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Novel method for calculating installed capacity of stand-alone renewable energy systems

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ABSTRACT

The use of new energy sources to replace traditional energy sources is the worldwide interest based on its irrefutable advantages, especially in regions where supply systems Power supply cannot reach. The devices installed capacity has a significant effect on the economy as well as on system operation. In this paper, formulate and solve the problem of optimizing installed capacity for devices (generators, charge controllers, storage, inverters ...) that are used in independent renewable energy systems. In illustrating this method of calculation, we apply it on a standalone system, i.e., it is not connected to the power supply grid.

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1. INTRODUCTION

The difficulty in choosing the installed capacity is caused by the inability to know precisely the consumption patterns of the load and the received energy. In renewable energy systems, the level of energy emitted at any given moment depends so much on the weather that it is only roughly determined. Together with the load consumption characteristics, the energy traits obtained in real-time are determined with a certain degree of accuracy based on factors such as weather forecasting, characteristics at similar time intervals in the past, …. This level of deviation is also taken into account when we simulate the system. In the conventional calculation methods [1-10], the authors often choose the installed capacity of the devices based on the estimation of the power consumption and the received power of the generating devices (renewable amount, converter, UPS, …). This is not enough to convince us to calculate the optimal investment cost for the necessary equipment and suggests us to find some more effective method for this issue. To illustrate the proposed method, we assume that energy-consuming objects consume only active power. The characteristics of the load have maximum daytime value and vary between days of the week and between different seasons of the year. The capacity of the load consists of two parts, the fixed component consists of the critical loads, and the component is changeable. That is, it is possible to shift the time of use. To solve this problem, we take the problem to solve the linear programming problem with the number of variables in the thousands. The working model of the system is simulated for a period of a year, with the