COMPARISON OF PEAK SHAVING AND ATYPICAL GRID USAGE APPLICATION FOR ENERGY STORAGE SYSTEMS IN THE GERMAN INDUSTRIAL SECTOR

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Abstract

With the increase of electricity costs, a higher fluctuating electricity supply and the reduction of investment costs of energy storage systems (ESS) in recent years, ESS have become an important component to stabilize the electricity grid [1] and for various applications in the industrial sector [2]. By utilizing the incentives, set by the Electricity Network Fee Regulation Ordinance (StromNEV), this paper describes a method that identifies the most economical ESS size for peak shaving and atypical grid usage.

Introduction

With the adoption of the "Climate Protection Program 2030" in 2019, and the target of neutralizing Germany's greenhouse gas emissions by 2050 [3], the pressure on industrial consumers has increased. Moreover, with an industrial electricity price in Germany of 0.19 euros per kilowatt-hour [4], Germany has one of the most expensive industrial electricity prices in Europe [5].

Consequential of the high price of electricity, the pressure of public opinion and stronger regulation in the years to come, the industrial sector is searching for solutions to save energy and to use it more efficiently. In regards to the continuous investment cost reduction of ESS, the usage of ESS for applications such as peak shaving and atypical grid usage are becoming economical [6].

A survey, conducted by Zimmermann et al. in 2019, investigated the significance of ESS in the industrial context. More than half of the survey respondents from the industrial sector occupied themselves with the integration of ESS in their organization. Companies without ESS cite lack of economic efficiency (25%) and lack of technical feasibility (8%) as justifications. [7]

Concept

The paper describes a method that defined the size and economic feasibility of ESS for industrial consumers in regards to lower the grid charges. In § 19 StromNEV creates incentives for the industrial consumers in Germany to reduce their peak load demand or shift the peak load demand out of previously defined peak load time windows. These incentives are utilized in this paper to reduce grid charges and size an ESS economical feasible.

In Figure 1, the process of the method is shown. The aim is to size the EES for the applications peak shaving and atypical grid usage. The method searches for the highest net present value after the linear optimization calculation. This is determined by linearly increasing the size of the battery and by linearly reducing the peak loads. The reducing of the peak loads leads to grid charge savings. At the same time, the battery size also increases below pre-defined technical and economic key figures. When calculating the net present value, the investment costs incurred at the beginning are discounted with the annual savings and the annual operating costs. The highest net present is shown as the optimum.

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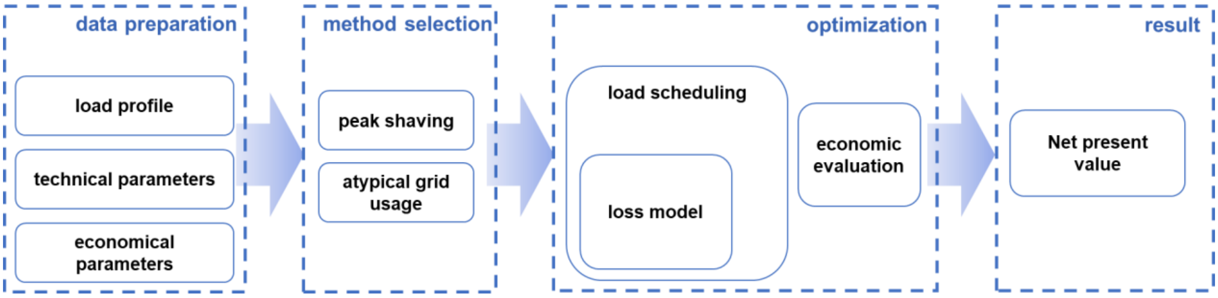

Figure 1: optimization method

Outlook

This method displays the optimum for an individual load profile of an industrial consumer with a certain scheduling strategy for different energy storage technologies. The application of reducing grid charges by peak shaving or atypical grid usage is only one application for industrial consumers. Further research can be conducted by extending the existing model with e.g. the implementation of on-premise renewable energy sources. Moreover, further research can enhance the model by combining energy storage technologies to generate hybrid energy storage systems.

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