

GEOTHERMAL RESOURCES AND DIRECT USES IN FUJIAN PROVINCE

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ABSTRACT

Geothermal energy in the rural energy in Fujian province had been proper position and perform an important function.

We have found out 20? hot springs. These spring are located in 14 counties. Most of them have hot water of medium or low temperature ($30-60^{\circ}\text{C}$). The average temperature of them is 51°C and the maximum temperature 89°C and 120°C of the spring well hole.

The main projects for geothermal field application in Fujian province are: geothermal greenhouse, geothermal fish breeding, geothermal incubation, duckweed over winter, leather processing, geothermal for propagation of edible fungus, drying mushroom, etc.

THE ADVANTAGEOUS POSITION AND GREAT EFFECTS OF GEOTHERMAL ENERGY IN THE RURAL ENERGIES IN FUJIAN

Geothermal energy is a reproducible new energy which can be exploited and utilized locally. It is not only easy to exploit, less in investment, simple in equipment, convenient to use, and capable of comprehensive utilization, but also has the advantage of safety, clearness and cheapness. It has been in proper position in the rural energy.

With various rural energies in Fujian, geothermal energy ranks next to marsh gas, fuel forest, hydraulic power. But it is more simple and easier in production and utilization, comparison with solar energy, wind power and tide power. For the past few years, it has shown more striking economic results. It has become a reliable productivity, as well as a complement of rural energy. It was reported that geothermal energy for direct uses (not including uses for electric power), in the world, which had come to a thermal power of 12000 MW, increased at a rate of 5-8.5% annually from 1975 till 1985. The same thing has taken place in China. Our statistics of 1986 showed that the total area of geothermal greenhouses in China used for

over-wintering crops, breeding vegetable growing were up to more than 690000m^2 , the water area used for aquatic product with geothermal water amounted to more than 920000m^2 . Other uses for drying, incubation, butchery and irrigation. Also showed obvious economic results, and played a good role in saving energy.

Fujian province is abundant in geothermal resource. We have found out 20? hot springs.

The yearly total amount of thermal energy which geothermal water brings to the earth surface approximates to 212000 tons of standard coal. For the past more than ten years, the exploitation and utilization of geothermal resource in Fujian has been in a position of importance. Remarkable successes have been achieved in geothermal uses for industry, farming, animal husbandry, fishery, medical treatment, sports and touring with both economic and social effects. According to our unfinished statistics, the daily volume of geothermal water flow in Fujian totals 11 billion tons, but the practical volume now used is only 21000 tons a day, that is to say, about 21% of it nearly 80% hot water has not been exploited and utilized yet, what a pity. Moreover Fujian is short of normal energy—coal and oil, particularly in the present day, we are carrying out the new opening economic policy, we have increasingly great demand of energy with the development of various economic undertakings, however, geothermal energy is available to solve these problems. Hence it is more necessary to exploit large amount of underground energy, so that coal petroleum and electric power will be greatly saved. As a complement of rural energy, geothermal energy will help develop rural economy of Fujian province and ensure energy supply in rural lives. In a word, geothermal energy will play more and more outstanding roles in rural energy with its further exploitation and utilization.

GEOTHERMAL RESOURCE AND ITS APPRECIATION

The number of spots we have found in Fujian is ranks the fourth place in China, after that in Tibet, Yunnan and Guangdong three areas,

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and the geothermal ranging density takes the third place in China, after Taiwan and Guangdong provinces. This is one of advantages of natural resource in Fujian.

(1) Range:

There are 207 geothermal spots, of which 167 are natural hot spring, 24 are artificial drill and the others are both of them, mostly located in forty-two cities and counties, particularly in the south-east and south-west in Fujian. For example, 57 spots in Zhangzhou are (most). 34 in Longyan area (second most), and the others in Fuzhou, Quanzhou, Putian, Amoy, etc.

(2) Temperature of water:

The average temperature of hot springs in Fujian is 51°C. The maximum temperature of natural hot springs is 89°C (Dehua). As for drill the highest temperature at the bottom of the hole is 121.5°C, while at the mouth of the hole is 106°C (Zhangzhou). Hot springs in Fujian are mainly of medium low temperature, of which 65 (31.5%) are of low temperature (20-40°C), 85 (41.1%) are of medium temperature (40-60°C), 44 (22.2%) are of medium high temperature (60-80°C) and only 11 (5.3%) are of high temperature (>80°C).

(3) Volume of geothermal water flow and thermal flow:

The average volume of geothermal water flow in Fujian is 72L/S (622 tons daily), the total volume is 1325L/S (114480 tons daily). If take a basic temperature on 20°C, the total volume of thermal flow is calculated to 47100 KCal/S (about 212000 tons of standard coal), of which 41%, 19300 KCal/S (about 87000 tons of standard coal) is of 11 hot springs of high temperature (>80°C), of which 34.7%, 16300 KCal/S (about 73600 tons of standard coal) is of those of medium high temperature (60-80°C) and only other less than 25% is of those of medium low temperature (<60°C).

(4) Appreciation:

Hot springs are dispersed wide, lie hidden shallow in the earth, and water quality is fine. These springs exploit by a few drill, with a little invest, may be achieve great effect. So that geothermal uses for farming, fishery, medical treatment, sports and touring, etc. has a broad prospect.

THE STATUS OF GEOTHERMAL EXPLOIT AND USES IN FUJIAN

The geothermal development and application in Fujian, had been started earlier. Recording to the record and narrate of old books, the geothermal resources had been exploit to use in Fuzhou city in A.D. 945. Since the seventies,

the geothermal development, application and research had got much progress and effect at a great pace. In 1970's began to used for industry (leather processing), farming and medical treatment, till eighties geothermal application had used for aquatic product, food processing (drying mushroom), spots and touring, etc. According to our unfinished statistics, now hot springs used for farming up to 64 spots, of which over 90% used for aquatic products, and other used for breeding plants, duckweed over winter.

(a) For aquatic products: Breeding eel in Chengfeng spot of Yongtai county output value more than 2300000 yuan (about over 300000 dollars). Also in Putian county breeding eel achieved 24000000 yuan (about over 3000000 dollars). And other counties (Lianjiang, Zhangtai, Minhou, Nanjin, etc.) also to develop breeding eel. Another counties as Yunxiao, Zhaoan breeding great shrimps achieved more values. Fuzhou, Amoy, Zhangpu etc. more than ten counties and cities had raising catfish and crucian fish (Tilapia Nilotica), achieved great effects.

(b) Geothermal comprehensive utilization in agriculture:

In end of seventies, Xiayang spot of Yongtai county used for breeding rice seedling, may be promote the rice hybrid into spread with a great pace. Hot springs of Liancheng, Yongding county used for breeding sweet potato seedling. In May 1980, Geothermal agro-utilization institute of Fujian started the study of multipurpose use of geothermal in agriculture. For example: (1) Mass production of rice seedlings in geothermal greenhouse. (2) Rice generation multiplied in geothermal greenhouse all the year-round. (3) Cutting propagation of camellia and grape plants on geothermal hotbed. (4) Geothermal for growing edible fungus. (5) For hatching box. It was run with 55°C water 200-300Kg per day, which volume is able to hatch 1600 eggs once. (6) For tropical fish propagation and over winter. (7) For hatching and raising young catfish (Clarias Leather), in one greenhouse three nursery ponds (7.2m²) were set up to keep the water temperature at 26-28°C by microcomputer. It may be hatching 400000-500000 fry. That institute took hot water into stair uses, may be develop geothermal efficacy in full.

(c) The others:

The hot springs in Fuzhou and Zhangzhou used for medical treatment, as treat skin disease and rheumatoid arthritis (articular). Else used for sports, as hot spring swimming pool, so that swimmers and athletes can be training in winter.

In a word, geothermal energy is an important way for complement the rural energy in Fujian province.

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