Chapter 8
Educating Entrepreneurs in Battery Storage Systems and Energy Markets

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ABSTRACT

Battery Energy Storage Systems (BESS) work by storing electrical energy during times of low demand and discharging said energy during times of high demand or for a specific ancillary service. Thus, establishing a small-scale enterprise to offer such ancillary service is becoming popular. At the same time, the utility gets benefitted as this lowers overall operating costs and reduces technical complexities. This Chapter illustrates the energy-based service as a business process with technical and financial aspects. Various factors that impact the BESS performance have been considered to develop various case scenarios. As a first, this chapter proposes a training program that can be utilized to educate prospective investors in this area. By completing the training program, the participants are expected to gain hands-on-experience in technical and financial operations.

INTRODUCTION

The implementation of Battery Energy Storage Systems (BESS) into power systems is set to be a transformative step in current energy management and distribution. BESS offer an ability to provide vast ancillary services whilst also offering a solution to fluctuating supply and demand of renewable energy systems such as solar and wind. Aspiring entrepreneurs need to be well informed on the opportunities and difficulties that these new and rapidly growing technologies offer. This requires developing a thorough understanding of both the technical and financial aspects of BESS to be successful in this venture. Our book chapter highlights the importance of educating aspiring business owners on BESS and how they

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operate. To accomplish this task, the chapter will offer a teaching plan which will go in depth on both the financial and technical aspects of BESS to teach aspirants who intend to invest in this sector. Thus, it is essential to understand technical and financial aspects of BESS to take informed decisions. In the chapter, the acronym BESS is used interchangeably for both singular and plural forms, depending on the context of the sentence.

The basic working principle of BESS is simple. Batteries store energy in the form of current until it is required. They can obtain electricity from the grid, directly from a power plant, or from another renewable energy source, such as solar panels. The energy is then discharged back into the grid for purposes such as arbitrage, firm capacity, Transmission and Distribution Upgrade Deferrals and other services. Such capacity not only helps to keep supply and demand in balance, but it also makes a major contribution to the grid's stabilisation and allows for many profitable venture opportunities.

BESS are becoming more common in the UK and around the world. This has been attributed to several causes, such as advancements in technology, lower pricing, and the capacity to offer a range of ancillary services (Mexis & Todeschini, 2020). BESS offer a wide range of opportunities based on their configuration and size. Direct sales opportunities include but are not limited to charging the electric vehicles for retail customers, ancillary services such as voltage support, load balancing, black start, peak shaving and frequency regulation for grid operators. Businesses are expected to meet certain technical, procedural and safety standards as specified by the regulator. For example, entrepreneurs entering this field need to understand the technical aspects, including the types of batteries available (lithium-ion, flow batteries, etc.) with their specifications, their energy capacities, and their suitability for different retail and bulk grid services. Without this knowledge, it would be difficult to design or procure the appropriate systems that meet the requirements. Additionally, understanding the integration of renewable energy sources like wind and solar with the BESS is critical to ensure adequate energy is available to service customers. Interestingly, the energy demand from the customers continuously changes in real time, over the day. Entrepreneurs need to understand various parameters such as the available energy for sale, time to recharge, rate of charging and discharging etc. Even the knowledge about weather changes that directly impact the business is critical as energy forecast studies highly relate and depend on weather changes.

Procurement of a BESS requires a large amount of capital investment to be successful. Investors need to be educated on the capital costs such as the battery packs and the power conversion systems as well as operational costs such as Levelised cost of storage (LCOS). Further knowledge of possible revenue streams from ancillary services such as demand response, arbitrage, and capital payments is additionally required. Furthermore, aspects such as return on investment, project lifecycles, and financial risks need to be understood (Shirunda et. al., 2024; Uutoni et. al., 2025). When the business is unable to provide the agreed upon energy requirements, operators and regulators impose financial penalties (Shirunda et. al., 2024). Therefore, it is essential that entrepreneurs know how to correctly determine potential revenue streams, project costs, and structure attractive deals to entice investors and secure funding. A major deterrent for BESS is the high cost of batteries, however recent trends suggest that the price of BESS will decrease significantly. It is generally anticipated that BESS technology cost reductions will play a major role in driving up their integration into the grid. It is forecasted that the cost of lithium-ion battery energy storage systems will drop dramatically, by 52% between 2018 and 2040, or by 54-61% between 2016 and 2030 (Kim et al., 2019). Thus, entrepreneurs should be educated about energy storage dynamics, technological aspects and financial models to ensure their businesses can respond to the intermittent nature of renewable generation and the dynamics of customer demand.