

Suggestions on the Development and Utilization of Clean Energy in Xizang

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Abstract: The 14th Five Year Plan of the country clearly points out the need to promote the energy revolution, accelerate energy technology innovation, and build a clean, low-carbon, safe, and efficient modern energy system. Therefore, the development and utilization of clean energy is of great practical significance in the context of the national scientific outlook on development. As an important ecological protection area in China, it is an inevitable trend for Xizang's future economic and social development to use clean energy as energy support. Therefore, accelerating the development and utilization of clean energy in Xizang is of great significance to respond to the national energy strategy, the economic development of the autonomous region, ecological environment protection, and regional stability and prosperity. In view of the problems in the development and utilization of clean energy in Xizang, this paper puts forward suggestions to help achieve the dual carbon goal, so as to promote the rapid development of clean energy development and utilization industry in Xizang.

Keywords: Xizang; Clean energy; Development and utilization; Opinions and suggestions.

1. Introduction

In recent years, with the call of national policies and the strong cooperation of relevant departments, China has achieved tremendous results in the development and utilization of new and renewable energy. It has become an indispensable part of the actual energy system. Vigorously developing new and renewable energy sources has played an important role in promoting national economic development and meeting the energy needs of urban, rural and remote areas. Furthermore, in terms of the domestic energy consumption structure, China is currently in a critical period of energy supply side structural reform. In recent years, the proportion of clean energy consumption to the total energy consumption in China has been continuously increasing. Although the energy consumption structure has been improved to a certain extent, the proportion of coal still ranks first^[1]. Currently, China's high carbon emission coal energy structure and industrial structure with high energy consumption, heavy pollution, and slow consumption decline are challenges that we must face in the long term.

Under the adjustment of the national energy strategy structure, the development and utilization of clean energy will experience rapid development. Since the founding of the People's Republic of China, the economy and society of Xizang Autonomous Region have developed rapidly under the care of the Party Central Committee and governments at all levels, but the overall development has lagged behind the mainland. The reason is that the energy problem is one of the important factors restricting the economic and social development of Xizang. Xizang is an important natural ecological treasure land in China, but because of its special geographical location and climate environment, the ecological environment of Xizang Plateau is very fragile and vulnerable to destruction. Under the national strategic deployment of developing the western region and accelerating the development and construction of the central and western regions, Xizang will enter the fast lane of economic and social development^[2].

This paper relies on the "Sunshine Forum" domestic conference held by the Xizang Autonomous Region Energy Research and Demonstration Center, gathers the advantages of Xizang's clean energy resources and the advantages of mainland talents' scientific and technological resources, promotes the development of Xizang's clean energy scientific and technological innovation, and through the conference discussion, puts forward the following suggestions for the problems in the development and utilization of Xizang's clean energy.

2. Brief Description of Existing Problems

After the 1980s, Xizang has made certain achievements in the application research, demonstration and promotion of solar energy, wind energy, hydropower, geothermal energy and other aspects, but the overall level of development and utilization is low. The development and construction scale of hydropower stations in the entire region is relatively small, and hydropower resources are not effectively utilized; The development and utilization of clean energy sources such as solar and wind energy are still in their early stages, with relatively weak technological capabilities, high utilization costs, and imperfect operational management mechanisms; The development and utilization of geothermal resources are also lagging behind due to the lack of comprehensive planning. In general, the development and utilization level of clean energy in Xizang is low due to insufficient research and development capacity of clean energy, lagging construction of scientific and technological teams, high development and utilization costs, imperfect industrial system and other reasons.

3. Relying on Advantages, Coordinating Planning, And Solving Consumption Problems

From the current situation of Xizang's clean energy industry, the development and utilization of clean energy is

basically extensive use of resources. The development and utilization of clean energy lacks overall, long-term and reasonable planning, and there is no development and utilization climate. Wang Dengjia, a "Young Changjiang Scholar" and doctoral supervisor of the Ministry of Education, stated in a report that "we should overcome the problem of the coordination between photovoltaics and the structure of the plateau power grid, the power storage and heat storage mode, as well as the heating load and electrification level of plateau buildings." Based on the analysis of key influencing factors, the development of new energy in the 14th Five Year Plan period will increase the development of "single scenario and comprehensive scenario" and "single variety development and multi variety complementarity" in the face of challenges such as land use space, consumption and system safety, and marketization, on the basis of "centralized and decentralized development" and "on-site consumption and external consumption" in the past.

3.1. Scientific system layout and expansion of clean energy construction scale

One is to promote the revision of the Renewable Energy Law and improve the working mechanism for unified coordination, promotion, and supervision among multiple government departments; The second is to strengthen the interconnection of power grids, increase the power transmission from Tibet to other regions, improve the pricing mechanism for provincial-level power grids, regional power grids, inter provincial and inter regional special projects, and incremental distribution networks, accelerate the rationalization of the transmission and distribution electricity price structure, and regard energy transmission as the main way to solve local consumption problems; The third is to expand the balance zone of the power grid and establish flexible scheduling mechanisms to promote the consumption of new energy on a larger scale. Give full play to the role of resource allocation in the large power grid, utilize the complementary characteristics and smoothing effects of clean energy power generation resources, expand the balance range of wind and photovoltaic power generation, establish more flexible market trading rules, promote the level of surplus and shortage mutual aid between (provinces) grids, fully utilize and share flexible resources at the lowest cost, and fully leverage the complementary advantages of power generation and load in different regions. Fourth, according to the recommendations of the 14th Five Year Plan for Xizang, in 2025, a national demonstration area for the use of clean and renewable energy will be built to vigorously promote the "water scenery complementarity"^[3], the installed capacity of hydropower projects completed and under construction will exceed 15 million kilowatts, and the development of photovoltaic solar energy will be accelerated to exceed 10 million kilowatts. Therefore, on the basis of improving the backbone grid structure of Xizang power grid and strengthening the interconnection with the southwest power grid, we should scientifically develop clean energy such as photovoltaic, geothermal, wind power, and solar thermal, accelerate the research and pilot of "photovoltaic+energy storage", and vigorously promote "water scenery complementarity". Fifth, we should firmly grasp the policy advantages given by the central government and Xizang's unique resource advantages, play a good combination of "policy+resources", introduce advantageous projects with advantageous resources, cultivate advantageous industries,

and realize the superposition of advantages. Sixth, hydropower is the main force of clean energy power generation in Xizang, photovoltaic power generation is the middle force, and wind power, geothermal power, etc. are the reserve forces. In the zero carbon clean energy energy consumption system throughout the entire lifecycle, it is necessary to systematically study factors such as local resource endowment, development status, energy structure, and technological progress. Therefore, the specific proportion of clean energy components needs to be divided according to local conditions.

3.2. Improve infrastructure and enhance delivery capabilities

A large part of the reason for abandoning wind and solar power is because the areas where electricity is generated and consumed are too far apart. Therefore, it is very important to improve transmission equipment and policies for cross regional power transmission. First, strengthen the construction of power transmission and distribution networks in Xizang, expand and transform the limited section of power grid transmission, adapt to the transmission of fluctuating clean energy power, make it more flexible and intelligent, and actively cooperate with the access of clean energy such as solar energy while meeting the demand of power development; The second is to improve the carrying capacity of distributed photovoltaic and decentralized wind power in urban and county power grids, enhance the optimization configuration ability of distribution networks such as source network coordination and vehicle network interaction, and avoid the transformation of "green electricity" into "garbage electricity" due to grid construction problems. Third, in 2023, Xizang is expected to deliver 1.82 billion kilowatt hours of electricity, covering five regions in North China, Central China, East China, Northwest China and Southwest China, as well as 12 provinces and cities in Beijing, Shanghai and Hunan. Through the transmission of electricity from Xizang, it will create economic benefits of about 500 million yuan for Tibet, and help China's central and eastern regions reduce carbon dioxide emissions by 1.815 million tons^[4]. Xizang has entered the era of 500 kV ultra-high voltage power grid, actively integrating into the "the Belt and Road", and taking advantage of its unique geographical advantages, it can also send Tibetan power to Nepal and other neighboring countries.

3.3. Increase on-site consumption rate and promote domestic sales of clean energy

First, optimize Xizang's energy structure, increase the proportion of clean energy consumption, attract investment from some industries in the eastern region that consume more electricity to Xizang, and make full use of Xizang's rich natural resources. For example, the East West Calculation Project takes into account factors such as abundant electricity, land, and superior natural environment in the western region; The second is to grasp the fundamental purpose of improving flexibility and improve the accuracy of wind and photovoltaic power generation power prediction at different time scales. Based on clean energy, promote the regulation of other power resources to achieve priority consumption and utilization of clean energy; The third is to integrate and optimize the demand on the electricity side, improve the demand side response mechanism, deeply explore flexible regulation resources such as elastic loads, distributed power sources, energy storage, microgrids, virtual power plants, electric

vehicles, and integrated smart energy systems, effectively reduce the peak valley difference of power loads, replace traditional regulation methods such as deep peak shaving on the power generation side, improve the clean energy consumption rate to a certain extent, improve the operating efficiency of the power system, reduce regulation costs, and improve regulation effects. Fourthly, it is suggested to increase the content of vigorously advocating for direct power supply policies and electricity prices, adhering to the strategy of reducing electricity prices by the power generation side, compensating for grid fees by the transmission side, and purchasing more electricity by the purchasing side, in order to improve the utilization hours of power generation in power plants.

3.4. Developing multi energy complementary technologies to improve the grid connected consumption rate of wind and solar power

Xizang ranks first in the country in solar energy resources and is one of the richest regions in the world; Wind energy resources rank seventh in the country^[5]. The clean energy technology of wind and solar energy storage has become very mature, with advantages such as independent and controllable energy, saving electricity costs, sustainability, green and pollution-free, low maintenance costs, no geographical restrictions, and short construction cycle time; But at the same time, it also has disadvantages such as high initial investment, low energy density, unstable power generation quality, being greatly affected by four seasons, day and night, and cloudy and sunny weather, high energy storage costs, and large land occupation.

Next development direction:

One is that multi energy complementarity is not only the complementarity of various power sources in terms of power generation characteristics at the medium and long-term scale, but also the complementarity of new energy sources in short-term output due to randomness, volatility, and uncertainty. The fluctuation of photovoltaic power generation includes three levels: random fluctuation, inherent fluctuation, and intermittent fluctuation. Therefore, the compensation for photovoltaic power also includes three aspects: first compensation eliminates sawtooth random fluctuation, fills the output gap of photovoltaic power generation as much as possible during the period of power generation, and makes the output curve as close as possible to the typical curve of cloudy and sunny days; Secondary compensation further adjusts the inherent fluctuations of photovoltaic power generation period on the basis of primary compensation, in order to form a stable power output during the power generation period; Triple compensation fills in the intermittent fluctuations at night on the basis of the first two levels, thereby ensuring stable output of photovoltaic power generation within a day. The second is to improve the grid performance of clean energy coupled power generation, enhance the active support ability of wind power, photovoltaic power generation, and the ability to adapt to power system disturbances. For example, research is being conducted to enable wind and solar power converters to have the ability to operate autonomously, in order to address the risks of low voltage ride through and large-scale disconnection faced by large-scale grid connection of clean energy in the future.

3.5. Grid type energy storage pilot project to improve energy storage economy

Firstly, as the proportion of new energy generation increases, the difficulty of maintaining grid stability also gradually increases. It is necessary to coordinate the planning and research of renewable energy integration, focusing on integrated resource allocation, integrated development and construction, integrated scheduling and operation, and integrated participation in the market; Secondly, in the entire energy storage system, batteries determine the capacity of the energy storage system, accounting for over 50% of the cost and attracting attention from all parties in the energy storage industry chain. The installation of a grid type energy storage system can not only provide a stable voltage source for the power grid, but also actively suppress various types of disturbances in the power grid, alleviate transient voltage, frequency and other stability problems in the power system, and effectively improve the new energy consumption capacity. Meanwhile, compared to conventional energy storage devices of the same capacity, grid type energy storage devices can not only actively provide inertia support, but also provide short-circuit capacity three times higher than their own capacity^[6]. It also has the advantages of better peak shaving, frequency modulation and voltage regulation performance, and faster response speed. It can effectively improve the transient power grid stability problems caused by conventional energy storage in weak grid areas, and enhance the active support ability of the energy storage system to the power grid. However, grid based energy storage technology is relatively cutting-edge and currently faces issues such as weak overload capacity, poor technical and economic efficiency, unreasonable configuration with active support, and lack of corresponding technical standards. Therefore, only pilot projects can be established.

4. Planning Schemes, Sharing Mechanisms, And Integrated Development

The achievement of the dual carbon goal has put forward new requirements for the development of clean energy. The role of clean energy in top-level design has been strengthened, and policies to stimulate clean energy consumption have become more active. Clean energy will enter a new stage of large-scale, high proportion, marketization, and high-quality development. At the same time, the internal and external situation is complex, and there are many problems to face. The clean energy policy system has expanded to a complex policy system deeply integrated with other power sources, regulatory resources, and power grid construction in the power system, based on the original relatively independent clean energy planning, development and construction, pricing, and consumption and utilization mechanisms.

The Clean Energy Industry Special Group of Xizang Energy Bureau proposed: "Promote the rapid development of Xizang's clean energy with a systematic concept, serve the new development pattern of" one base, two demonstrations "of clean energy, and build a" 1+2+N "energy and power planning system." Promote the development of power grids, implement clean energy base consumption markets and supporting power grid projects, and ensure the coordinated development of clean energy planning and power grid development planning from the source. Effectively promote

the strategy of prioritizing the development of clean energy, and tilt policies such as research and industrialization support towards clean energy.

4.1. Improve and clarify grid electricity prices

First, Xizang's competent price department formulated the peak valley time-sharing electricity price policy, widened the gap between peak and valley prices, and defined the guiding electricity price for domestic demand photovoltaic and energy storage projects; Secondly, the electricity price of off grid photovoltaic projects with self use incremental loads shall be determined through negotiation between the supply and demand parties; The electricity price for self use incremental load grid connected photovoltaic projects shall be determined through negotiation between the supply and demand parties and the power grid enterprise; The third is the electricity price for external photovoltaic projects, which shall be determined through negotiation between the transmitting and receiving markets in accordance with relevant national regulations.

4.2. Establishing a market-oriented resource allocation mechanism

Firstly, for market-oriented grid connected projects with self load of up to 100000 kilowatts (inclusive), except for those that can be directly allocated, other supporting photovoltaic projects such as pumped storage and hydropower stations are generally determined as investment entities through market-oriented competition; Secondly, the local (city) energy regulatory department shall prepare a competitive allocation implementation plan in accordance with the annual development and construction plan issued by the autonomous region's energy regulatory department, and organize its implementation. The allocation results shall be reported to the autonomous region's energy regulatory department; The third is to improve the competition work, with the procedure as follows: issuing announcements → enterprise application → qualification review → comprehensive evaluation → public announcement → organization and implementation.

4.3. Accelerating the Integration and Development of Resource Advantages and Industries

Firstly, combining the advantages of abundant photovoltaic resources and market demand in the entire region, we will scientifically and orderly promote the integrated development of the photovoltaic industry chain, attract and drive the gathering of cutting-edge technologies, advanced processes, and equipment manufacturing industries, and drive the development of upstream and downstream industry chains; Secondly, it is proposed to clarify the independent market position of new energy storage, improve the pricing mechanism of new energy storage, improve the incentive mechanism for "clean energy+energy storage" projects, and set targets for the scale of electrochemical energy storage by 2030; Thirdly, by leveraging the hydropower transmission channels and regulation capabilities, new energy projects can be reasonably arranged within a certain range of the hydropower station transmission end, improving the proportion of clean energy transmission and channel utilization, fully leveraging the hydropower regulation capabilities, and maximizing the integrated development of

clean energy in the basin.

4.4. Strengthening the market-oriented allocation of projects

Firstly, we will support the development of key areas such as clean energy, energy conservation and environmental protection, and carbon reduction technologies in a steady, orderly, and precise manner, and leverage more social funds to promote carbon reduction; Secondly, the People's Bank of China provides funding support for eligible carbon reduction loans issued by financial institutions to relevant enterprises in key areas of carbon reduction through a direct mechanism of "loan first, loan later", with a loan principal of 60%, an interest rate of 1.75%, a term of 1 year, and two extensions. At the same time, energy regulatory authorities in various regions (cities) shall prepare project configuration plans according to the project development timeline and propose specific investment entity selection results to the energy regulatory authorities in the autonomous region for review. The energy regulatory authorities in the autonomous region shall submit them to the people's government of the autonomous region for approval.

5. Conclusion

In the context of sustainable economic and social development, the development and utilization of clean energy will inevitably become the mainstream trend in the energy industry in the future. Clean energy will lead the transformation and development of the energy industry with its advantages of low-carbon, environmental protection, safety and efficiency. Xizang has unique advantages in clean energy resources. On the premise of adhering to ecological protection, we should accelerate the development and utilization of clean energy in Xizang, lead the rapid development of clean energy industry, form a clean energy development and utilization model with Xizang characteristics, and make Xizang a model for China's clean energy development and utilization.

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