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Battery Storage: Accelerating Germany's Transition to Renewable Energy

Significant storage capacities are necessary to unlock the full potential of renewables — offering a great opportunity for infrastructure investors.

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Renewable Energy: A Growing Trend

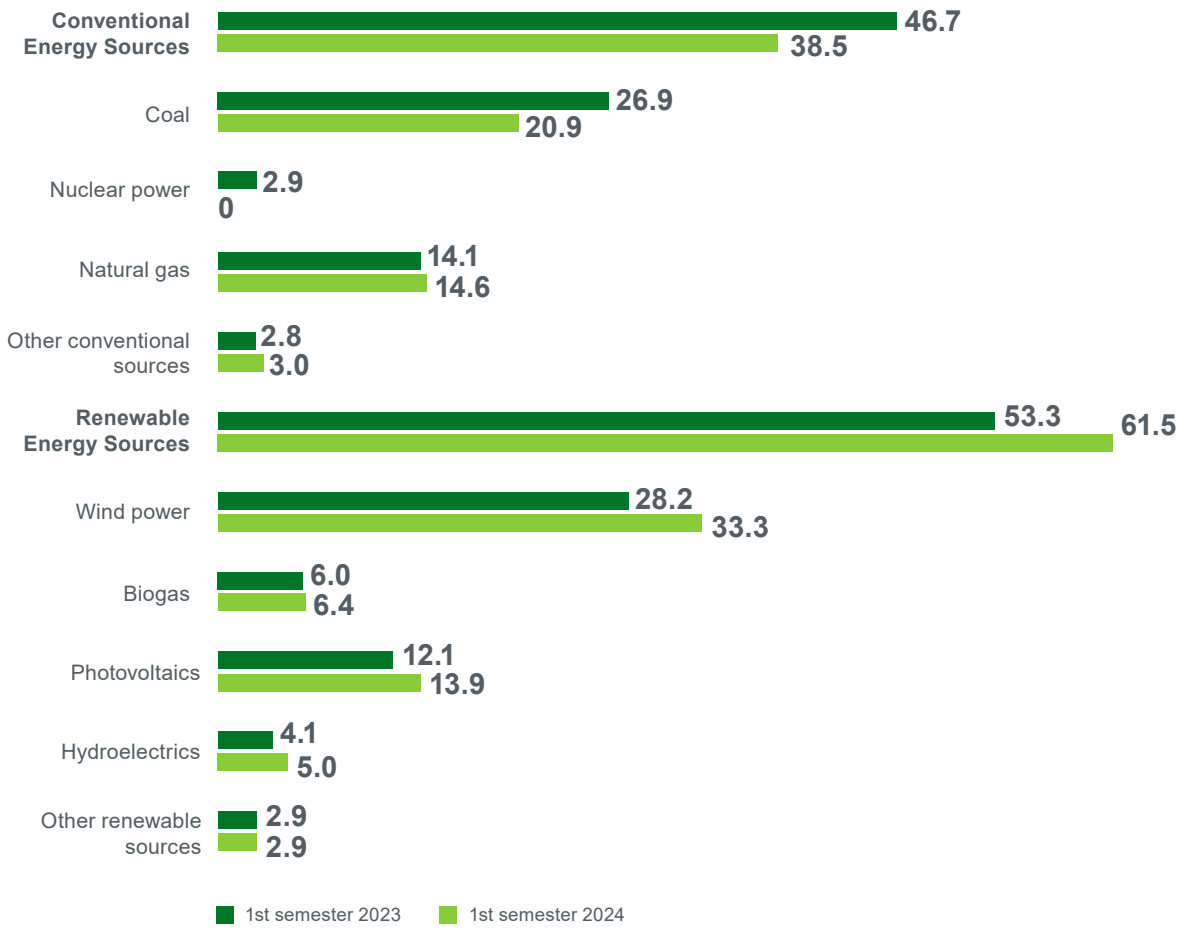
Germany is making progress in its transition to renewable energy: In the first half of 2024, 61.5% of electricity was generated from renewable sources, according to the Federal Statistical Office. In the same period of the previous year, the figure was 53.3%.

This upward trend is likely to continue, especially since solar energy is expanding more rapidly thanks to accelerated approval processes. According to the Federal Network Agency, photovoltaic systems with a total capacity of 7.6 gigawatts (GW) were commissioned in the first half of this year alone.

However, renewable energies come with a catch: Due to a lack of storage capacity, Germany cannot fully leverage the potential that solar energy offers. During sunny and windy phases, wind and solar park operators have to throttle or even shut down their systems repeatedly to avoid overloading the power grids. This resulted in redispatch costs of €3.1 billion in 2023.

A successful energy transition will require a variety of storage systems to absorb electricity during peak times and release it when needed — for example in the evening and at night. Large battery storage systems are a particularly interesting solution because they are environmentally friendly, efficient, and profitable.

Power Supply by Conventional and Renewable Sources (%)



Source: Federal Statistical Office (Destatis), 2024

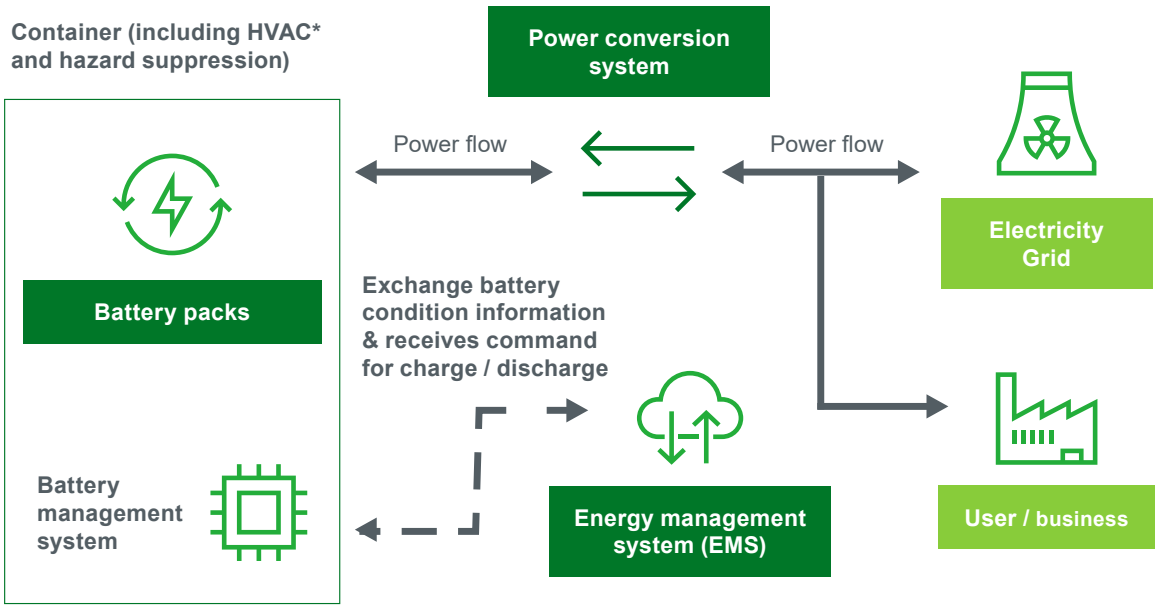
BESS Optimisation and Revenue Growth Through AI

Currently, most large battery systems (Battery Energy Storage Systems, or BESS) are powered by lithium-ion batteries. Such batteries are favoured especially due to their long life cycle and simple operation. Furthermore, alternative battery technologies are still in development and therefore not yet ready for market launch.

In addition to battery packs, BESS consist of two other main components: an energy conversion system and an energy management system, which monitors the power flow and the battery's temperature.

Since each component can be controlled remotely, the batteries can be charged and discharged at optimal times. System optimisation often occurs with the help of artificial intelligence (AI), which reacts to changes in weather and price fluctuations in real time.

Overview of the Battery Energy Storage Systems



Source: Jefferies, Latham & Watkins Tactical Opportunities Analysis
* Heating, Ventilation, and Air Conditioning (HVAC)

System optimisation frequently uses AI, which can produce real-time energy strategies that maximise potential revenue gains.

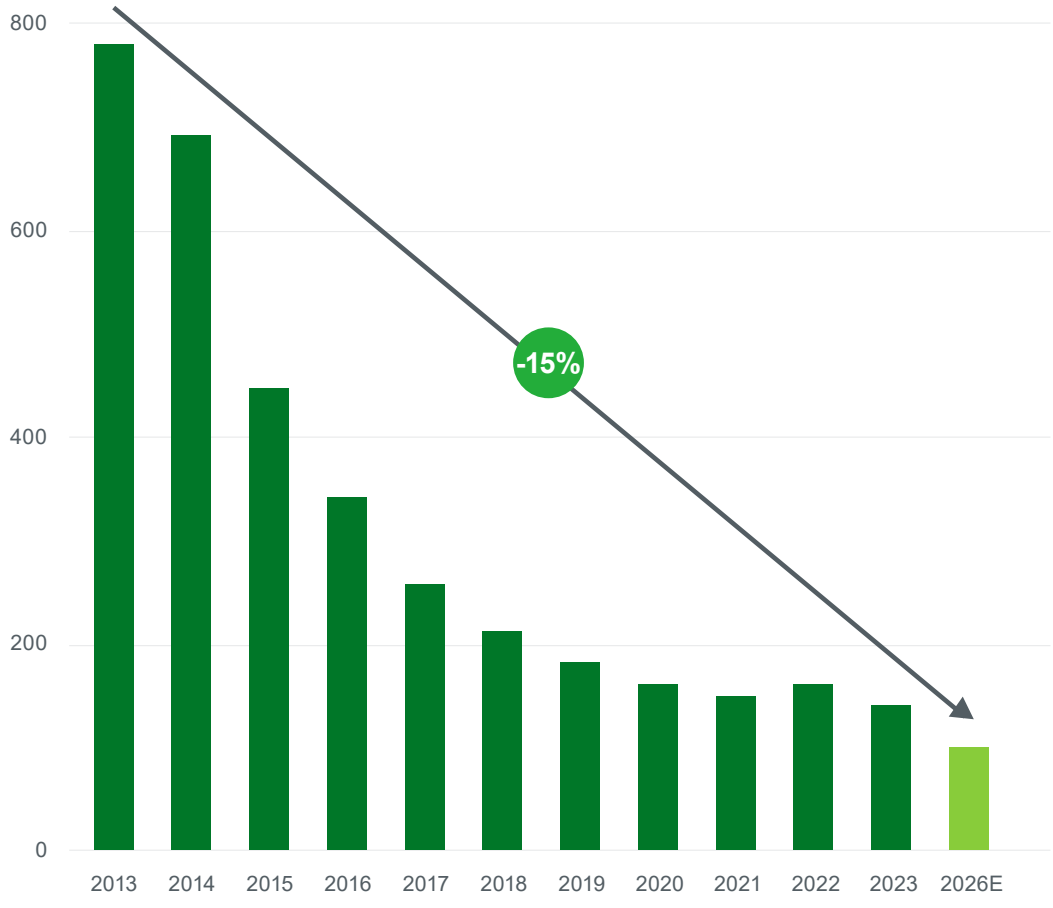
Global Market Rates for Lithium-Ion Batteries Continue to Hit Record Lows

Following a brief interruption due to global supply chain problems, the downward trend in battery prices continued in 2023, reaching a record low of US$139 per kWh. In comparison, the cost was more than five times higher a decade ago.

Experts predict a further decline to around US$100 per kWh — mainly due to increasing production capacities and falling component and raw material prices. However, prices in Europe could rise further than the global average, since the continent is creating dedicated local production capacities. Therefore, cost advantages from global supply chains may not come into play.

Average Prices for Lithium-Ion Battery Packs

Volume-Weighted Average in US$/kWh



Source: Benchmark Mineral Intelligence, Jefferies, Latham & Watkins Tactical Opportunities Analysis
Note: Latest data available.

Value Creation and Profitability: Output, Charge Cycles, and Location Are Crucial

Output: Large batteries primarily differ in the power output they can deliver. Most operational systems generate less than 100 megawatts (MW). However, increasingly larger systems are being built, some in the gigawatt range.

Charge Cycles: Another key question is how long batteries take to charge and discharge. Batteries can usually discharge their power for up to two hours per cycle. For example, a 20-MW battery can continuously discharge 20 MW for two hours. Longer periods can be achieved by installing additional battery cells.

Location: Finding the right geographical location for storage systems is crucial. Particularly important factors include cost-effective grid connections and minimal power losses during transmission. Technical uncertainties, ESG risks, and regional electricity pricing models must also be considered.

Revenue Sources: Operators can sell electricity units on the traditional wholesale market or through an exchange. They can generate additional revenue by offering so-called “ancillary services”, such as providing storage capacity for grid stabilisation. Emergency power supply could play a more significant role in the future, as Germany aims to establish a “capacity market” to ensure security of supply even during prolonged periods of low renewable energy production.

Market Framework Overview

Years → Hours → Minutes → Seconds

Capacity Market	Wholesale Market (Trading)	Balancing Mechanism (Trading)
Ensures national security of supply by procuring a sufficient level of capacity to meet peak electricity demand.	Provides a platform to buy and sell power to meet demand.	Ensures balance is maintained in the power system in each trading interval.
		Ancillary Services
		Maintains operational grid requirements.

Source: Jefferies, Latham & Watkins Tactical Opportunities Analysis

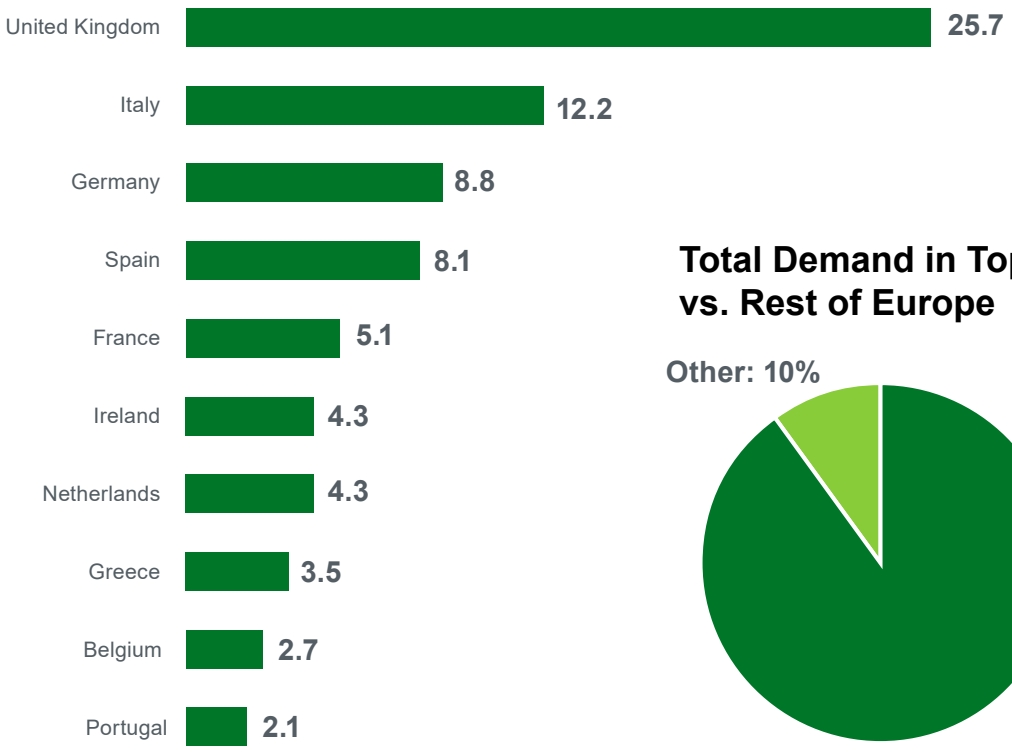
Project Pipeline: Numerous Battery Storage Projects Planned in Europe

In the coming years, numerous large battery projects will be commissioned in key European countries. The United Kingdom has the largest pipeline, followed by Italy, Germany, and Spain.

Germany will likely add many more projects in the coming months, as the federal government increasingly focuses on storage solutions. In December 2023, the Federal Ministry for Economic Affairs and Climate Action (BMWK) published its “Power Storage Strategy” to accelerate the development of new capacities.

Top 10 European Grid-Scale Energy Storage Markets

New Capacity, 2022-31 (GWh)



Source: Wood Mackenzie, Latham & Watkins Tactical Opportunities Analysis
Note: Latest data available.

How the EU Will Improve the Framework for Battery Storage Projects

At the EU level, additional storage is also high on the agenda. Below is an overview of directives and regulations aimed at promoting development:

EU Net-Zero Industry Act (Regulation 2024/1735): This regulation aims to expand and increase the production of clean technologies in the EU. Key technologies promoted by the law (Net Zero Technologies) include batteries and energy storage.

EU Critical Raw Materials Act (Regulation 2024/1254): This regulation aims to ensure a secure and sustainable supply of critical raw materials in the EU, including lithium. This is an important factor for expanding local battery production.

"Fit for 55" in 2030: This legislative package aims to advance the EU's climate, energy, land use, transport, and tax policies to achieve its target of reducing greenhouse gas emissions by at least 55% by 2030, compared to 1990 levels.

Renewable Energy Directive III (Directive 2023/2413): As part of the "Fit for 55" package, the RED III directive establishes "renewable energy acceleration areas" featuring reduced legal requirements and simplified approval procedures. The directive also clarifies that the public has an overriding interest in storage.

EU Battery Regulation (Directive 2023/1542): The new regulation for batteries and used batteries covers the entire life cycle and aims to strengthen innovation, growth, and supply chains in the European battery industry. The new regulation also increases regulatory challenges in some areas, such as supply chains.

Summary

Large Battery Projects: Opportunities for Infrastructure Investors

Demand: The increasing market share of renewable energies automatically leads to a growing need for storage capacity.

Regulation: New EU regulations are likely to improve the regulatory framework.

Returns: The business model — buying electricity at low prices and selling it at higher prices — promises attractive and long-term stable returns.

Risk Management: Investments in storage secure the future of new and existing wind and solar park projects, as these investments encourage leveraging the full potential of renewables.

Impact: In addition to financial returns, large battery projects also generate immaterial returns, as these storage systems accelerate the energy transition and contribute to reducing CO2 emissions.

Risks and challenges include the lack of transparency about the power grid layout, which makes identifying suitable sites difficult. Additionally, the processes to obtaining building permits and grid connections are still lengthy and uncertain despite the regulatory relief that has been announced.

Other hurdles include regional differences in construction cost subsidies and grid connection costs, the risk of grid charges doubling from 2029, and uncertainties regarding battery lifespan.

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