Analysis on the Development of Renewable Energy Power Application in the Energy Transition

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Abstract: Today's world is in a wave of energy transition. Relying on the advantages of low carbon and rapid cost reduction, renewable energy has gradually become the core of many countries to promote energy transition and an important way to deal with energy crisis and environmental pollution. Renewable energy power generation has also become the main source of new power generation. Combining energy development, this article analyzes the problems of China's renewable energy power, puts forward suggestions on related issues, promotes energy transition, and contributes to the establishment of a green and low-carbon circular economic system.

1. Introduction
After the Paris Climate Conference was held, the use of clean energy has become the mainstream of the world's energy, and renewable energy has become an emerging energy that is increasingly admired.¹ A research report published by the British think tank Carbon Tracking Agency also pointed out that global stone reserves may be reduced by about two-thirds in the next 50 years, and fossil fuels such as oil, natural gas and coal resources are consumed relatively large. The renewable resources market has a bright future.

As shown in Figure 1, the proportion of fossil fuel consumption such as coal in my country is on a downward trend, while the proportion of clean energy continues to rise. Existing renewable energy power projects are constantly weakening the competitiveness of fossil fuel power, and renewable energy is gradually becoming the dominant force in global power growth.² Global fossil fuel power generation declined for the first time in 2019, and the growth of renewable energy power exceeded the growth of power demand. Photovoltaic power generation and wind power generation have gradually become lower-cost sources of power generation. In the next 10 years, most renewable energy sources will have price competitive advantages and huge market potential.
2. Development status of renewable energy power

Table 1 shows the country’s installed power generation capacity and its share during the 13th Five-Year Plan. My country’s renewable energy power is booming. As of the end of November 2020, my country’s installed power generation capacity was 2.12 billion kilowatts. Hydropower installed capacity is 370 million kilowatts, of which conventional hydropower installed capacity is 340 million kilowatts; wind power installed capacity is 240 million kilowatts; solar power installed capacity is 230 million kilowatts; the cumulative installed capacity of biomass power generation reaches 26.17 million kilowatts, of which 2.47 million new installed capacity kilowatt. It is estimated that the national installed power generation capacity will be approximately 2.14 billion kilowatts in 2020, an increase of about 6.3% over the previous year. The national installed capacity of non-fossil energy power generation reached about 930 million kilowatts, an increase of 1.7% compared to 2019, accounting for 43.7% of the total installed capacity. The proportion of wind power and solar power installed capacity increased to 22.8%, an increase of 2.2 percentage points from the previous year. Renewable energy power is gradually developing from supplementary power sources to main power sources.

Table 1: National installed capacity of power generation from 2016 to 2020

| Power generation method | National installed capacity of power generation (Ten thousand kilowatts) |
|-------------------------|-----------------------------------------------------------------------|
|                         | 2016   | 2017   | 2018   | 2019   | 2020   |
| Thermal power           | 106094 | 111009 | 114408 | 118957 | 123000 |
| nuclear power           | 3364   | 3582   | 4874   | 4874   | 4989   |
| Hydropower              | 33207  | 34377  | 35804  | 35804  | 37000  |
| wind power              | 14747  | 16400  | 20915  | 20915  | 24000  |
| Solar energy            | 7631   | 13042  | 20418  | 20418  | 23000  |

3. Limitations of renewable energy power development

3.1. Renewable energy output is volatile, intermittent and uncertain in forecasts

Both wind power and solar energy are typical intermittent energy sources. The output of wind power has strong randomness and volatility. The output of photovoltaic power is mainly affected by seasonal
and weather factors. When considering the power system planning, operation and dispatch of wind power and photovoltaic power generation grid connection, the uncertainty of wind power output and photovoltaic power output must be considered. Although the short-term forecasting technology of wind power output and photovoltaic output has been applied to the power system, there is still a certain error between the existing technology forecast and the actual output.

3.2. Energy system issues
The current energy system is dominated by conventional energy and is not well adapted to the development needs of renewable energy. With the continuous development of renewable energy, the relationship between renewable energy and the entire energy system is becoming more and more complicated. The current energy planning, energy system, market mechanism, and management mechanism are mainly based on fossil energy, which has a relatively restrictive effect on renewable energy power generation.

3.3. The reform of the electricity market puts huge pressure on renewable energy competition
2019 to 2020 is an important time period for renewable energy parity, and it is also a critical period for power market reform. By 2020, wind power and photovoltaic power generation will be developed with zero subsidies. Renewable energy construction is faced with the problems of high construction and operating costs. At the same time, it has to compete with traditional energy for market share, and there is greater pressure to compete with traditional energy without subsidies.

3.4. The regional development model of renewable energy is strong
The development of renewable energy is affected by the region. Most of the regions with abundant renewable energy have low electricity load, resulting in the low matching of renewable energy development model and resource load distribution. Insufficient consumption of electric energy can easily lead to the phenomenon of "abandonment of wind" and "abandonment of light". At the same time, the cost of connecting wind power and photovoltaic power generation to the grid is relatively high.[3]

4. Recommendations for the development of renewable energy power

4.1. Strengthen guidance and improve mechanisms.
The development of renewable energy must transition from stimulating installed capacity to guiding consumption. It is necessary to open up more development space for sustainable development of renewable energy through new mechanisms. At the same time, it is necessary to improve the corresponding renewable energy laws and regulations, establish and improve the relevant policy guarantee system, increase policy and technical support for the development of renewable energy, and improve the financial and insurance system for renewable energy power generation. Promote the healthy development of renewable energy power.[4]

4.2. Synergistic and complementary development of multiple energy sources to form a cluster industrial chain
Adjust measures to local conditions and achieve reasonable allocation of energy. Develop localized, miniaturized, distributed wind power and photovoltaic power generation. At the same time, relying on my country is a large agricultural country with abundant biomass energy, and actively develop biomass power generation. Gradually form a new pattern of coordinated development of several energy sources, complementary utilization, local consumption, and at the same time the surplus electricity is connected to the grid to obtain certain benefits.
4.3. Continuously improve the intelligence of the power grid and increase the flexibility of the power system.

The power generation characteristics of renewable energy sources such as wind, solar energy, and water determine that its grid-connected consumption requires strong flexibility in the power system. It is necessary to actively develop new energy generation power prediction technology and level based on weather forecast, adjust and optimize the power installation structure, and strengthen the flexibility and regulation ability of the power regulation performance of the unit. Do a good job in the connection of grid planning and power demand, and create a technological environment suitable for the development of renewable energy.

4.4. The principle of marketization

In the early stage of renewable energy development, government subsidies are mainly used to ensure its sound development. In the case of “zero subsidies” for wind power and photovoltaic power generation, the government should actively encourage enterprises to carry out technological innovation to gain market competition and avoid excessive reliance on the government. Renewable energy companies should actively undertake market research and development and capital investment functions. Form a renewable resource integrated industry cluster, become the backbone of the promotion of industrial development, and have the advantage of competing with traditional energy. The role of the government should also be transformed from participation to service and supervision. It is necessary to actively improve the construction of the renewable energy market and create an environment suitable for renewable energy power.[5]

4.5. Establish a management system suitable for renewable energy power generation

According to the characteristics of renewable energy power generation projects, establish a public information management platform, establish a coordination management mechanism for relevant departments, and do a good job in the information exchange between upstream resource forecast intermediate production enterprises and downstream end users.

4.6. Optimized power grid configuration capabilities to improve energy consumption

Optimize the complementary and coordinated control of multi-energy such as water, fire, wind, and light, comprehensively use wind energy and light energy to complement each other, water elevator cascade adjustment, thermal power deep peak shaving, energy storage peak and valley filling, to make room for new energy and improve Renewable energy consumption level.[6]

5. Conclusion

My country needs to actively improve its independent scientific research capabilities and independent innovation capabilities to provide technical support for the development of renewable energy; strengthen the construction of the renewable energy system, increase clean energy consumption, and provide a suitable environment for the development of renewable energy; actively stabilize policies and market stability, adhere to scientific and reasonable long-term planning; play the key role of enterprises in the market, accurately locate and actively solve the bottleneck in the development, and achieve faster and better development of the renewable energy power generation industry.

6. Concluding remarks

The vigorous development of renewable energy power will affect the development trend of the power system. In the future, my country will build a flexible power system centered on clean energy, and study the development status and existing problems of renewable energy power will help promote renewable energy. The healthy development of electricity will also help promote the sustainable development of our country.
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