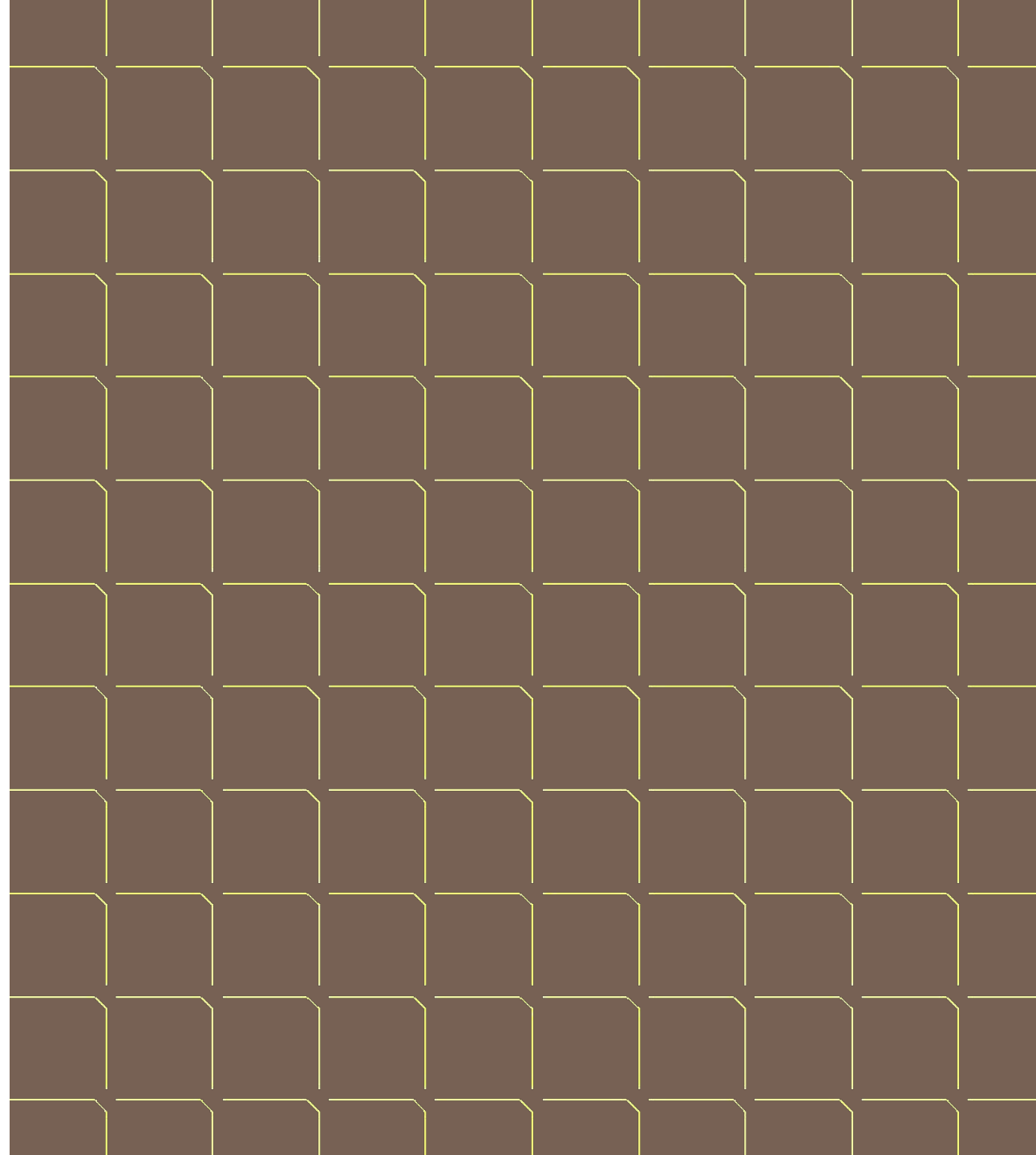
**Cost Reduction:** Minimize peak demand charges and lower operational costs. Optimize time-of-use, shift loads, and enhance overall energy efficiency.

**Reliable Backup:** Provide seamless power transition during grid outages and backup for critical loads.

**Power Quality:** Stabilize voltage, correct power factor, and manage reactive power to improve power quality and system reliability.



# Baltic Market for Energy Storage



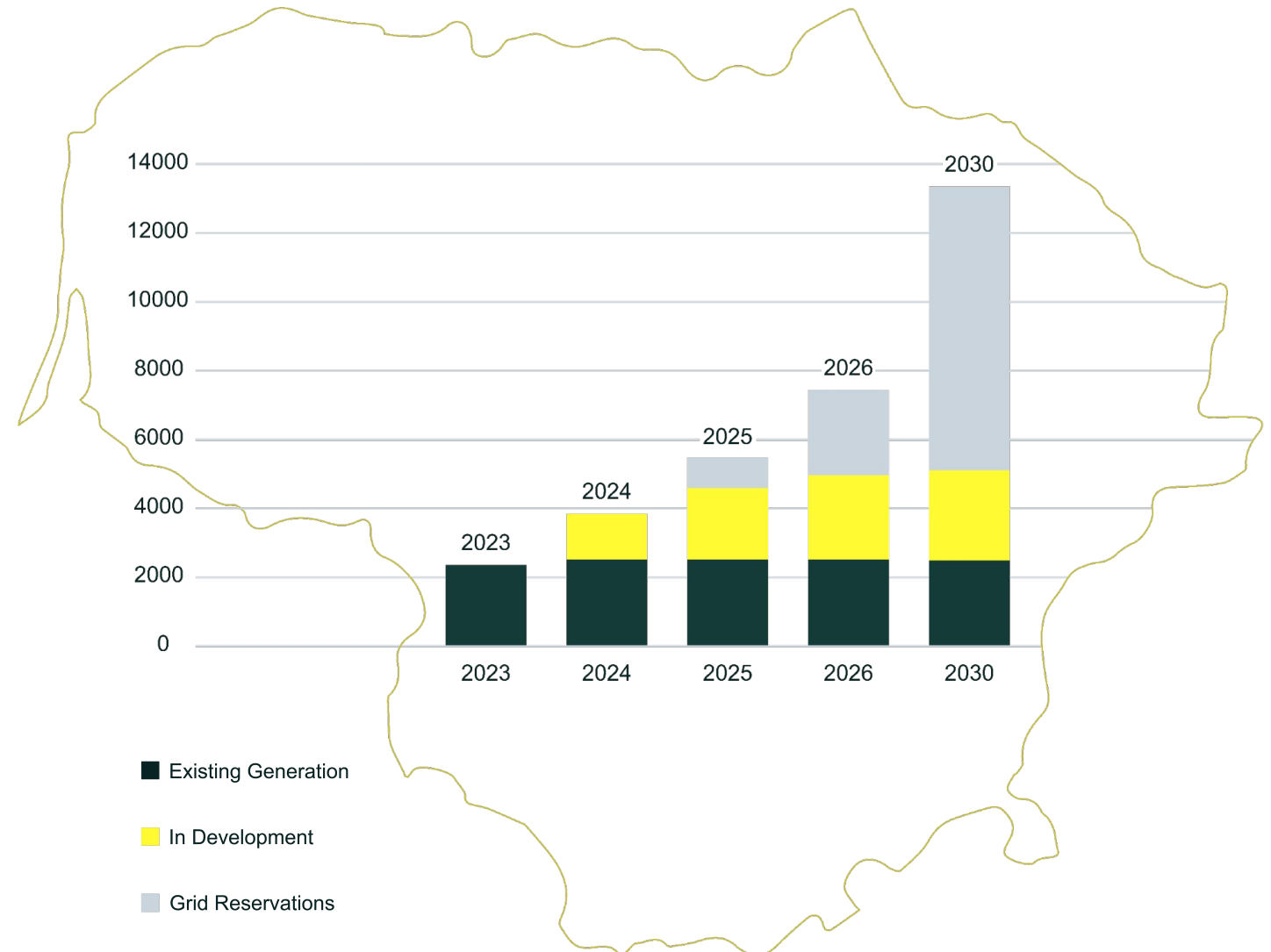


# Development of Renewable Energy in Lithuania

## Lithuania as a green energy export country

The Baltic region has been integrating a substantial amount of renewable energy sources (RES) such as wind and solar power. In 2022, wind power capacity alone in the Baltic countries reached approximately 1600 MW, and it's projected to grow further .

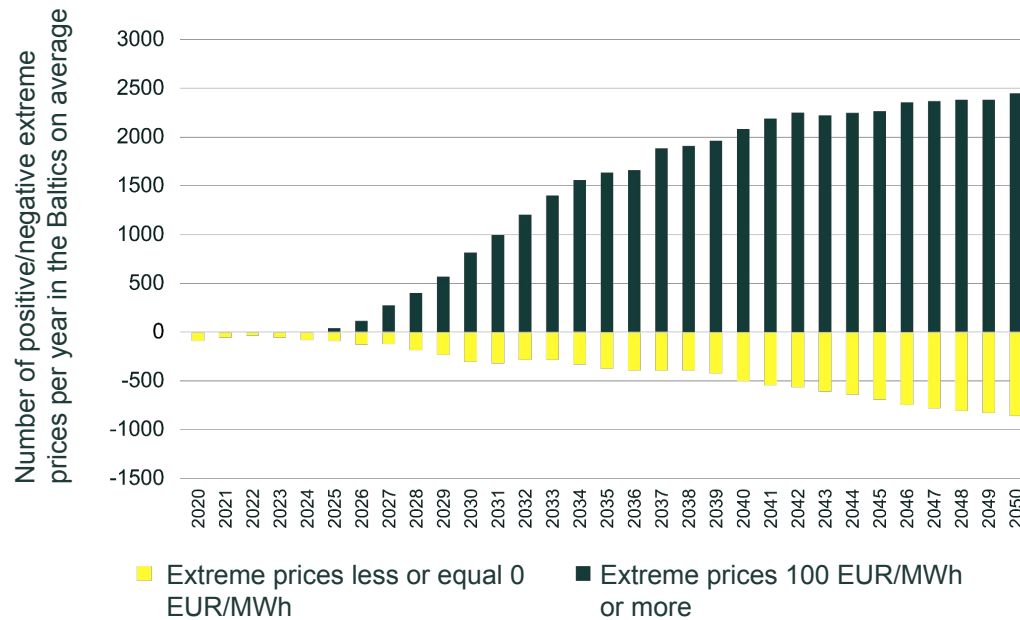
The intermittent nature of RES contributes to the volatility in the energy grid, requiring more frequent and larger balancing interventions through mFRR.





# Baltic Wholesale Energy Market Development

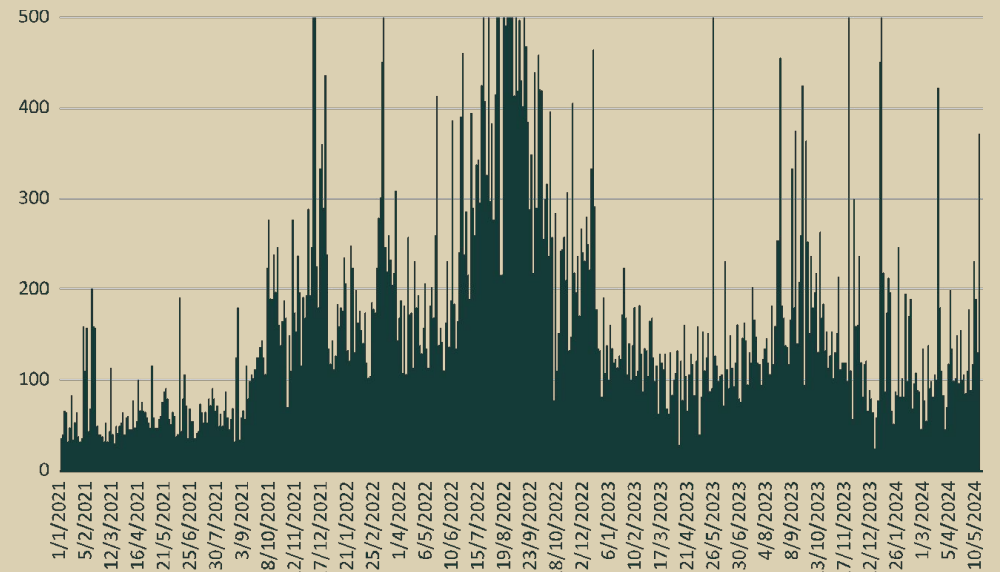
- The Baltic states' planned grid synchronisation with Western Europe in February 2025 will slightly raise average electricity prices for consumers, due to the need for balancing capacity



(Litgrid) (EnergyPricesEU) (Nordpool)

- Increased Volatility: Wind and solar energy's intermittent nature causes greater price volatility, needing more frequent balancing actions.
- Renewable integration as well mean larger price spreads make energy storage for arbitrage more profitable.

Daily wholesale energy price spreads in the Lithuanian market.





# Top Markets for Energy Arbitrage in 2023

Baltic countries, particularly Lithuania and Estonia, are among the most profitable markets for energy arbitrage in 2023.

These regions offer high returns due to efficient renewable integration, strong market dynamics, frequent price fluctuations, and supportive energy policies.

Profit: EUR / kw / year

Year: 2023

Marker: Day Ahead

Efficiency: 85%

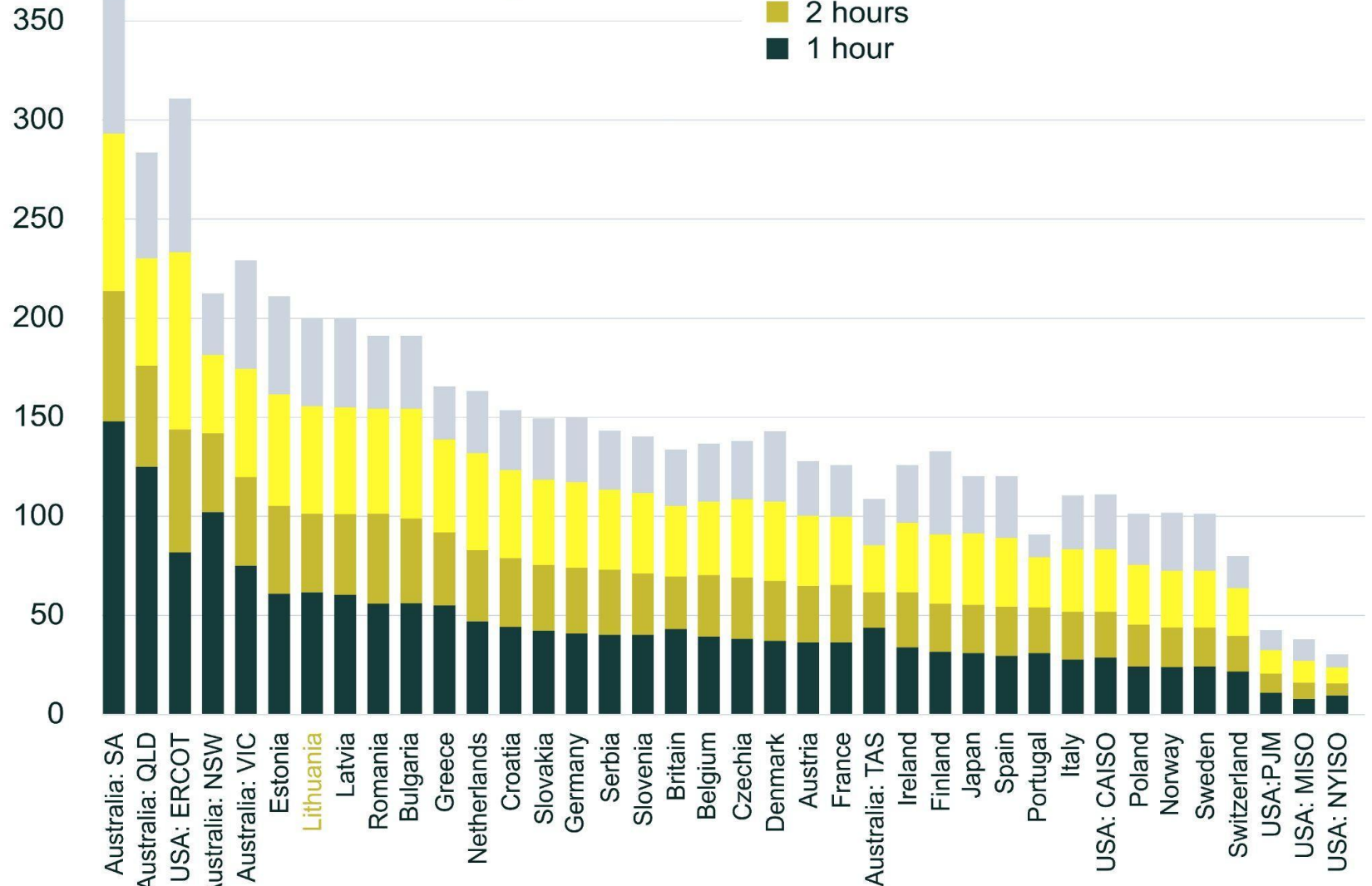
Duration:

8 hours

4 hours

2 hours

1 hour

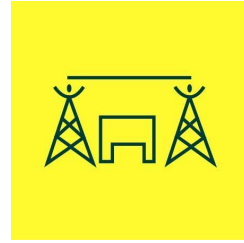




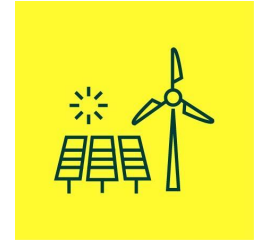


## Balancing Markets: Key to Energy Storage Revenues

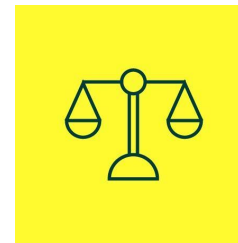
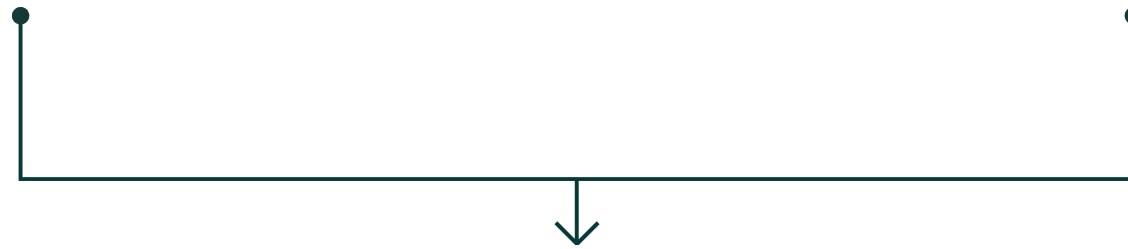
**February 2025, Lithuania will disconnect from the BRELL network and synchronize with the EU grid.** This transition, alongside the rapid development of renewable energy sources, highlights the critical role of balancing markets in the Baltic region. Balancing markets are essential for ensuring grid stability and optimizing revenue streams for Battery Energy Storage Systems.



Synchronisation



RES development



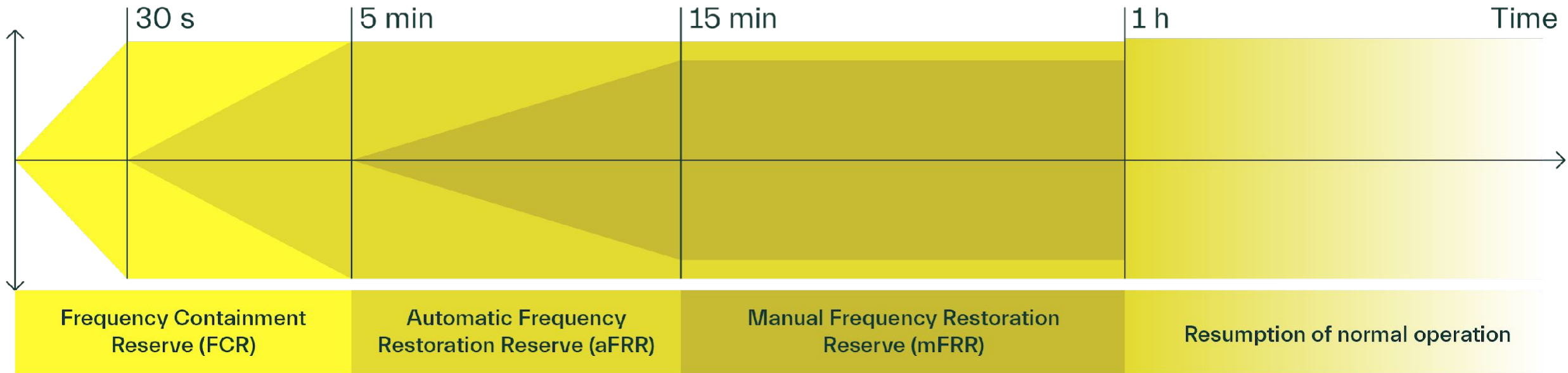
Balancing market  
development

# ↘ Baltic Balancing Market Size

The Baltic region, including Lithuania, Latvia, and Estonia, operates a common model for mFRR balancing markets, enhancing grid stability and integrating with European standards through the MARI platform.

From 2025, the Baltics will also join the aFRR market, further improving frequency control and system reliability.

- Transition to 15-minute Imbalance Settlement Period (ISP) by January 1st, 2025.
- Integration with European balancing markets: MARI (mFRR) and PICASSO (aFRR).
- Market participants to cover approximately 70% of total reserve needs.



- **Estimated Volume: 36 MW**
- Reassessed annually by CESA expert group.

- **Capacity Range: 90 to 120 MW**

- Upward Regulation:
- **Range: 600 to 770 MW.**
- Downward Regulation:
- **Range: 370 to 610 MW.**



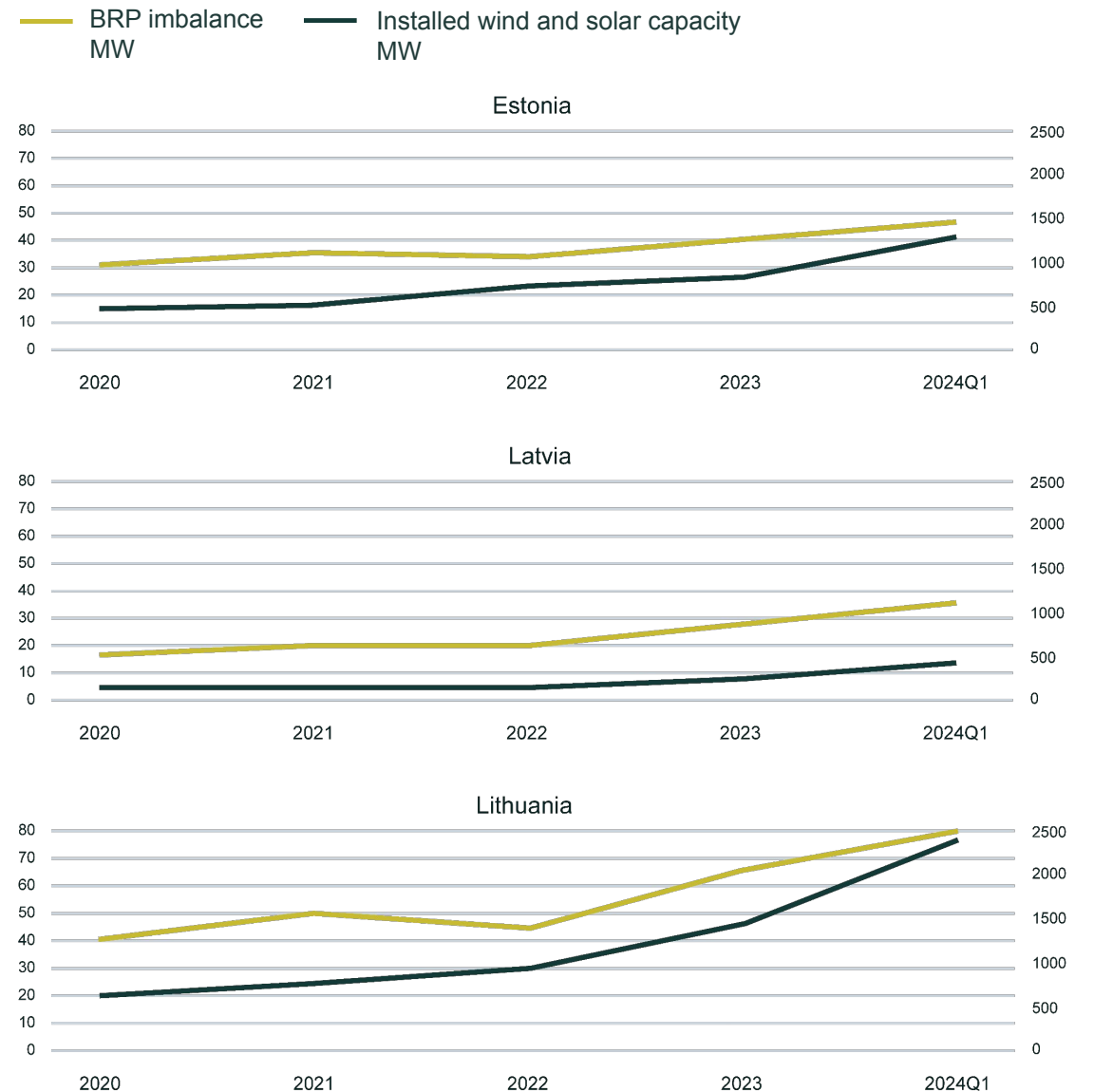
# Baltic mFRR market demand growth

## Renewable Energy integration:

Physics requires that electricity generation always be in real-time balance with load, despite variability in load on timescales ranging from sub-second.

The high share of renewable energy sources in electricity systems and their volatile output can influence the balance between supply and demand.

Energy storage systems are used in the power grid to solve these imbalances.

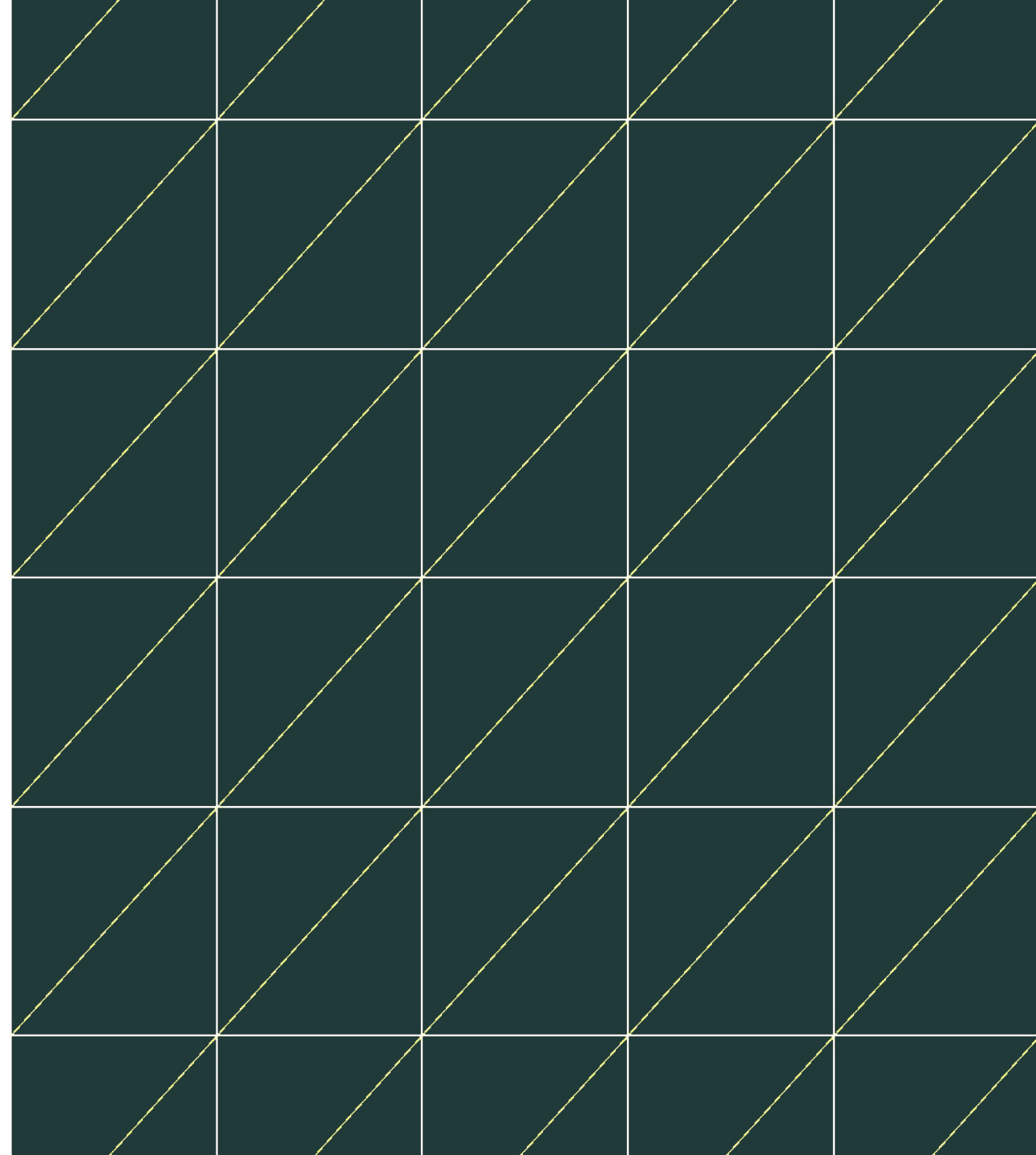


- BRP imbalance (Market imbalances) in Estonia, Latvia and Lithuania significantly increased over last 4 years
- Highest increase in Lithuania from 40MW in 2020 to 80MW in 2024Q1
- BRP imbalance directly correlates with installed capacity of intermittent RES: solar and wind



# NordNest Energy Storage Solutions

Our batteries provide essential services at various stages of the power system, enhancing stability, efficiency, and reliability from generation to consumption.





# NordNest Hardware Solutions

## Our Expertise and Partnerships

We collaborate with tier-one battery cell suppliers to ensure optimal capital investment, performance, and longevity. Our engineers are certified to provide local commissioning, operation, and maintenance services. We work closely with industry leaders such as **CATL**, **LG**, **Samsung**, **Gotion**, and **Great Power**, tailoring solutions to meet specific project requirements.



## Diverse Battery Chemistries

We offer a range of battery chemistries to meet diverse client needs:

- **LFP (Lithium Iron Phosphate):** Cost-effective, safe, and stable for grid storage and renewable integration.
- **NMC/NCA (Nickel Manganese Cobalt/Nickel Cobalt Aluminum):** High energy density for space-constrained applications.
- **LTO (Lithium Titanate):** High power, long cycle life, and superior safety for critical infrastructure.





# Power Solutions and Grid Compliance

## Comprehensive Power Solutions

We partner with top **European power converter manufacturers** to provide complete power solutions. Our certified teams handle the integration, commissioning, operation, and maintenance of all crucial equipment, ensuring system reliability and performance.

## EU-Based Systems and Controls

We utilize proprietary Power Plant Control, SCADA, and Energy Management Systems, ensuring optimal integration, security, and expandability. Our power systems and control solutions are EU-based, with proprietary software designed, developed, and maintained in Lithuania and other parts of Europe.

## Meeting TSO Requirements

Our systems comply with stringent TSO requirements, including those of Litgrid and other Baltic TSOs. Key features include:

- Full control and telemetry signal integration
- Synthetic inertia
- Voltage and frequency droop control.
- Power oscillation damping
- Grid fault ride through
- Integration with wind and solar power sources
- Readiness for participating in FCR, aFRR, and mFRR markets
- Compliant with any cos phi (Power Factor) requirements depending on power plant type and its TSO requirements. Compliant with standard Lithuanian TSO and DSO Requirements

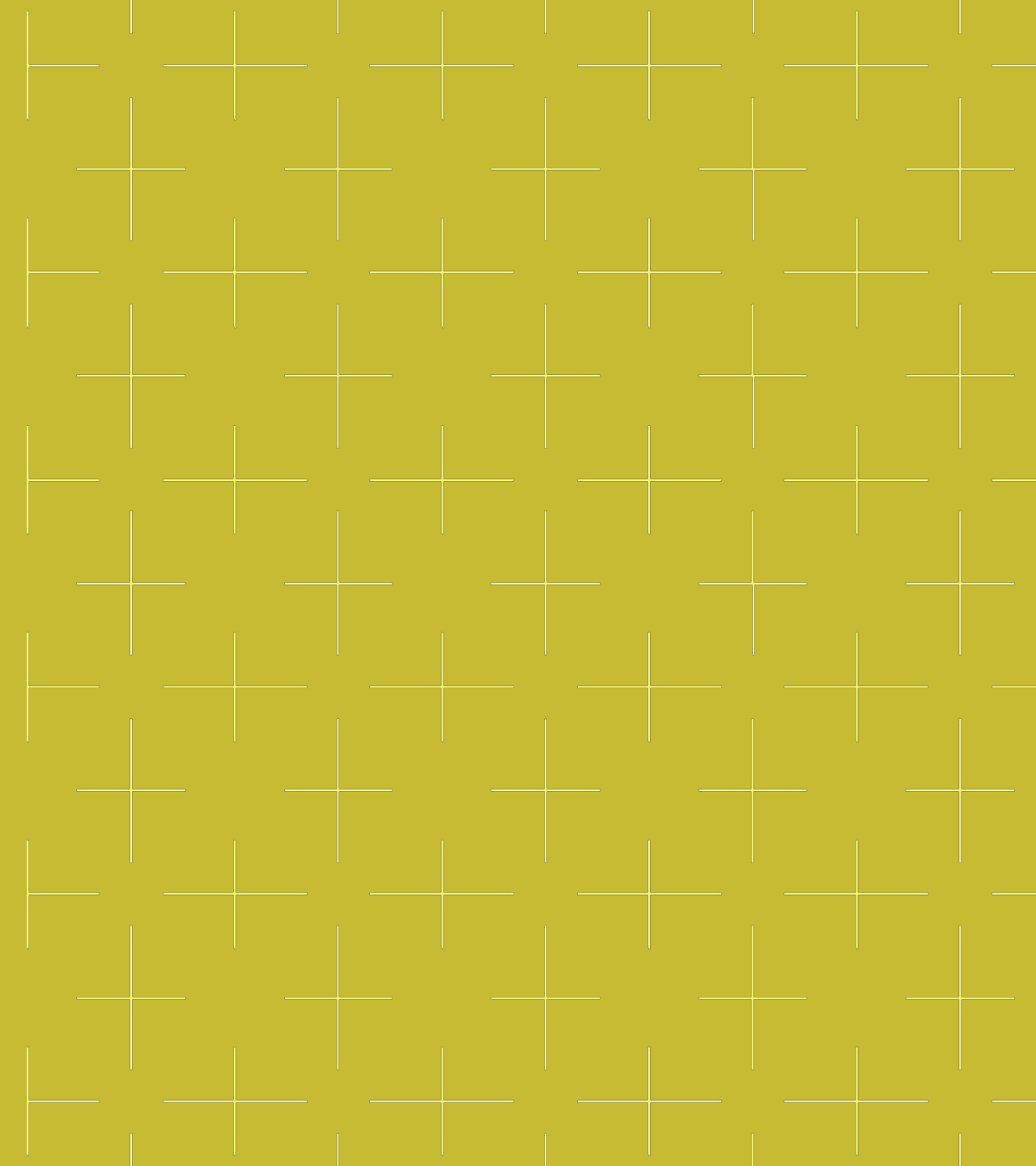




# NordNest Software Solutions

NordNest's Energy Management System (EMS) optimizes energy storage performance and profitability. It offers real-time monitoring, smart control, and automated trading.

With advanced forecasting and seamless API integrations, our EMS ensures efficient energy management and maximized financial returns.



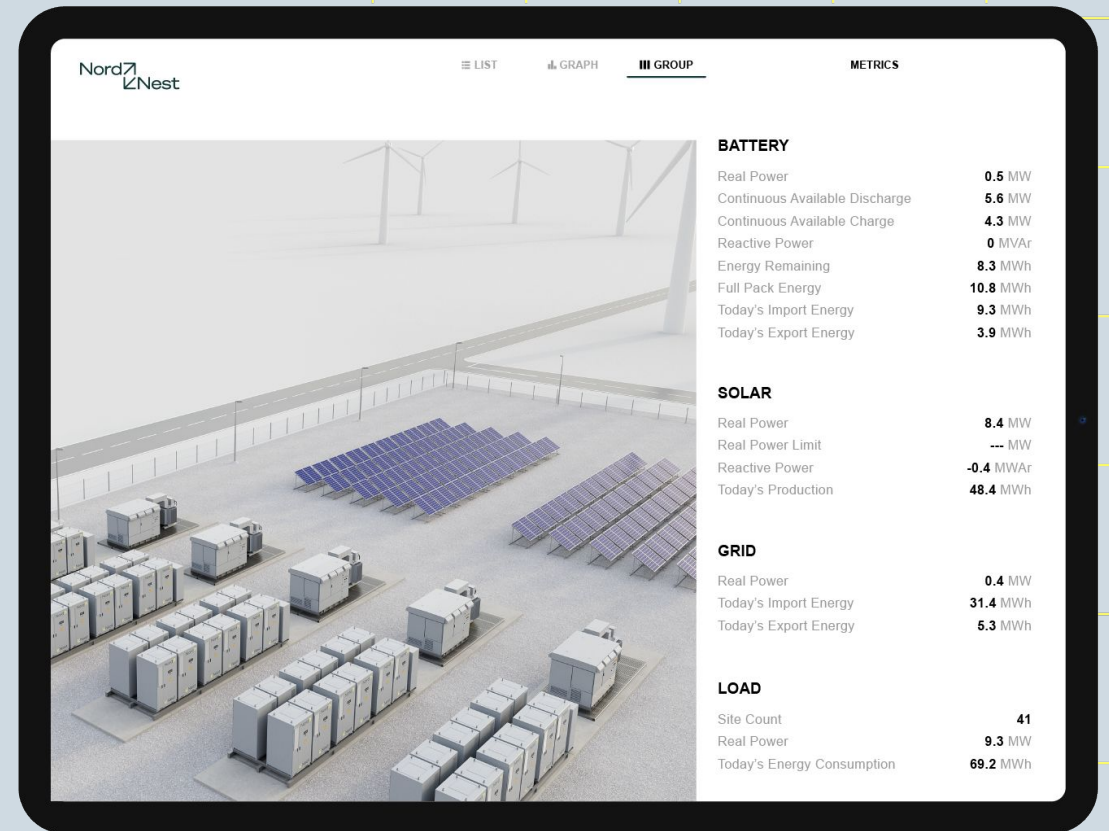
# ↳ NordNest EMS: Energy Management & Optimization

## Monitoring and Reporting:

**Real-Time Data Access:** Continuously monitor system performance for immediate insights and quick response to issues.

**State of Health Monitoring:** Track battery health to ensure optimal performance and timely maintenance.

**Automated Alerts:** Receive immediate notifications for faults and maintenance needs to ensure rapid resolution.



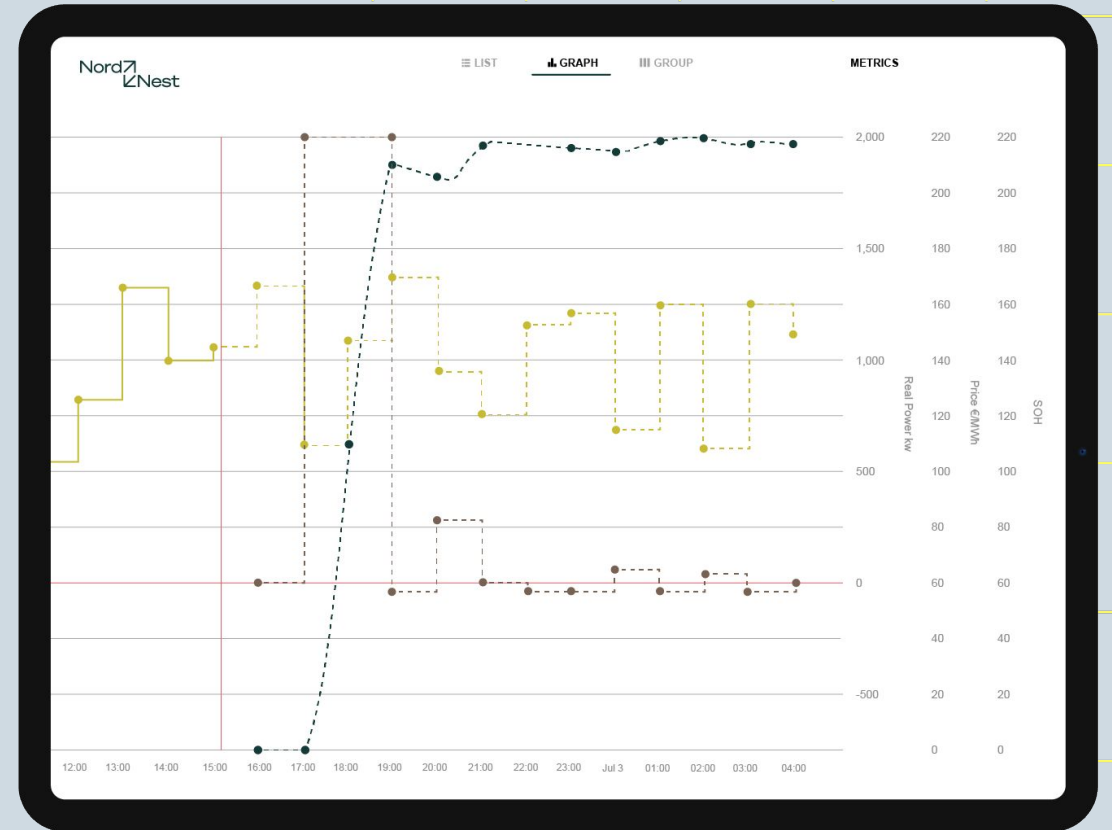
# ↳ NordNest EMS: Energy Management & Optimization

## Smart Control:

**Automated Charge and Discharge:** Optimize battery usage with automated scheduling based on real-time data and predictive analytics.

**Peak Shaving and Load Shifting:** Manage energy storage to lower peak demand charges and shift loads to off-peak times.

**TSO Synchronization:** Ensure seamless battery control integration for market participation and grid stability.



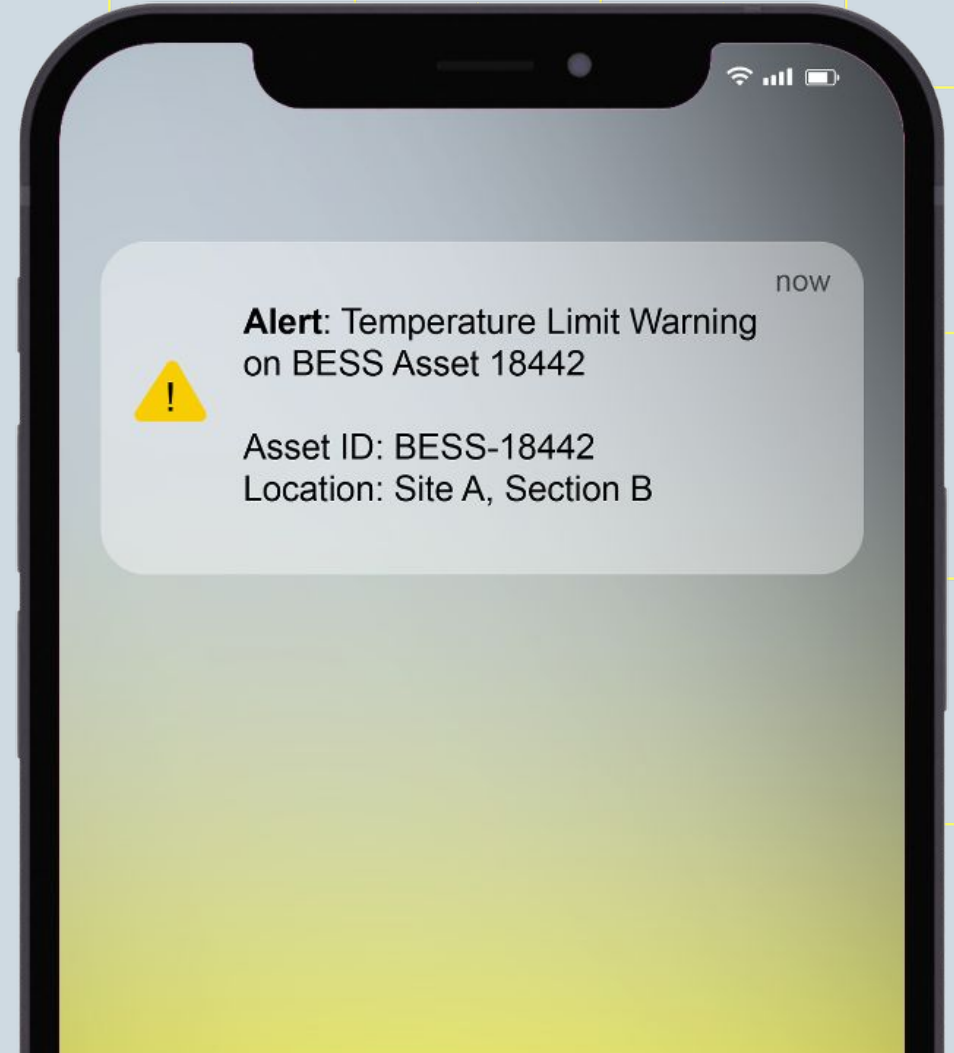
# ↳ NordNest EMS: Energy Management & Optimization

## Predictive Maintenance and Actionable Insights (Available Q2 2025)

**Automated Maintenance Scheduling:** Use real-time data and predictive analytics to optimize maintenance schedules, reducing downtime and extending asset lifespan.

**Condition-Based Maintenance:** Perform maintenance based on actual component conditions for timely interventions.

**Fault Prediction:** Prevent faults with machine learning for preemptive actions, ensuring system reliability.





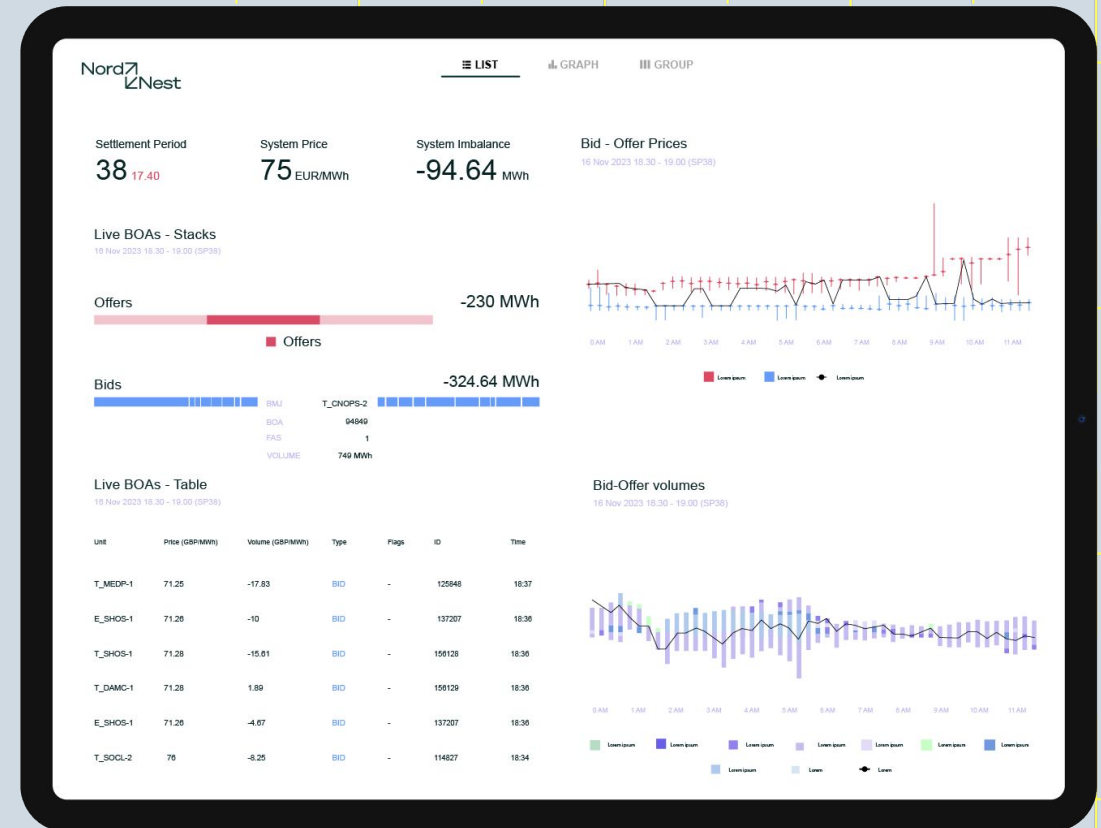
# ↳ NordNest EMS: Energy Management & Optimization

## Revenue Optimization (Available Q3 2025):

**Market Participation:** Ensure grid stability and receive payments by participating in Balancing Services (aFRR, mFRR). Earn stable income through Capacity Markets (FCR) and maximize returns in Wholesale Markets (Day-Ahead and Intraday).

**Automated Trading Strategies:** Implement automated trading strategies to take advantage of market opportunities. Adjust setpoints in real-time to optimize performance and earnings.

**Advanced Forecasting Algorithms:** Enhance decision-making with predictive analytics based on weather and market forecasts. Improve trading accuracy with advanced forecasting tools.



# ↘ Project Implementation and Maintenance

## Engineering and Commissioning with National DSO and TSO

NordNest ensures efficient deployment, maintenance, and management of your BESS, tailored to local requirements and optimized for performance and cost-effectiveness.

**Avoiding delays and surprises with local expertise.**



# Project Implementation and Maintenance

**Building and Integrating:** System build and integration, adhering to all technical and regulatory standards.

**Maintenance:** Provide regular check-ups and predictive maintenance to prevent failures and extend system lifespan.

**Planning and Engineering:** Tailor systems to meet specific performance and cost requirements, ensuring smooth and efficient project initiation.

**Commissioning:** Expert local engineering team ensures compliant and efficient system commissioning with local DSO and TSO.

**End-of-Life Recycling:** Ensure safe recycling and disposal of batteries, adhering to environmental standards.





# Energy Storage Market

## CATL Leads LFP Battery Market

### CATL's Leadership in ESS:

CATL maintains its dominant position with a **43% market share** in the global energy storage systems (ESS) market, delivering over **110 GWh** globally in 2024.

### Shift in Market Dynamics:

Competitors like **LG Energy Solution** and **Samsung SDI** are transitioning from **NMC (Nickel Manganese Cobalt)** to **LFP (Lithium Iron Phosphate)** batteries, as they work to regain market share lost to CATL, which capitalized on LFP's cost advantages and safety

### Global Market Expansion:

The total energy storage market is set to exceed **500 GWh** by 2025, fueled by increased demand for utility-scale storage projects and renewable integration

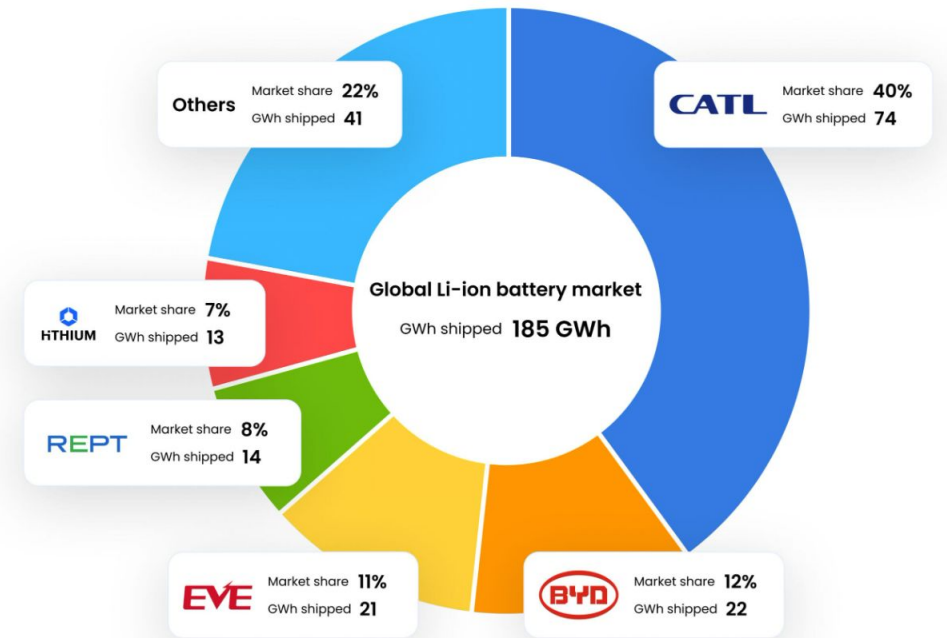
### Cost Reduction in LFP Batteries:

LFP battery prices have dropped by up to **50%** in 2024, making them the preferred choice for both energy storage and EV applications

### Competitors in Transition:

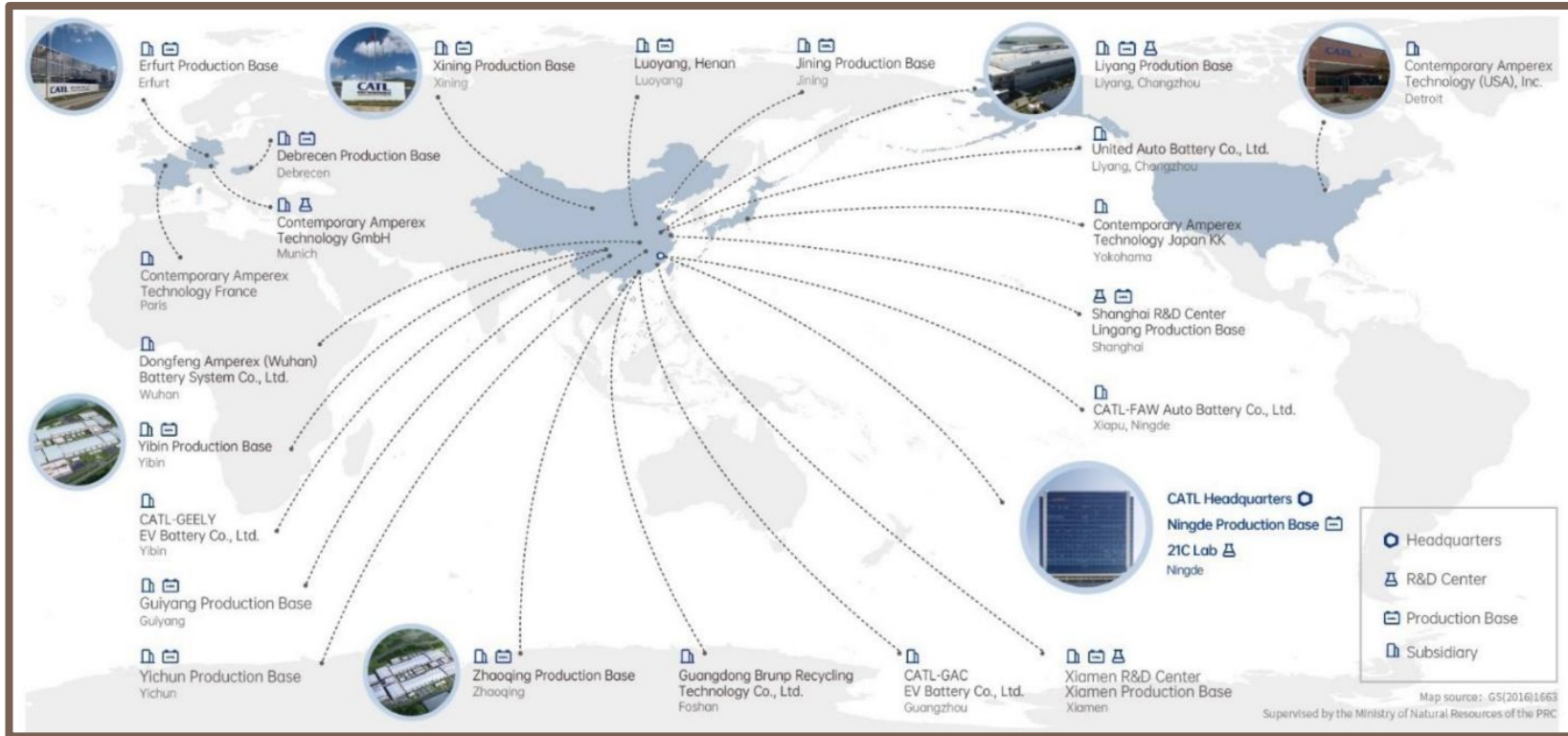
Other major players, such as **Panasonic** and **Samsung SDI**, are also pivoting towards LFP batteries as part of their strategy to increase competitiveness in both EV and energy storage sectors

## Global market share Li-ion battery makers 2023





# Intro to CATL



**Revenue:** \$54.9 billion in 2023 (CNY 400.92 billion).

**Market Capitalization:** \$150 billion.

**Employees:** Over 120,000 employees, with 20,000 dedicated to R&D.

**R&D Spending:** Estimated at 5-7% of revenue, approximately \$3.8 billion in 2023

**European Operations:** CATL has 50 engineers dedicated specifically to aftersales services for energy storage systems (ESS), with 18 warehouses across Europe, and two gigafactories supporting the region.

**ESS Projects:** CATL has delivered over 1,500 ESS projects globally, deploying more than 110 GWh of energy storage capacity and capturing a 43% market share in the ESS sector

# Power Conversion Systems (PCS)

## Power Electronics as our Preferred Partner

### Risks of Chinese PCS:

- **Sungrow** and **Huawei** dominate the **Asia** and **European** PCS markets but face increasing scrutiny due to **cybersecurity concerns**.
- European governments are discussing **potential bans** on Chinese PCS and **software integration**, which could impact supply chains

### Power Electronics (Spain):

- A **European leader** with over **30 GW** of installed ESS capacity and **60% market share** in the U.S.
- Record-breaking **\$1.2 billion revenue** in 2023, with **75% growth**.
- Known for **Twin Skid solutions** and trusted for **secure, large-scale projects**

**Technological Growth:** The growing shift toward **renewable energy** and the expansion of ESS projects globally have driven Power Electronics' growth. The company is investing **\$330 million** over the next few years to expand production facilities in the **U.S.** and **Spain**, preparing for increased demand.

## Current Track Record



# Importance of secure energy grid

## Recent Cyber Attacks on Energy Grids (2022-2024)

**Ignitis Group (Lithuania, 2022):** DDoS attack disrupted services, with 2024 data leak

**Ukraine Power Grid (2022):** Russian cyberattack disabled grid during conflict

**German Wind Turbines (2022):** Attack on 6,000 turbines disrupted renewable energy supply

**Poland Grid (2023):** Continuous daily cyberattacks from Russian sources targeting grid operations

**Tata Power (India, 2022):** Ransomware exposed critical data

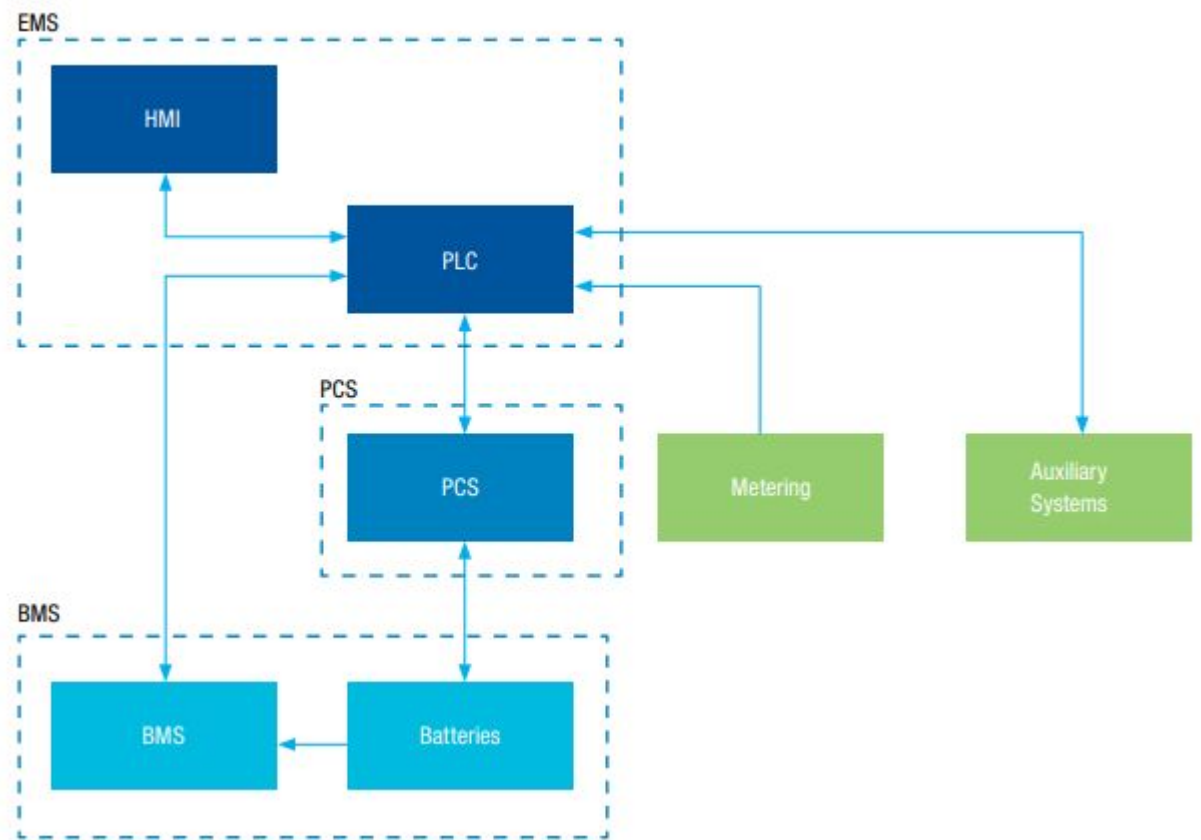
**DESFA (Greece, 2022):** Ransomware caused gas supply disruptions

**Ongoing European Grid Attacks (2022-2024):** Persistent attacks reported on grids across Europe, particularly from Russian-backed sources



# ↳ Cybersecurity Vulnerabilities in ESS

1. **Cloud-based EMS Vulnerability:** The foreign-owned and cloud-managed EMS exposes the system to **remote attacks**, where hackers could gain unauthorized access to critical system controls and data.
2. **Firmware Manipulation via PCS/PLC:** **Direct firmware updates** from foreign maintenance providers can introduce **malicious code** into the PCS or PLC, creating a backdoor for hackers or compromising system stability.
3. **HMI Access Exploits:** The **HMI** is susceptible to malware injections or phishing attacks, giving attackers direct access to manipulate system operations.
4. **PLC Control Manipulation:** Unauthorized access to the **PLC** can result in altered power flow and uncoordinated grid connections, threatening both local and regional grid stability.
5. **PCS Communication Disruption:** Attackers can intercept or disrupt communications between the **PCS** and external systems, causing power outages or grid destabilization.





# ↘ EU grid security measures

## NIS2 Directive (2022/2555):

- Requires stringent **cybersecurity measures** for all critical infrastructure, including energy storage systems (ESS).
- Drives the need for **localized control** and security, limiting reliance on external, foreign-controlled software and ensuring independent management of key systems

## EU Network Code on Cybersecurity (2024):

- Focuses on securing **cross-border electricity flows** and protecting energy storage systems from cyberattacks that could compromise regional grids

## CER Directive (2022/2557):

- Addresses both **cyber and physical security** of energy systems, emphasizing the importance of protecting against **Russian and Chinese cyber threats** that target European infrastructure



# NordNest Approach

## Our Product

### In-House SCADA & EMS:

- Developed internally for **full local control** over the energy storage system.
- CATL batteries and Power Electronics inverters isolated from **direct internet access** to prevent cyber vulnerabilities.

### Collaboration with CATL & Power Electronics:

- **Firmware updates and system changes** are supervised by NordNest to ensure security.
- Total control over hardware and software to mitigate **third-party risks**.

## Our Services

### Maintenance & Operation:

- Ongoing **local support** for system updates, monitoring, and security.
- Preventing external access to guarantee long-term **protection and reliability**.

### Compliance with EU Directives:

- Aligns with **NIS2** and **CER** regulations for cybersecurity.
- Ensures compliance and **operational sovereignty** in the energy storage system.



We make most  
ambitious projects  
happen

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[www.nordnest.com](http://www.nordnest.com)

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[info@nordenergija.lt](mailto:info@nordenergija.lt)

+370 698 22225

