Analysis of New Energy Storage Development Policies and Business Models in Jilin Province

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Abstract. In order to achieve the goal of "carbon neutral, carbon peak", China is vigorously developing new energy industries, and the rate of abandoned wind and abandoned light is increasing, while energy storage is an important technology and basic equipment for building new power systems, which can solve the problem of abandoned scenery and other new energy consumption, and is an important support to achieve the goal of carbon peak and carbon neutral. The National Energy Administration and relevant departments have released the "Implementation Plan for the Development of New Energy Storage in the 14th Five-Year Plan" and "The 14th Five-Year Plan for Technology Innovation in the Energy Field", for the development of new energy storage and technology innovation in the energy sector, which provide guidance for the innovative direction and large-scale development of new energy storage and play a crucial role in solving the problem of new energy consumption in Jilin Province. Firstly, this paper analyses the current situation of energy storage in Jilin Province and interprets the policy plan issued by the Jilin Provincial Government, proposing that energy storage is an effective measure to solve the problems of new energy consumption, wind power and other energy generation and load demand asymmetry, and is the key to new energy development, and analyses a variety of energy storage methods. Then, through the analysis of various energy storage business models, a shared energy storage business model applicable to Jilin Province is proposed for the consumption of new energy sources, giving full play to the flexibility of energy storage. Innovations in energy storage technology, business models and policy mechanisms are particularly important. Finally the future outlook for new energy storage is briefly discussed.

Keywords: energy storage mode · policy · new energy storage

1 Introduction

The National Energy Administration and relevant departments have successively issued guidance for the innovation direction and large-scale development of new energy storage, emphasizing the overall coordination of the development and utilization of individual

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energy sources, the improvement of the absorption capacity of clean energy, the improvement of the comprehensive efficiency of the power system and the promotion of energy transformation [1]. The inclusion of energy storage devices in the power system can effectively promote new energy sources to replace traditional power generation technologies such as thermal power and reduce wind and light abandonment [2, 3]. The application sites of energy storage systems vary greatly in terms of the purpose of their use and the various aspects of economic benefits they bring. Therefore, different application scenarios will correspond to different models for assessing the economic benefits of energy storage technologies [4–6]. At the same time, different investors in energy storage generally want to be able to achieve multiple functions at the same time [7]. Therefore, it is very necessary to conduct research on the evaluation methods for the economic benefits of energy storage in various settings, calculate all the benefits for different investment entities, and provide reference for measuring the value of energy storage and determining the settlement mechanism and benefit sharing mechanism for energy storage applications [8–9]. Firstly, this paper analyzes the current situation of energy storage in Jilin Province, and interprets the policy planning issued by Jilin Provincial government. It proposes that energy storage is an effective measure to solve the problems of new energy consumption, wind power generation and load demand asymmetry. Then through the analysis of a variety of energy storage business models, a shared energy storage business model suitable for Jilin Province is proposed to absorb new energy and give full play to the flexibility of energy storage. Finally, the future prospect of new energy storage is briefly discussed.

2 Analysis of the Current Situation of Energy Storage in Jilin Province

New energy sources such as wind and solar power account for a large proportion of installed power from the installed power data of Jilin Province. The national abandoned wind power 2.12 billion kilowatt hours, abandoned photoelectricity 650 million kilowatt hours, the total abandoned power accounted for 1.67%. This shows that with the development of new energy sources, the amount of abandoned wind and light is on the rise. According to the investigation and research, the most important reason for wind and light abandoning is the lack of peak regulating capacity. In this context, energy storage, as an important direction in the energy sector, is an effective measure to solve the problems of new energy consumption, asymmetry between wind power and other energy generation and load demand, and is the key to the development of new energy.

It is proposed to improve the operational flexibility of the power system, build a new power system with new energy as the theme, and promote the synergy of source, network, load and storage. “During the 14th Five-Year Plan period”, the flexibility of thermal power units will be transformed to increase the peaking capacity of the system by 3 million kilowatts. Accelerate the construction of energy storage facilities, guide new energy development entities to jointly carry out the construction of centralized energy storage power stations on the grid side, with the scale of energy storage no less than 10% of the new energy installed capacity and the length of energy storage no less than 2 h. Improve the market-based peaking mechanism, build a market for energy storage and

peaking auxiliary services, or use market-based means to tap into the system's peaking capacity.

3 Energy Storage Business Models

3.1 Energy Storage Methods

There are a variety of energy storage technologies which can provide a wide range of services. Mainstream energy storage technologies include pumped hydro storage, compressed air storage, battery storage. Different forms of energy storage devices can be used in a variety of scenarios in power systems. Among these, mechanical and chemical forms of energy storage are used more often. The accelerated implementation of the "Three Gorges Pumped storage" project in eastern Jilin Province is one of the key pumped storage policies to ensure emergency peak and frequency regulation in the northeast. By 2025, the installed capacity of new energy storage will reach more than 250,000 kilowatts, and by 2030, the installed capacity of pumped storage power plants in Jilin Province will reach about 12.1 million kilowatts. However, due to topographical constraints and construction cycle field and other factors, can not meet the short-term grid peak and frequency regulation and household energy storage. Compared to pumped energy storage, electrochemistry is hardly affected by natural environmental factors, and with its fast response, more flexibility and high energy storage efficiency, the technology has gradually matured and has been widely used in the market. Considering the market competition and the cost effectiveness of energy storage, electrochemical energy storage is expected to become the main development direction of energy storage.

3.2 Analysis of Different Business Models

1) Household light storage

Distributed PV energy storage currently suffers from "high equipment and installation costs", "uneven product quality", "difficulties in operation and maintenance after installation" and "low user motivation". The problems are not high". In order to solve these problems, NPI has proposed the idea of "standardization" and "digitalization". By creating an integrated platform for light and storage as shown in Fig. 1, using the digital platform, users can declare installation, equipment procurement and after-sales operation and maintenance online, improving user experience and solving the problem of operation and maintenance difficulties. The model has great potential to contribute to the rural revitalisation strategy, increase the market share of NPI's distributed photovoltaic power plants and build a rural energy internet.

2) Hydrogen energy applications

The hydrogen energy industry has some market shortcomings, such as the shortage of cheap and large-scale hydrogen resources, the incomplete hydrogen supply chain system, and the concentrated application of hydrogen energy in the transportation field.

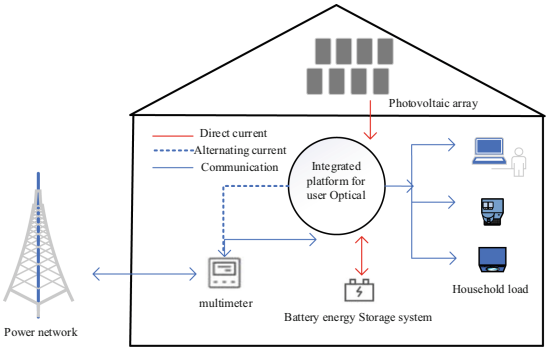

Fig. 1. Integrated platform for household light and storage

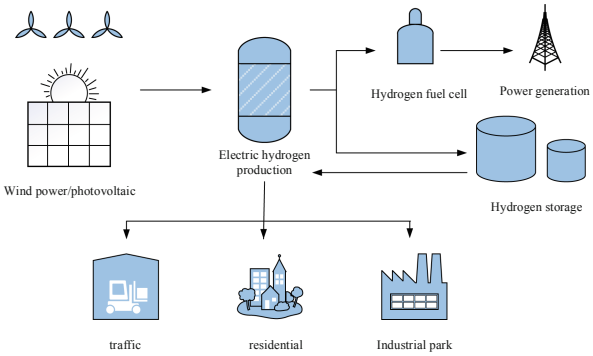

Fig. 2. Hydrogen energy production and consumption network

At present, the hydrogen produced by Aluminum Power Company meets the market price of hydrogen and the internal rate of return of the project capital is good. This model uses the new energy electrolysis water to produce hydrogen, provides the demonstration and guidance for the national power investment of new energy electricity consumption, and provides a reference for the development of hydrogen energy concept. The application of hydrogen energy is extending from electricity to construction, industry, construction and other fields, gradually replacing fossil fuels, as shown in Fig. 2.

3) Shared energy storage

Shared energy storage power stations have flexible investment bodies and clearer business models, which to a certain extent also facilitate their development and application. From existing experience, shared energy storage power stations can be invested and built by a single entity, such as a power generation group, grid-related enterprise or other private capital, or by all of the above parties together. Relevant policies have also repeatedly proposed the construction of a new business model of energy storage sharing to support the construction and development of new power systems. This energy

storage model can reduce the pressure of investment in supporting energy storage for new energy power plants, reduce abandoned wind and light, and also make a difference in enhancing the safe and stable operation of the power grid and improving the capacity of new energy consumption.

4 Energy Storage Operation Model for Jilin Province

Traditional energy storage projects only serve a single energy plant and do not have direct links with other energy storage facilities in the region, making the business model simpler and less economical to operate. The development of shared energy storage is in line with the national "14th Five-Year Plan" to achieve the initial commercialisation to scale development change, and its advantages are diversified, the model is win-win, and the market is recognized in many places, the shared energy storage model will have a greater promotion space.

4.1 Energy Storage Investment Risks in Jilin Province

The energy storage development challenge boils down to the question of whether the value of its services is greater than its cost, and its business model dilemma is in fact to establish a market unblocking mechanism for the cost of energy storage, and to discover the price of energy storage services by the market as a fundamental condition for energy storage access. However, even under sound market conditions, the following investment and operational risks should be considered.

1) Policy risk. In the direction of promoting the development of energy storage, policy is still in an early state and has not yet reached a deep state. There is a lack of refined implementation outlines, such as detailed technology development roadmaps, potential subsidies, incentives sharing and accounting, and a range of related measures or implementation methods. In terms of the construction of demonstration projects, the policy lacks a systematic programme design to achieve development goals, and there is little correlation between projects, which is not conducive to mutual promotion and optimisation between projects. The effects of the projects have yet to be further clarified and strengthened in terms of policy. In terms of government subsidies, there are currently relatively few relevant policies and approaches in Jilin Province, and in its relevant policies, the variability and ambiguity of the relevant subsidies also make it difficult to achieve the goals and effects envisaged by the subsidies.
2) The energy storage volume is small. Jilin Province's energy storage load level is small, the stock is small while the increment is small, and the province's load category is more traditional, which will lead to the peak-valley differential arbitrage space is small, in the peak-valley differential arbitrage model, energy storage power station in the low time to buy electricity from the grid, storage of electricity, in the peak time to release electricity, sell electricity to users using the peak-valley differential to achieve profit, and the above-mentioned provincial energy storage shortcomings are not conducive to accelerate the promotion of new energy storage development, need Through scientific and reasonable scheduling production operation mode, using higher purchase and sale price difference to obtain higher revenue.

3) The operation strategy is more complex. At present, when evaluating the income of frequency modulated power stations and peak modulated power stations, the adjustment frequency compensation standard and the peak-valley price difference standard are set according to the given standards of local policies, that is, the price level obtained is a fixed value, and the market mechanism is not generally established. It is reasonable for the power station to be the price taker, and the operation strategy of the power station is relatively simple. Taking peak-valley arbitrage as an example, charging and discharging can be carried out only according to the peak and valley periods, and its capacity allocation and revenue calculation are simple.

4.2 Shared Energy Storage Operation Model for Jilin Province

The operation mode of shared energy storage was first proposed and put into operation in Qinghai Province. It is a centralized large-scale independent energy storage power station invested and constructed by a third party. It not only meets the needs of its own power station, but also provides services for other energy power stations. By analyzing the business models of shared energy storage that have been implemented in China, Jilin Province can refer to these operational models to make the business model of shared energy storage in Jilin Province have a way to follow.

By studying the concept of shared energy storage, we can analyse the sources of revenue for energy storage operators and simulate an energy storage business model for Jilin Province as shown in Fig. 3, where energy storage operators can purchase and build their own energy storage plants for leasing, and trade energy storage resources with multiple interests. This model has the advantage of clarifying the status of energy storage entities and bringing together the idle energy storage resources of various social entities for unified deployment, so that energy storage resources can be fully utilised. With the opening up of the market, third-party entities have gradually emerged, with the original sales and distribution companies, load integrators and energy service providers becoming new auxiliary service providers, not only integrating energy storage resources to respond to the power system, but also reducing the burden on the dispatching and trading system. Services and reduce the burden of the dispatching and trading system, and at the same time can play the role of lower-level resource integration and dispatching and monitoring.

Overall, this model of shared energy storage takes full account of the needs of all parties. For new energy enterprises, it reduces the construction cost of new energy storage, saves the daily operation and maintenance cost of energy storage facilities, and enables them to fully enjoy the peak-to-valley tariff difference of grid-side energy storage in the future. For power grid enterprises multi-point centralised medium and large energy storage stations will be conducive to the reinforcement of the distribution network and the scientific consumption of new energy by the grid. The shared energy storage business model can promote the energy storage industry to maximise economic and social benefits.

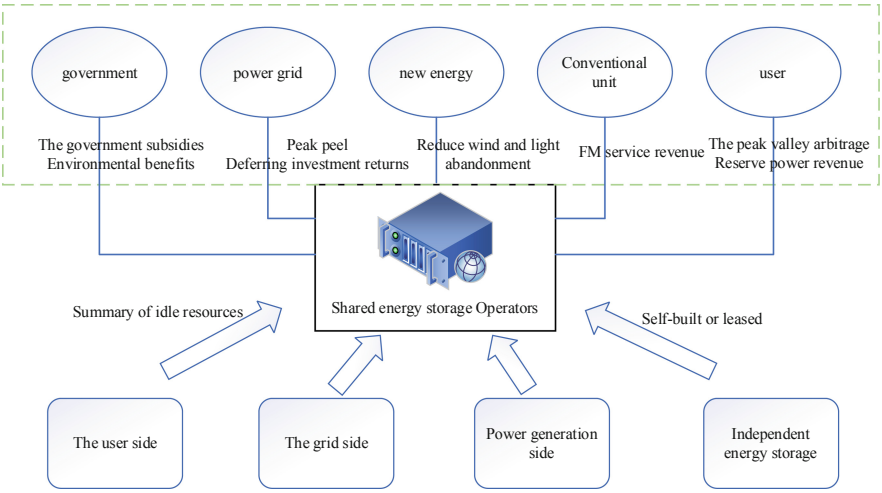

Fig. 3. Shared energy storage model

5 Conclusions and Perspectives

In order to promote the construction of the power system with new energy as the main body and ensure the power quality and safe and stable operation of the grid, it is very important to study the technical application and business model of new energy storage. Represented by sharing energy storage business models are introduced in detail a new type of commercial energy storage type, analyzes such energy storage application scenarios, complied with the "difference" state plan early in the commercial to large-scale development, and its advantages of multivariate, win-win mode, more market also is gaining recognition, Shared storage mode will have a bigger promotion space. However, if the new energy storage is to be applied more efficiently on a large scale, it will require concerted efforts from all sides for some time to come. To make a simple discussion of the power market trading system, trading system needs to be more perfect, through the market profit is the basic direction of the commercial application of energy storage, driven by commercial value energy storage operators to respond to the demand actively and participate in power grid regulation and control is an important way.

Overall, the "shared energy storage" model takes full account of the needs of all parties. For new energy enterprises to reduce the construction cost of new energy storage, saving costs, and can enjoy the grid side storage peak and valley tariff difference income. For grid enterprises, it is conducive to the scientific consumption of new energy. This business model can promote the energy storage industry to maximise economic and social benefits, and shared energy storage has great potential for the future.

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