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Trinity Topics:

# Financing Battery Storage in Emerging Markets


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Trinity Topics

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# Financing Battery Storage in Emerging Markets

With countries across the globe facing ambitious clean energy targets, and the proliferation of intermittent renewable power generation, it is perhaps no surprise that energy storage systems are fast becoming an essential component in the development of energy markets worldwide.

Energy storage systems not only have the ability to "smooth-out" the supply of energy from renewable sources, and assist in balancing the supply and demand of energy, but they also have the ability to offer a variety of ancillary services (e.g. frequency control, voltage control and black start capability), which are essential in maintaining grid reliability, stability and power quality.

While there has been a rapid increase in the development of battery storage projects over the last few years, fuelled to a large extent by advancements in battery storage technology, as well as significant reductions in the cost of this technology, "*these projects have mostly been commissioned in developed countries, despite it being clear that batteries can deliver substantial benefits in less developed countries*"[1].

In this article we consider the reasons why this is the case, as well as certain key issues when developing and financing battery storage projects in emerging markets.

[1] Source: Guidelines to implement battery energy storage systems under public-private partnership structures (January 2023); The World Bank Group.

## Revenue models

For the majority of existing battery storage projects in developed markets, the only way to achieve economically viable revenue streams, is by "revenue stacking" – in other words, earning revenue simultaneously from several sources using the same capacity. For example, by way of "price arbitrage" (i.e. purchasing electricity when the price is low, and selling it, or consuming it when the price is higher), at the same time as offering frequency response and other ancillary services in exchange for a fee.

In developed countries, markets often already exist for many of the services that a battery can provide. The ancillary service market in the UK, for example, has been booming, with revenues for 1 hour duration batteries soaring above 200 £/kW/yr in 2022, more than double the levels required to cover long run investment costs.[2]

In many less developed countries, these markets (including wholesale markets) simply do not exist. This creates a problem for developers looking to invest in battery storage projects in emerging markets, where there is a pressing need for the types of services that battery storage projects are able to provide, but the revenue streams required to build an economically viable base case or "revenue stack" are not easily identifiable. As a consequence, developers and their lenders are having to work from scratch, to build viable revenue models and to agree appropriate

[2] Source: https://timera-energy.com/structural-transition-in-the-uk-battery-revenue-stack/.

compensation with offtakers and, where relevant, network operators, for the services that battery storage projects are able to provide.

## Use case

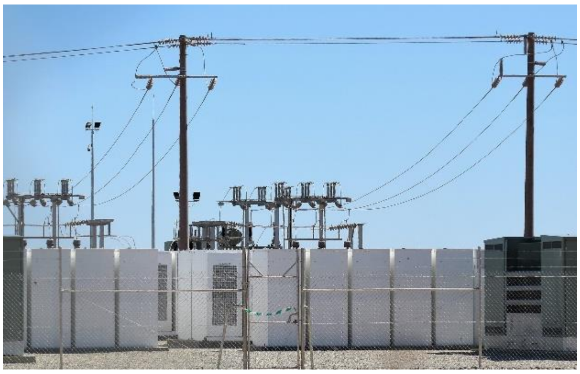
Before any commercial agreement can be reached in respect of revenues (and associated tariff) of a battery storage project, it is necessary to determine the intended use case – i.e. why does the utility or government want a battery storage element in the relevant project?

It may be the case, for example, that the battery storage project is intended solely (or mainly) for "load-shifting" or grid stability purposes – in other words, providing energy in peak times, or when other forms of intermittent renewable energy are unavailable (e.g. at night, when there is no sunlight). One example of this is in South Africa, where we advised on one of the projects in the Risk Mitigation IPP Procurement Programme ("**RMIPPPP**"), being a large solar plus battery storage facility designed specifically to be dispatchable outside of usual daylight hours. The remit of the RMIPPPP was technology agnostic, but generation facilities were expressly required to be dispatchable from 0500 to 2130 each day, so the private sector was able to design a plant that utilised a battery storage system with this clear purpose. Other projects may focus on the provision of network and grid support services, which has been our experience to date in other emerging market countries.

It is noted that these two types of use case may be developed on a stand-alone basis, but may equally be developed as part of a hybrid project, where the battery storage project is developed and financed as part of a co-located solar, wind or other renewable power generation project. In this scenario, the intended use case of the battery might be to ensure that the renewable generator meets certain minimum technical requirements (e.g. with respect to minimum availability, or ramp rates) or is intended to assist with load shifting.

What is important is that the intended use case is clear from the outset of the project, and that appropriate technical assessments are undertaken so as to ensure that the intended use case is feasible from a technical and financial perspective. In this respect, we note that in the case of stand-alone battery projects, the proposed location of the battery on the grid may be important in determining whether it is able to provide the services that are intended to be offered – particularly where the battery storage is intended to address a particular issue such as voltage support.

In contrast with our experience in South Africa, we have seen that the intended use case for battery storage in many emerging markets can often be a secondary consideration. This is caused in part, by the fact that battery storage is often seen as an "add-on" to renewable power generation projects (and either grant funded or funded on a concessional basis), but also by the fact that the parties involved often do not have sufficient technical expertise (or the benefit of good quality technical advice), in order to fully understand the scope of functions that battery storage systems can provide.



## Tariff structure

To-date, the majority of battery storage projects developed and commissioned in emerging markets have been developed in the context of hybrid projects – largely because of the absence of a wholesale market for the sale of energy (so there is no ability to earn revenues from price arbitrage) but also because of the absence of an ancillary services market (so there is no ability to "revenue stack" or build a viable base case on a stand-alone basis).

In this hybrid context, we have a seen a variety of different forms of tariff structure. For example, we have seen structures where:

- The offtaker pays for the metered energy output of the hybrid project at a single delivery point. The battery is charged during the early hours of the morning using energy from the grid, and then discharged once a day at the start of the peak demand period (at a "neutral" or zero cost to the offtaker). In the event that the battery storage facility is discharged more frequently than set out in an agreed discharge profile (at the request of the offtaker), then a supplemental fee is paid by the offtaker. With this type of structure, the additional capex costs associated with construction of the battery storage element of the project have either been built-in to the tariff for metered energy output or funded by way of grant funding.

> *these projects have mostly been commissioned in developed countries, despite it being clear that batteries can deliver substantial benefits in less developed countries*


- The offtaker pays for metered energy output of the hybrid project but imposes certain performance requirements on the independent power project ("**IPP**") (e.g. with respect to availability or the ability to dispatch energy during certain periods). Again, with this type of structure, the additional capex costs associated with construction of the battery storage are either built-in to the tariff for metered energy output or funded by way of grant funding.

- The IPP charges a separate capacity charge for the battery storage (which is added to, and paid with the monthly invoices and included in the PPA tariff schedule). This charge is based on the available storage capacity (i.e. declared storage capacity plus deemed storage capacity), with actual capacity tested on an annual basis. The terms of the power purchase agreement ("**PPA**") set out what the purchase of capacity entitles the offtaker to (e.g. whether this is limited to a certain number of charging / discharging cycles).

- The IPP procures the battery storage and is responsible for its construction and commissioning, then hands the battery storage over to the offtaker / network operator at the commercial operations date, to own and operate. In this case, the offtaker pays a "tariff add-on" which essentially amortises the additional capex associated with construction of the battery storage over the life of the PPA.

These are just a few (simplified) examples. The tariff structure will be dependent on a number of factors, including the intended use case, as well as the intended ownership and operation model (see below).

## Ownership and operation

Another key issue to consider in determining the tariff structure and commercial arrangements in respect of a battery storage project, is who will own and/or operate the battery storage project following its construction. Although the obvious answer might be "the developer", as noted above, we have seen structures where the battery storage is constructed by a developer as part of a larger, co-located renewable generation project, but ownership and operation of the battery storage is handed-over to the offtaker / network operator following commissioning. It is important to obtain local law advice in this regard, as it may be the case that local legislation or regulation prohibits the private ownership of battery storage (particularly in the case of stand-alone battery storage projects), and considers these assets as part of the offtaker / network operator's regulated asset base.

Linked to the question of <u>who</u> will ultimately own and operate the battery storage assets, is <u>how</u> those assets will, from a practical perspective, be operated. A number of points need to be considered in this regard, including:

- How the battery is to be charged (i.e. whether it will be charged from the grid or from a co-located power generation facility or a mixture of both)?

- Where the battery is charged from the grid, whether there will be a "charging notice" delivered by the offtaker / network operator or simply a "standing charging instruction" (e.g. at a certain time of day) under the PPA (which remains in place unless otherwise varied by the offtaker or network operator).

- Where the battery is charged from the grid, how much is paid by the developer for that energy (assuming that the developer retains ownership of the battery storage)?

- How the battery is intended to be discharged / dispatched? For example, is it intended that the battery storage is only discharged during those periods where there is no sun / wind? Or will there be a discharging notice or similar delivered by the offtaker or network operator (or a "standing discharge" notice)?

- Whether there will be a separate metering system to meter the energy output delivered by the battery storage?

It is essential that these questions are considered at the outset of a battery storage project, as the answer to each of these questions will have an impact on the overall commercial arrangements and tariff structure.

In our experience, these issues are often overlooked on emerging market battery storage projects, largely due to a lack of technical expertise and understanding as to the different ways in which these projects can be owned and operated.

## Performance requirements

When considering operational requirements, it is of fundamental importance that the technical capabilities of the battery are in alignment with the commercial arrangement reached with the offtaker or network operator, regarding the intended performance and operation of the battery.

In terms of performance parameters, we have seen the following parameters referred to in battery supply and engineering, procurement and construction (EPC) contracts:

- "Rated Power Capacity", being the total possible instantaneous discharge capability (in megawatts (MW)) of the battery.

- "Energy Capacity", being the maximum amount of stored energy (in megawatt-hours (MWh)), when the battery is fully charged (noting that a battery's energy capacity will degrade over time, depending, in part, on the number of charging and discharge cycles, and this degradation will be reflected in the performance warranty provided by the battery supplier).

- "Round Trip Efficiency", being the ratio of the energy charged to the battery, to the energy discharged from the battery (as a %), thereby representing the efficiency of the battery storage system (in other words, how much you get out versus how much you put in).

- "Standby Losses", being the losses that occur (through internal chemical reactions or otherwise) when the battery is on standby and not being discharged (expressed as a % of charge lost over a certain period).

What is therefore important from a developer and lenders' perspective, is ensuring that whatever contractual undertakings are given to the offtaker or the network operator in respect of the performance of the battery storage system, are within the technical capabilities of that battery storage system, as warranted by the EPC contractor and / or battery manufacturer.

Any liquidated damages (or equivalent) payable by the developer for non-performance of the battery storage system need to be passed-through to either the EPC contractor or battery manufacturer (noting that on hybrid co-located battery storage projects, we have seen two different types of contracting structure - the battery storage component is either fully wrapped by the EPC contractor or the battery is supplied direct to the project company, under a separate battery supply contract). As with any type of project, where the EPC is not fully wrapped, this presents a risk of disputes arising between contractors in terms of who is liable for deficiencies in performance – in this context, between the "balance of plant" EPC contractor, and the battery supplier.

## So what is next for battery storage projects in emerging markets?

It is clear that we are going to see more and more battery storage projects developed in emerging markets over the next few years, as battery storage technology continues to develop and improve, and hopefully reduce further in cost (notwithstanding recent increases in the cost of Lithium-Ion battery packs[3]). Whilst at the moment, it is difficult to successfully finance stand-alone battery storage projects, as energy markets liberalise, and offtakers and network operators see the monetary value in the different types of services that batteries can provide, we will no doubt see stand-alone battery projects start to materialise.

In the meantime, we foresee a huge increase in the number of hybrid co-located battery projects, as network operators battle with the integration of variable renewable energy into the grid. In fact, it is not difficult to see a future in which "solar plus BESS" or "wind plus BESS" etc. becomes the norm.

As a consequence, it is vital that developers and their lenders fully understand the technology and economics of battery storage projects.

As we have highlighted, there are a number of issues to consider when structuring a battery storage project, and there is certainly no "one-size fits all" approach when it comes to battery storage. So asking the right questions, and having the right technical and legal advice, is key.

**As with all Trinity Topics, we will provide regular updates on the matters raised in this article and welcome any comments, suggestions or questions, using the contact details set out below.**

For further information, please contact:

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[3] Source: https://about.bnef.com/blog/lithium-ion-battery-pack-prices-rise-for-first-time-to-an-average-of-151-kwh/.

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