Energy storage for peak shaving harare

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A proportional relationship between grid filling power and capacity demand is proposed. It is used to determine the energy storage configuration for auxiliary peak shaving.

A dynamic economic evaluation model considering energy storage investment and maintenance costs, electricity profit, and auxiliary service compensation is proposed.

In addition to the high cost of electrochemical energy storage, it also faces problems such as unclear application value and imperfect participation in market mechanisms. In response to this, relevant policy documents have been issued to encourage the establishment of relevant compensation mechanisms to promote the development of energy storage technology. We will use this as an entry point to study electrochemical energy storage technology in the current Chinese market environment.

However, the continuous development of energy storage technology has broadened its application field beyond microgrids, but there are limited studies on peaking as the application scenarios for ESS. In this paper, China"s three provincial-level power grids will be used as application cases for electrochemical energy storage, and the economics of participating in grid-assisted peak-shaving will be analyzed.

When the ESS participates in the auxiliary service of grid peak shaving, the capacity and power configurations of the ESS must be determined. Each configuration should be selected according to the peaking demand and load characteristics of the power grid. The peaking demand of the power grid and the characteristics of the load valley period will affect the capacity configuration of the ESS, while the charging power of the ESS and the characteristics of the load peak period will affect the power configuration.

where PT is the given filling power, E is the capacity demand of the energy storage, Pload,min is the minimum value of load power, and Pload,t is the load power at time t. iC is the charging efficiency of the energy storage, t1 is the starting time of the period of the valley filling, and t2 is the ending time of the period of the valley filling. When PT + Pload,min-Pload,t > 0, the tth time is in the period of the valley filling.

However, because of the different daily load characteristics, it is not sufficiently accurate to obtain the energy storage capacity configuration with typical day data. Figure1 shows the schematic diagram of the power demand calculation based on the typical days of three different load characteristics.

It can be seen from Fig.1 that under the same filling power PT, the electricity demands of the three typical daily load are: EB, 1 = S1, EB, 2 = S2, EB, 3 = S3, and EB, 3 > EB,1 > EB, 2. Because of the different load characteristics of each day, the amount of electricity required each day is different. Therefore, the daily demand for electricity in the filling power of PT will form the following matrix:

In addition, to eliminate data acquisition bias in the sample, this section uses the confidence interval method to optimize the capacity demand matrix. The specific calculation process is described as follows:

where N(m, s2) is a normal distribution function expression, m is the normal distribution function position parameter, i.e., the average value of E, and s2 is the variance of E.