Battery Storage Funding Critical to Europe's Energy Transition

This KBRA Europe (KBRA) report examines current funding methods for battery storage in mainland Europe and the UK, as well as the revenue streams and regulatory environment that underpin the sector's transactions. While there is an emerging opportunity for battery storage to become an important technology in Europe's renewable energy transition, the financial community faces challenges in funding the sector, and there are uncertainties regarding how it can achieve the requisite scale to meet its full potential.

In our view, there is a need for greater collaboration between sponsors developing the batteries, regulators and national policymakers setting renewable targets, and the financing community funding development. This cooperation is necessary for battery storage to be maximally useful amid profound shifts in how Europe and the UK source energy.

Key Takeaways

- Battery storage is set to come into focus given government requirements to keep up with renewable energy and energy security ambitions, especially given headwinds stemming from the Ukraine-Russia conflict.
- Funding techniques vary, but most battery storage transactions are funded on a short-term basis, taking into account corporate risk rather than on a pure stand-alone, nonrecourse basis.
- Regulation has a role in bridging the gap between inherent merchant exposure and long-term lenders' needs for predictable cash flows.
- Achieving scale for battery storage will likely require a greater diversity of funding including from long-term nonrecourse bank, institutional, and capital market funding.

Battery Storage Key to Support Energy Transition

As traditional utility-scale renewables such as wind and solar represent an increasing portion of the energy mix, the importance of battery storage—storing excess energy and discharging it during peak times—has never been greater. Further, given today's geopolitical and economic climate, there is heightened uncertainty around supply security and higher gas prices. This could accelerate the reliance on renewables and lead to more urgent actions to ensure sufficient storage is available. For many in the market, the Russia-Ukraine war has created a window of opportunity that could catalyze the energy transition, spurring the government to support newer technologies such as battery storage.

According to the International Energy Agency (IEA), global battery storage capacity as of 2021 was 4GW-8GW. Factoring in renewable targets, the IEA expects battery storage capacity will need to increase to 148GW by 2025 and 585GW by 2030. Current battery storage capacity covers 1% to 2% of new wind and solar non-dispatchable capacity that is being brought online every year. To keep up with the amount of renewables currently coming online, the market would need to reach about 100GW, according to experts.

While renewable energy generation has various storage alternatives (e.g. pumped hydro and hydrogen), battery storage stands out as a key contender in terms of opportunity to scale up and provide a substitute for fossil fuel-based storage terminals. This is in the context of Europe and the UK seeking not only short-term avenues for curtailing reliance on Russian energy, but also longer-term and broader methods of reducing reliance on fossil fuels (including gas imports). That said, although many market commentators have highlighted the bright prospects for battery storage, KBRA notes a number of challenges, including:

- A revenue profile that is typically unpredictable and exposed to fluctuation in market price and demand.
- Regulation that fails to sufficiently incentivise the financial community, developers, and users to consider adopting battery storage on a large enough stand-alone or utility scale.
- Lack of collaboration between sponsors developing the batteries, regulators and national policymakers setting ambitious renewable targets, and the financing community.

Battery Storage Funding

KBRA has observed an important distinction in the funding tools for battery storage depending on whether batteries are being funded on a stand-alone basis or as part of a portfolio, versus those that are part of hybrid projects (utility-scale solar or wind combined with battery storage). In our view, the funding tool deployed has been largely predicated on the nature of the revenue streams that underpin operations. For example, short-term revenues generated by single assets or portfolios of assets that are volatile and fully exposed to price and grid market conditions have been mostly funded on the basis of the corporate risk of the sponsor. The funding for these has broadly originated from private equity firms specialising in nascent renewable technologies as well as banks with a dedicated exposure limit for such assets. In contrast, hybrids—which have attracted long-term offtake arrangements via commercial power purchase agreements (PPA) with creditworthy counterparties, and which have more predictable revenue streams—have recently

emerged and are being funded on a nonrecourse project finance basis. Hybrids have therefore invited support from institutional debt and debt capital markets as well as nonrecourse bank funding.

Corporate Funding

Currently, stand-alone battery storage or portfolios of battery storage assets derive their revenues through three principal means:

- Arbitrage: This method entails buying power when wholesale prices are low, storing it, and releasing it during periods of high demand. Arbitrage traders can also profit by taking positions on how often peaks and troughs occur on a particular grid, thereby enabling margins to be made on trading that draws on volatility over a day or a certain number of hours.
- Ancillary services: These refer to additional functions that help grid operators maintain a reliable electrical system by maintaining flow and direction, addressing imbalances between supply and demand, and helping the system to recover in the event of a power system event. These services are typically classified into one of three categories: frequency control, network control, and system restart.
- Firm Capacity: This is the ability to provide reliable capacity to meet peak system demand, typically remunerated through capacity markets or resource adequacy (RA) payments.

Although it varies depending on the type of transaction, we understand that ancillary services represent the bulk of revenues generated by battery storage transactions in the UK and Europe, while arbitrage forms only a small percentage. The principal counterparty in each case is typically the independent service operator (ISO), which is responsible for grid operation.

A key characteristic of current stand-alone battery or portfolio storage revenue streams is that they are volatile and exposed to a high degree of price and supply/demand risk. Broadly speaking, the variability and uncertainty associated with wind and solar energy generation drive a need for various ancillary services, which ultimately affects the scheduling and pricing of those services. Even when considering firm capacity-based revenues such as RA, these revenue streams are notably limited by their relatively short terms and the lack of standardisation regarding how charging is treated.

As a result of the revenue uncertainty, banks with appetite for such exposure along with private equity firms have provided most of the funding to date. Funding is often equity-like with shorter terms (around three to five years). Further, private equity firms and banks have sometimes required corporate guarantees from sponsors to mitigate revenue volatility.

The reliance on battery owners' trading expertise—as well as their ability to accurately call the market and understand how different grid conditions may evolve on an hour-to-hour, day-to-day, and month-to-month basis—add to the complexity and the corporate risk features of such transactions. Furthermore, assessment of effective risk management policies, and in some cases the reliance on corporate guarantees, accentuates the corporate-like nature of such financings. Risk considerations for funding such transactions is similar in some respect to risks associated with lending to a physical commodity trader, where the lender/investor is largely reliant on the financial discipline and experience of owners (and their trading team) rather than merely looking at underlying cash flows from the battery activities to assess the funding risk.

Nonrecourse (Project Finance/Infrastructure) Funding

While long-term institutional debt funding of stand-alone and portfolio battery storage transactions has been relatively limited, there is a growing appetite for long-term nonrecourse debt funding of hybrids, which benefit from 20- or 30-year PPA offtake terms.

While KBRA sees the unpredictable short-term and volatile nature of the revenue sources (given how battery storage is currently being used) as the largest obstacle to long-term institutional debt funding, there are additional limiting factors in this regard.

These include the lack of regulatory support, battery life uncertainty and obsolescence risk, and uncertainty around general degradation effects and augmentation requirements. While lithium-ion systems (that have one-, two-, and four-hour battery durations) are becoming established as a principal storage technology, other technologies may well emerge, adding to uncertainty surrounding future revenue-generating capability, particularly in the absence of long-term revenue-generating contracts.

Hybrid transactions have provided a degree of revenue certainty by incorporating remuneration terms that are availability based with fixed prices, so long as certain operating key performance indicators (KPIs) are met. For example, these KPIs can measure the battery's ability to reduce moment-to-moment variations in total energy output over the life of the PPA. Importantly, these contracts mitigate a material amount of credit risk—whether it be from market risk, future regulatory uncertainty, or obsolescence—because payments will be received over the term of the PPA, so long as the KPIs are satisfied.

Lessons From Other Renewable Technologies and Regulations

Since 2019, the key development in the UK and broader European battery storage sector has been the introduction of battery storage into capacity market auctions.

The UK's T-4 Capacity Market auction awarded 1,093MW of battery storage contracts in February. Around 60% of battery storage had a two-hour or longer duration, similar to the UK T-4 2024-25 results (storage duration is the amount of time storage can discharge at its power capacity before depleting its energy capacity). Previous UK capacity auction results have been dominated by one-hour duration batteries. This is partially due to the treatment of longer-duration projects in the capacity market but also reflected in the access to other services available for battery storage to participate in.

Battery storage providers were allowed to benefit from 15-year contracts with National Grid, with battery storage entry beginning in 2025-26. The auction cleared at a record high price of GBP30.59/kW ($41.03/kW) per year, largely due to the decommissioning of old assets and higher capacity needs. In Italy, grid operator Terna recently awarded 1.1GW to new-build energy storage facilities at a price of EUR70/MW ($78.47/MW) per year. The success in recent capacity market auctions in Italy and the UK, as well as other European countries that are building large-scale battery energy storage systems (BESS) projects, signals that the European and UK regulatory environment is providing a degree of limited support to the technology.

While fixed-capacity payments over a 15-year horizon can add visibility and predictability to revenue streams from large-scale battery projects, these revenue streams notably remain a fraction of their overall revenue-generating profile. Other revenue streams highlighted earlier (such as ancillary services and arbitrage) remain dominant, leading to ongoing overall volatility in earnings streams for such batteries over the long term.

Despite these positive developments, there is a notable absence in the UK and Europe of regulatory support for battery storage on the scale, size, and form of subsidies for traditional renewables (wind and solar) in the past two decades. For example, feed-in tariffs played a pivotal role in accelerating utility-scale traditional renewable energy projects. Renewable support schemes and indirect penalties and costs also helped drive development. As an example, contracts for differences (CfD) have been important in providing stability to the revenue profile of renewable transactions, making them more attractive to lenders from a credit quality standpoint.

In the absence of such support, and given that capacity market-based revenues are relatively limited in scope and do not typically eliminate full exposure to revenue volatility, KBRA expects attention to also turn towards the ability of commercial revenue contracts (including PPAs) to mitigate market risk in battery storage use.

Potential Funding Models

In addressing the question of what constitutes an appropriate funding model, it is important to consider aspects such as how the batteries are being used; whether the battery storage asset is stand-alone, part of a portfolio, or hybrid; whether multiple revenue streams or a single main revenue stream is being contemplated; and regulatory/national government policy targets.

We understand battery storage investors and equity funders appreciate their flexibility of use and the potential to generate diverse revenue streams, including those generated from utilising the same battery assets on multiple grids. The battery storage sponsors benefit from the potential for revenue stacking from these diverse streams that can help improve potential returns, while equity sponsors and specialised bank lenders are comfortable with the risk-return profile that is achieved, which they consider commensurate with the risk being taken.

As things currently stand, the battery storage market remains characterised by a small number of transactions with short tenors funded by a narrow pool of specialised funders, with a notable absence of large-scale, long-term debt institutional capital.

KBRA recognises that there is unlikely to be a one-size-fits-all approach in terms of the relevant funding strategy for debt or equity. However, as the technology develops and sponsors become more experienced in the services available, the average size of utility-scale storage sites has increased. For example, in the UK the average grid-scale battery project size grew to more than 45MW in 2021 from 6MW in 2017. In 2021, the majority of sites installed were stand-alone, and seven out of the 10 key projects completed were 49.9MW. Larger stand-alone projects may become a trend in terms of future installations.

As the size of transactions increases, and as renewable energy targets spur growth in battery storage technology, alternative funding to equity in the form of nonrecourse long-term debt finance from the private sector may increasingly be considered. This will be particularly important to the extent that governments and regulators are unwilling to provide direct funding support to the sector.

Conclusion

KBRA expects to see more innovation in battery storage financing to capitalise on the window of opportunity that has been created as a result of geopolitical conditions surrounding the Russia-Ukraine war and the ambitious energy transition goals set by the European Union and UK. Today, the amount of battery storage capacity added is struggling to keep pace with the incremental penetration of traditional renewables on national grids in the EU and UK. This is impacting the ability of batteries to fully utilise their potential in terms of grid rebalancing as opposed to being a back-up power source.

There is no singularly fitting approach in terms of appropriate funding arrangements, as it depends on how the batteries are used as well as whether the arrangement forms part of a hybrid transaction that involves long-term offtake contract underpinnings.

Regulatory support, by way of capacity market auctions, is being provided on a limited basis to help address revenue volatility, although most battery storage transactions in the UK and Europe continue to be funded with high levels of merchant risk exposure.

In KBRA's view, the battery storage sector may struggle to sufficiently grow enough to match the speed at which renewable technology is dominating national grids in the absence of a wide range of funding tools, including long-term, fixed-rate nonrecourse institutional project finance and debt capital market funding. These forms of financing were critical in allowing traditional renewables to gather pace, in tandem with supportive regulation. We believe that for the battery storage sector to expand quickly and to an appropriate scale, it will require a broader range of funding, as well as supportive regulation, which can create a more predictable long-term revenue profile. Stakeholders from all angles must work together for battery storage to fully aid in Europe's energy transition.

Contacts

Gordon Kerr, Head of European Research
+44 20 8148 1020
gordon.kerr@kbra.com

Karim Nassif, Director, Project Finance & Infrastructure
+353 1 588 1245
karim.nassif@kbra.com

Garret Tynan, European Head of Project Finance & Infrastructure
+353 1 588 1235
garret.tynan@kbra.com

Andrew Giudici, Global Head of Corporate, Project, and Infrastructure Finance
+1 646-731-2372
andrew.giudici@kbra.com

Related Reports

- Demand for Environmentally Friendly European Power Assets Risks Weakening Credit Profiles
- The Coming Charge: Energy Storage Impacts on Project and Corporate Credit Quality
- Diminishing Russian Carbon Reliance: Funding the Household Renewable Energy Transition in Europe