Comprehensive exploration of the development status and future prospects of abandoned wind heating

Qiwei An

Department of Power Engineering, North China Electric Power University, Baoding, Hebei 071000, China
1589078941@qq.com

Abstract. As a renewable energy source, wind energy has been rapidly developed in the current exhaustion and lack of energy. However, while wind power construction is developing rapidly, the wind curtailment phenomenon caused by the difficult problem of transportation and consumption is also becoming more and more popular. Seriously, it caused a lot of waste of energy. This paper introduces the background of the cause of abandoning wind and the development status of abandoned wind power generation at home and abroad. Combined with a large number of related researches, it analyzes the prospects of abandon wind power generation operation and evaluates the development prospect of wind power heating. Finally, the development of abandoned wind heating has been prospected.

Keywords: wind power heating, wind abandonment, wind power grid connection, wind power capacity, renewable energy, pollution.

1. Introduction

As the quality of life improves, residents need more and more heat. For a long time, China's heating areas mainly use coal-fired boilers for heating. In energy consumption, coal accounts for about 72% of the total, of which 159.99 million tons are used for heating. Coal is a representative non-renewable energy source. The large amount of it used for power generation and heating will cause great environmental pollution, such as smog. As a renewable and clean energy source, wind energy is the next energy choice for developing countries with more pollution than protection under current conditions. In the 1980s and 1990s, the development of wind energy has quietly bloomed in China. Today, Inner Mongolia, Gansu, Xinjiang, Hebei, Jiangsu and other places have abundant wind energy resources. China's wind power installed capacity is also growing faster and faster, ranking first in the world. However, while the wind power construction is developing rapidly, the large-scale abandonment of wind and electricity caused by the difficult problem of transportation and consumption has become the biggest problem in the history of China's energy development. Figure 1 shows the loss of electricity in the past few years. Therefore, this paper analyzes the prospects of wind power heating operation based on the current situation of using wind power generation heating at home and abroad, combined with the causes of wind abandonment, and finally evaluates the development prospects of wind power heating.
Figure 1. shows the loss of electricity in the past few years

2. Research background and significance

2.1. Research background.
In recent years, China's economy has developed rapidly, but the use of non-renewable energy is increasing, such as coal, oil, and natural gas. This has not only led to energy shortages, but also caused serious pollution of the environment, such as smog. Wind energy has attracted people's attention as a clean renewable energy source. However, due to various reasons, the wind abandonment phenomenon has become more and more serious. Therefore, it is urgent to find a new heating mode, which can get rid of the excessive energy of traditional energy. Dependence, reduce pollution to the environment, and can solve the phenomenon of abandoning wind well, so as to achieve multi-win.

2.2. Causes of grid abandonment.
Because most of the abandoned wind occurred in the low temperature period of the winter heating period in Northeast China, the main reasons for the generation of abandoned wind were analyzed for the characteristics of the power system in the area.

(1) Insufficient peaking ability leads to abandoning wind

Wind resources are uncertain, which leads to wind power volatility and poor predictability. This requires other power supplies to provide backup and peak shaving services to meet the needs of wind power grid-connected. The proportion of wind power in the system determines the difficulty of system peaking to a certain extent. When the proportion is small, the power dispatching agency will reduce the proportion of other power generation to achieve a real-time balance, and as its proportion is higher, the wind power output of some areas may exceed the load. Requirements. At this time, nuclear power, thermal power, etc. will play a major role in the system.

(2) Blockage of distribution lines leads to wind abandonment

In general, the geographically rich areas of the wind energy resources may be relatively remote, at the end of the power grid, the power distribution structure is relatively weak, and the volatility is relatively large. Moreover, wind power development has become more and more rapid in recent years, and the strength of power grid investment construction is far less than the demand for wind power development. Therefore, before the upgrade of the supporting distribution network, the power dispatching agency forced the wind power output to be limited in the case of line congestion.

(3) Insufficient transmission capacity leads to abandonment of wind

Although many countries are strengthening the planning and construction of power grids, the development of cross-regional multinational power grids must not only face the constraints of the management system, but also the difficulty of coordination and the long construction time. At this time, discarding the wind will become an option for the organization.

2.3. Research significance.
Wind energy has great commercial potential and environmental value. Another feature is that the part that can be developed is relatively high. According to statistics, about 2 * 10^7 mw of wind energy can be
developed and used on the earth, about 10 times the energy of water. At the same time that the wind power development speed is too fast, the wind abandonment phenomenon becomes more and more serious. Wind power heating scheme may be the most effective way to solve the problem of wind abandonment in Northeast China. It has been promoted in Northeast China, and it is of great significance to promote wind power consumption and ease the operation of winter wind power grid connection.

2.4. Research status of wind power consumption at home and abroad

2.4.1. Status of foreign research. By the end of 2010, the installed capacity of wind power in Denmark has been about 3,750 mw, and the proportion of wind power connected to the grid has gradually reached about 20%. At the same time, the proportion of cogeneration units has also become higher. The proportion of wind power integration is also far ahead in the world. It has a good guiding role for the development of wind power in China.

(1) By coordinating with the power grids of Germany, Norway and other countries, the Danish power grid has optimized the allocation of resources and achieved a balance.
(2) Improve the peaking ability of the power system.
(3) The Danish electricity market has promoted wind power consumption. The Danish electricity market has solved the peaking problem caused by excessive wind power in the power grid.

2.4.2. Status of domestic research. The scale of China's wind power grid-connected network has gradually increased in recent years. However, in recent years, due to the expansion of wind power grid-connected scale, the wind-induced phenomenon caused by insufficient wind power capacity has gradually emerged in the north and other places. At present, in view of the current situation in China, in addition to the traditional pumped storage power station program, the tie-line delivery program, other new and effective methods have emerged.

(1) Pumped storage power station program. The reservoir is built upstream and downstream of the power station, and the electric energy is converted by pumping and discharging. The position of the water storage is determined by the magnitude of the peak pressure, either the upstream reservoir or the downstream reservoir, thereby achieving mutual energy conversion.
(2) Contact line delivery plan.
(3) Electric boilers to eliminate wind abandonment scheme.

2.5. Research content and innovation points

2.5.1. Research content. The research object of this paper is the current situation of China's use of abandoned wind power for heating. By discussing the utilization of wind energy and the principle of wind power heating, we will lay the foundation for the next step of analyzing China's wind energy and heat supply, as well as wind power supply. In the discussion of Chapter 3, we will analyze the target of China's thermal power supply and How to improve and develop wind and heat supply, this paper will get the research conclusions in the empirical study of wind power heating development prospects in Chapter 4, as detailed below.

2.5.2. Innovation points. This paper can combine the wind and heat development prospects, and outlines the development mode of wind power heating under the current conditions, and in-depth discussion of wind power heating. As a country with a large population and a polluting country, China has practiced for a long time on the road of sustainable development. Finally, it has found a model that uses clean energy to avoid the harm of chemical energy. This paper can be combined with current politics and wind system. The future development model of the hot future is deeply discussed and thought.
3. Related theoretical basic research

3.1. Analysis of wind power heating background
At present, fossil energy-based fossil energy has become more and more developed and developing countries to think about choosing wind energy to make electricity and electricity because of its non-renewability and the danger of huge environmental pollution. At present, solar energy-based heating equipment has occupied a certain position in the market, but there are too many constraints on solar heating. For example, if rainy weather or night will affect energy supply, we need to find another renewable energy source to replace it. Solar energy, this article will study the heat supply prospects of abandoned wind.

3.2. Operation mechanism of wind power heating

3.2.1. Configuration Scheme. The wind power heating system mainly includes wind farms, transmission lines, electric heating boilers, heat storage devices (including storage and heating water pumps), heat exchange devices, automatic control systems, heating pipes and heat loads.

3.2.2. Wind power heating scheme to eliminate the operating mechanism of abandoned wind. According to the operating principle of wind power heating, the following modes exist in the scheme.
(1) Electric boiler simultaneous heating and heat storage mode
(2) Heat storage tank independent heating mode
(3) Electric boiler and heat storage tank jointly heat supply mode
(4) Electric boiler independent heating mode

3.3. Analysis of wind power heating operation prospect mode

3.3.1. Leading mode of wind power enterprises. The current situation of China's thermoelectric power production in enterprises is the production and operation mode of "heating electricity", which makes many enterprises stagnate and difficult to promote the heating of wind power. However, wind farm-based wind-heat power mode is a good choice to adapt to China's current situation. Electric heating is not too economical in nature. If the benefits of grid-connected wind power are used to compensate for the loss of electric heating, enterprises will have a large profit margin. The main mode of wind power companies has tended to combine heat and wind power cycles.

3.3.2. Multi-party benefit sharing model. The main idea is to combine wind farms, heating companies and the power sector, and the related settlement of prices between them is based on the principle of mutual benefit. As shown in Figure 2, the price we are talking about here is not the cost price of wind power generation and heating. In the future, many companies will be involved in such a shared benefit model, because in this way, many parties are in the wind power supply. It can obtain benefits and greatly mobilize the enthusiasm of wind power heating to promote the development of national wind power heating.

3.3.3. Thermal power plant is the dominant mode. There is also a mode for the peak of wind power and the peak period of heating. In order to reserve space for the wind power grid, the thermal power plant will invest and construct electric steam boilers by itself, and provide heat for the users through the boiler when the wind power is low. The advantage of this mode is that we are less abandoning wind and electricity, and interacting with wind power by thermoelectricity to reduce the pressure of wind power heating. The advantage of multi-network power generation is that the cost of implanting is first saved, followed by the stabilization of the wind power heating system.
4. Wind power heating status and problems

4.1. China's wind power generation status and existing problems analysis

4.1.1. Analysis of current status of wind power generation in China. China's rapid development in the field of wind power in recent years, the state's investment in scientific research has also increased year by year, with the implementation of national science and technology projects, industrialization projects and "863" projects, China's sustainable development strategy is gradually implemented into new energy construction. As one of the traditional clean energy sources, wind power generation is low. The high conversion rate and relatively mature technology have greatly helped China to get out of the haze of polluting countries.

4.1.2. Analysis of China's wind power generation heating problem. Wind power generation in China is only used in Inner Mongolia, Gansu, Xinjiang, Hebei, Jiangsu and other regions. However, due to grid transportation, wind energy is not fixed, wind energy forecast is not accurate, etc., this part of the region chooses coal and other chemical industries. The raw materials are supplied with more power and the pollution is very large. Moreover, the heat generated by the wind is very low in heat supply efficiency. And there are many influencing factors in the use of wind power generation during peak hours, which will generate a large amount of abandoned wind. Therefore, we need to further solve the problem of abandoned wind. The use of abandoned wind power generation is a good choice for China's current and future.

4.2. China's heating development status and existing problems

4.2.1. Analysis of China's heating status. China's heating is mainly supported by thermal power supply, and the support of new energy such as wind energy is analyzed through thermal supplementation. The main source of heat required for urban heating and heating villages in China is through the consumption of chemical energy. The form of central heating in the city is mainly based on large thermal power plants and coal-fired boilers, as well as some gas heating stations and thermal power plants that rely on waste to convert into energy. At the same time, some new energy heating modes such as wind energy are developed, which can meet the heating needs in most parts of China.

4.2.2. China's heating problem. Analysis of China's heating efficiency is relatively low, the heating quality is poor, and the chemical energy consumption is extremely high. Even though the current proportion of chemical energy is as high as 80%, China's wind energy is very rich, and there is a large amount of wind abandonment, and the population's heating gap is very large. Without a recession, we want to reduce the impact of energy consumption and pollution. Looking for a new alternative to traditional heating modes, using abandoned wind to generate heat will be a good and alternative model.

5. Wind power heating development prospects evaluation

5.1. Wind power heating case prospects use
At present, China's use of wind power heating as an emerging wind power consumption and heating method is the preferred way to alleviate the shortage of local wind power installed capacity in China. The relatively insufficient wind power resources are in sharp contrast with the country's wind energy. The former is under-consumed, while the latter may be underpowered. China's wind power development needs to be driven by national policies, but the rapid and disorderly development of wind power in China has seriously delayed the consumption of wind power products.

5.2. Comprehensive evaluation of wind power heating benefits
The economic benefits of wind power heating comprehensive benefits include the benefits of wind power operators in wind power heating multi-network combined power generation. It also includes the
benefits of grid companies participating in wind power and the benefits of investing in wind power installations for heating and heating companies. Therefore, the comprehensive benefits of wind power supply to the tropics are multifaceted, not only in line with national sustainable development goals, but also in the interests of all parties.

5.3. Wind power heating power industry

The current development environment, the future development is relatively simple. It needs to re-enhance the efficiency of new energy use, reduce costs, and improve the profitability of all parties. On the one hand, the development of the energy Internet is conducive to promoting the use of wind power grids to improve power efficiency, avoiding electrical energy and heat energy, thereby saving cost waste; on the other hand, it is beneficial to solve the problem of eliminating clean energy such as wind energy, thereby accelerating China’s Adjustment of the power structure. In addition, the development of the energy Internet has a huge and far-reaching impact on the intelligent deployment of wind power and the increase in wind power utilization of wind power.

6. Conclusion

The purpose of this paper is to develop the new energy in China. Taking wind energy as an example, we will think about and discuss, how to use wind energy, how wind energy can be heated and its principle, how wind energy can be applied in China, and how to abandon wind power generation in China in the future. What is the specific mode? For the detailed information provided by academics and scientific research, although the article has a wide range of wind energy knowledge, it can make corresponding theoretical and practical suggestions for the current focus of heating.

According to many aspects mentioned above, the author believes that the current development prospects of wind energy in the world are very good, and it is gradually being valued by the government in China. However, China has a vast territory, uneven distribution of wind energy resources, and low utilization of wind resources. High, we need to make reasonable use of the wind, and rebuild the wind energy transmission network. Taking heat as an example, although China has been vigorously seeking a reasonable utilization plan, the future road is still very long. Therefore, the author believes that wind power is connected to the network. The thermal supply solution can achieve the best state of energy utilization in the short term, and can achieve mutual benefit and win-win situation. It is hopeful that it will become the best choice for the present and even the future.

References

[1] Chang Zehui, Zheng Hongfei, Hou Jing. Research on performance of multi-curved trough concentrating solar cell electric heating system[J]. Journal of Beijing Institute of Technology, 2012, 32(9): 935 - 940.

[2] He Kaiyan, Zheng Hongfei. Ray tracing and receiver window optimization for a three-dimensional concentrating system[J]. Journal of Guangxi University, 2010, 35(12): 1050 - 1057

[3] Xie Guo, Zheng Hongfei, Wang Haijiang, et al. Research and experiment of new trough solar collectors [j]. Renewable Energy, 2010, 28 (12): 1 - 5.

[4] Zheng Hongfei, Tao Tao, He Kaiyan, et al. Research on multi-curved composite focusing trough solar collectors[J]. Journal of Engineering Thermophysics, 2011, 32(2): 193-196.

[5] Su Wenjuan, Li Yongguang. Experimental Study on Stirring Wind Heating[J]. Journal of Shanghai University of Electric Power, 2016, 32( 3): 274-276.

[6] Zhang Chao, Li Junrui, He Jingkun, et al. Research progress of wind energy heating technology and key equipment in China [j]. Energy Engineering, 2016(4): 31-39.

[7] Jin Hao, Hu Yihuai, Tang Juanjuan, et al. Wind-heating seawater desalination device and parameter design [j]. Renewable Energy, 2017, 35( 5) : 747-752.

[8] Gao Xiangzong, Li Yongguang, Ling Dongdong, et al. Experimental study on the heating characteristics of straight blade stirring [j]. Energy and Energy Conservation, 2016( 5) : 111-
[9] Li Yongguang, Zhang Zhifei, Weng Jianhua, et al. Experimental study on wind-heating with wind agitation[j]. Journal of Shanghai University of Electric Power, 2014, 30(2): 111-114.

[10] Wang Shirong, Shen Dechang, Liu Guoxi, et al. Wind power lifting and wind heating [m]. Beijing: Science Press, 2012, 168-175.

[11] Morren J, de Haan S W H. Short circuit current of wind turbines with doubly fed induction generator[J]. IEEE Transactions on Energy Conversion, 2007, 22(1): 174-180.

[12] Hilbert–Huang Transform Based Approach for Measurement of Voltage Flicker Magnitude and Frequency[J]. Yasemin Nal, Doan Gkhan Ece, mer Nezih Gerek. Electric Power Components and Systems. 2015 (2)

[13] BTM Consult Aps. International wind energy development, World Market Update 2001[R]. Ring koebing, Denmark, 2002.