

Guidance on the Promotion of Energy Storage Technology and Industry Development

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and the National Energy Administration

To the development and reform commissions and energy administrations of all provinces, autonomous regions, municipalities directly under the Central Government, cities under separate state planning and Xinjiang Production and Construction Corps; and State Grid Corporation of China, China Southern Power Grid Co., Ltd.:

Energy storage is an important part and a key support technology of the smart grid, energy system having a high proportion of renewable energy and "Internet Plus" intelligent energy (hereinafter referred to as the energy Internet). Energy storage can provide a variety of services, such as peak regulation, frequency modulation, standby, black start and demand response support for power grid operation. It is an important means to enhance the flexibility, economy and safety of traditional power system. Energy storage can significantly improve the absorption level of renewable energy, such as wind, light and the like, and support distributed power and microgrid. It is the key technology to promote the replacement of the main energy from fossil fuels to renewable energy. Energy storage not only can drive the open sharing and flexible trading of energy production and consumption and achieve the collaboration of various kinds of energy, but also acts as the core foundation for building the energy internet, promoting the reform of the power system and advancing the development of new energy formats.

In recent years, China's energy storage presents a good momentum of diversified development. Pumped storage is developed rapidly. Research and application of energy storage technologies, such as compressed air storage, flywheel energy storage, superconducting energy storage and super capacitors, lead-acid batteries, lithium-ion batteries, sodium sulfur batteries, flow batteries and the like, are accelerated. Some progress has also been made in heat storage, cooling storage, and hydrogen storage technologies. In general, China's energy storage technology has initially had the basis of industrialization. Speeding up the development of energy storage technology and industry is of strategic significance for building the modern "clean low-carbon, safe and efficient" energy industry system, promoting the supply side reform of the China's energy industry and driving the reform of energy production and use. Meanwhile, it will lead the development of the whole industry chain from the material preparation to the system integration, and become a new energy to enhance the industrial development level and promote the economic and social development. In order to implement the energy strategy of "four revolutions, one cooperation" put forward by General Secretary Xi Jinping, to carry out the tasks proposed in "Outline of the 13th Five-Year Plan for the National Economic and Social Development of the People's Republic of China" and "Energy Production and Consumption Revolution Strategy (2016-2030)", and to promote the development energy storage technology and industry, the following comments are made.

I. Overall requirements

A/ Guiding ideology

We should comprehensively implement the spirit of the 18th National Congress of the Communist Party of China and of the Third, Fourth, Fifth, and Sixth Plenary Sessions of the 18th Central Committee of the Communist Party of China and thoroughly implement the spirit of the important speeches of General Secretary Xi Jinping, to adapt and lead the new normal of the economic and social development, to focus on the overall and long-term development demand of the energy industry and to closely stick to the reform and innovation in accordance with the major decision-making deployment requirements by the sixth and fourteenth meetings of the Central Leading Group on Financial and Economic Affairs and by the first and second meetings of the National Energy Commission. By focusing on the mechanism breakthrough, on the basis of the technological innovation, and by means of the application demonstration, we should vigorously develop the "Internet plus" intelligent energy to promote the development of the energy storage technology and industry, to support and advance the energy revolution, and to provide the technical support and industrial security for the change of our country from a big energy power to a strong energy power and for the economic quality improvement and efficiency.

B/ Fundamental principles

1. Government guidance, business participation

Promote the best design; Improve policy support;
Research and introduce the supporting measures, *e.g.* finance;
Systematically solve the major common problems of the industry regarding innovation and development;
Reinforce the guidance and information services;
Promote the reasonable access to energy storage facilities;
Encourage diversified players to participate in market competition.

2. Promote innovation and demonstration projects

Create an open and inclusive innovation environment;
Encourage technological, mechanism and business-model innovations in various forms;
Provide full support to the pilot role in demonstration projects;
Advance the pilot measures for new technologies and new models of energy storage;
Provide a good atmosphere for innovation.

3. Market-driven, reform-boosting

Give full support to the decisive role of the market in resource allocation;
Encourage social capital to enter the energy storage field;
Gradually establish and improve the pricing mechanism of power market transactions and flexible resources in combination with the power system reform process;
Restore the commodity attributes of energy;
Avoid and solve institutional and process obstacles.

4. Overall planning, harmonious development

Strengthen overall planning;
Optimize the layout of energy storage projects;
Pay attention to the harmonious upstream and downstream development;

Optimize the complete industrial chain from materials, parts, systems, operation to recycling;
Develop energy storage with the aim of ensuring safety, improving the standard, developing testing and certification systems, and ensuring product quality and orderly competition;
Promote the green design concept by:

- doing research to establish the cascade utilization and recycling system for energy storage products;
- strengthening supervision;
- preventing pollution.

C/ Development goals

The related work shall be advanced in two stages in the next 10 years. It is in the first stage that energy storage moves from R&D demonstration to initial commercialization. It is in the second stage that energy storage moves from initial commercialization to full scale application.

During the "13th five-year plan" period, we shall build a number of pilot demonstration projects having different technical types and different application scenarios, and develop a number of major key technologies and core equipment to make the main energy storage technology reach the international advanced level. We will preliminarily set up the energy storage technology standard system and form a number of key technical specifications and standards. Furthermore, we shall explore a number of scalable business models and cultivate a number of competitive market entities. Energy storage is developed in the early stage of commercialization, and the key goal is for the energy storage to produce the desired effect within the energy system.

During the "14th five-year plan" period, the energy storage projects will be widely used to form a more complete industrial system and will become a new economic growth point in the energy field. We shall comprehensively master the key technologies and core equipment of the energy storage to a leading international level, wherein energy storage technologies and equipment lead the development internationally. We will form a more comprehensive technology and standard system and have an international say. A variety of energy storage business models based on the power and energy markets shall be booming; and a number of internationally competitive market entities shall be formed. Large-scale development in the energy storage industry shall be achieved by demonstrating the role of energy storage in the promotion of energy change and the development of energy internet.

II. Key tasks

A/ Promote research and demonstrate the benefits of energy storage technologies and equipment

1. Focus on research regarding a number of energy storage technologies and related materials

The energy storage principles, key materials, units, modules, systems, and recycling technologies shall be researched and developed. By continuing to research basic, common technologies; by striving to produce inexpensive, durable, safe, and powerful energy storage, and by analyzing tests and simulations, materials and devices shall be developed. The focus will be on variable-speed pumped storage technology; large-scale new compressed-air storage technology; preparatory technology for various new materials for chemical energy storage; high-temperature, superconducting, magnetic-energy storage technology; phase change thermal storage material; high-temperature heat storage technology; integration technology for the energy storage system; and energy management technology; etc.

2. Test a number of energy storage technologies and equipment having industrial potential

For different application scenarios and needs, the energy storage technologies and equipment respectively suited to the application of long-term large-capacity, short-term large-capacity, distributed and high-power modes shall be developed. The integration of the energy storage system and intelligent control technologies shall be vigorously developed to achieve the coordinated and optimized operation of the energy storage and modern power system. The focus includes 10MW/100MWh supercritical compressed air energy storage system; 10MW/1000MJ flywheel energy storage array unit; 100MW lithium-ion battery energy storage system; large-capacity new molten salt heat storage device; and super capacitor power quality control system used in smart grid and distributed power generation; etc.

3. Apply and promote a number of energy storage technologies and products with independent intellectual property rights

We should strengthen guidance and support to promote the combination of production, research and application, and to accelerate the transformation of technologies. The energy-storage product manufacturers shall be encouraged to improve quality and efficiency by adopting advanced manufacturing technology and ideas; to reduce costs by bringing forth innovative investment and financing models; and to stimulate domestic equipment manufacturing by participating in foreign application markets. **The focus includes 100MW-grade, vanadium redox flow battery energy storage stations; high-performance, lead-carbon capacitor battery energy storage system; and the like.**

4. Improve energy storage product standards, and the testing and certification systems

Establish a standard system which is geared to international standards, covers each application aspect, such as energy storage planning and design, equipment and testing, construction and acceptance, grid connection and testing, operation and maintenance, and continue to improve with the technical development and market demand;

Improve performance and security testing and certification standards of energy storage products;

Establish a national energy storage testing and certification organization;

Strengthen and improve the full life cycle quality control of energy storage products;

Establish and improve the recall system of substandard products.

B/ Promote demonstrations that shows that energy storage enhances the use of renewable energy

1. Encourage renewable energy stations to properly configure energy storage systems

The requirements of the energy storage systems - having different characteristics on access mode, network adaptability, operation control, network protection, information exchange and security protection - shall be researched and determined. The energy storage system that meets the requirements should be granted access by the power grid and incorporated into grid dispatch management.

2. Promote the harmonious operation of energy storage systems and renewable energy

The energy storage and renewable energy stations as a consortium shall be encouraged to participate in power grid operation optimization, to accept power grid operation dispatching, and to achieve the functions of smooth output fluctuations, thereby enhancing the absorption ability, and providing the power grid with the ancillary services. Power grid companies shall treat the consortium as a special "power plant", and sign the grid dispatching protocol and the power purchase agreement under the guidance of the government, wherein the consortium has the appropriate rights and bear the obligations.

3. Research and establish the energy storage compensation mechanism on the renewable energy station side

Research and quantitative assessment should be performed to determine the value of allocating the energy storage facilities on the renewable energy station side. Reasonable compensation modes should be explored.

4. Support the use of a variety of energy storage methods to promote renewable energy consumption

Support should be given to:

- the development of energy storage and output utilization of renewable energy sources in the form of power storage, heat storage, hydrogen production in the areas having highlighted problems of renewable energy consumption
- the advancement of the construction of pilot demonstration projects, such as wind power heat storage, and wind power hydrogen production.

C/ Promote the application demonstration that the energy storage enhances the flexibility and stability of the power system

1. Support the direct access of the energy storage system to the power grid

Do research on the technical requirements on the access of the energy storage to the power grid, such as capacity range, voltage grade, grid adaptability, operation control, grid protection, information exchange and security protection;

Encourage the enterprises such as power grids and other enterprises to get centralized or distributed access to the energy storage system according to the relevant national or industry standard requirements in combination with the needs, and to carry out the technical research and application demonstration of operation optimization;

Support all kinds of entities to invest, build and operate in accordance with the market-oriented principle the energy storage system getting access to the power grid;

Encourage the use of existing lines and facilities in the eliminated or decommissioned power plants to build energy storage systems.

2. Establish and improve the market mechanism that the energy storage participates in the ancillary services.

Allow the energy storage system to be associated with the machine set or as an independent entity to participate in ancillary service transactions by reference to relevant policies and mechanisms that thermal power plants provide ancillary services;

Gradually optimize according to the development of the power market, and form the market mechanism of "pay for results, and who benefits, who pays " on the basis of voluntary trading principles.

3. Explore the establishment of the rule mechanisms of the energy storage capacity charge and the participation of the energy storage in the capacity market

In combination with the power system reform and by reference to the relevant policies of pumped storage, we shall explore and establish the rules of the energy storage capacity charge and the participation of the energy storage in the capacity market, and make the capacity compensation to various types of large-scale energy storage systems which satisfy the conditions.

D/ Promote the application demonstration that the energy storage enhances the intelligent level of energy consumption

1. Encourage the construction of distributed energy storage systems on the user side

Research and develop the access policies and technical standards of getting access to the energy storage on the user side, and guide and regulate the construction and operation of the distributed energy storage system on the user side;

Support the electric power companies with the power distribution network management and qualified resident users to configure the energy storage;

Increase the local consumption rate of the distributed energy by participating in the demand response, lowering the energy cost, and encouraging the exploration of relevant business models.

2. Improve the support policies of the energy storage system on the user side

In combination with the power system reform, the energy storage shall be allowed to participate in power trading through the market approach. A certain scale of power storage facilities built on the user side shall be supported in combination with power generation enterprises or as independent entities to participate in ancillary services, such as frequency modulation, peak regulation and the like.

3. Support micro-grids and off-grid areas to configure energy storage

We shall encourage to increase the reliability and power quality of micro-grid power supply by deploying a variety of energy storages, and vigorously explore new technologies and new modes in which micro-grids comprising the energy storage participate in power trade and power grid operation and optimization. We shall also encourage to develop an economic and applicable energy storage system to solve or optimize the power supply without electricity.

E/ Promote the application and demonstration that the diversified applications of energy storage support the energy internet

1. Improve the informatization and control level of the energy storage system

To ensure network information security, we shall promote the deep integration of the energy storage infrastructure and information technology, and support the research and application of energy information technology. We need to gradually realize the energy internet control of the energy storage, increase the utilization efficiency of the energy storage resources, and give full play to the diversification of the energy storage system in the energy internet.

2. Encourage multi-energy complement and multi-source interaction of the energy internet on the basis of a variety of energy storages

Encourage the large-scale comprehensive energy base to reasonably allocate the energy storage system, and achieve the multi-energy complement of wind, light, water and fire storage;

Support the building of open, shared, distributed energy storage, big data platform and energy service platform;

Encourage the end-users at different levels, such as home, campus, and region and the like to complementarily use all kinds of energy and energy storage resources, so as to realize the multi-energy coordination and energy cascade utilization.

3. Expand the energy storage application of decentralized battery resources such as electric vehicles

Actively carry out the intelligent charging and discharging business of electric vehicles;

Explore the energy internet control and energy storage application of decentralized battery resources, such as electric vehicle power battery, communication base station battery, uninterruptible power supply (UPS) and the like;

Improve the full life cycle monitoring of power batteries;

Carry out the research on the energy storage cascade utilization of the eliminated power batteries.

III. Support measures

A/ Strengthen organizational leadership

National Development and Reform Commission, and National Energy Administration in conjunction with the Ministry of Finance, Ministry of Science and Technology, Ministry of Industry and Information Technology, and other relevant departments shall coordinate and solve major problems, establish and improve the support policies, effectively promote the implementation of measures in place, and coordinate interaction among the various entities including government, industry, academics, researchers and users. We shall rely on industry strength to build a national energy storage technology innovation platform and give full support to professional associations (societies) and seminars to guide the industry innovation direction. The energy storage professional advisory committee shall be established to provide support for government decision making. We shall promote the establishment of state-level industry alliances, strengthen industry research, and establish information channels. The provincial governments shall be encouraged:

- to support the energy storage in accordance with the relevant policies, which have been introduced, including smart grid, micro-grid, multi-energy complementation, "Internet plus" intelligent energy, electric vehicle charging facilities, waste power battery recycling, distribution network construction, power spot market;
- introduce supporting policies;
- give financial support;
- carry out pilot demonstration work according to the actual situation. Eligible energy storage enterprises can enjoy the relevant preferential tax policies in accordance with the provisions. The energy storage shall be included in the key support direction focused by special funds, such as smart grid, energy equipment manufacturing, and the like. The comprehensive regional pilot demonstration of technology and policy mechanisms shall be carried out in the areas which satisfy the conditions. Clean energy demonstration provinces shall be encouraged to develop energy storage according to local conditions. All local energy and related departments should combine with practice to research and develop the implementation plans suitable for the local; make appropriate use of local conditions and scientific organizations; put an end to blind construction and repeated investment; and advance the development of the energy storage technology and industry in a pragmatic and orderly manner. Each energy regulatory agency dispatched by National Energy Administration shall actively participate in relevant mechanism research according to their duties, strengthen safety and market supervision, and urge the implementation of relevant policies and major demonstration projects.

B/ Improve policies and regulations

Establish and improve the relevant laws and regulations to protect the healthy and orderly development of the energy storage industry;

Strengthen the collaborative connection of the power system reform and energy storage development market mechanism;

Research and form the price mechanism of the energy storage application in combination with the power market construction;

Actively carry out the pilot policies of energy storage innovation and application, getting rid of policy barriers, such as equipment access, subject identity, data exchange, trading mechanism and the like;

Research and formulate relevant financial and insurance policies and regulations adapting to the new development characteristics of energy storage;

Strengthen the intellectual property management and protection of energy storage technologies, products and models;

Strengthen the establishment of energy storage safety and environmental protection policies and regulations, as well as of standard system;

Research and establish the responsibility extension system of energy storage product producer;

Encourage the use of standardized, versatile and easy-to-dismantle structural design for the development of the energy storage system;

Negotiate to open relevant information conducive to recycling, such as energy storage control system interface, communication protocols, and the like.

C/ Develop pilot demonstration

A number of major energy storage pilot demonstration projects having a leading role shall be laid out around the major demands for promoting the consumption of renewable energy, developing distributed power and micro-grid, improving the flexibility of power system, and speeding up the construction of energy internet. We shall follow the construction and operation of the pilot demonstration projects, and establish and improve the system and mechanism promoting sustainable development of the industry. The national demonstration areas of renewable energy and other qualified areas, departments and enterprises shall be encouraged and supported to carry out according to local conditions, the application pilot demonstration of various types of energy storage technologies. In respect to the technical innovation, operation mode, development format, and institutional mechanism, we shall explore in depth new approaches, and sum up and accumulate successful experiences that can be promoted.

D/ Establish compensation mechanism

Research in combination with the power system reform the policy of promoting the energy storage to participate in power market transactions and obtain a reasonable compensation;

Establish the energy storage service compensation mechanism compatible with power market-oriented operation service;

Promote the compensation mechanism pilot work of the energy storage for participating in power ancillary service;

Establish a matching energy storage capacity charge mechanism;

Establish and improve the compensation regulatory mechanism;

Severely punish violations.

E/ Guide social investment

We shall implement the spirit of decentralization and research, and establish the energy storage investment management mechanism that has a simplified process and promotes investment. For independent energy storage projects, the filing system shall be implemented uniformly, in addition to those stipulated under the *Catalogue of Investment Projects subject to Government Confirmation*. In accordance with the principle of territorial filing, filing organizations and authorities shall be set by the governments of the provinces, autonomous regions, municipalities directly under the Central Government, and cities under separate state planning. The enterprise shall file with the competent department in accordance with the relevant local regulations. We shall give full play to the role of the *Scientific and Technological Programs (Special Programs, Funds, etc.) Financed by the Central Government*, and support the research and development of the basic, common and key technologies of energy storage. We shall research and implement advanced energy storage demonstration projects through the central and local infrastructure investments, and guide social capital to accelerate the popularization and application of advanced energy storage technologies. It shall be encouraged to lower the access threshold and risk of energy storage development through financial innovation, and it shall be supported to guide more social capital investment in energy storage industry by adopting a variety of financing methods.

F/ Promote the market reform

Speed up the construction of the power market;

Establish the market-oriented mechanism and pricing mechanism of flexible resources, such as energy storage;

Encourage the energy storage to directly participate in the market trading to achieve profitability through the market mechanism and to stimulate the market vitality;

Establish and improve the access system;

Encourage third-party capital, small micro-enterprises, and other emerging market entities to participate in the market, to promote the equal and coordinated development of all types of ownership enterprises.

G/ Consolidate the foundation of development

Rely on the industry to establish the public platform for energy storage information, and strengthen information connection, sharing and trading services;

Innovative talents introduction and cultivation mechanism: Introduce a number of leading talents, and cultivate a group of professionals to form the intelligence security system supporting the energy storage industry;

Strengthen the publicity, expand the demonstration driving effect, and attract more social resources to participate in the energy storage technology research, industry innovation and development.

National Development and Reform Commission

Ministry of Finance

Ministry of Science and Technology

Ministry of Industry and Information Technology

National Energy Administration

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