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Insights

A SHORT INTRODUCTION TO BESS PROJECTS IN GREAT BRITAIN

ENERGY TRANSITION: OPPORTUNITY AND OBSTACLES IN BATTERY STORAGE

Sep 30, 2024

SUMMARY

In a new series of articles we will explore:

- what BESS is;
- why it is needed/what drives investment in BESS;
- key regulatory considerations for BESS;
- the structure and financing of BESS projects;
- the nature of revenues available to BESS projects, including revenue stacking and route to market agreements (RTMAs); and
- the future development of BESS.

What is BESS?

Battery storage or "BESS" (Battery Energy Storage Systems) projects are electrochemical infrastructure assets that allow energy to be stored and released on demand, and most of these projects are Lithium-Ion batteries (the vast majority of new BESS projects are currently lithium iron phosphate (LFP) and some are lithium nickel manganese cobalt (NMC) - there is likely to be technological developments in the future, but for the foreseeable future Lithium-Ion will be the dominant technology). There are other forms of energy storage, but currently these are largely either early stage and not in development on a significant commercial scale (e.g. heat storage or hydrogen) or are largely (but not solely) existing assets with relatively limited expected further deployment in contrast to BESS projects (e.g. pumped hydro). When referring to BESS projects, these are inherently "grid scale" projects – not individual mobile phones or electric vehicle batteries (which use similar technology) but battery systems on a commercial scale and charging/discharging electricity onto the local distribution or transmission network. In this series of articles we will concentrate on batteries, though we will briefly discuss other forms of energy storage where relevant.

BESS project metrics

BESS projects are often referred to by their "size", for example "300 MW/624 MWh":

- Megawatts or "MW" is a metric of the maximum amount of energy that can be imported or exported by the battery at any point in time (often referred to as the "power" or "rated power" of the battery); and
- Megawatt-hours or "MWh" is a metric of the maximum energy capacity that the battery can hold (sometimes referred to as the "rated power capacity").

These metrics may determine the suitability of the project for any particular use – a higher power to energy ratio may suggest a battery appropriate for use where a large amount of power needs to be discharged/charged in a short period of time, such as with frequency regulation services (see further below). "Duration" is generally taken to be the amount of time that the battery can discharge/charge at its maximum power. "State of charge" expresses the amount of capacity remaining in the battery at the relevant time.

Why are BESS projects needed, and what drives the deployment of BESS?

From a macro-scale, BESS projects are needed to support meeting net zero obligations. In contrast to conventional/fossil-fuel based power generation infrastructure, some renewable generation technologies (such as solar and wind) are inherently "intermittent" – if the sun doesn't shine or the wind doesn't blow then there is an adverse impact on energy generation volumes. Conversely, in sunny periods or where there are windy conditions these technologies generate large amounts of energy. BESS projects provide both a "technical" and a "market" solution to issues raised by this intermittency.

From a "technical" perspective, the Great Britain electricity grid is designed to operate at a 50 Hz frequency (i.e. alternating current oscillating between positive and negative voltage fifty times every second). The frequency is impacted by the balance of demand and supply of electricity on the electricity grid – if generation is less than demand frequency will drop and, conversely, if generation is greater than demand it will rise. If this frequency isn't maintained then electricity grid infrastructure may be damaged, and blackouts may occur. Under its operating licence National Grid, as the Electricity System Operator or "ESO" for Great Britain[1](Northern Ireland is on a separate electricity grid to the remainder of the United Kingdom), is required to maintain the frequency within 1% of the 50 Hz target (i.e. within 0.5 Hz), whilst operationally the ESO targets a frequency within 0.2 Hz of that 50 Hz target. As such, batteries can help the ESO regulate grid frequency by charging from the electricity grid or discharging to the electricity grid accordingly, or by providing a standby capacity to do so (these actions are discussed in detail in our later article on revenue stacking). From a technical perspective, batteries can help promote grid stability through providing balancing and ancillary services – and can generate revenue by doing so. Batteries, with fast response times, are well-suited to grid stabilisation requirements, as they can both charge from the electricity grid (creating demand) and discharge to the electricity grid (creating supply).

From a "market" perspective, intermittent renewables provide revenue generation opportunities not only from providing services to the electricity grid/ESO, but also from electricity price arbitrage. In a simple arbitrage scenario, electricity is bought when there is lower demand and/or higher supply and the price of electricity is lower (or may even be negative) and sold when the price of electricity is higher – the "arbitrage" and profit being the difference between the purchase and sale prices of the electricity charged then discharged by the battery. This revenue stream therefore benefits from electricity price volatility, and that volatility is increased by the intermittency of renewables. In theory (at least), as renewable energy generation increases, price volatility increases and BESS projects can take advantage of the arbitrage opportunity presented by this volatility. The revenue that is 'stacked' by a BESS project to make that project viable/investable is, in practice, likely to be much more complicated and we discuss revenue stacking in further detail in our next article.

It is also worth noting that as well as providing balancing and ancillary services to the electricity grid/ESO, and generating revenue through arbitrage, the electricity storage provider could also generate revenue by "leasing" the battery to another party. Such leasing generally occurs under a tolling agreement and by undertaking such an arrangement the electricity storage provider removes market risk for the period of the lease, both foregoing revenue upside and avoiding downside risk – effectively hedging its revenues. Not only might this potentially be an advantageous position for the electricity storage provider (as a 'bet' on what future revenues it may be foregoing during the period), reducing marginal cost of the battery (for example, not having to pay fees to an optimiser[2]) and, subject to the length of the tolling arrangement, providing a fixed income stream capable of being financed through leverage. Such tolling arrangements may be advantageous to electricity suppliers (as the electricity storage provider's counterparty) in helping them avoid balancing and "use of system" charges through balancing their own generating asset portfolios (as well as providing them with the revenues from providing services to the electricity grid/ESO and from arbitrage).

What are the key regulatory considerations for BESS projects in the UK?

From an electricity licencing perspective, the Energy Act 2023 introduced material changes to the treatment of electricity storage for licencing purposes, introducing a specific definition of "electricity storage" into the Electricity Act 1989 (by reference to the conversion of electricity into energy for storage and future reconversion). Electricity storage is therefore a subset of generation for electricity licencing purposes and in this context an electricity storage provider must obtain a generation licence unless an exemption applies.

The key exemption to consider is the Class A "small generator" exemption whereby if a project has rated power of 10 MW or less or rated power of 50 MW or less where the generating asset has a declared net capacity of less than 100 MW. If the project does not qualify for an exemption then the electricity storage provider must comply with the relevant electricity network industry codes (the Grid Code, Distribution Code, Balancing and Settlement Code and Connection and Use of System Code).

From a planning permission perspective, grid scale BESS projects require planning permission and consent from the local planning authority pursuant to the Town and Country Planning Act 1990 (as amended, the "**TCPA 1990**") regardless of the capacity of the project. Statutory instruments have removed BESS projects from the development consent order regime for Nationally Significant Infrastructure Projects (NSIPs) regime.[3]

What project documents make up the contractual structure of a project-financed BESS project in Great Britain?

BESS projects are in many ways similar to other renewable energy projects. A BESS project company (generally incorporated as a 'clean', newly incorporated SPV entity with no existing trading history or liabilities other than in respect of the BESS project) will need to acquire land rights via a lease, and that lease will cover the anticipated project lifetime, and there may be an option put in place on these land rights conditional on acquiring necessary consents and authorisations (for example, planning permission); land rights in respect of access to the relevant site may also be a material consideration if the relevant site does not abut a public highway, and in respect of any land rights agreement the (lack of) ability of the counterparty to terminate the relevant agreements on a no-fault basis will be a material consideration. An accepted grid connection offer (for distribution network-connected assets there will be a split between "non-contestable" works – which must be undertaken by the distribution network operator – and "contestable" works, which may be undertaken by accredited third parties) will also be required and, upon project commissioning, a grid connection agreement.

There will also be EPC (energy, procurement and construction) and O&M (operations and maintenance) contracts (which, subject to the specific project may be addressed, at least partially or contingently, under a long-term service agreement ("LTSA") from the battery equipment supplier. The EPC contract would ideally be a fixed price turnkey contract and will require appropriate liquidated damages provisions and liability caps negotiated with the EPC contractor. Again with the O&M contract(s), sponsors would ideally achieve long-term O&M contracts with fixed or indexed costs, limited opportunity for re-opening the price and appropriate liability caps. Similar to solar projects, significant reliance is placed on the warranty provided by the battery equipment supplier which generally warrant freedom from manufacturing defects and minimum performance standards (subject to compliance with certain conditions, such as environmental, operating and maintenance conditions). The terms and duration of the warranty are important both from a revenue perspective (subject to overriding economic incentives, the operation of the battery may be limited by the conditions attaching to the warranty – such as limiting the number of charging/discharging cycles in a given period of time and depth of discharge - whilst the creditworthiness of the battery equipment supplier/warranty provider will also be a key consideration.

The energy storage provider will also need appropriate insurance arrangements, but otherwise the key consideration is the revenue (!) – the equivalent of an offtake/revenue agreement, often known as a "route to market agreement" ("RTMA") or "optimisation agreement". There are a number of key considerations with these types of revenue agreement including counterparty creditworthiness, counterparty liability caps and whether there is a "floor" in the revenue generated under the revenue agreement. We consider RTMAs/optimisation agreements in greater detail in our next article.

Why is geography important to BESS?

No two BESS projects are alike, and the Great Britain electricity grid is not a "single" entity with unrestricted transmission of electricity across it. Their geographic location, as well as their size, may have a significant impact on a BESS project's revenue potential and the methods by which it generates revenue. The Great Britain electricity grid has physical limitations on capacity to transmit energy (creating "boundaries"), and this creates bottlenecks in the Great Britain electricity grid and such constraints enable BESS projects generating revenue from charging from the electricity grid in Northern Scotland (with large amounts of offshore wind generation transmitting on shore) and generating revenue from providing supply in Southern England where electricity demand exceeds supply.

It is also worth mentioning the concepts of "behind the meter" (BTM) and "in front of the meter" (FTM) – "independent" BESS projects (i.e. those not "co-located" with other generation assets, such as commonly with solar and sometimes with wind generation) are in front of the meter whereas co-located projects are behind the meter.[4] Co-located projects may allow intermittent generation projects to generate higher revenues by charging from the generation when electricity prices are lower and discharging when electricity prices are higher, thereby increasing revenue for the project - though the BESS project and intermittent generation are likely to share a connection to the electricity grid (to which the generation has priority) so the additional revenue that can be generated by the battery is partially constrained.

Conclusion

Above we have set out a basic introduction as to what BESS projects are, how they are structured, key regulatory considerations and the overarching characteristics of revenue in a BESS project is. Unlike with many other renewable energy projected financed projects, BESS projects often have a relatively complex revenue/offtake agreements, with the guaranteed period of these arrangements often being relatively short-term (other than in respect pf capacity market agreements) and often exposed to at least an element of market risk, as opposed to other renewable energy projects which generally have a high degree of revenue certainty through power purchase agreements (PPAs). In our next article we will explore in detail these potential revenues, revenue stacking and routes to mark/optimisation agreements.

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[1] This is shortly to become the National Electricity Systems Operator (NESO) – initially the NESO will take over the ESO's responsibilities with a view to in future expanding to a wider strategic role overseeing the future electricity grid.

[2] Optimising being third parties paid (and/or taking a percentage of profits to maximise battery revenues – we will discuss optimisation further in future articles.

[3] In Scotland BESS projects with a capacity over 50 MW require consent from Scottish ministers.

[4] The meter being, in simple (and perhaps overly reductive) terms, the point at which the electricity leaves the BESS project.

RELATED CAPABILITIES

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