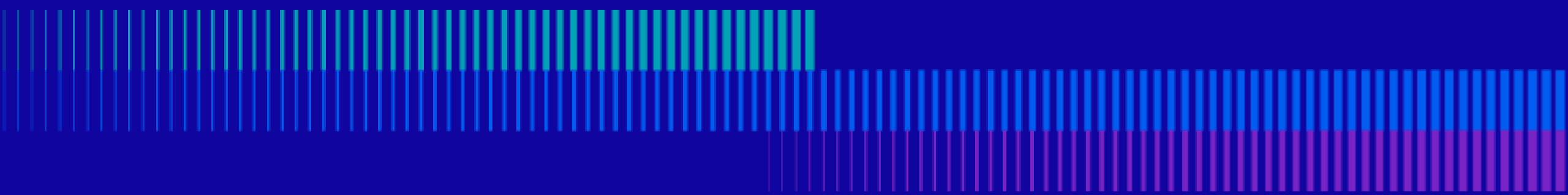




ROLLS-ROYCE

SUSTAINABLE POWER SOLUTIONS (SPS)

July 2026 | Arne Kaschubowski



TODAY'S AGENDA | 18. JULY 2026



01 Overview About Rolls-Royce

02 Market Overview & Trends

03 A practical example

04 A sizing Exercise

05 Summary

06 Q&A



01


OVERVIEW ABOUT ROLLS-ROYCE


About Us, Our Technology & Our Markets

ROLLS-ROYCE GROUP

A world-class technology company, built on three strong and complimentary business units.




 **35** types of commercial aircraft powered by us


 **13,000** engines in service around the world

 **18,300** total employees

 **10.38 billion (€ 12.14 billion)** underlying revenue



 **160** customers in over 100 countries


 **16,000** engines in service around the world

 **12,000** total employees


 **4.77 billion (€ 5.58 billion)** underlying revenue



 **> 40,000** customers in 13 different industries

 **8,000** engines sold per year

 **11,000** total employees

 **4.89 billion (€ 5.72 billion)** underlying revenue



A LEGACY OF POWER | DELIVERING RELIABLE AND SUSTAINABLE ENERGY

Our Vision

Powering, protecting and connecting the modern world

About Us

We are Rolls-Royce SPS

We are a European energy storage leader with 13+ years of experience delivering reliable solutions that dispatch sustainable electricity on demand.

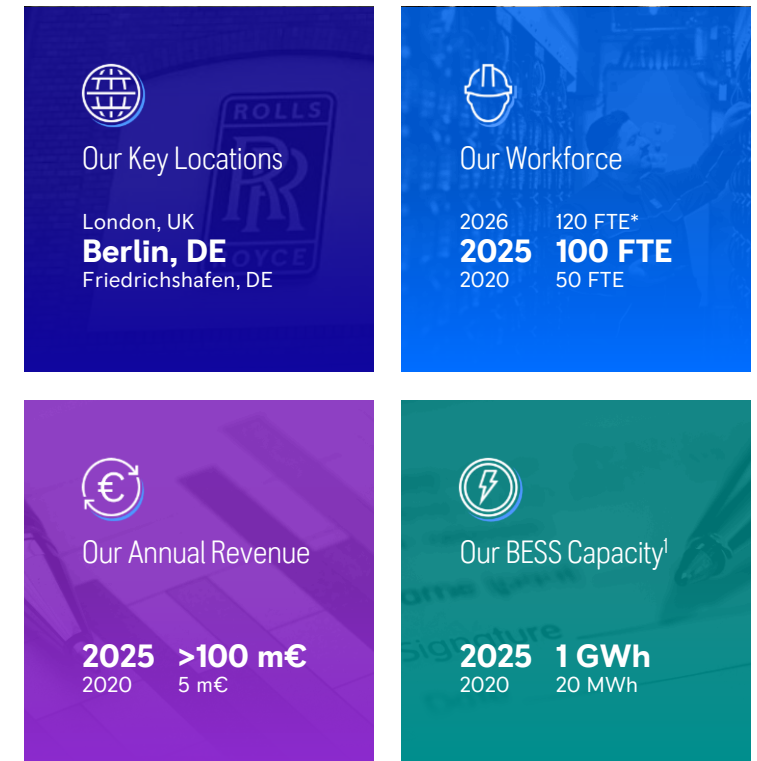
We are part of Rolls-Royce

Rolls-Royce (LSE: RR) is a global engineering leader with 100+ years of experience delivering mission-critical power and propulsion across aerospace, defense, marine and energy markets.

Backed by the scale and financial strength of Rolls-Royce, we bring trusted engineering to battery energy storage.

¹Installed and Contracted, *Forecast

Key Figures



The information in this document is proprietary and confidential to Rolls-Royce and is available to authorized recipients only – copying and onward distribution is prohibited other than for the purpose for which it was made available.



OUR TECHNOLOGY | DRIVING THE ENERGY FUTURE WITH BESS - PROVEN, SCALABLE, AND ECONOMICALLY VIABLE



BESS - Powering Modern Grids

Battery Energy Storage Systems (BESS) provide flexible energy that enhances grid stability and optimizes the performance of power generation assets through intelligent controls delivered by an Energy Management System (EMS).

BESS support a wide range energy applications across two primary segments:

Front of Meter Utility



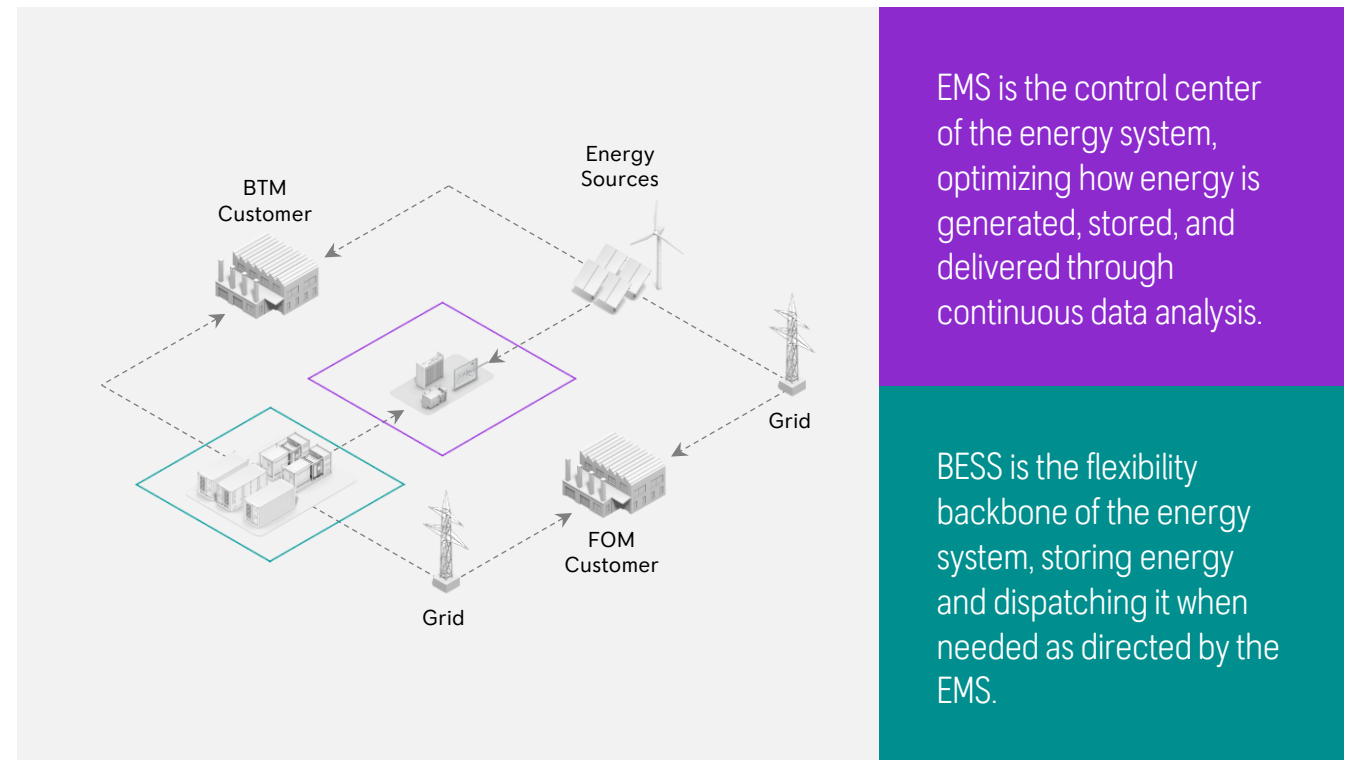
Behind the Meter C&I*



*Commercial & Industrial, ¹Incl. Curtailment Reduction, ²Incl. Arbitrage (Participation in Day-Ahead, Intraday and Real-Time Wholesale Markets),

³Incl. Ancillary Services (Frequency Control, Black Start Capabilities, Transmission & Distribution Investment Deferral), ⁴Incl. Peak Shaving, Backup Power, Load Balancing

BESS and EMS in the Energy Landscape



EMS is the control center of the energy system, optimizing how energy is generated, stored, and delivered through continuous data analysis.

BESS is the flexibility backbone of the energy system, storing energy and dispatching it when needed as directed by the EMS.

OUR MARKETS | SIGNIFICANT LONG-TERM GROWTH ACROSS UTILITY AND C&I ENERGY STORAGE SEGMENTS



BESS - Accelerating the Future Energy

BESS enters a sustained growth phase

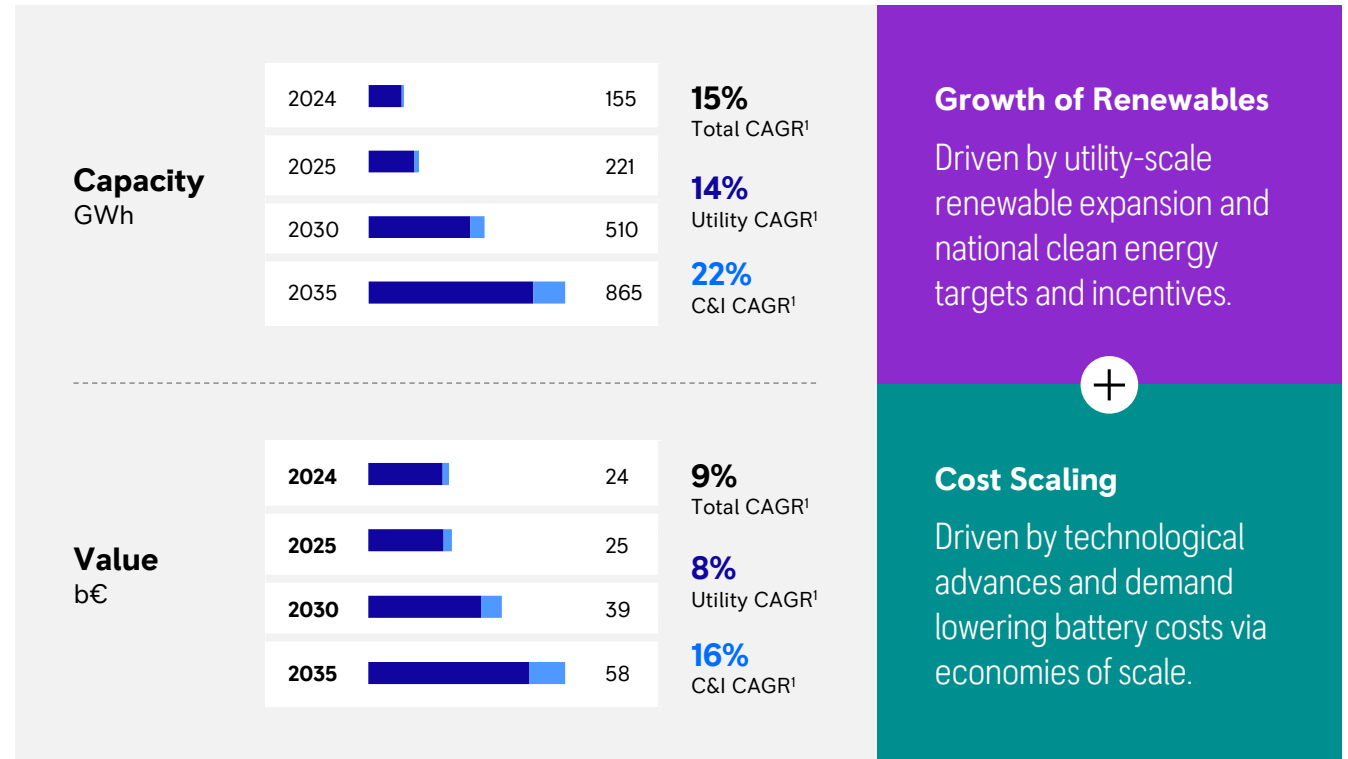
The BESS market is entering a sustained expansion phase, with global installed capacity projected to more than quadruple and total market value more than doubling over the next decade.

Utility-scale deployments are expected to account for a significant share of this growth, underscoring the growing role of BESS in large-scale power system integration.

From emerging technology to core infrastructure

As BESS becomes embedded within energy networks worldwide, it is evolving from a complementary technology into a foundational component of modern energy systems.

BESS Development & Growth Drivers



¹For the period 2025 - 2035

02

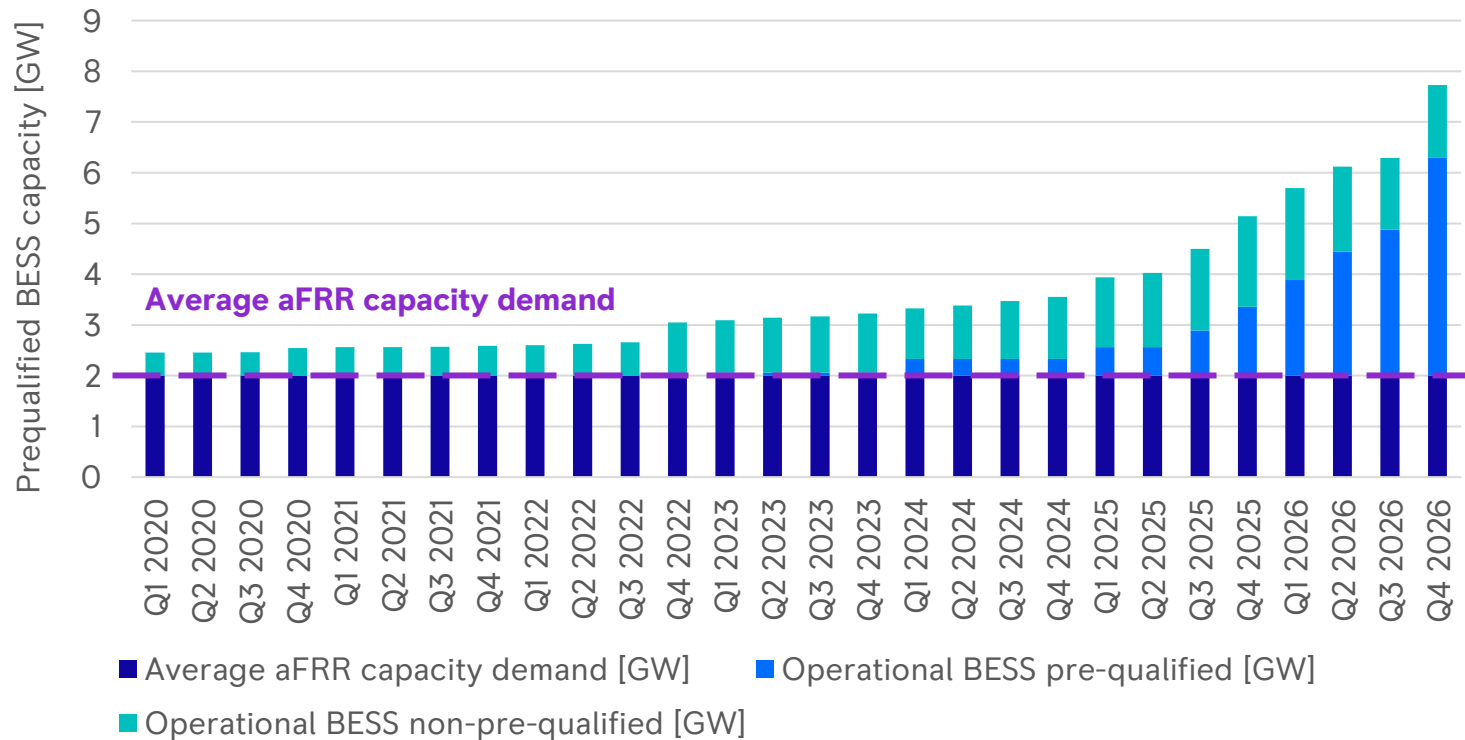
A MARKET OVERVIEW & TRENDS

Overview about the BESS market trends

AFRR MARKET SATURATION | GERMAN BESS CAPACITY APPROACHING DEMAND



Prequalified BESS Capacity vs. Average aFRR Demand



Key messages

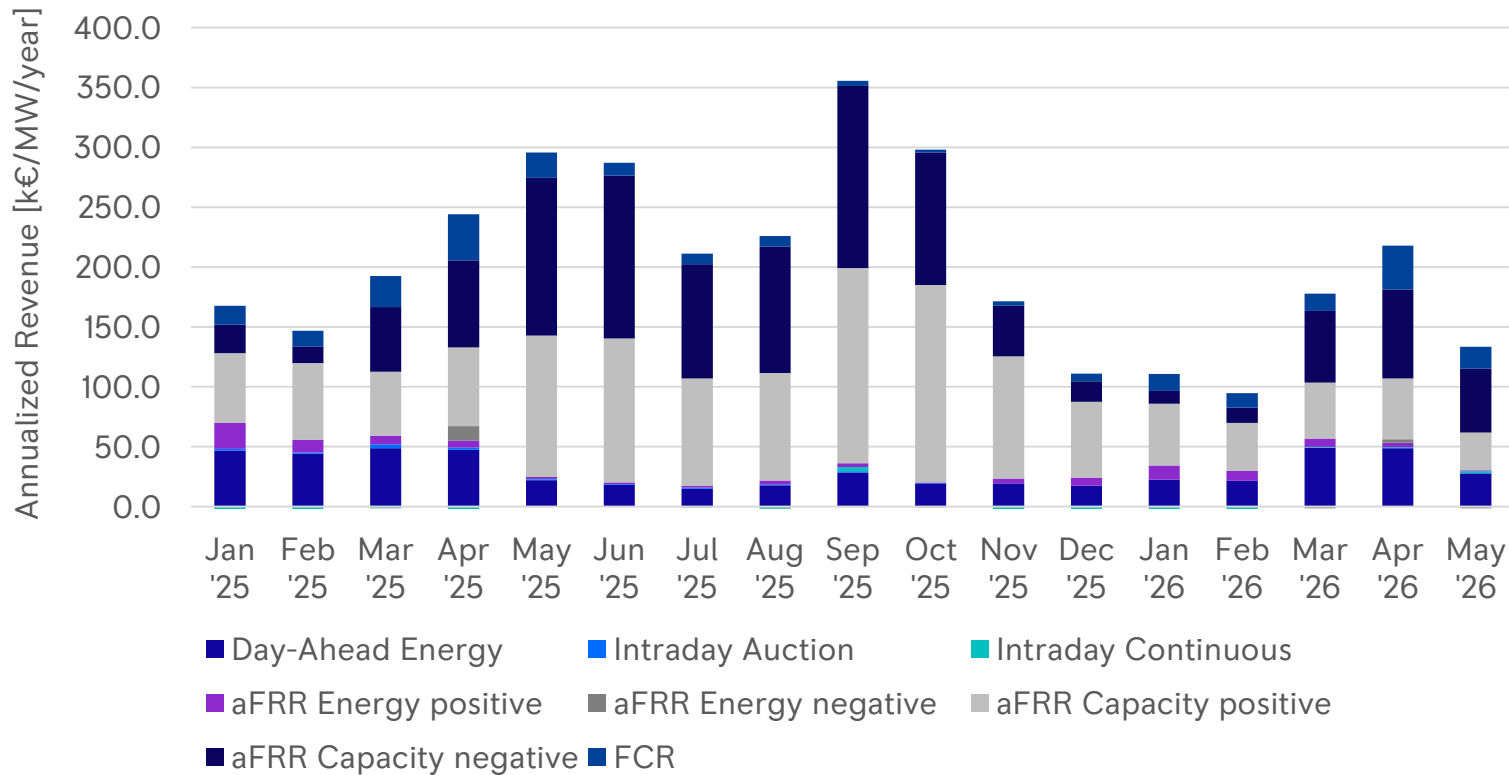
- Prequalified BESS capacity is expected to reach average aFRR demand by 2026
- Increasing BESS participation creates more competition in ancillary service markets
- As aFRR markets saturate, revenue stacking and arbitrage become increasingly important

<https://modoenergy.com/research/en/october-2025-germany-afrr-saturation-bess-frequency-services>

INDUSTRY TRENDS | HOW THE EUROPEAN BESS MARKET IS EVOLVING



Revenue Stacking in German BESS Projects (2025–2026)



Key messages

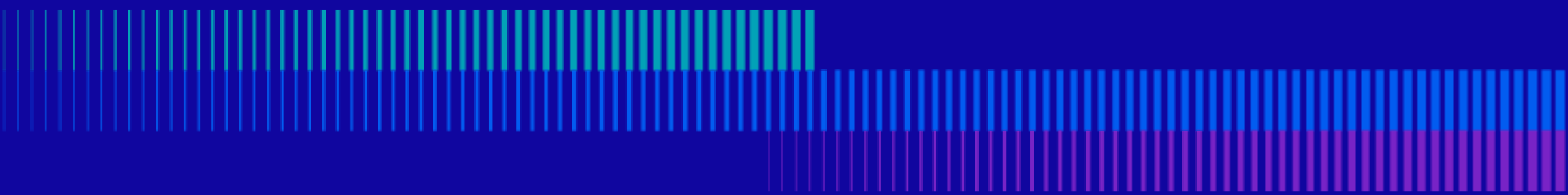
- BESS revenues increasingly come from multiple markets rather than a single service
- aFRR currently represents the largest revenue stream in the German market
- Commercial success depends on intelligent market optimization, not only battery technology

<https://modoenergy.com/research/de/me-bess-de-1h-2h-4h-germany-battery-bess-benchmark-live-terminal-virtual-asset-simulation-may-2026>

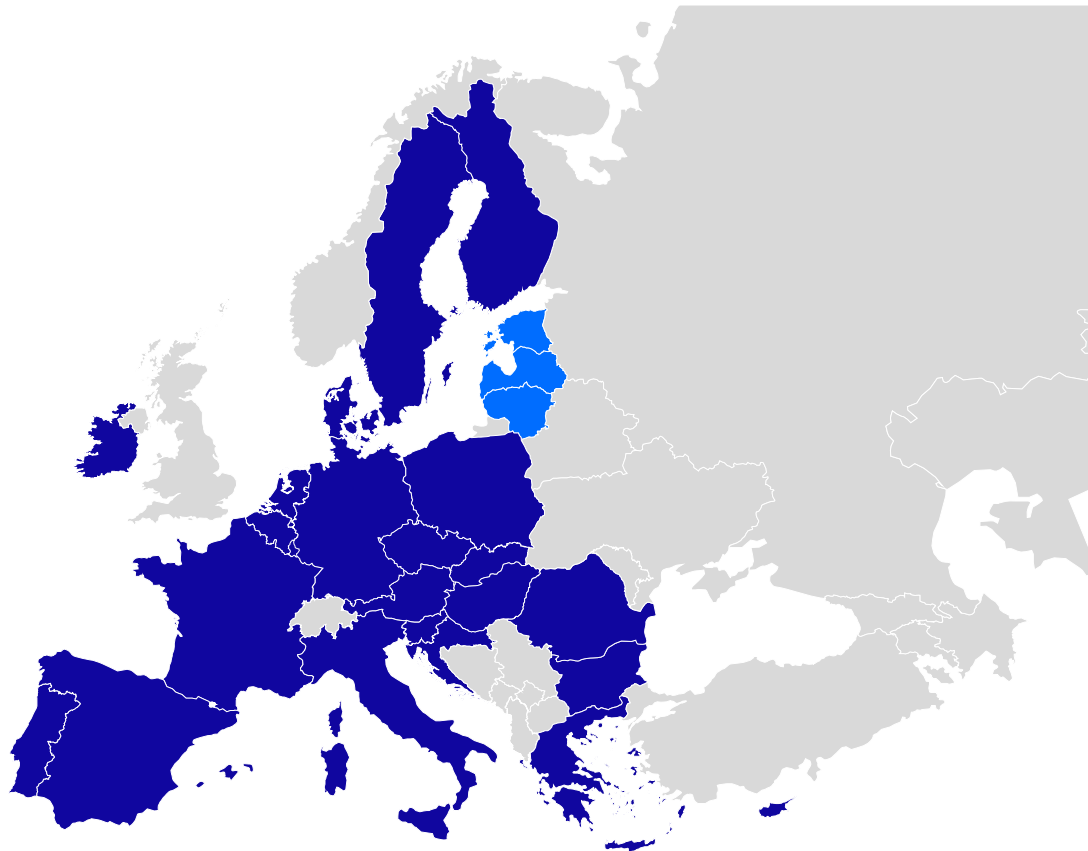
03

A PRACTICAL EXAMPLE

Large-Scale Battery Storage for Grid Stability in Latvia



INTRODUCTION & CONTEXT | LATVIA'S PATH TO GRID INDEPENDENCE



Before Disconnection from BRELL¹

- Part of the BRELL¹ synchronous area
- Frequency support from Russia and Belarus
- Limited operational independence



After Synchronisation with Continental Europe

- Integration into Continental Europe
- Own frequency control required
- Additional balancing reserves needed

¹ BRELL = Belarus, Russia, Estonia, Latvia and Lithuania synchronous power system

SYSTEM REQUIREMENTS | ENABLING SECURE SYNCHRONISATION



Functional Requirements



Ensure grid frequency stability



Provide balancing and reserve services



Support voltage regulation



Respond instantly to grid disturbances



Maintain stable operation under dynamic grid conditions

Project Requirements

24/7

High system availability (>98%)



Compliance with ENTSO-E grid codes



Cybersecure system architecture



Seamless TSO integration



Multi-site deployment architecture

OUR OFFER | HOW ROLLS-ROYCE ADDRESSES THE REQUIREMENTS



Full Turnkey Solution

- Engineering & system design
- Procurement & installation
- Commissioning & acceptance testing



Integrated System

- Battery containers
- PCS, transformers & EMS
- Fully integrated system architecture



Long-Term Service

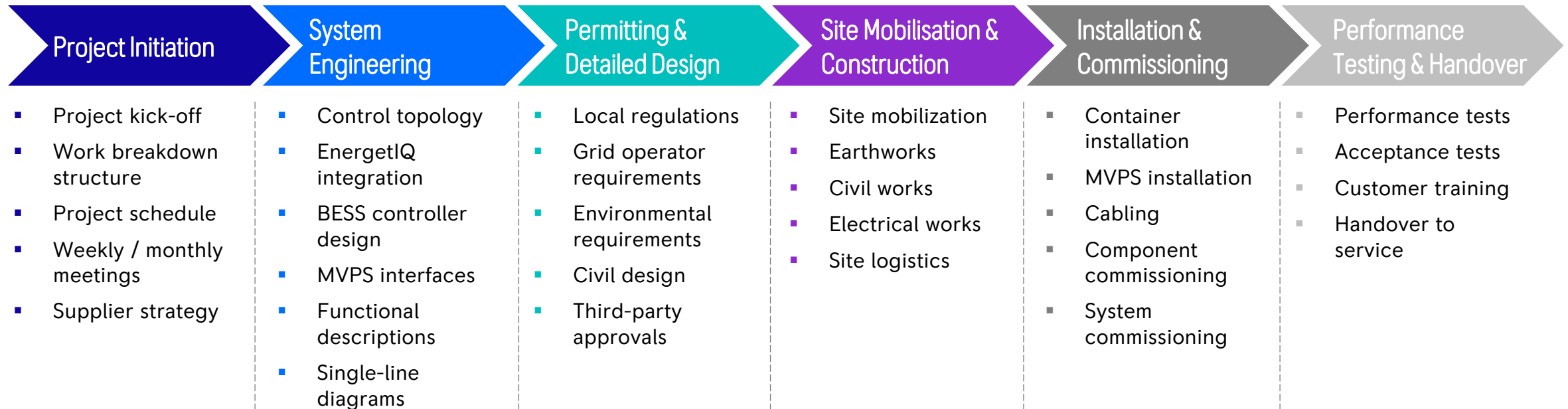
- Remote monitoring
- Preventive maintenance
- Guaranteed spare part support



Grid Integration

- ENTSO-E compliant design
- SCADA integration
- Cybersecure operation

PROJECT PLAN | TYPICAL PHASES OF A TURNKEY BESS PROJECT



The complexity of utility-scale BESS projects lies not only in the technology, but in the coordination of engineering, construction, regulatory compliance and stakeholder requirements.

THE PROJECT | LATVIA GRID STABILIZATION BESS



Customer: AST (Latvian Transmission System Operator)



Application: Grid stabilization & synchronization with Continental Europe



Location: Latvia (Tume & Rezekne)



Total capacity: 80 MW / 160 MWh on two sites



Commissioned: 2025

TECHNICAL ARCHITECTURE | BATTERY CONTAINER



EnerC+ Battery Container from CATL



Key figures

Dimension (LxWxH)	6.06x2.44x2.90 m
Weight	35 t
Energy Capacity	4.073 MWh
Cell capacity	306 Ah
Duration	2 h
Footprint	14.79 m ²
Energy Density	275.39 kWh/m ²
Operating Temperature	-25 °C to +55 °C

TECHNICAL ARCHITECTURE | INVERTER



SMA SCS 3800 UP



Key figures

Dimension (LxWxH)	2.82x1.59x2.32 m
Weight	< 3.7 t
Output Power	3.8 MW
Efficiency	98.8 %
AC Voltage	660 V
Footprint	6.54 m ²
Operating Temperature	-25°C to 60°C

TECHNICAL ARCHITECTURE | CONTROL UNITS



mtu EnergetIQ BESS Controller

- **Control of all subcomponents** including Engine, Inverter and Battery Management System
- Asset and grid protection for **safe and reliable** single asset operation
- **Asset data management** including warranty data, performance data and on-premise **Battery Analytics**
- **Remote visualization** for monitoring and control for operator and service



mtu EnergetIQ Manager

- **SCADA* System** for data management, trending, monitoring, reporting and alarm management
- **Switchgear Controller** for breaker control and protection
- **Application Manager** for grid services, peak shaving, energy trading and self-consumption optimization
- **Power Plant Controller** for grid code compliance and grid operator interface integration
- **Microgrid and Master Controller** for rule-based and mathematically optimized power dispatch

*Supervisory Control And Data Acquisition

CHALLENGES & LESSONS LEARNED | SUBTITLE



Challenges



Civil Engineering Adaptations



Country-Specific Requirements



Control System Customization



Operation in Baltic Climate

Lessons Learned



In Latvia, elevated groundwater levels required higher foundations than initially anticipated



Grid integration often require more engineering effort than expected



Utility-specific requirements often require controller and interface modifications



Environmental requirements should be considered from the earliest design stages

04

A SIZING EXERCISE

Undertitle

EXERCISE | DESIGN A BESS FOR A FICTIONAL TSO PROJECT



Given requirements

- Required power: 40 MW
- Guaranteed capacity after 10 years: 80 MWh
- Assumed degradation: 1.5% per year
- Available site area: limited
- Use components from the Rolls-Royce portfolio

Battery System	Energy Capacity [MWh]	Approx. Footprint [m ²]
CATL EnerOne+	5.0	30
CATL Ener530-H	5.64	30
CATL TenerS	6.02	30

PCS System	Power Rating [MW]	Approx. Footprint [m ²]
SMA 4400	4.4	15
SMA 4600	4.6	15
Power Electronics Single Skid	4.39	20
Nidec PU 20 ft	5.0	15
Power Electronics Twin Skid	8.78	35
Nidec PU 30 ft	10.0	25

SOLUTION | DESIGN A BESS FOR A FICTIONAL TSO PROJECT



$$1 \quad C_{installed} = C_{required} * (1 + \text{assumed degradation per year})^{years}$$

$$2 \quad C_{installed} = 80 * 1.015^{10} = 92.9 \text{ MWh}$$

$$3 \quad N_{battery} = \frac{93.00 \text{ MWh}}{C_{container}}$$

$$4 \quad N_{PCS} = \frac{40.00 \text{ MW}}{\text{Power per Unit}}$$

$$5 \quad N_{total} = N_{battery} + N_{PCS}$$

SOLUTION | THE RIGHT ANSWER DEPENDS



Option	Battery	PCS	Installed Capacity	Installed Power	Footprint	Bewertung
A	16 × CATL TenerS	4 × Nidec PU 30 ft	96.3 MWh	40 MW	580 m ²	Best footprint
B	17 × CATL Ener530-H	4 × Nidec PU 30 ft	95.9 MWh	40 MW	610 m ²	Good alternative

Decision Drivers



Available site area

Footprint, spacing, access roads and maintenance areas



System compatibility

Battery, PCS, EMS and protection concept must work as one integrated system



Grid connection & PCS requirements

Voltage level, local content requirements and approved suppliers

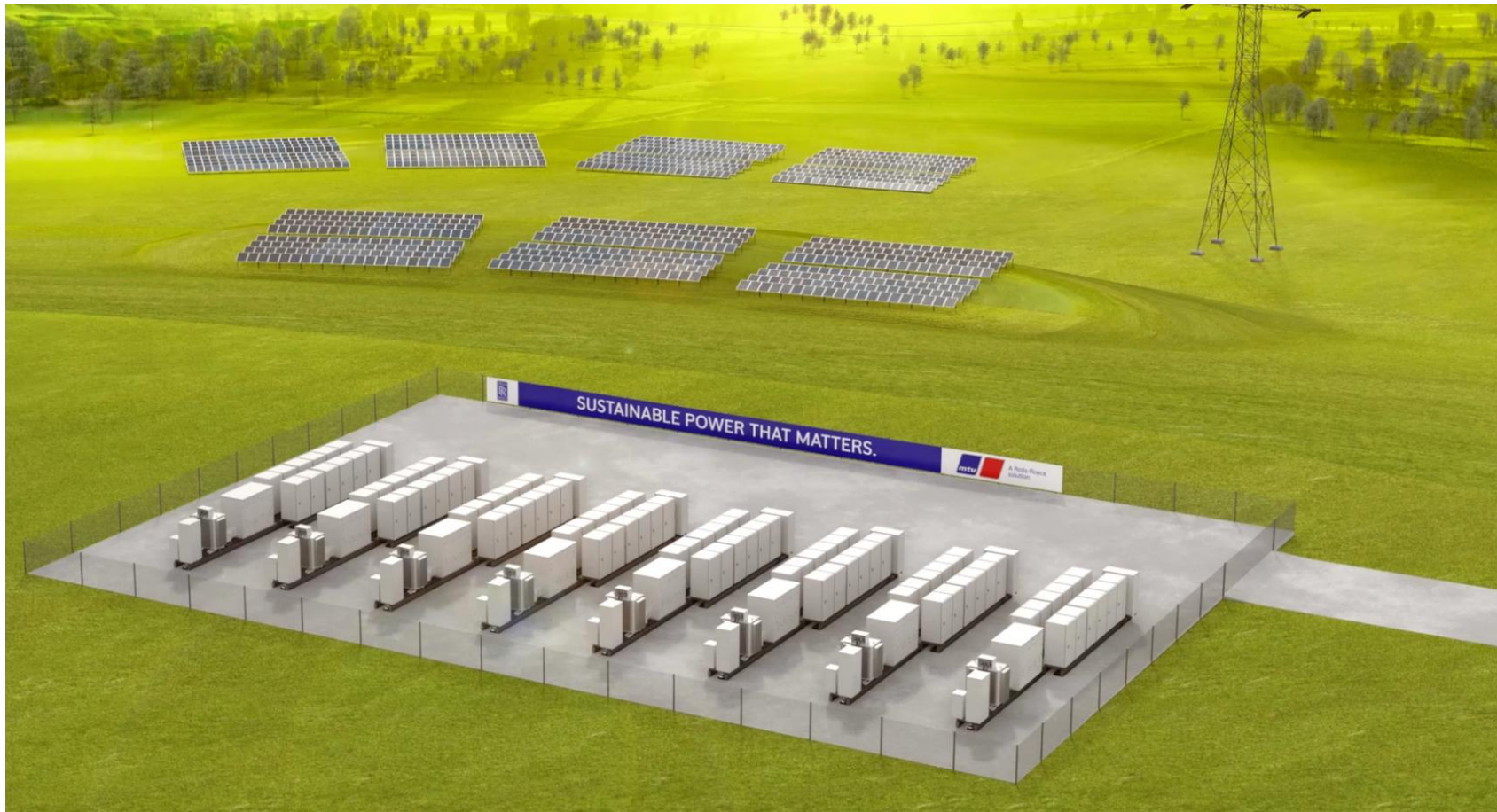


Environmental conditions

Temperature range, humidity, noise limits, fire safety and civil constraints

05 SUMMARY

SUMMARY | KEY TAKEAWAYS FROM A UTILITY-SCALE BESS PROJECT



Utility-Scale BESS are critical for modern power systems

Engineering complexity goes far beyond the battery itself

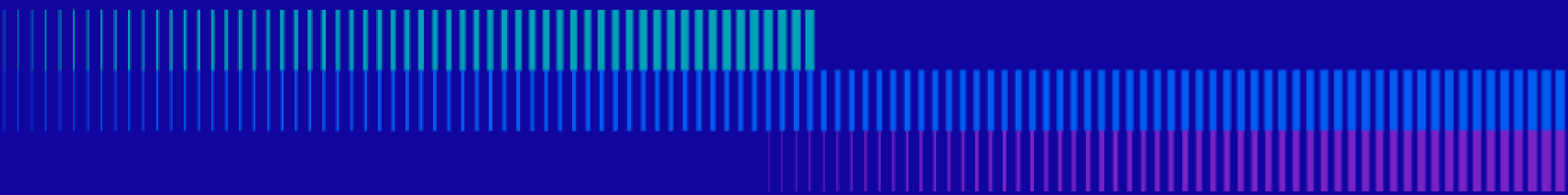
Every project is highly site- and country-specific

Turnkey integration creates value



06

Q&A



The information in this document is proprietary and confidential to Rolls-Royce and is available to authorized recipients only – copying and onward distribution is prohibited other than for the purpose for which it was made available.