

Hybrid Energy System for the German Mining Industry: An Optimized Model

Authors : Kateryna Zharan, Jan C. Bongaerts

Abstract : In recent years, economic attractiveness of renewable energy (RE) for the mining industry, especially for off-grid mines, and a negative environmental impact of fossil energy are stimulating to use RE for mining needs. Being that remote area mines have higher energy expenses than mines connected to a grid, integration of RE may give a mine economic benefits. Regarding the literature review, there is a lack of business models for adopting of RE at mine. The main aim of this paper is to develop an optimized model of RE integration into the German mining industry (GMI). Hereby, the GMI with amount of around 800 mill. t. annually extracted resources is included in the list of the 15 major mining country in the world. Accordingly, the mining potential of Germany is evaluated in this paper as a perspective market for RE implementation. The GMI has been classified in order to find out the location of resources, quantity and types of the mines, amount of extracted resources, and access of the mines to the energy resources. Additionally, weather conditions have been analyzed in order to figure out where wind and solar generation technologies can be integrated into a mine with the highest efficiency. Despite the fact that the electricity demand of the GMI is almost completely covered by a grid connection, the hybrid energy system (HES) based on a mix of RE and fossil energy is developed due to show environmental and economic benefits. The HES for the GMI consolidates a combination of wind turbine, solar PV, battery and diesel generation. The model has been calculated using the HOMER software. Furthermore, the demonstrated HES contains a forecasting model that predicts solar and wind generation in advance. The main result from the HES such as CO₂ emission reduction is estimated in order to make the mining processing more environmental friendly.

Keywords : diesel generation, German mining industry, hybrid energy system, hybrid optimization model for electric renewables, optimized model, renewable energy

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