

## Current Situation of Geothermal Resources Utilization in China

Hongwei Zhu

North China Electric Power University, Baoding, China

1067409250@qq.com

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**Abstract:** There are many geothermal resources in China, which are widely distributed and have considerable application prospects. Based on the analysis of the current situation of geothermal resources utilization in several provinces, this paper summarizes the general situation of geothermal resources utilization in China.

### 1. Introduction

With the development of the national economy, people's awareness of environmental protection is increasing. The disadvantages of high consumption, high pollution and high investment brought about by traditional development methods are no longer a problem that can be ignored. In recent years, the haze of major cities has increased the number of patients with respiratory diseases, the greenhouse effect has caused sea levels to rise, and the sharp reduction in fossil fuels has brought about an energy war. Therefore, it is particularly important for the development and utilization of clean, efficient and renewable new energy [1]. Among them, geothermal resources stand out from many renewable energy sources due to their large reserves, wide distribution, and basic geographical limitations. The full use of geothermal resources plays a major role in environmental protection and energy structure adjustment. .

### 2. Overview of geothermal resources

Geothermal resources are due to volcanic eruption, earthquakes, and other methods that cause crustal movement to extract natural energy that exists as thermal energy and is generated by the lava inside the crust and the decay of radioactive materials [2]. The internal temperature of the earth can be as high as 7000 ° C. The most common method of using geothermal resources is to directly extract heated underground water and use this heat source. The main uses of people for geothermal resources are: geothermal power generation, geothermal heating, geothermal hot springs, and geothermal farming. China is rich in geothermal resources, mainly distributed in Yunnan, near Tibet to the Indian Ocean, Guangdong in the South China Sea, Fujian and Jiangsu along the Yellow Sea, and Tianjin and the Northeast around the Bohai Sea. The total reserves are large. Since the 1970s, China's mining technology for geothermal resources has been relatively mature, providing effective assistance for the current protection of the environment and the resolution of environmental problems.

### 3. Current status of geothermal resource utilization by province

In January 2017, the National Development and Reform Commission, the National Energy Administration, and the Ministry of Land and Resources released the "Thirteenth Five-Year Plan" for geothermal energy development and utilization. The plan states that during the "13th Five-Year Plan" period, additional geothermal heating (cooling) The area is 1.1 billion square meters; the newly installed geothermal power generation capacity is 500MW. By 2020, the geothermal heating (cooling) area will total 1.6 billion square meters, and the installed capacity of geothermal power generation will be about 530MW. In 2020, the annual utilization of geothermal energy will be 70

million tons of standard coal, and the annual utilization of geothermal heating will be 40 million tons of standard coal. The annual utilization of geothermal energy in the Beijing-Tianjin-Hebei region reaches about 20 million tons of standard coal. As the first geothermal energy industry plan, this will greatly promote the development of the geothermal energy industry. The following will explore the status of geothermal development from the perspective of each province.

### **3.1 Shanxi Province**

Geothermal resources in Shanxi Province are mainly distributed in the Fenwei Rift Hot Water Zone, which is one of the six hot water zones in China. The area of geothermal well fields and geothermal anomalies in Shanxi Province accounts for about 28% of the province's total area, totaling 43,359.85km<sup>2</sup>. According to 2014 statistics, there are 210 geothermal wellbores in Shanxi Province, which are widely distributed, reaching 10 cities and more than 40 counties [3].

The development and utilization of geothermal resources in Shanxi are mainly used for hot spring bathing, geothermal heating, medical treatment, breeding, planting, and irrigation. Among them, Jinzhong, Taiyuan, Yanggao and other places have developed geothermal resources into hot spring bathing, healing, and entertainment as a hot spring resort industry due to their unique landscape scenery. In terms of geothermal heating, Shanxi Province will use geothermal water in winter. The area used for heating has reached about 1.0625 million m<sup>2</sup>. In terms of aquaculture and farmland cultivation, as of the end of 2014, the annual output of tilapia has reached 300,000 kg, and the annual income from flower cultivation has exceeded one million. 7,500 acres.

However, the use of geothermal resources in Shanxi Province is mainly based on hot spring bathing. No cascade development has been implemented. The utilization of geothermal energy is low, the amount of wastewater is large, and there is no good recharge, which reduces the regeneration capacity of geothermal resources and has a serious negative impact on the environment. influences.

### **3.2 Shaanxi Province**

The geothermal resources of Shaanxi Province have the characteristics of regional distribution, and the geothermal resources are mainly concentrated in the Guanzhong Basin. And according to the latest estimates [4], the geothermal reserves of Shaanxi Province can reach 3227 × kcal, and the calculation is about 461 billion tons of standard coal, while the shallow geothermal energy development area of Shaanxi Province has reached 11.53km<sup>2</sup>, and the groundwater source heat pump [5] It covers an area of 10.268 million m<sup>2</sup>. The use area of ground-source heat pumps is 1.19 million m<sup>2</sup>, while the other types of use are 69,000 m<sup>2</sup>. Geothermal heating is currently the main development and utilization method. As far as Xianyang City is concerned, as the mining volume slows down, the trapezoidal utilization technology is gradually optimized. It has reached 40% of the city's total heating area and the heating ratio has increased to 85%. Geothermal applications have the best effect in cities; geothermal power generation takes second place, although the scale has not yet formed, but high-temperature geothermal water or high-temperature steam in geothermal resources can be used for power generation first; in-situ thermal farming and planting are convenient. The geothermal greenhouse construction area of the park project is 32,000 m<sup>2</sup>. [4] The geothermal breeding farm has reached more than 270 acres, which is mainly used for tilapia and soft-shelled turtles. At the same time, in combination with its own local characteristics, the tourist hot spring scenic area built in the style of mountains and rivers has also been gradually built.

However, the geothermal energy development in Shaanxi Province is too blind, there is no corresponding macro planning guidance, groundwater recharge is difficult, the utilization efficiency is generally low, and there is no overall research and analysis of the departments currently developing and utilizing geothermal energy. At the same time, the inadequate supervision has caused serious problems such as "fake refilling" and "difficult refilling". Although research on trapezoidal technology has begun, less comprehensive utilization has been carried out. In this case, there is less recharge and more utilization, but the utilization rate is low, which can easily cause the regeneration of geothermal resources to be slow and wasted.

### 3.3 Hebei Province

The causes of geothermal resources in Hebei Province are diverse, and they are superimposed on epidemic, conductive, and multiple causes. According to the regional geological structure and topography, the geothermal resources in Jibei can be divided into four major hot water areas in the Jibei Mountain Area, Jixi Mountain Area, Northwest Jishan Mountain Basin, and Hebei Plain Area. [6] There are many hot springs distributed in the underground hot water area of Jibeishan area and Jixishan area, while there are many geothermal wells in the northwestern Hebei mountain basin and Hebei plain area, and there are 3 oil holes in Xiongxian County.

Hot springs in Hebei Province have a long history. Pingshan, Chicheng, Huailai, Funing, Zunhua, Longhua, Suning, Xiongxian and other places have long been established with hot springs of different sizes; in terms of planting and breeding, Xiongxian, Gaoyang, Hejian The use of geothermal resources in other places for planting yields an annual output value of nearly 10,000 yuan per mu, and the tilapia, French snail, and soft-shelled turtle farming industries around the country also earn a lot of income each year. Among them, the snail farm in Xiongxian County has an annual output of more than 10 In the heating of geothermal plants, all counties and cities with geothermal wells directly use underground hot water for domestic heating in winter; meanwhile, Hebei Province in Xiong County [7], Gaoyang, Xinji, etc. The ground also uses groundwater for processes such as leather processing, dehydration of vegetables, and processing of agricultural and sideline products.

The main drawback of the development of geothermal energy resources in Hebei Province is that the survey work is low, most resources are in the blind development stage, and the utilization level is low. Most hot spring water is not used properly, and finally flows freely. In terms of heating, the waste water after heating is directly discharged and there is no recharge. This will cause the country's geothermal resources to be regeneratively difficult, and the wanton discharge of tail water will also increase environmental pollution, which is contrary to the beginning of new energy utilization. View.

### 3.4 Shandong Province

The geothermal resources in Shandong are mainly medium and low temperature geothermal resources, which are widely distributed, many types, and moderate burial degrees. The available shallow geothermal resources of 3000m across the province are about  $31.863 \times [8]$ , which can be converted into 15 billion tons of standard coal. As many as 15 natural hot springs have been discovered, and more than 100 geothermal boreholes have been exposed by thermal engineering.

As of the end of 2018, the geothermal heating area in Shandong Province exceeded 10,000m<sup>2</sup>, and the area of hydrothermal geothermal energy application reached 40 million m<sup>2</sup>. Among them, the new rural geothermal heating demonstration project in Wu'an Town has been able to achieve 100% recharge at the same level. One irrigation mode, while achieving 100% tailwater recharge, the heating area will be increased to about 57,000 m<sup>2</sup>. At the same time, the development of health care and rehabilitation projects in Shandong Province is also rapid, and the mineralization of many hot springs in Shandong Province They are all very good, rich in a variety of trace elements and radioactive elements such as radon, which are very suitable for spa treatment.

Similarly, during the development process, changes in geothermal resources such as water temperature, water quality, water quantity, and water level should be monitored in real time, rational exploitation, effective recharge, and utilization of geothermal resources for different purposes according to different levels. More importantly, we must actively use trapezoidal development technology to improve the utilization efficiency of geothermal resources and prevent waste and ground subsidence from damaging the environment again.

## 4. Development opportunities for geothermal resources

From a policy perspective, since the first plan on geothermal energy was issued in 2017, it can be seen that the use of geothermal energy resources has gradually received attention and ushered in a new dawn. The ground pointed out the forward direction and forward target, and the development of related technologies and resource utilization of geothermal resources is quite broad [9].

At the same time, with the ruling concept of “advancing green development, circular development, and low-carbon development”, people are more willing to choose low-carbon environmental protection and reduce environmental pollution to use energy.

With the dual promotion of policies and popular support, the development speed of geothermal energy resource utilization will surely further increase. The use of resources will also develop from coarse to fine, from heating to drying and efficient agriculture, and then change the heating aspect from a single geothermal energy to a combination of multiple clean energy sources for heating, and increase geothermal power generation.. In the future, China's geothermal power generation industry will implement a "three-step" development strategy that is: medium- and high-temperature geothermal power generation will be the main focus in the near future, supplemented by low- and medium-temperature geothermal power generation; Dry hot rock power generation is the main, and geothermal power generation is promoted nationwide [10].

## 5. Conclusion

After studying the current status of geothermal energy utilization in Shanxi, Shaanxi, Hebei and Shandong provinces, it can be found that Shanxi and Hebei provinces mainly use geothermal resources for hot springs, etc .; while Shaanxi and Shandong provinces mainly use For geothermal heating. At this stage, most of the geothermal energy resources in China's provinces and cities still exist in geothermal heating. With the advancement of technology, the heating area and heating efficiency have also greatly improved, saving many coal resources. However, problems such as low utilization efficiency, where to discharge wastewater, and recharge of geothermal water still exist and are very urgent. If not solved in a timely manner, the problems will be difficult regeneration of geothermal resources and secondary damage to the environment. Therefore, it is necessary to study the trapezoidal development technology of geothermal resources. At the same time, supervision and guidance should be strengthened to ensure that the recharge is practical and effective to ensure the renewability of geothermal resources.

## References

- [1] Zhao Xiaotao, Fu Haiying. Analysis of the status and prospects of geothermal energy development and utilization [J]. *Environment and Development*, 2019,31 (05): 233 + 235.
- [2] Hu Junwen, Yan Jiahong, Wang Shejiao. The status, problems and suggestions of the development and utilization of geothermal energy in China [J]. *Environmental Protection*, 2018, 46 (08): 45-48.
- [3] Gong Limei, He Teng. Distribution and Development Status of Geothermal Resources in Shanxi Province [J]. *Land Resources of North China*, 2018 (06): 19-20.
- [4] Jin Guang. Shallow geothermal energy development and utilization status and countermeasures in Shaanxi Province [J]. *Groundwater*, 2017, 39 (03): 47-48.
- [5] Qiu Genlei, Zhang Xiaolong, Wu Kai. Research on the Status and Problems of the Development and Utilization of Geothermal Resources in Shaanxi Province [J]. *China Non-metallic Minerals Industry Guide*, 2018 (S1): 70-73.
- [6] Zhang Guobin. Distribution characteristics, development and utilization status, existing problems and suggestions of geothermal resources in Hebei Province [J]. *China Coalfield Geology*, 2006 (S1): 25-27.
- [7] Pang Zhonghe, Kong Yanlong, Pang Jumei, Hu Shengbiao, Wang Jiyu. Research on Geothermal Resources and Development and Utilization in Xiong'an New District [J]. *Proceedings of the Chinese Academy of Sciences*, 2017, 32 (11): 1224-1230.
- [8] Xu Junxiang. The geo-environment significance of Shandong geothermal resources and its development and utilization [A]. *Geothermal Professional Committee of China Energy Research*

Association. Proceedings of the National Symposium on Sustainable Development of Geothermal Industry [C]. Committee: China Energy Research Association Geothermal Professional Committee, 2005: 7

[9] Han Ershuai, Wang Feilin, Meng Zhiyuan. Status and Prospects of Extraction, Development and Utilization of Geothermal Energy Resources in China [J]. Clean and Air-Conditioning Technology, 2019 (01): 71-73.

[10] Shen Hengming. Current status and development trend of geothermal energy development and utilization in China [J]. Science and Technology Innovation, 2019 (14): 20-21.