

# THE ROLES OF LOCAL GOVERNMENT IN THE ADMINISTRATION OF GEOTHERMAL RESOURCES IN CHINA

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## ABSTRACT

Unlike most market-oriented economies in the world, China as the biggest planning economy country has its unique characteristics in the administration of its geothermal resources. Take Tianjin municipal city as an example. Tianjin City is located 100 km south of Beijing-the capital city of China and covers an area of 1000 km<sup>2</sup>, having a population of over 8 million. There are 10 abnormal geothermal areas in the city; all of them belong to low-medium temperature basement geothermal fields. Tianjin began to develop geothermal energy in early 1980's. There are 144 geothermal wells in production now. Among them 104 wells are producing from sedimentary geothermal reservoirs and 40 from bedrock. Most of the geothermal energy is for space heating and tap water, and also for swimming pools, green house and fish farming. The geothermal wells belong to different owners and many wells produce from the same geothermal reservoir. The administration and management of the geothermal resources was a big problem. As a kind of mineral resource, geothermal resources belong to the nation. Obviously, only the government has the authority to control and administrate the geothermal resources. On this background, the Tianjin municipal government set up a special department called Tianjin Geothermal Administration Office to control and administrate the geothermal resources in July 1994. The Tianjin government issued a detailed regulation to provide terms and conditions for the geothermal administration. The major roles of the Tianjin Geothermal Administration Office are: 1) to make development plans for the geothermal fields; 2) to organize the feasibility studies for drilling geothermal wells and give permission; 3) to collect tax from the individual geothermal energy users on behalf of the government; 4) to organize the monitoring studies of the geothermal fields; 5) to finance the geothermal research programs. The Tianjin Geothermal Administration Office is the first one of its kind in China and is very successful. Other cities and provinces are learning from the experience to establish their own similar government departments now.

## 1. INTRODUCTION

The geothermal resource is very rich in China. Geothermal fields are scattered all over the country. The types of the geothermal fields include high-temperature tectonic ones and low-medium temperature sedimentary basin ones. The proved total geothermal fields cover an area of about 10149.5 km<sup>2</sup>; the extractable geothermal energy is about  $9.26 \times 10^{19}$  J, which is equivalent to  $3.16 \times 10^9$  tons of standard coal, or  $2.6 \times 10^{13}$  kwh of electricity. It is estimated that the total geothermal area in China is 49808.53 km<sup>2</sup>; the extractable geothermal energy is about  $3.42 \times 10^{20}$  J, the equivalent of  $1.17 \times 10^{10}$  tons of standard coal or  $9.49 \times 10^{13}$  kwh of electricity. Geothermal power plants have been set up in The Tibet and Taiwan high temperature geothermal fields. The low-medium temperature geothermal energy is mainly used for space heating, tap water,

green house and fish farm.

Most of the geothermal fields in remote areas have not yet been developed. But some fields in or near to big cities have been greatly developed or even overdeveloped, such as Tianjin, Beijing, Fuzhou and Xi'an. A lot of geothermal wells have been drilled throughout the years. The wells belong to different owners. Many wells produce geothermal water from the same reservoir, and the well owners operate their wells in their own way without cooperating each other. Thus some problems occurred accordingly. The most serious problem is that in some areas the water level goes down too fast. As a result, some geothermal wells cannot produce water anymore.

Under such circumstances, an organization is urgently needed to regulate the geothermal fields. As a central planning economy nation, only the Chinese government has the authority to form such department. Geothermal administration offices have been set up in some cities where geothermal energy has been well developed in the past years. As a successful one of them, Tianjin Geothermal Administration Office has been running quite well since its establishment in 1994. A regulation has also been issued to control the geothermal development.

## 2. GEOTHERMAL CONDITIONS IN TIANJIN

Tianjin autonomous municipality, located in northern China, near Beijing, is one of the four administrative units directly run by the central government in Beijing. Tianjin is a major port and industrial center. The leading manufactures of the municipality include steel, textiles, machinery, electronic equipment, machine tools, and chemicals. It covers an area of about 1000 km<sup>2</sup>; its population is about 8 million.

In early 1980's, Tianjin Municipal authority began to explore and develop geothermal energy with the help and aids of the United Nations Development Agency (UNDP). The total investment for the geothermal exploration is more than 8 million USD. 10 geothermal areas were located, among which 3 have been thoroughly explored.

The geothermal fields in Tianjin are very large and widespread. The geothermal water stored in the sedimentary basin. It belongs to static storage type. The sedimentary geothermal reservoirs are from 500—2000 m deep, the temperature is from 30-78°C; the bedrock geothermal reservoirs are relatively deeper with maximum temperature 98 °C and the total discharge solid 2000 mg/l.

## 3. GEOTHERMAL DEVELOPMENT IN TIANJIN

Since the geothermal exploration and development in Tianjin, a lot of benefit has been obtained in many aspects. The priority uses are district space heating and tap water. The other uses are green house, fish farm, mineral water, public bathrooms, swimming pools, and industrial washing and drying.

There are now about 144 geothermal wells in Tianjin, among which 104 wells are producing from sedimentary reservoirs and 40 from bedrock reservoirs. Most of the geothermal energy is used for district space heating. The total area heated by using geothermal energy is 4.50 million m<sup>2</sup>.

Because developing geothermal energy can make large profits, so more and more units and companies invested to drill geothermal wells and produce geothermal water for space heating or other utilization. Most geothermal wells are concentrated in certain limited areas where space heating and tap water are great demands. Therefore, some problems were: the water level went down too fast in some areas; the well owners produced geothermal water as much as they like with relatively low cost, so the waste was very large; land subsidence was induced, etc.

#### **4. AN ADMINISTRATIVE DEPARTMENT ESTABLISHED AND A REGULATION ISSUED**

To manage and control the geothermal fields and to alleviate the geothermal development induced problems, an administrative department and a law were urgently needed. Under such circumstances, the Tianjin government established an authority department in 1994 called The Tianjin Geothermal Administration Office. In 1995, a governing regulation was issued: Tianjin Geothermal Resources Administration Regulation.

##### **4.1 Personnel Structure of the Office**

The administration of the geothermal resources should be professional based on science and technology. Therefore, most officers of the Tianjin Geothermal Administration Office are experts on geothermal or relevant specialties. One accountant and one computer expert are also members.

##### **4.2 Major Roles of the Office**

There are many different roles being played by the Office, the major ones are as follows:

###### To make development plans for the geothermal fields.

It is very important to have a general plan for efficient development of a geothermal field. Without such a plan, anyone could drill geothermal wells in any place. A great waste of investment as well as geothermal energy might be caused. Based on the scientific data, the Geothermal Office makes a development plan for every geothermal field of the municipal city, and makes sure the plan to be carried out.

###### To organize the feasibility studies for drilling geothermal wells and give permission.

Drilling geothermal well will not be free anymore in the city. If a unit wants to extract geothermal water in a certain place, it should first apply to the Geothermal Office. The Office made a pre-feasibility study. If the results are not favorable, then the application will be refused. If the pre-feasibility study is satisfactory, then a certain qualifying institution will make a detailed feasibility study. If the feasibility study produces a good result, then the Office would give the permission.

###### To collect tax from the individual geothermal energy users on behalf of the government.

The principle is that the geothermal energy be a kind of

mineral resource, which belongs to the nation. Anyone who taps the geothermal energy has to pay tax to the nation. The Office is authorized to collect the geothermal tax on behalf of the local government. The rate of the geothermal tax is based on the temperature of the produced geothermal water and the quantity.

40°C ≤ t < 50°C	2 USD/100m <sup>3</sup>
50°C ≤ t < 60°C	3 USD/100m <sup>3</sup>
60°C ≤ t < 70°C	4 USD/100m <sup>3</sup>
70°C ≤ t < 80°C	5 USD/100m <sup>3</sup>
t ≥ 80°C	6 USD/100m <sup>3</sup>

###### To organize the monitoring and studying of the geothermal fields.

Monitoring of the reservoir behavior is very important for large geothermal fields. But it is sometimes difficult to make the reservoir monitoring because there are relatively too many well owners in the same field and many owners either do not have the necessary technique and trained personnel or lack the interest. In the past, the Office holds some courses to train necessary personnel for many well owners. Now, most of the wells are being monitored. The data include water level, geothermal water production and water temperature and chemicals in some selected wells.

###### To finance geothermal research programs.

Research is important for the development and utilization of geothermal energy, especially for detailed exploration and reservoir evaluation. Since there are too many geothermal users in the same geothermal field, so none of the users would like to financially support the research programs. Under such condition, only the Geothermal Administration Office could take the responsibilities to finance the research. The programs supported by the Office up to now include exploration and reservoir evaluation of 3 large geothermal fields near the Tianjin city; geothermal space heating and tap water system; anti-corrosion and scaling methods; the feasibility of using heat pump in geothermal heating systems; geothermal re-injection test; the impact of geothermal production on land subsidence. The money used for the research is from the tax levied on geothermal production.

#### **5. CONCLUSIONS**

In a non-market economy country like China, the local government is actively involved in the control and administration of the geothermal energy resources. To achieve such goals, a specialized department has been set up and a detailed regulation is issued, such as Tianjin Geothermal Administration Office and the Tianjin Geothermal Resources Administration Regulation. Geothermal experts of different specialties are appointed as officers of the departments. Tax are charged on the geothermal energy production and a handsome part of the tax is used to support the monitoring of the geothermal fields and geothermal research programs. Special short courses are generally needed to train personnel for the different well owners.

After 5 years operation, the Tianjin Geothermal Administration Office is a very successful organization. Many provinces and cities in China have learned the experience and set up their own similar government departments. The geothermal administration is working as law and guaranteed to the geothermal water production owners.

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