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MARKET OPPORTUNITIES AND REGULATORY FRAMEWORK CONDITIONS FOR STATIONARY BATTERY STORAGE SYSTEMS IN GERMANY

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Abstract

In the current and future German power system, characterized by large penetration of intermittent renewable energy sources, the demand and the importance of flexibility options are escalating. Therefore, this contribution provides, based on a literature review and market data analysis, a comprehensive discussion of today's potential application areas for stationary battery storage systems (sBSS) in Germany. The core research focus is based on market opportunities (estimation of application monetary benefits and if possible market sizes) in combination with regulatory framework conditions for each potential sBSS application. Given the background, the analysis identifies twelve use cases for sBSS services with three market opportunity categories: low, medium and high. However, the general outcome shows that especially the policy and regulatory treatment defines the demand and dynamics for mainly all sBSS application areas and hitherto, the multi-application character does not fit into existing regulatory frameworks.

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I. INTRODUCTION

Stationary battery storage system (sBSS) technologies are auspicious and complementary tools to accomplish a system transformation into a low-carbon power sector, based on intermittent renewable energy (RE) sources, like wind and solar. Especially, the bidirectional transformation process of sBSS is a valuable and significant mechanism to decouple energy supply and demand: first, electricity is transformed into a storable form of energy at certain efficiency, and second, with certain losses the stored energy is recovered rapidly into electric energy [1]. Due to that

fact, sBSS have multiple-application forms along the electricity value chain (supply, transmission, distribution and demand) in a liberalized market setting. According to [2], multi-application technologies are operable in many different ways by diverse actors and thus, have different potential value creation sources. Due to this special technology characteristic, market conditions and policy environments are still vague [3]. Moreover, [4] consternates that until now no clear pattern or preferred application has emerged, which indicates the strong influence of local policy, regulatory and market drivers that differ across energy systems worldwide. Based on these insights, country-specific studies which address legal framework issues are released. Some important market and legal analysis for sBSS applications in the German electricity market are: [5]; [6], [2], [7] and [8]. However, all of the mentioned studies have some drawbacks: some consider only parts of the possible sBSS application areas in the German electricity sector, some do not have specific market opportunity estimations or are missing an in-depth investigation of legal framework conditions. Accordingly, this contribution elaborates plausible sBSS applications and their market opportunities within the German legal framework setting of 2015. In that regard, it is noteworthy that all market opportunity estimations are without any battery specific costs and thus serve as a general revenue indicator.

II. APPLICATION ANALYSIS

Due to the unique features and characteristics of sBSS, the potential service are either based on a power or a capacity application and the energy to power ratio range from seconds to hours [9]. Hence, the application areas in the German electricity sector are vast and multidimensional: ranging from power quality to time shift, with numerous stakeholders involved (s. fig. 1). Generally, an application defines the operation mode of sBSS, whereas a market opportunity assessment describes its potential benefit under the current legal framework conditions. There are two forms for a benefit assessment: first, revenues received by the storage owner or operator and second, cost reduction or avoidance by the storage owner or operator [10]. Thus, revenues can be realized in two forms: via existing markets with uniform and standardized product requirements or via bilateral contracts with negotiation potential. Whereas, cost reduction or avoidance is based on individual use cases by the storage owner or operator. In accordance to the mentioned categories, figure 1 illustrates the possible application areas within the German market environment.

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