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Effects of Development of Geothermal Energy on Promotion of Local Activities in Japan

Mitsuru Sekioka* and Motoo Higo**

*) Department of Geoscience, National Defense Academy, Yokosuka, Kanagawa 239, Japan

***) Japan Geothermal Energy Association, Denki Bldg. 1-7-1 Yurakucho, Chiyoda, Tokyo 100, Japan

ABSTRACT

Although Japan has a large amount of geothermal resources because of a volcanic country, environmental protection activities and hotel/inn businesses in spas around and in geothermal fields are opposed to development of geothermal energy. To coexist with locals developing enterprises of geothermal energy to generate electric power propose to bear some burdens, in addition to grants-in-aid by the national and local governments. The local communities can, therefore, obtain various benefits from development of geothermal energy. In the present article, benefits the communities have received are illustrated separately for supplying of hot water, attracting of tourists, increasing of taxation and introducing of grants-in-aid.

1. Introduction

As 83 active volcanoes or 10 % of about 800 ones in the world exists in Japan, whose area is only $0.4 \times 10^6 \text{ km}^2$ or 0.27 % of $1.46 \times 10^8 \text{ km}^2$ of land area of the entire world, Japan is blessed with many beautiful scenic spots having prospective geothermal resources.

Recently Miyazaki et al.(1991) estimated that the high temperature hydrothermal resources above 150°C is $48.5 \times 10^{18} \text{ J}$, the medium temperature resources between 90 and 150°C is $48 \times 10^{18} \text{ J}$ and the low temperature resources between 42 and 90°C is $82 \times 10^{18} \text{ J}$.

However, national parks cover about 5.43 % of country of Japan. Moreover, the Japanese have enjoyed the pleasures of natural baths. Therefore, oppositions by environmental protection activities and hotel/inn businesses in local spas, who fear drying up of shallow hot spring wells by drilling of deeper geothermal ones for geothermal power generation, are opposed frequently to development of geothermal energy.

To get harmony with locals in developing sites, local governments and developing enterprises of geothermal energy bear some kinds of burden.

In 1987 the Geothermal Energy Association organized a committee to promote growing of local activities through development of geothermal energy. In the present article, based on investigation by the committee by 1994, various contributions of geothermal development on local communities including spas are described for the Mori, Matsukawa, Onuma, Otake and Hatchobaru geothermal power plants (GPP).

2. Supplying of hot water

2.1. Mori GPP, Hokkaido Pref.

Just after starting of exploration for a geothermal power plant in 1973, some feasibility studies of direct use of geothermal water gushing with steam from production wells were carried out by local governments. The power plant began to supply heat transported by a fresh water loop of 250 t/hr at 85°C produced from geothermal water of 150 t/hr at 115°C before its reinjection through heat exchanger to 31 greenhouses ($15,690 \text{ m}^2$) when the plant started operation in 1983. As of 1986 the number of greenhouses increased to 33.

2.2. Matsukawa GPP, Iwate Pref.

A part of geothermal steam was supplied to nearby 3 inns for their space heating when the power plant started its operation in October of 1966. In 1971 fresh-heated water of 60 t/hr at 70°C produced from river water through heat exchanger using geothermal steam to the Hachimantai resort housing complex. The supplying system was improved and expanded to further supply hot water of 200 t/hr at 70°C to 95 greenhouses of the two agribusinesses and 42 hotels/inns, 296 country cottages and 24 others in the Hachimantai resort housing complex in 1984. The improved system was to heat hot water of 48°C discharged from condensers of the power plant by geothermal steam through heat exchangers.

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2.3. Onuma GPP, Akita Pref.

Drilling of production wells set about for the power plant in 1968, after 3 years an exploration project started in 1965. Supplying of hot water of 30 t/hr at 60 °C produced from river water by jetting geothermal steam to nearby 3 inns started in 1972. At present the system is providing hot water of 25 t/hr at 70-75°C to 6 inns in Hachimantai spa for bathing.

2.4. Otake GPP, Oita Pref.

The Otake GPP began to supply geothermal water gushing at exploration wells to local community from 2 years before its operation in 1967 by 1983. Since 1984 the hot water supplying system has been switched over to fresh-heated water of 150 t/hr at 80°C through heat exchangers. At present 122 houses, 12 hotels/inns and 2 greenhouses are benefited by the system.

2.5. Hatchobaru GPP, Oita Pref.

Similar to the case of Otake GPP, the plant started to supply geothermal water from its exploration wells to Sujiyu Spa near the plant from 1969 to 1983. At present the plant supplies fresh water of 150 t/hr at 80°C produced through heat exchangers to 16 houses and 30 hotels/inns.

3. Attracting of tourists

Some geothermal power plants have set up a display room to give publicity of exploration, development and utilization of geothermal energy. By combining the display room with sight-seeing spots of nearby national parks, an increase in tourists is attempted to contribute economically to local communities.

3.1. Mori GPP

The Mori GPP is located near the Onuma National Park. Since 1982 visitors of about 4000 come and see the display room (74.8 m²) every year.

3.2. Matsukawa GPP

Matsukawa GPP is located in the Towada-Hachimantai National Park. The GPP has no display room, but visitors to the GPP is about 36,000 per year.

3.3. Onuma GPP

The Onuma GPP is located in the Towada-Hachimantai National Park. It has no display room. Visitors to the GPP is 4,500 per year.

3.4. Hatchobaru GPP

The Hatchobaru GPP is located in the Aso-Kuju National Park. It has a display room, to which tourists is about 70,000 per year.

4. Taxation

The local taxation of local communities, in which geothermal power plant is located, abruptly increased at the beginning of operation of the GPP as a turning point.

4.1. Mori GPP

In Mori Town (a population of 17,000), Hokkaido Pref., where the Mori GPP is located, the local taxation increased 153 % from ¥ 684,000,000 in 1980 to ¥ 1,046,000,000 in 1985 across the operation of the GPP in 1982.

4.2. Matsukawa GPP

In Matsuo Village (a population of 7300), Iwate Pref., where the Matsukawa GPP is located, the local taxation increased 121 % from ¥ 75,000,000 in 1965 to ¥ 91,000,000 in 1969 across the operation of the GPP in 1966.

4.3. Onuma GPP

In Kazuno City (a population of 45,000), Akita Pref., where the Onuma GPP is located, the local taxation increased 178 % from ¥ 469,000,000 in 1972 to ¥ 837,000,000 in 1975 across the operation of Onuma GPP in 1974.

4.4. Otake and Hatchobaru GPPs

In Kokonoe Town (a population of 14,000), Oita Pref., where the Otake and the Hatchobaru GPP are located, the local taxation increased 191 % from ¥ 255,000,000 in 1975 to ¥ 487,000,000 in 1978 across the operation of the Hatchobaru GPP in 1977. The increase across the operation of Otake GPP in 1967 is unknown by missing of the data.

5. Grants-in-aid

For improvement projects of agriculture by the use of geothermal energy in the local communities, where the GPPs are located, the national and local governments provide various grants-in-aid to the agribusinesses.

On the other hand, the Japanese government has delivered the grant-in-aid of development of power resources to the local offices with and around GPPs.

5.1. Mori GPP

For making of agricultural lands, constructing of greenhouses and buying of

heat exchangers in the greenhouse complex in Mori Town, the Ministry of Agriculture, Forestry and Fisheries, the Hokkaido Prefectural Government and the Mori Local Office subsidized to the agribusiness ¥ 257,000,000, ¥ 2,600,000 and ¥ 120,000, respectively.

The grant-in-aid of development of power resources is ¥ 67,500,000 for Mori Town and the same amount for the 2 neighboring towns.

5.2. Matsukawa GPP

The Ministry of Agriculture, Forestry and Fisheries, the Iwate Prefectural Government and the Matsuo Local Office subsidized to the 2 agribusiness ¥ 224,000,000, ¥ 49,000,000 and ¥ 74,000,000, respectively.

5.3. Hatchobaru GPP

The grant-in-aid of development of power resources is ¥ 120,000,000 for Kokonoe Town and the same amount to the neighboring towns.

6. Conclusion

Development of geothermal energy is frequently not easy in Japan, even at the stage of its exploration, because of opposition by environmental protection activities and hotel/inn businesses in spas in

Thus, for promotion of geothermal power generation in Japan, it is necessary to grow by providing economical and social benefits to the local communities. The present article shows various economical and social policies which have been applied to grow the local communities where GPP are in operation.

Another paper will treat development of geothermal energy having harmony with the environmental protection activities.

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