Economic Development and Comprehensive Utilization Trend of Energy and Electric Power in the Western Region

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Abstract. This article systematically analyzes the development of Western region from the perspective of economy, industry, and energy and power utilization. Based on the characteristics of energy-intensive industries in western region, this paper investigates the development trend of comprehensive utilization of energy and electricity in western region and puts forward relevant suggestions.

Introduction

At present, there are many studies on the economic development and energy and electricity in the western region. For example, Literature [1] proposes measures such as the use of new technologies to transform and upgrade traditional industries, vigorously develop energy conservation and environmental protection industries, and exploit new energy sources. Literature [2] discusses the development and utilization of sustainable energy resources such as West-East Gas Transmission and West-East Electric Transmission. Literature [3] puts forward many agricultural development problems and their evolitional trends in the process of economic development in the western region. Literature [4] optimizes the design of eco-industrial parks in the western region, puts forward a plan for the realization of the industrial eco-cycle of industrial parks, and Literature [5] demonstrate the advantages and benefits of the northwest-southwest network in China. These documents have analyzed the situation of boosting the economic development of the western region from different angles, but the angle is relatively single. This paper systematically analyses the trend of economy and energy and power utilization in the West from three angles of economy, industry and energy, and puts forward relevant suggestions as a supplement to the study of the situation in the west.

Overview of Western Economic Development

Since the reform and opening up, the national economy has made great progress. However, due to various factors, the economic development in the western region has been relatively slow. Although the western region is rich in natural resources, the deep industrial structure has problems with the differences in the industrial structure and the differences in the industrial structure. It is an important reason for the backward development of the western region. The layout of China's industrial area has the basic characteristics of "South Light North Heavy, East Light West Heavy". The eastern region is dominated by light or light mixed industries, while the western region is dominated by heavy industries. Structural differences in industry have led to huge differences in economic output levels between regions.

In the early period, the effective implementation of the Great Western Development Strategy has laid the foundation for the economic take-off of the western region and the accumulation of human resources. In particular, the Belt and Road Strategy is also a great opportunity for the western region to give full play to its geographical advantages and to open up to the outside world.
Overview of High Energy Consumption Industries in the West

After years of rapid development, high energy consumption has become an advantageous industry in the western region. Taking crude steel, caustic soda, cement, non-ferrous metals and other major energy-consuming products as examples, since 2006, the proportion of the output of corresponding products in the western region has gradually increased, and by the end of 2015, the output of crude steel, caustic soda and cement in the western region accounted for more than 20% of the country's total output. Non-ferrous metals production accounts for more than 40% of the country's total production.

Judging from the changes in the layout of the energy-intensive industry in the country, the textile industry and the paper industry have gathered from the central and northeastern regions to the eastern regions, and the oil processing industry has shifted from the Northeast to the western regions. The proportion of the chemical industry in the country has increased.

Current State of Energy Consumption in the West

Judging from the current situation of terminal energy consumption, coal still occupies a dominant position in the Western energy consumption, of which Inner Mongolia and Guizhou coal consumption account for more than 50%. In Qinghai and Ningxia, electricity accounts for the highest proportion of terminal consumption, accounting for more than 30%.

In recent years, the growth rate of electricity consumption in the West is higher than in other parts of the country, and the contribution to the growth of electricity demand in the country has increased significantly. Most provinces are growing faster than the national average, with Xinjiang, Tibet and Inner Mongolia showing higher growth rates.

Judging from the structure of power consumption, the consumption of electricity in the West is dominated by secondary production. In 2015, the proportion of secondary production of electricity in the West was about 78%, which is higher than that in other regions of the country. In particular, in the western provinces, except for Tibet, the proportion of secondary electricity consumption in other Western provinces exceeds 60%, of which Qinghai and Ningxia account for more than 90%, far exceeding the national average, and Xinjiang, Gansu, Yunnan, Guizhou, and Inner Mongolia are higher than the national average level.

The West is gradually replacing the East as the main source of high energy consumption growth. During the 12th Five-Year Plan period, the growth rate of high energy consumption in the West reached 9.5%, which was 3.8 percentage points higher than in the East. The proportion of high-energy consumption in the western part of the country has increased significantly, from 35% in 2010 to 41% in 2015.

Non-ferrous metals and chemical electricity in the western region account for a relatively large number. According to the ranking of high energy consumption in the country in 2015, the black metal industry ranks third in Inner Mongolia and seventh in Guangxi. The non-ferrous metals industry ranks second in Xinjiang, third in Inner Mongolia, and fifth in Gansu. The chemical industry ranks first in Inner Mongolia and fourth in Xinjiang.
Table 1. Electricity consumption in the four major energy-intensive industries in the western region in 2015.

| Area     | Chemical Materials and Chemical Products Manufacturing(%) | Non-metallic mineral products as a percentage of electricity(%) | Electricity share in ferrous metal smelting and pressing processing(%) | Electricity share in non-ferrous metal smelting and pressing processing(%) |
|----------|----------------------------------------------------------|---------------------------------------------------------------|------------------------------------------------------------------|---------------------------------------------------------------------|
| Nationwide | -                                                        | -                                                            | -                                                              | -                                                                  |
| Mongolia  | 14.17                                                    | 1.78                                                          | 6.86                                                            | 9.34                                                               |
| guangxi    | 1.37                                                     | 3.58                                                          | 4.46                                                            | 2.54                                                               |
| chongqing  | 1.18                                                     | 2.57                                                          | 1.01                                                            | 1.62                                                               |
| sichuan    | 3.77                                                     | 5.05                                                          | 4.40                                                            | 2.39                                                               |
| guizhou    | 2.80                                                     | 3.70                                                          | 2.26                                                            | 2.46                                                               |
| yunnan     | 3.14                                                     | 3.34                                                          | 3.51                                                            | 5.22                                                               |
| xizang     | 0.00                                                     | 0.17                                                          | 0.00                                                            | 0.00                                                               |
| shanxi     | 2.35                                                     | 1.54                                                          | 1.23                                                            | 0.83                                                               |
| gansu      | 1.18                                                     | 2.07                                                          | 2.00                                                            | 7.55                                                               |
| qinghai    | 1.23                                                     | 0.91                                                          | 2.47                                                            | 5.81                                                               |
| ningxia    | 4.20                                                     | 1.61                                                          | 4.03                                                            | 3.21                                                               |
| xinjiang   | 6.80                                                     | 1.59                                                          | 1.23                                                            | 14.97                                                              |

Analysis of Energy Development Trend in Western Region

With social development, economic growth and the improvement of people's living standards, the demand for energy and electricity in the western region will continue to grow, but the growth rate of energy and electricity demand will generally slow down. At the same time, China has promised to peak carbon dioxide emissions around 2030 and will strive to reach them at an early date. In the future, energy and electricity needs to meet the National carbon emission requirements. Clean energy utilization is increasingly important.

Renewable energy in the western region has developed rapidly, and wind power and solar power generation have accounted for an increasing proportion of the total installed capacity in the western region, which is higher than the national average. In 2015, the installed capacity of non-fossil energy in the western region accounted for about 53 %, which was 32 percentage points and 25 percentage points higher than that of Gaoyue in the East and central regions respectively, which was close to the level of the United Kingdom in the same period.

The western region is rich in wind power and solar energy resources. Wind power installed capacity in the western region accounts for nearly 60 % of the National wind power installed capacity; Inner Mongolia, Xinjiang, and Gansu rank among the top three wind power installations in the country, and the three provinces account for 40 % of the total wind power installed capacity in the country. The installed capacity of solar power generation in the western region accounts for about 65 % of the total installed capacity of solar power generation in China; The installed capacity of solar energy in Gansu, Qinghai and Xinjiang ranks among the top three in the country, and the installed capacity of solar power generation in the three provinces accounts for 40 % of the installed capacity of solar energy development in China.

The output of renewable energy power generation is random and intermittent. Due to the slow growth of power demand, the lack of peak adjustment capacity of the power grid, and the lack of delivery channels, the abandonment of wind and light in the western region is serious. Gansu and Xinjiang abandoned the wind rate ranks first in the country, and Gansu, Xinjiang and Ningxia abandoned light rate ranks first in the country.

In order to alleviate the increasingly serious situation of abandonment of wind and light, the western provinces must actively explore the comprehensive utilization model of renewable energy for energy consumption and civilian use, and improve the capacity for on-site absorption of renewable energy.
Renewable energy heating

The wind power heating scheme is to replace traditional coal-fired boilers with electric boilers and heat storage devices, and use the trough to "discard the wind" for heating. That is, wind power heating uses wind power instead of coal-fired boilers to heat cities and towns, which can increase the regional power load, increase the local capacity of wind power generation, and reduce the pressure on power grid delivery, especially when the power load at night is low. At the same time, the air pollution caused by coal heating was avoided, and wind energy was effectively used to increase the wind energy absorption level of the power grid. Starting from the demand side, the technology reduces the difficulty of wind power peak adjustment and elimination, and has important significance for the continuous development of wind power.

Renewable energy for energy-intensive industries

The use of renewable energy in high-energy industries is also known as the "non-grid wind power development model." That is, wind energy is directly used in high-energy industries that can adapt to wind power characteristics through technological transformation, and can also play a very good role in the power grid. Peak adjustment. In the West, there are also relevant practices for wind power application in the electrolytic aluminum industry. Representative is the Holin River recycling economy demonstration project in Inner Mongolia. The demonstration project built the world's first intelligent local power grid operated jointly by wind, fire and aluminum, with high installed capacity and high renewable energy penetration. The demonstration project made full use of the abundant wind resources in the area of the Horin River, and planned to build a wind farm with a total installed capacity of 800 megawatts. The clean power produced by the demonstration project is directly connected to electrolytic aluminum production enterprises through a self-built smart local power grid. This injected a lot of clean energy into aluminum products. By replacing the same amount of thermal power with zero carbon emissions, the combination of traditional energy and renewable energy has been achieved. At the same time, while increasing the level of wind power absorption, coal is used to generate electricity, aluminum is used for electricity, and aluminum is used for electricity promotion. The operation is optimized through real-time scheduling and systems. The economical comprehensive utilization and efficient local transformation of low-quality lignite, wind energy, electric power and dry water in the area of the Horin River were realized.

Complementary scenery

The scenery complementary power generation system is a device that converts light energy and wind energy into electricity. It uses the complementarity of wind and solar energy resources to solve the problem that the use of wind power alone or solar energy is constrained by factors such as seasons and weather. To make up for the discontinuous imbalance and instability in the resources of wind power and photovoltaic independent systems, the capacity of the system can be reasonably allocated according to the user's power load and resource conditions, and wind and solar energy resources can be used comprehensively. The development of complementary power generation technology has become a research and development trend in the new energy field in China. The complementary power generation technology has promoted the diversification, scale and industrialization of renewable energy, and has also been widely used in the western part of China.

Development Trend of Comprehensive Utilization of Energy and Electric Power in the West

There have been some successful examples of integrated renewable energy systems established in the West, but they are still in the exploratory phase as a whole, with a major focus on the elimination of renewable energy by increasing electricity demand and energy substitution.

In the future, on the basis of exploring technologies for on-site wind power absorption, we will establish a horizontal, multi-source, complementary, vertically coordinated system of absorption, and explore mechanisms for the interaction of supply and demand and market transactions, so as to tap flexible resources on both sides of supply and demand and enhance the flexibility of the entire system.
The comprehensive utilization model of energy and electricity will become the development trend of the comprehensive utilization of energy and electricity in the West.

① Constructing a Multi-Energy Complementary System

Based on the existing complementary systems of scenery, on the one hand, the total user's electricity, heat, cold, gas and other various energy requirements are optimized, and the development of traditional energy and new energy resources is coordinated; On the other hand, the complementary characteristics of different types of power supply are analyzed by considering the spatial and temporal differences and adjustment performance of different types of power supply.

② Construction of Renewable Energy Absorption Mechanism

Absorption mechanism includes demand and supply interaction mechanism and market mechanism. On the basis of studying the characteristics of the electric power load in the West, the mechanism focuses on analyzing the characteristics, potential and scope of the demand-side flexible load in two-way interaction with the power grid, tapping the demand-side flexible resources, and considering the feasibility of participating in the interactive operation of energy-intensive industries. We will integrate the output characteristics of renewable energy and the power load characteristics of the western region, explore the establishment of a mechanism for the interaction between renewable energy generation and electricity consumption by users in the western region, implement demand-side management, and adopt demand response measures such as electricity prices or interruptible load based on market mechanisms. We will tap user-side flexible resources, guide users to participate in the interactive operation of the system in the form of peak adjustment and auxiliary services, promote cleaner production of renewable energy on the ground and local acceptance, and improve the efficiency of comprehensive energy utilization.

In the case of high-energy industries, preliminary research shows that most high-energy loads have varying degrees of ability to participate in system peak adjustment, of which the average load interruptible time can reach 2 H, and the average load adjustment margin is 10 % ~20 %. Because of the use of Silicon controllable control, with fast adjustment characteristics, it is an ideal response resource. The high energy-consuming industries in the western region account for a high proportion of the total load. It is of great significance to analyze the production characteristics and load characteristics of different industries in an in-depth way, and to establish a mechanism for the interaction between supply and demand.

Suggestion

① To raise the level of electrification, actively carry out the substitution of electrical energy, promote the cleaner use of primary and final energy, improve the power grid's ability to access renewable and clean energy, and advocate the improvement of the mechanism for optimizing and regulating the energy structure. Optimization of energy demand structure from the supply side.

② It is recommended that the government improve supporting policies to promote new energy consumption. Under the background of total energy consumption control, we will adjust the distribution of energy demand, speed up the establishment of a comprehensive mechanism for ensuring the consumption of clean energy, increase the capacity for new energy consumption, achieve the scientific and orderly development of new energy sources, coordinate the development of new energy sources and power grids, and coordinate the development of new energy sources and other power sources. Solve the structural contradiction of power supply. We will push forward the reform of the electricity market, further improve the market-based trading mechanism, and stimulate market vitality.

③ It is proposed to strengthen the role of the tariff mechanism in attracting industrial transfer, improve the ability of industrial transfer in the central and western regions, and speed up the rationalization of China's industrial distribution. We will improve the quality of power supply services in the central and western regions, improve the capacity of the central and western regions to
undertake energy-dependent industries through high-quality power supply services, and strengthen industrial transfer power.

④ It is recommended that power grid companies strengthen their research on load characteristics in typical industries, improve their grasp of load characteristics in high-energy industries, fully exploit load increment, and cultivate flexible load. It is proposed that demand-side management should be carried out in energy-intensive industries and pilot projects should be carried out to eliminate renewable energy.

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