Social Acceptance of Geothermal Development

— Case Study of Social Acceptance in Izu-Oshima Island, Japan—

Yuki SHIBATA[1], Mihoko KANASUGI[1], Jouju UECHI[2]

1 *Toho University,* 2 *Tokyo Institute of Technology*

Geothermal power has been expected as a renewable energy in Japan, but the geothermal developments have been struggle against stakeholder conflicts. More than 30 new development plans have been formulated in many different areas, but those plans go into deadlock in almost all cases because of the conflict with traditional hot spring spa (Onsen) businesses. In those cases, they strongly/moderately oppose to the new developments due to fear of negative impacts on the hot spring resources. Onsen (=hot spring spa) tourism has traditionally been recognized as an important culture for their community. To avoid these conflicts, we need to identify the stakeholder's concerns/expectations about the social/economic impacts, and integrate those concerns into the assessment process. We conducted an interview survey to all hot spring spa businesses in small volcanic island, Izu-Osima Island. This paper presents the result of the survey and discusses measures for enhancing the acceptance for geothermal development.

Keyword: Geothermal Development, Social Acceptance, Social Impact, Izu-Osima Island, Japan

1. Introduction

After the nuclear power plant accident at Fukushima in 2011, Japanese national government has promoted policies for quickly expanding renewable energy including photovoltaic, wind, biomass and geothermal. In the world of geothermal, there has been growing expectations in geothermal power developments because of Japan's location at the Pacific Ring of Fire.

Japan has world's-third geothermal resource potential (23-GW) behind US (39-GW), and Indonesia (27-GW) (Williams, C.F. *et.al.*, 2008, Darma, S. *et al.*, 2010). However, the Japanese electric capacity of installed geothermal power (537-MW) ranks 8th in the world lists behind US, Philippine, Indonesia, Mexico, Italy, New Zealand, Iceland (**Fig 1**). Geothermal power development in Japan has been started in the early 1970's, and currently 17 large/medium scale geothermal power plants are in operation (**Fig 2**), but the total geothermal electric power generation is only 0.2% of the total electric power supply in this country (Thermal and Nuclear Power Engineering Society , 2012). Further more, after the late 1990's, only one new plant was

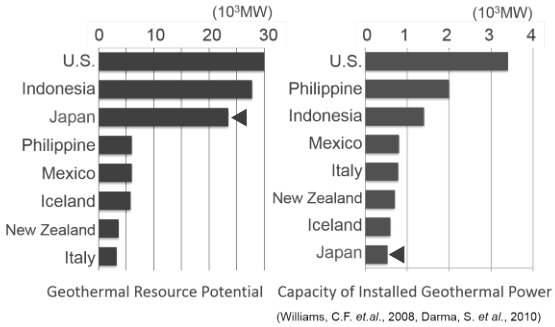

Fig 1. Geothermal Resource Potential and Installed Capacity

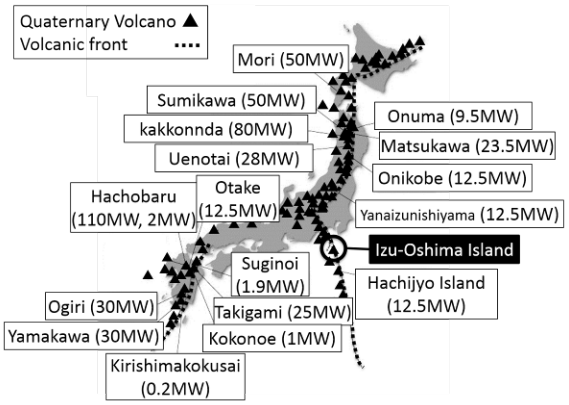

Fig 2. Major geothermal power plant and Ohshima Island
[Thermal and Nuclear Power Engineering Society]

developed and the total geothermal power generation has been decreasing.

As of 2014 though, 38 plans of new geothermal power plant developments have been formulated in many different areas. Many of those plans go into deadlock in almost all cases because of the negotiation with traditional hot spring spa (Onsen) businesses. In those cases, hot spring spa businesses strongly oppose to the new geothermal power developments due to fear of negative impacts on the hot spring resources such as hot spring depletion. From the geological viewpoint, Onsen uses groundwater flowing shallower than impermeable layer, geothermal power uses groundwater flowing deeper then impermeable layer (**Fig 3**). For this reason, it is said that geothermal development rarely affects on the Onsen resource. However, it is difficult to understand instinctively the invisible subsurface structure for local Onsen businesses. They sensitively concern about the risks of affection from geothermal development.

From this background, geothermal developers are required not only explaining their projects to the stakeholders, but also considering the stakeholder's concerns into their projects. In order to clarify the concerns of Onsen businesses, we conducted an interview survey to all Onsen businesses at Izu-Osima Island, a volcanic island.

2. Overview of Survey

Izu-Osima Island is located at 100km south of Tokyo, the largest island in a group of Izu Volcanic Islands. At the center of Izu-Oshima Island is the 764meter tall Mount Mihara, an active volcano which is the source of several interesting geothermic feature sites and various Onsen (hot spring) on the island. Mt. Mihara frequently erupts, most recently in 1986. This island is

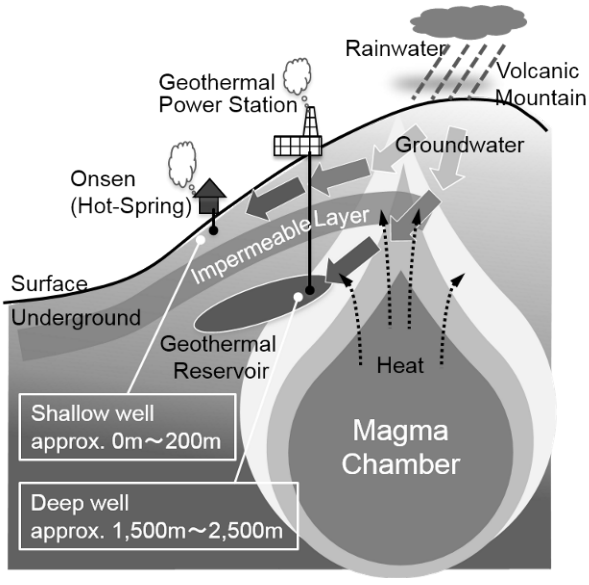

Fig 3. Subsurface structure of geothermal resource uses.

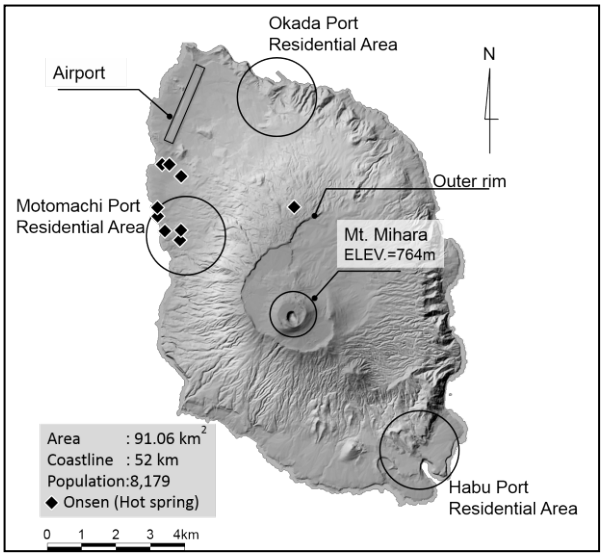

Fig 4. Map of Izu-Oshima

Table 1. List of all Onsen facilities in Izu-Oshima Island

No.	Water temperature [°C]	Water quantity [m^3/day]	Well depth [m]
1	NA	8	27
2	34.3	55.7	3
3	46.6	70	1
4	84.2	296	NA
5	25	60.6	NA
6	29.5	69.4	NA
7	37.2	26	54
8	NA	60	NA
9	44.5	58.7	109

designated a Japan Geopark Sites, well known as a popular tourist destination. Approximately 200 thousands visitors, per a year, enjoy the volcanic tourism and the Onsen culture.

This island has as many as 8,179 habitants at three residential areas. Almost all the electric power depends on the diesel electric power generation and the capacity of the facility is 15.4 MW. The municipality of this island, Oshima-Town plans to newly install the renewable energy and increases to 1.5MW by 2020.

In this island, 9 Onsen facilities are in business, and all those facilities are operated as a part of spa facility at hotels/Japanese style hotels (**Table 1**). We conducted questionnaire based interview survey to all those Onsen facility owners. Interview items are consisted of 5 large question categories, understandings of geothermal related knowledge, attitudes toward geothermal development in the island, positive/negative images of geothermal power, concerns of geothermal development, expected benefit of geothermal development. In the process of this interview, we explained some information about the geological mechanism of geothermal power, possible risks and the benefits. We clarified the changes of their acceptances of geothermal developments by analyzing the differences of the answer between before and after the explanation. What should be emphasized here is that there is no plan to develop new geothermal power in Izu-Osima Island at this time. This means that the people living here have not discussed about geothermal development and have not learned about it specifically.

3. Result of Survey

3.1 Understandings and attitudes

In the interview, we explained geological description about the mechanism, risks and benefit of geothermal development. After the explanation, we asked respondents whether you knew that or not. As the result, only two respondents answered “extremely well” and three respondents answered “not at all” (**Fig 5**). This result shows that even the businessperson who uses geothermal resources does not always understand the mechanism.

We asked their attitude whether favor or against for the new geothermal development in Izu-Osima island. We asked this question twice, at the beginning and the end of interview, put many sided explanation about geothermal development including risk information and benefit information between those two questions. As the **Fig 6** shows, no respondents oppose to the development. Though two respondents, No. 1 and 9, answered

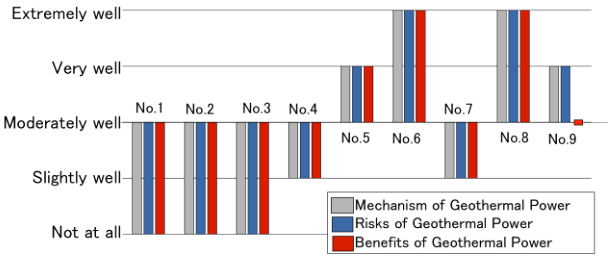

Fig 5. Understandings of geothermal knowledge

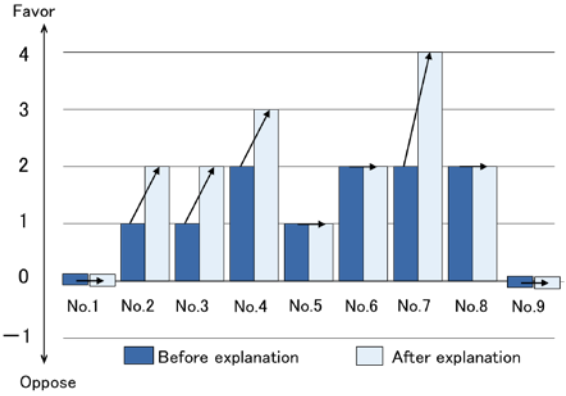

Fig 6. Attitude toward geothermal development in Izu-Osima Island

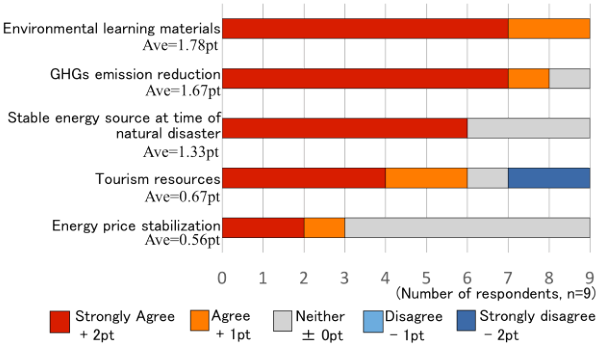

Fig 7. Positive images related to geothermal power generation

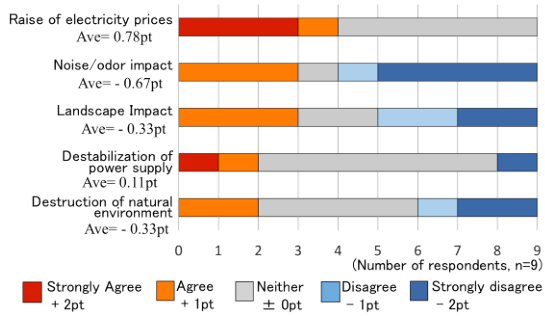

Fig 8. Negative images related to geothermal power generation

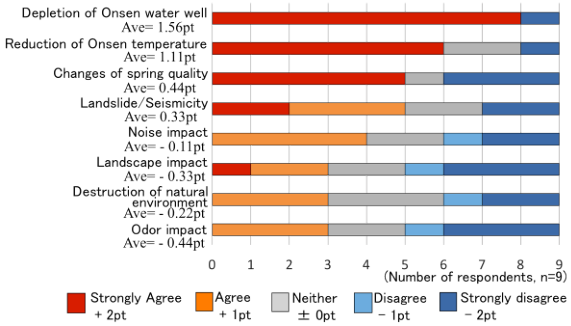

Fig 9. Concerned negative impacts of geothermal development

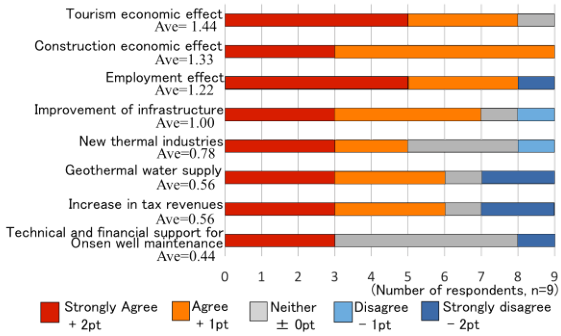

Fig 10. Expected benefits from geothermal development

"neither", others answered favor and 4 of them positively intensified their favor attitude through this interview.

3.2 Positive and negative images of geothermal power generation

Social studies have generally pointed that attitude judgments of project stakeholders depend on their images of the matter when they have enough knowledge about it. So we asked respondents about their positive and negative images of geothermal power generation (**Fig 7, Fig 8**). The average points of positive images are tend to be higher then the average points of negative images. This shows that the respondents of this survey generally have good image geothermal power. Regarding the positive images, the respondents widely recognize environmental learning and climate change aspects as favorable aspects of geothermal power. On the other hand, there is no image, which is recognized as negative by all respondents. However, three respondents pointed that introducing the geothermal power cause rise of energy price. If power companies and governments provide accurate future prospect of the electricity price and propose subsidy as needed, such concerns are probably dispelled.

3.3 Negative and positive impacts

Clarifying the stakeholder's concerns is a first step for the consensus building of development project. Fig 9 shows that Onsen businesses in the island concern what kind of impact from the geothermal development. As the results, many respondents answered that the impact on their Onsen resources such as depletion of the well, reduction of the temperature and spring quality changes. It also shows that these Onsen resource impacts are higher concerned than other environmental impact such as noise, landscape and destruction of natural ecology.

On the other hand, many respondents pointed that local economic effect is expected such as increasing tourism, construction

economy and local employment. And more than five respondents out of nine answered that improvement of local infrastructure, new thermal industries (e.g. aquaculture, greenhouse culture), geothermal water supply to each existing Onsen facilities.

4. Conclusion

As the result of the questionnaire based interview survey to all Onsen facility owners in Izu-Osima Island, we clarified their attitude toward the new geothermal development, impact concerns and benefit expectations. It seems reasonable to conclude that more than half of respondents do not have enough knowledge about geothermal mechanism, even though they use geothermal resources for their businesses. And positive changes of the attitudes toward the new geothermal development are observed at four respondents after the brief explanations on geothermal mechanism and risks-benefits information. Regarding this result, it is to be noted that the respondents of this survey were relatively positive than other past Japanese cases. It is possible that positive attitudes were generated because of the recognition among respondents that there is no current possibility of actual geothermal development at their sites. It is not outright denying that they may change their positive attitudes if actual geothermal development were to take place there.

Additionally, it is also important to mention that respondents more concern about Onsen resource impacts than the other environmental impacts such as noise, landscape and destruction of natural ecology. Based on these results, providing the not-biased information about geothermal power and considerable assessment of social impact on Onsen culture is quite important for enhancing the social acceptance in the Onsen culture regions. It seemed to be particularly important is that the timing of information providing. Once the project implementation officially decided, the negative attitude probably quickly generated among the Onsen businesses. Therefore, such the not-biased information needs to be provided at the initial step of the project formulation and the consensus building process.

This paper reported a result of a social survey to nine Onsen businesses at small volcanic island. Since there are thousands of Onsen businesses in Japan, it is not appropriate to generalize this result. But these findings are seemed to be effective suggestions to design the appropriate process for consensus building of geothermal development.

Acknowledgment

This work was supported by JSPS Grant-in-Aid for Young Scientists (B) Number 25870612.

References

Darma S., Harsoprayitno S., Setiawan B., Hadyanto, Sukhyar R., Soedibjo Anton W., Ganefianto N., Stimac J. (2010) “Geothermal energy update: Geothermal energy develop- ment and utilization Indonesia”.

Mighty River Power, Tauhara No.2 Trust (2009) Ngatamariki Geothermal Power Station Resource Consent Application and Assessment of Environmental Effect.

Ministry of Business, Innovation and Employment (2013) “ENERGY IN NEW ZEALAND 2013”

Takemae, Y. (2013) “Lead time reduction of geothermal development –Case study in Iceland and New Zealand-”

Thermal and Nuclear Power Engineering Society (2012) “Current situation and Trends of Geothermal Power Generation”

Williams, Colin F., Reed, Marshall J., Mariner, Robert H., De Angelo J., Galanis, S. Peter Jr. (2008) “Assessment of moderate- and high-temperature geothermal resources of the United States”.