

# Compensation measures for auxiliary services of energy storage power stations

How Auxiliary Service of energy storage is realized?

In the case, the auxiliary service of energy storage to the power grid is mainly realized through the peak regulation of the power grid. The peak-valley price difference between various regions is about 0.36-1.06  $\text{\$/kW}\cdot\text{h}$ , while the unit capacity price of sensible heat energy storage is generally 170-260  $\text{\$/kW}\cdot\text{h}$  [36].

What is auxiliary service stage?

Auxiliary service stage: the excess power of the power grid is stored in the form of heat to the heat accumulator when the power consumption is low, and the cogeneration of heat and power is carried out to provide auxiliary services for the power grid when the power grid needs power for auxiliary services.

What is the allowable continuous charging capacity of the group?

The allowable continuous charging capacity of the group is not less than 212 MVar. The emergency reserve of the unit is 1 h full power equivalent operation time, and the reserve capacity of black start is 0.5 h full power equivalent operation time.

How does energy storage affect economic performance?

In summary, the economic performance of the energy storage power station is mostly affected by rental fees and the heat price, the price of auxiliary service also exerts a great impact on the economy, while the impact on the economy of cost per unit capacity of energy storage and downtime is less significant.

How does ancillary service cost affect thermal storage?

Influence of ancillary service prices and downtime The solid thermal storage may experience heat accumulation in the heating process, which may lead to temperature exceeding the critical value in some places and thermal storage life declining, resulting the shutdown maintenance is required.

What is the operation and maintenance cost of CSESS C2?

The operation and maintenance cost of CSESS C2 ( $\text{\$/kW}\cdot\text{h}$ ) refers to the daily costs of employees, materials and financial resources required to be invested in the daily operation and maintenance of the power station, including the annual water purchase expenditure, equipment management and maintenance expenditure and annual personnel expenditure.

The shared energy storage power plant is a centralized large-scale stand-alone energy storage plant invested and constructed by a third party to convert renewable energy into electricity and store it, and the leaseholder rents the storage capacity of the shared energy storage power plant to store and release the electricity [3].

The Economic Value of Independent Energy Storage Power Stations Participating in the Electricity Market

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Then, considering that the pumped-storage power station has both source-load characteristics, the peak-shaving value of the pumped-storage power station is deeply excavated to share the peak-shaving pressure of thermal power units, and a compensation mechanism for peak ancillary service fees is established.

The pumped storage power station (PSPS) is still the most mature device worldwide capable of large-scale energy storage [1,2]. Typically, hydropower plants and pumped storage power stations play a critical role in load balance, peak regulation, and frequency modulation in the power grid due to their flexibility and rapid response [3-5].

Semantic Scholar extracted view of "Design of Compensation Mechanism for Energy Storage Participating in Auxiliary Services and Analysis of Its Investment Economics"; ...

Authorities should improve the compensation system of power supply side energy storage, support conventional power sources such as thermal power and new energy storage technologies to participate in auxiliary services together such as peak regulation, frequency regulation and reserve dispatch, improve the subsidies for energy storage allocated ...

In comparison, the US MISO ramp assistance service market is more conservative, with admission not including energy storage and demand response resources; the CAISO ramp assistance service market considers economic factors more, and its market rules

To face these challenges, shared energy storage (SES) systems are being examined, which involves sharing idle energy resources with others for gain [14].As SES systems involve collaborative investments [15] in the energy storage facility operations by multiple renewable energy operators [16], there has been significant global research interest and ...

The "Measures" pointed out that when the agencies dispatched by the National Energy Board formulate the implementation rules for the management of auxiliary power services, in principle, they mainly stipulate the relevant mechanisms for the types of auxiliary power services obtained through voluntary provision and fixed compensation; in ...

Regarding the optimal operation strategy of PSPS in EESM, many scholars at home and abroad usually regard PSPS as the recipient of EESM price, establish a planning model aiming at maximizing the profit of PSPS, and regard MCP as a known exogenous variable [[6], [7], [8]].On this basis, the optimal economic operation strategy of PSPS -- electricity ...

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Therefore, the service provider's frequency regulation performance will influence the final amount of compensation it receives for frequency regulation services. These measures ensure that energy storage systems providing AGC frequency regulation receive suitable compensation for the services they provide. 3. Optimizing the clearing process

Energy storage power stations can participate in auxiliary services for instance peak regulation and frequency modulation, reactive power compensation and power grid black ...

Paid auxiliary services include paid primary frequency modulation, automatic power generation control (AGC), automatic power control (ECC), low frequency regulation, paid peak ...

In this paper, the auxiliary service cost compensation mechanism is designed from five aspects, including the organization structure of auxiliary service supply subjects, the auxiliary service ...

On August 8, the Shandong Regulatory Office of the National Energy Administration issued the "Notice on soliciting opinions on the Shandong Power Climbing auxiliary Service Market Trading Rules (Draft for Comments)" , marking the official release of the draft for comments on the first domestic climbing auxiliary service market trading rules. The ...

Under the guidance of the "Work Plan for Improving the Power Ancillary Services Compensation (Market) Mechanism," ancillary services markets have been constructed in multiple regions in recent years, and energy ...

With the abundance of peak-shaving resources and the development of power auxiliary service market, the optimization of peak-shaving cost of power system has become an urgent problem. ... Energy storage facilities have recently declared the next day's peak compensation price and energy storage capacity. The peak compensation price is capped at ...

The draft pointed out that we should explore the establishment of a market-based capacity compensation mechanism based on actual needs, do a good job in linking the ...

In view of the increasing trend of the proportion of new energy power generation, combined with the basic matching of the total potential supply and demand in the power market, this paper puts forward the bidding mode and the corresponding fluctuation suppression mechanism, and analyzes the feasibility of reducing the output fluctuation and improving the ...

In order to fully compensate the pumped storage power station for participating in the auxiliary services of the power grid, the auxiliary service cost of the pumped storage power ...

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In order to give full attention to the auxiliary service capacity of the pumped storage power station, a multi-power optimal dispatch model considering the auxiliary service cost of the pumped storage power station was established, and the efficient operation of the pumped storage power station was realized by the dispatching method combined with the auxiliary service cost ...

In order to promote the deployment of large-scale energy storage power stations in the power grid, the paper analyzes the economics of energy storage power stations from three aspects of business operation mode, investment costs and economic benefits, and establishes the economic benefit model of multiple profit modes of demand-side response, peak-to-valley price ...

Then, considering that the pumped-storage power station has both source-load characteristics, the peak-shaving value of the pumped-storage power station is deeply excavated to share the peak ...

4 Auxiliary service compensation, time of day rate, and energy storage cost that enable energy storage to reach an economic equilibrium point are determined. \*Correspondence:

The application of energy storage in auxiliary service of power system is mainly reflected in five aspects: peak regulation, frequency modulation, reactive power compensation, standby and black start.

According to the "Opinions on Further Improving the Price Formation Mechanism of Pumped Storage" issued by the Chinese National Development and Reform Commission (2021) No. 633, pumped-storage power stations are encouraged to participate in the electricity market or the compensation mechanism for auxiliary ...

The large-scale battery energy storage scattered accessing to distribution power grid is difficult to manage, which is difficult to make full use of its fast response ability in peak shaving and ...

Electrochemical energy storage power stations participating in the peaking auxiliary service of the power grid. However, because of the high investment cost of electrochemical energy storage, how to improve its economics in the market has become a research hotspot in recent years [10-13]. In addition to the high cost of electrochemical energy

The energy scale of energy storage power station is expanding. By the end of 2022, it has reached 18.27 GWh, with an average charging and discharging time of 2.1 hours. Influenced by local policies that "new energy power stations must be equipped with energy storage", storage in power supply-side is the largest, more than 50%.

Pumped-Storage Power Stations in Peak Shaving Zilong Zhang\*, Wenbo Cong, Shizhong Liu, Chenglong Li

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and Shaolong Qi ... Pumped-Storage Power Stations in Peak Shaving. Front. Energy Res. 10:915125. doi: 10.3389/fenrg.2022.915125 ... shaving auxiliary service fee compensation mechanism model based on Kaldor, which improves the wind power ...

In response to the "Regulations on the Management of Power Grid Connection Operation" and "Measures for the Management of Power Auxiliary Services" issued by the National Energy Administration at the end of 2021, the Southern Region was the first to release a revised version of the "Two Rules" in this region, and it is expected that other ...

Under the background of dual carbon goals and new power system, local governments and power grid companies in China proposed a centralized "renewable energy and energy storage" development policy, which fully reflects the value of energy storage for the large-scale popularization of new energy and forms a consensus [1].The economy of the energy ...

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