

TWAICE

Verbund

MAXIMIZING PROFITABILITY OF ENERGY STORAGE SYSTEMS

How VERBUND increased profitability of battery energy storage systems by incorporating battery aging into its operating strategy

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/ INTRODUCTION

VERBUND owns and commercially operates battery energy storage systems (BESS) on its own behalf and for third parties. The Austrian utility is currently rapidly increasing its BESS deployment. VERBUND enhances its commercializing efforts and operating strategies using its algo trader, which is one of the best performing algo traders in the German speaking markets.

The market VERBUND is operating in is constantly changing. Traditional use cases such as frequency response are becoming less popular while markets such as energy arbitrage or intraday trading are becoming

more profitable. Additionally, it is now possible to commercialize battery energy storage systems in multiple use cases at once. This increases the revenue potential but also the complexity for algo traders.

Traditionally, the best possible approach for choosing a strategy was based on its revenue potential. However, different operating strategies have different impacts on how the battery ages, and a battery that ages faster will result in a less profitable battery energy storage system long term. Therefore, it is now vital that battery degradation is a factor in choosing an operating strategy.

/ THE CHALLENGE OF BATTERY DEGRADATION IN A SUCCESSFUL TRADING STRATEGY

VERBUND commercializes its BESS portfolio with use cases such as peak shaving, frequency response, and intraday trading. These use cases differ in terms of how much revenue they bring, and in the way that the batteries are charged and discharged. This is determined by VERBUND's operating strategy and its operating conditions, translated in a set of rules in which the algo traders operate.

The challenge facing VERBUND was that the way the batteries are cycled has a significant impact on the lifetime of the battery, and therefore the revenue potential and profitability of its battery energy storage systems.

For example, in Intraday Trading, VERBUND's algorithms automatically charge the battery when prices are cheap and discharge the battery when prices are higher. The difference between these

prices is the so-called spread. For the business case to be profitable, VERBUND must bid in such a way that the revenue – or spread – exceeds the true operation costs. As battery degradation represents a substantial part of these costs, VERBUND realized that its algorithms need to learn how to incorporate this. However, battery aging mechanisms are complex, and a lot of different factors like C-rate, energy throughput, depth of discharge, calendar life and more determine the impact. Additionally, every individual battery cell is different.

VERBUND realized that if battery aging mechanisms were included in its trading algorithms, the battery would be harmed less and have a longer lifetime. This way, VERBUND would be able to operate in the sweet spot between revenues and aging, thus achieving the highest possible profit.

/ WHY TWAICE?

VERBUND looked for an easy-to-use tool that predicts the battery degradation for a specific cell in a flexible but highly accurate way.

TWAICE is a platform for predictive battery analytics and provides several different solutions along the battery lifecycle - all with a clear and easy-to-use interface. TWAICE's solution, the Operating Strategy Planner, was a good fit for VERBUND.

“A big advantage of the cooperation with TWAICE is that we don't have to create new battery models, calibrate and validate them for every cell technology we use in practice – because they do that for us. In addition, the Operating Strategy Planner has a front-end which is very easy to handle.”

- Lukas Weissböck, Technical Battery Engineer at VERBUND

/ THE SOLUTION

VERBUND started using TWAICE's Operating Strategy Planner to enhance its storages' operating strategies. This helps VERBUND to precisely predict the battery degradation for several future scenarios that are based on potential market and price development.

For every scenario, the Operating Strategy Planner can output the impact on the battery degradation in total, or relative per cycle. Calendric and cyclic aging can also

be separated. This is then translated into the aging costs for each BESS, therefore providing a more complete picture of the overall operating costs. The aging costs are incorporated into VERBUND's trading algorithms, meaning that the complex aging mechanism of the respective battery is accounted for. The algorithm is incentivized to perform bids that harm the battery in the least possible way whilst maximizing revenue.

/ THE RESULTS

TWAICE's Operating Strategy Planner helps VERBUND bring its battery energy storage system commercialization to the next level. VERBUND's algorithms can incorporate the complexity of battery aging and is therefore incentivized to perform less harmful operational decisions. This results in an expected increase of storage lifetime of more than 20%. With a planned lifetime of 10 years, this results in additional two years in the market. VERBUND expects to gain around €1.6 million of additional revenue¹ from intraday trading per 10MWh BESS.

"By optimizing our operating strategy with the TWAICE Battery Analytics Platform, we expect a 2 year longer lifetime of our energy storages. This would result in €1.6 million more revenue for every 10MWh of Energy Storage!"

- Karl Potz, Head of Battery Solutions Center at VERBUND

VERBUND and TWAICE are continuing their partnership with additional storages and battery cells.

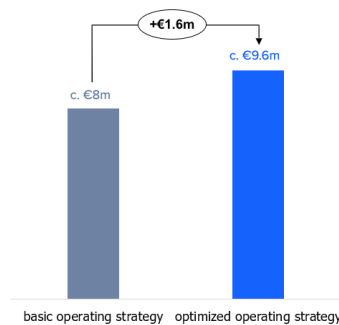
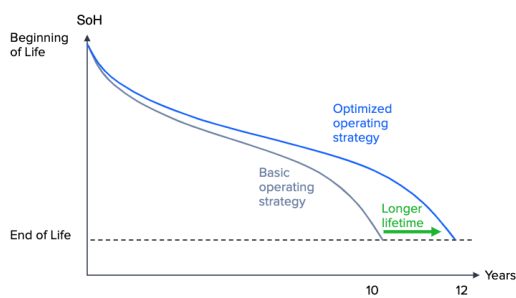


Figure 1: Expected business case impact of an enhanced operating strategy

¹ Based on today's market prices of €80,000/MW/year in Intraday Trading.

/ ABOUT TWAICE

TWAICE provides predictive analytics software that optimizes the development and operation of lithium-ion batteries. TWAICE's core technology is the digital twin – a software that combines deep battery knowledge and artificial intelligence to determine the condition and to predict battery aging and performance.

This makes complex battery systems more transparent, effective and reliable. As the leading battery analytics software for global players in the mobility and energy sectors, TWAICE is committed to increasing the lifetime, efficiency and sustainability of the products that power the economy of tomorrow.

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