East Asian Science, Technology and Society: an International Journal (2007) 1:53–75
DOI 10.1007/s12280-007-9002-9

Social Decision-making Processes in Local Contexts: An STS Case Study on Nuclear Power Plant Siting in Japan

Kohta Juraku · Tatsujiro Suzuki · Osamu Sakura

Received: 21 September 2006 / Accepted: 23 August 2007 /
Published online: 14 November 2007

Abstract This is an STS case study of the social decision-making process on the siting of a nuclear power plant in Japan, from the point of view of a sociological case analysis. Energy technologies are critically important for industrial society but often trigger serious disputes through the R&D phase and the phase involving introduction into society. Nuclear power technology especially has provoked a lot of conflicts all over the world. By focusing on serious trust issues among decision-making processes and stakeholders, we found very interesting consequences and/or results of participatory social decision-making process in nuclear issues. As an example, we take up the case of a local referendum in the siting area (Maki-machi town, Niigata prefecture of Japan) and describe and analyze it to highlight the critical sociological factors involved in the application of participatory methods in social decision-making processes regarding technological issues. Through this description and analysis, we would like to emphasize the effects of the complicated and subtle structure of local context on the consequence of local decision-making processes. We then propose a concept, "relevant marginal actor," to clarify which actors play critical roles in the whole local decision-making process in which controversial technological issues are framed, and reframed.

Japanese Abstract 本稿は、日本における原子力発電所立地の社会的意思決定プロセスについての、科学技術の社会学的な観点からの事例研究である。エネルギー技術は現代社会にとって死活的に重要であるが、その研究開発か

K. Juraku (✉)
Graduate School of Interdisciplinary Information Studies, University of Tokyo, Tokyo, Japan
e-mail: juraku@ba3.so-net.ne.jp

T. Suzuki
Graduate School of Public Policy, University of Tokyo, Tokyo, Japan

O. Sakura
Interfaculty Initiative in Information Studies, University of Tokyo, Tokyo, Japan

ら社会への導入までのあらゆる局面で大きな論争を巻き起こすこともしばしばである。とりわけ、原子力技術の開発・利用については、世界各国で多数の社会的な衝突を招いてきた経緯がある。本稿では、実際の意思決定プロセスの事例を例に取り、その経緯を詳しく追うことで、参加型意思決定手法の適用とその結果について、事例に基づいた示唆を得ることを目指す。取り上げる事例は新潟県巻町の事例である。社会学的な分析によって、原子力発電所立地をめぐる住民投票の実現や、それによる立地阻止という経緯について、何が決定的に重要だったのかを特定したい。特に、地域特有の微妙かつ込み入った社会的な文脈に焦点を当て、「relevant marginal actor」と呼ぶべき主体が重要な役割を担ったことを指摘するとともに、論争的な技術をめぐる社会的意思決定を考える際の分析概念としての可能性を探る。

Keywords Social decision-making process · Nuclear power · Local contexts · Referendum · Relevant marginal actor

Introduction

This paper is an STS (Science, Technology and Society) case study which sheds new light on the social decision-making processes of Japanese nuclear power plant siting within local contexts. In order to highlight the critical factors involved in the application of participatory methods in a social decision-making process regarding technological issues, the analysis of the case study has been carried out mainly from a sociological perspective. Through this analysis, we would like to emphasize the effects of the local context on the consequence of local decision-making processes. We then propose a concept, "relevant marginal actor," to clarify which actors play critical roles in the whole local decision-making process in relation to controversial technological issues, such as nuclear power plant siting.

The commercial use of nuclear power technology is typically very controversial all over the World.[1] It is often very difficult to find unique optimal solutions in nuclear policy in general, and compromise and contingency usually play a role in the site selection in particular. In Japan, there has been a serious dispute centering on nuclear policy since the 1950s. Today, there are serious trust issues between stakeholders, with the result that, in an attempt to counteract these issues, various participatory processes have become necessary.[2] In 1996, the Japanese government,

[1] Kaplan (2000) is an excellent example of the study of the local controversies on nuclear power plant issues.

[2] Yearly (1992) analyzed the "green ambivalence" of social movements. He pointed out that the movements took their basis from scientific knowledge, whereas they did not trust the science and its knowledge. In Japanese disputes on nuclear power development, there have been similar phenomena. They have often resorted to technological controversies (especially on safety issues), while they have looked askance at the established experts regime.

prompted by the accident at the "Monju" fast breeder reactor (FBR),[3] set up "The Round Table Conference on Nuclear Policy." This conference tends to be regarded as an epoch-making event because for the first time in almost 40 years of Japanese nuclear power program history, the government invited several representatives from the anti-nuclear side. The round table conference method attracted both public and academic attention, and set up an atmosphere which demanded more participatory decision-making processes on so-called STS issues in Japan. However, the conference did not produce clear decisions on Japanese nuclear policy, and many experts were of the opinion that the conference was an unsuitable setting for substantial discussion.[4] Pickett commented that the conference could not even achieve consensus on the goal of the conference itself, meaning that the participants were unable to enter intensive discussions on each particular issue. Oyama drew attention to another problem from the context of policy and administration studies. He pointed out that although the conference did collect a wide range of opinions, the lack of a well-defined position for the conference within the context of the whole national policy making process on nuclear power was a problem. He argued that the conference had potential as a participatory policy assessment (PPA) which could have made nuclear policy more flexible, and that the government should have made this clear. Although Oyama recognized the significance of the conference as the first trial case of PPA and argued it should be continued, the conference has been suspended since 1999. Consequently, the conference is often cited as an example of the difficulties of the participatory approach to nuclear issues.

There have been few studies which analyze the highly complicated social consequences and factors involved in the round table conference, both of which are crucial for the utilization and implementation of the participatory decision-making process. Nevertheless, with the identification of these factors still incomplete, the hot issue of Japanese STS research soon changed to other participatory methods, such as

[3]On Dec. 8, 1995, 700 kg of sodium leaked from the secondary coolant system of the Monju FBR and caused a fire. At that time, the reactor was in the trial phase preparatory for regular operation. Though the accident itself was not fatal, there were no appropriate responses and the crisis management of the PNC (Power Reactor and Nuclear Fuel Development Corporation, a special governmental corporation for research and development of nuclear fuel cycle systems and FBRs) was strongly criticized by the public. They did not disclose a video of the site which had been taken shortly after the accident occurred; instead showing a very short and edited movie to reporters. Media learned about the other video after several days, and the PNC was forced to disclose it after having denied the existence of any other films. They lost credibility and the government began to consider reforming the organization. PNC reorganized in 1998 and merged into the Japan Atomic Energy Agency (JAEA) in 2005. The operation of Monju reactor is not permitted but JAEA plans to begin improvements in the near future. Monju is a prototype FBR and the second fast reactor built in Japan. Its construction began in 1985, and it attained criticality for the first time in April 1994. It is the successor of the experimental fast reactor "Joyo," which has operated since 1977.

[4]Pickett (1999). Also see Oyama (2002).

the consensus conference.[5] What is observed here is a move from one imported method to another without substantial *ex ant* critical examination and *ex post* critical assessment, and the pattern repeats itself.[6] Recently, some Japanese STS researchers once again changed their focus from participatory TA (technology assessment) to science communication methods including the so-called "science café." The change seems to represent a shift of attention, leaving behind the critical examination and assessment of consensus conferences in relation to the actual social decision-making process.[7] In our opinion, it is very important for STS to carry out critical reflective studies on the conditions and effects of the participatory method.[8] Such critical reflective studies are essential to the utilization and implementation of the latest participatory methods to improve current social decision-making processes with relation to science and technology. Therefore, here we try to analyze the complicated social processes and consequences of a participatory decision-making case in detail.

We adopted a case method and sociological perspective (specifically, sociology of science and technology) to clarify the social factors which are critical to the consequences of participatory decision-making processes in the local area considered in this paper. The controversies of scientific/technological issues have been taken up as one of the most remarkable phenomena in the science-technology-society interface. It is well known that many sociologists have worked in this area and produced a number of contributions to STS studies. Dorothy Nelkin has reviewed controversy studies from the early 1970s, analyzing the structure and consequences of various case studies and highlighting specific patterns of scientific controversy.[9] She categorized the scientific/technical controversies into four groups. According to her categorization, nuclear plant siting disputes fall into controversy because of the

[5]In Japan, the first trial case of a consensus conference was held in 1998. Its theme was GMOs (genetically modified organisms). It was conducted by several experts in STS. The second one was on the diffusion of Internet and society in 1999. After these trials, many studies on the consensus conference method were published one after another and a series of conferences on GMOs has been held since 2001. They are sponsored by the Ministry of Agriculture, Forestry and Fisheries (MAFF). The round table conference on nuclear policy was considered a "failure," and is usually neglected in discussions. Pickett (1999) and Oyama (2002) are exceptional cases. Both authors are outside Japanese STS studies. Picket is a US researcher at the engineering department of the University of Tokyo. Oyama is a scholar of policy and administration studies.

[6]There are several studies which include a plenty of raw information on the actual operation of consensus conference written by advocates. Kobayashi (2004) is a report and comment by the facilitator of consensus conference trial himself.

[7]A few studies examine this point carefully and critically. Matsumoto (2002) reviewed the situation centering around this point, then critically analyzed and proposed an alternative way to escape "the failure of the science-technology-society interface" (a structural pitfall which produced unintended and fatal errors). Kiba (2003) argued that participatory methods (including the consensus conference) should be utilized to overcome "petit experts syndrome" (every citizen has very narrow view on STS issues and can only propose sub-optimal solutions).

[8]For example, Lin (2006) is a reflective study which examines the negative aspects of the consensus conference method based on data from several trials in Taiwan. It pointed out that the method may have a negative influence in terms of social equality. It should be noted that this study was conducted by the leader of the consensus conference trial himself.

[9]Nelkin (1992) is one of the most essential of her controversy studies.

"tension between environmental values and political or economic priorities."[10] She also pointed out the phenomenon that social conflict (like moral conflict) often tends to be transformed into specialized scientific or technological controversy. These categorizations and frameworks are useful to visualize the structure and consequences of scientific/technological controversies. Jasper followed Nelkin's framework to analyze the controversy surrounding nuclear technology in the US, France and Sweden by comparative case studies, and described very close relationships between political conflicts and technological controversies.[11] Although these Nelkin-style controversy studies indicate the structure and consequences of each dispute, we have to take into consideration the effect of local contexts more closely.

In this vein, Kaplan pointed out that the initiatives of local residents can trigger the introduction and institutionalization of participatory processes.[12] He describes the consequences of institutionalization of participatory methods in a case study of the Hanford site in the US. It showed that participatory consensus building and technology assessment in Western countries were initiated by residents via local protest movements. According to the Hanford case and its analysis by Kaplan, participatory methods were initiated by local citizens under a particular local context, and as a result, the principle of public participation was implemented in the formal (governmental) decision-making process. In other words, the emergence of dispute and conflict amongst stakeholders, the introduction of participatory methods and the institutionalization of participatory decision-making processes were a series of consequences. Participatory processes were not devised by an expert in a far away location and then applied to each case, rather they were initiated spontaneously by citizens in the local community and developed in the particular social situation. Therefore, we should carefully place the local participatory decision-making process case within a local context in order to identify the social factors critical to the consequences.[13]

In Japan, the past decade provides us with some remarkable local cases regarding the siting of nuclear power plants. In particular, there were several significant cases around the end of the 1990s. For example, the siting of a nuclear power plant was cancelled by a local referendum in Maki-machi in Niigata prefecture. (The first referendum was held in 1997, and the plan was finally cancelled in 2003.) In Hokkaido prefecture, the northernmost of Japan's main islands, a plan to build a new plant received the approval of the Governor, which is legally essential, only after the deliberation of an inquiry committee made up of experts and citizens. (The

[10] Nelkin (1992).

[11] Jasper (1992).

[12] Kaplan (2000).

[13] Hecht (1998) describes the history of French nuclear development in terms of the effect of national identity ("Frenchness"). He shows how the whole consequence of nuclear development has been constructed under the influence of particular social contexts. It means the characteristics of the consequences are different among countries, regions or societies. In other issues included in the STS field, several studies pointed out the importance of local contexts in evaluation and tried to establish theoretical frameworks to include it. Abelson (2001), Abelson et al. (2003) on local health-care policy in Canada case and Thurston et al. (2005) on regional health policy are examples of them. Also see Smith et al. (1997) in the environmental management field.

committee had been continued from 1997 to 1999, and Governor's final decision was in 2000.)[14]

In our opinion, the Maki-machi case is a good example to use to think about the critical conditions of participatory methods in local contexts. In this case, a referendum was not suggested by outside experts, but adopted by local residents spontaneously. A series of referendum movements resulted in the cancellation of the proposal. This means that the referendum method could have a big influence on the entire decision-making process. We would like to explore this case in detail, and try to extract the critical social factors which gave validity to, and had impact on, the referendum method. Cancellation of a nuclear power plant siting plan by local referendum in Japan was unprecedented, so it attracted much public attention.

Of course, several researchers have already taken up the Maki-machi case from various points of view.[15] However, we feel it has not been fully discussed, in terms of sociological studies, to identify critical social factors. As discussed above, in order to utilize the lessons from cases studies to improve the social decision-making process at the science-technology-society interface, we have not only to precisely understand what happened, but also identify the social factors contributing to particular consequences. For example, if we pick up the merits of the referendum from the cases without showing the relevant social conditions in which it functions well, we cannot make it effective in practical use.[16]

Therefore, we aim to re-interpret the Maki-machi case from a sociological point of view, which has the following three focuses:

1. We focus on the "social decision-making process," incorporating both formal processes (legally binding, or institutionalized by law) and informal ones, rather than the "policy making process." The phrase "policy making process" gives the impression that the study focuses only on processes in the "public" sector (government or bureaucracy) in terms of administrative studies or political science. In this paper, we analyze many events throughout the whole process, not just inside the "public" sector alone. To make this point clear, we adopted the term "social decision-making process" as a keyword of this study.[17]
2. This paper focuses on the critical social factors of key events during the case and intends to understand the social role they played. We describe the case based on a qualitative exploration, including interviewing local actors. We scrutinize the case in terms of the effect of local context on the consequences of the process.
3. This paper is not intended to analyze national nuclear policy itself. We focus on the process of social decision making, and try to propose a way to improve it. In Japan, as elsewhere, the political circumstances surrounding nuclear policy often

[14]We tried to analyze these cases from more of a policy-oriented stance in our former papers (Juraku et al. 2005, 2006).

[15]Imai (2000) depicts it as a citizen movement and discusses the potential of the referendum method in Japanese politics. Nakazawa (2005) analyzes the transformation process of the local community from the point of view of the sociology of regionalism.

[16]Stirling (2005) and Irwin (2006) examined the complicated structure around participatory practice critically and pointed out the possibility to utilize participatory methods to maintain traditional initiatives in the governance of science and technology.

[17]But we note here that recent policy studies also take the wider view, such as Kingdon (1995).

cannot allow an open-ended discussion, since an argument on nuclear policy itself is not free from interest conflicts or mistrust between pro-nuclear and anti-nuclear parties. This kind of atmosphere pollutes even academic discussion. Therefore, we focus on process rather than policy.

We attempt to identify the social factors contributing to particular consequences in the local context. Several factors which seem to define the sociological characteristics of the case are highlighted. In particular, we address the critical effect of the marginal agent (the voluntary group which planed and carried out the "citizen's referendum") on the final consequences of the decision-making process in the Maki-machi case and conceptualize it as "relevant marginal actor". Finally, we also aim to review some implications for the assessment and improvement of the quality of decision-making processes in technology policy, based on the lessons from the sociological STS case study.

Description of the Maki-machi Case — Cancellation of Power Plant Siting by "Citizen's Referendum"

Maki-machi ("machi" means "town" in Japanese) in Niigata prefecture is located around the centre of Japan's main island (Honshu), close to the Japan Sea coastline. It is one of the most productive and famous rice-field zones in Japan. Though Maki-machi had been a prosperous town since the middle ages, it had begun to lose some of its past glory during the rapid industrialization of post-war Japan. The Maki-machi nuclear power plant was an initiative by the Tohoku Electric Power Corporation (Tohoku-EPCO), which has monopolized the regional power supply of the Tohoku district[18] since the late 1960s, under these economic circumstances. The legal processes involved in siting of the plant seemed to proceed smoothly. But in September 1983, the company withdrew their application for governmental licensing (it was under the safety review process) and the siting process was suspended. In their final confirmation review, Tohoku-EPCO found out that several pieces of their planned site were not secured and, furthermore, one of them was owned by anti-nuclear groups.[19] There was also a legal dispute over the ownership of the land in the proposed area. Part of the land was thought to be owned by the town however, two Buddhist temples protested arguing their ownership. They brought the issue to the courts, causing an obstacle to the continuation of the governmental safety review process.

[18] In Japan, there are nine regional monopoly power utility companies. They have been protected by law and cooperate with national government. Since 1995, the government has deregulated this scheme in stages. But the market for home use is not open to other independent companies yet. And though the consideration process on the deregulation of the home market was started from the spring of 2007, in July 2007 the working group on the deregulation issue founded by the government concluded to suspend the intensive discussion "during a certain period" after only meeting twice.

[19] According to the Japanese nuclear power plant regulation system, utility companies have to ensure the siting plan before receiving final governmental permission. In fact, government requires three conditions to consider the plan "ensured": (1) complete land acquisition, (2) agreement of compensation for the local fishery industry and (3) approval of local council and mayor/governor. In this case, it meant Tohoku-EPCO did not complete land acquisition, so that they could not get governmental permission to begin the construction.

Moreover, the local conservative party,[20] split since the beginning of the 20th century,[21] came into conflict on the nuclear power issue too. Though the party had kept the administration in power, two political cliques won the mayoral election in turns. The clique who lost the last election expressed a certain amount of caution about the siting of the nuclear power plant in their election campaign, to gather the support of a wide range of voters. But once they won the seat, the leader of the clique was obliged to change his stance to be in favor of the nuclear power plant plan.[22] This is because the conservative party to which the two cliques both belonged had clearly taken the pro-nuclear side in their national policy and the party headquarters did not admit such inconsistency.[23] In the next election, the opposite clique criticized the "apostasy" of the incumbent and came back to the mayor's office. Therefore, the siting process was deadlocked during the 1980s.

In the beginning of the 1990s, the land issue was finally settled. The legal case ended in favor of the town, and the area owned by the anti-nuclear group was excluded in the modified construction plan. Kanji Sato, the mayor of Maki-machi at the time, was able to integrate the two political cliques to promote the nuclear plant plan strongly. He made the need for a power plant an issue in the mayoral campaign of 1994 and was successfully reelected.[24] The deadlocked plan began to crystallize again with his reelection, despite the fact that the number of votes shared between two opponents who were against the nuclear power project was higher than the number of votes for the mayor.[25]

Some citizens, mainly self-employed individuals, raised questions about these overall processes. They thought the decision should reflect the residents' will directly.[26] Takaaki Sasaguchi, manager of his own Japanese sake brewery and later

[20]In Japan, the conservative political party [Liberal Democratic Party (LDP)] has kept the national administration in power from 1955 to 1993. They also keep the administration in power in most local governments. In Niigata prefecture, their power has been very strong. Former Prime Minister Kakuei Tanaka (1972–1974) was from this prefecture.

[21]Nakazawa (2005) points out that this conflict can be observed in the Taisho era (around 1915).

[22]Mayor Sato changed his attitude to nuclear issues in his third election campaign.

[23]In addition, Prime Minister Tanaka was an enthusiastic advocate of nuclear power plant siting in rural areas. He established laws which provided subsidy funds to local governments that accepted nuclear plants. He believed that attracting huge facilities and developing social infrastructure, including highways and the Shinkansen express train system are among the most effective ways to encourage regional economic development.

[24]He succeeded in relaxing tension between two political cliques inside the local LDP and integrated two local pro-nuclear groups. Until then, each clique had their own pro-nuclear movement group.

[25]Mayor Sato got 9,006 ballots, Mr. Muramatsu (took a deliberate stance on nuclear plant issue, but was relatively critical of nuclear plant plan) got 6,245 ballots and Mr. Aisaka (anti-nuclear stance) got 4,382 ballots.

[26]This statement became their basic policy. In other words, they argued that the 'democratic' process was essential. They did not take any particular stance on the nuclear plant issue itself. Kaplan (2000) pointed out a similar phenomenon in the Hanford case in the US.

to become leader of the local referendum movement group and subsequently Mayor of Maki-machi, described the conversation at that time as follows:[27]

"We residents have to show 'the public opinion' clearly."
"To do it, the referendum method is most effective and suitable, I think."
"Can we do it?"
"The Mayor and the town council understand that if they do it, the cons vote will be in majority. They will never allow a referendum."
"Then, we try to do it voluntarily."
"Yes, a self-management referendum."
"But, is it permitted by the laws? Not illegal?"

They enlisted Tamio Takashima,[28] a lawyer in Maki-machi and an anti-nuclear activist, to discuss the legal issues. His opinion was that there was no legal problem. They established the "Group to Hold a Referendum on the Maki Nuclear Plant" (hereafter referred as the 'referendum movement group') on October 19, 1994. Sasaguchi became the leader of the group. The founding members were 34 residents of Maki-machi. Their mission was:

1. To request a referendum from the Maki-machi local government to confirm the majority opinion on the pros and cons of the "Maki Nuclear Power Plant" plan.
2. If the local government does comply, carry out a self-managed referendum.

The members of the referendum movement group met Mayor Sato and requested a local referendum on November 11, 1994. They also asked him for logistics support for a citizen's referendum if the local government would not comply.[29] The local government and the town council rejected both of their requests,[30] so they decided to hold a "citizen's referendum" (that is to say, not authorized by any law).[31] In order not to be seen as a "biased" movement, the referendum movement group did not

[27]Quoted from Sasaiwai-shuzo Co. website (http://www.sasaiwai.com/touhyo/index.html) on Feb. 7, 2007 and translated by the authors. Sasaiwai-shuzo is Sasaguchi's sake brewery and he has posted the story of the local referendum movement. He also explained about the conversation in our interview.

[28]He joined the anti-nuclear movement in the 1970s and has played an active role in it. He came up for election in the early 1980s but lost. He participated in the referendum movement after it started and

[29]They requested that the mayor provide the public halls and town gymnasium as the voting stations, provide the human resources for poll monitoring and materials for the vote.

[30]According to Sasaguchi, his official answer was as follows: (1) Maki-machi has no referendum ordinance, so that it is impossible to carry it out, (2) we cannot spend public money and resources for a referendum unless it is carried out by the town government.

[31]Some members said, "Though we expected the negative replies from the mayor and town council, we did the request to confirm the views of the mayor and legislators." Their intent from the beginning was to proceed with the referendum. The name of the group also shows this. It is "A group *to hold the referendum* on Maki-machi nuclear plant."

Table 1 The result of the "citizen's referendum" in Maki-machi in January, 1995

	Number of ballots	Voting rate to all registered voters
Affirmative ballots for the nuclear power plant plan	474	4.34%
Negative ballots for the nuclear power plant plan	9,854	43.11%
Invalid ballots	50	0.22%
Total ballots	10,378	45.40%

take any particular stance on the issue of nuclear power plant siting,[32] and indeed took various measures with great care to ensure the fairness of the referendum as follows:

1. Disclose all conferences and meetings to everyone including mass media.
2. Protect citizens who might face risk if they express their opinion. Generally speaking, residents hesitate to declare their opinion clearly in public because they are constrained by complicated commercial or traditional relationships within the local community. These social relationships are vital in a small community. In some cases, to show individual opinion that may go against the community's interest is socially dangerous behavior. They requested that media did not publicly identify dissenting citizens.
3. Maximize voting opportunities for citizens. They set the term to vote with more than one station and continuing over more than one day. Additionally, voting stations remained open until late evening to allow voters to keep their privacy and flexibility.
4. They also created some mobile voting stations and performed door-to-door visits. This was not only for voters' convenience, but also to protect voters' privacy (for example, to guard them from any harassment).
5. Entrust the poll watching and the safekeeping of the ballot boxes to the third parties.[33]

The citizen's referendum was carried out in January, 1995, and although the campaign of the pro-nuclear group was severe,[34] the result was that the number of dissenting votes exceeded the number of votes that the mayor obtained at the previous mayoral election. The referendum movement group deepened their conviction that the people's will on the nuclear plant issue should be confirmed separately by these independent results. The pro-nuclear group was also shocked by

[32]Nakazawa (2005) quotes a member of the referendum movement group: "He (Sasaguchi) never confessed his opinion on the nuclear plant plan even in the informal drinking meeting." In our interview, he never discussed the pros and cons. His point was solely about public opinion or the democratic process. He has consistently argued those points.

[33]They invited lawyers and university professors from outside Maki-machi as poll monitors. They also invited members of the pro-nuclear group to monitor. They entrusted the ballot boxes to a warehouse rental company.

[34]They strongly criticized the legitimacy of the referendum movement. Though they do not admit it, some interviewees pointed out that many people were compelled not to go to polls by their employers. The pro-group refused to participate in the citizen's referendum. The figure of voting rate and balance of pro and con votes shows the fact that pro-group did not go to voting station.

the results. The impact of this undeniable fact was the turning point of the whole process Table 1.[35]

Following the result of the referendum, the group again called for an official referendum. Just after the citizen's referendum, in April, 1995, an election for town council was scheduled. This referendum ordinance issue became one of the most controversial points in the election campaign. At that time, 17 of the 22 council members were anti-referendum legislators. However, after the unofficial referendum, their position changed and many candidates pledged to support a referendum ordinance in their election campaign. After the election, 12 out of 22 council members were in favor of the referendum ordinance, although two suddenly changed their mind before the deliberation on the referendum ordinance in the council. Members of the referendum movement group were disappointed at their behavior and protested, and many stakeholders believed that the ordinance would not be approved. However, eventually the ordinance was approved at the council meeting on June 25, 1995. It was said a pro-nuclear (anti-referendum ordinance) legislator made a mistake at the vote. On that day, to prevent the vote of ordinance, many motions were proposed by pro-nuclear council members and voting took place again and again, so it was possible that someone was confused and made a mistake.

The ordinance included a prescription that the Mayor had to carry out the referendum on the nuclear power plant plan within 90 days of the ordinance approval. Pro-nuclear residents resorted to direct citizen petition to amend that strict prescription. The town council, which was still ruled by the anti-referendum group, accepted the petition and approved the amendment on October 3, 1995. The ordinance was modified as follows: "The mayor decides whether or not to carry out the local referendum. If the mayor decides to conduct it, he will carry it out under the agreement of town council." In other words, a referendum would be never carried out as long as Mayor Sato was in office. This amendment actually eliminated the chance to hold the referendum. Consequently, the referendum movement group began a campaign to recall the mayor. It seemed that it would be very difficult to collect the necessary number of signatures to call for a recall election because it was not anonymous.[36] It was predicted that citizens would hesitate to reveal their names in public. But, contrary to this prediction, the required number of signatures was collected in just 2 weeks. Mayor Sato recognized he had lost, and on December 15, 1995, he resigned of his own will before the recall election.

Takaaki Sasaguchi, the head of the referendum movement group was elected as the new mayor on January 21, 1996,[37] and he called the referendum in August. This

[35]Made by the authors, based on the data from our interviewees and Imai (2000).

[36]According to Japanese Local Autonomy Law, collected signs must be disclosed to the public by a local election administration committee to prevent fraud.

[37]He got 8,569 ballots. The pro-nuclear group boycotted the election voting again, so that the voting rate was 45.8%. Just before the election, two remarkable events occurred: the Monju FBR accident and the Hanshin earthquake. The Monju accident eroded the public confidence in nuclear organizations, policies and the safety of nuclear technology itself. The Hanshin earthquake killed more than 6,000 people in the Hanshin area (around Kobe city), and people realized the powerlessness of civilization against the forces of nature. These events could have influenced the residents voting behavior (but, no other potent candidate elected in the Mayor election, in fact).

Table 2 The result of the ordinance-based referendum in Maki-machi in August, 1996

	Number of ballots	Voting rate to actual voters	Voting rate to all Registered voters
Affirmative ballots for the nuclear power plant plan	7,904	38.55%	34.04%
Negative ballots for the nuclear power plant plan	12,478	60.85%	53.73%
Invalid ballots	121	0.59%	0.52%
Total ballots	20,503		88.29%

time there was a higher voting rate of 88.29% and the dissenting vote ran up to 60.85% (53.73% of registered voters) Table 2.[38]

This result received a lot of publicity, and had an impact on the national government and electric power companies. Mr. Sasaguchi kept his promise made before the vote,[39] and declared that he would not sell the land owned by the town, which was necessary to proceed with the siting of the nuclear plant, and urged Tohoku-EPCO to reconsider.

The company held onto the plan. The central government and industry officials, as well as some experts, criticized the referendum, saying it had "no legal authority" with respect to nuclear plant siting and the result should not be considered valid.[40] Legally speaking that was true, but the argument did not have much impact on the political validity of the referendum.

In order to make sure that the land would not be sold to a pro-nuclear group in future, Mayor Sasaguchi decided to sell the land to residents who supported his policy[41] on August 30, 1999.[42] In fact, the referendum movement group lost the town council election in April, 1999 so they were concerned about the possibility that the land would be sold to the utility company by a future mayor. This land transaction was carried out in complete secrecy. Mayor Sasaguchi officially announced the transaction on September 2, 1999.[43]

[38]Made by the authors, based on the data announced by the election board of Maki-machi.

[39]He distributed a document to all households on the day before the vote. It contained the following statement: "The conclusion decided by the sovereign residents themselves with sufficient deliberation is unquestionably valid. I assume that we promote the construction plan if the affirmative ballots are in the majority, or we never sell the land owned by town to the power company and the plan is canceled if the negative ballots are in the majority. We the mayor and legislators have to receive the result and to obey it in our administration from now." (Translated by author).

[40]They also used the logic that the direct democracy method, like a referendum, was not suitable for national level issues including nuclear power.

[41]"The decision of the town must reflect residents' will directly".

[42]Many newspaper articles and other documents on the Maki-machi case describe them as the "anti-nuclear" residents. Indeed, many of them had anti-nuclear opinions. But Sasaguchi called them "people who respect the public consensus."

[43]He decided this transaction without approval of the town council based on the law of local autonomy. It allows the mayor to process small transactions without any permission from the local council. In this case, the land was under the limit of this allowance. And Sasaguchi legitimated this deal by the logic "based on the result of the referendum". On the other hand, former mayor Sato dared to call for the approval of town council to ensure its legitimacy when he tried to sell that land to Tohoku-EPCO company in February, 1995. But he faced to the strong opposition of residents and could not sit at the council meeting. This contrastive and ironic consequence reminds us that we should think carefully on what the "democratic process" is.

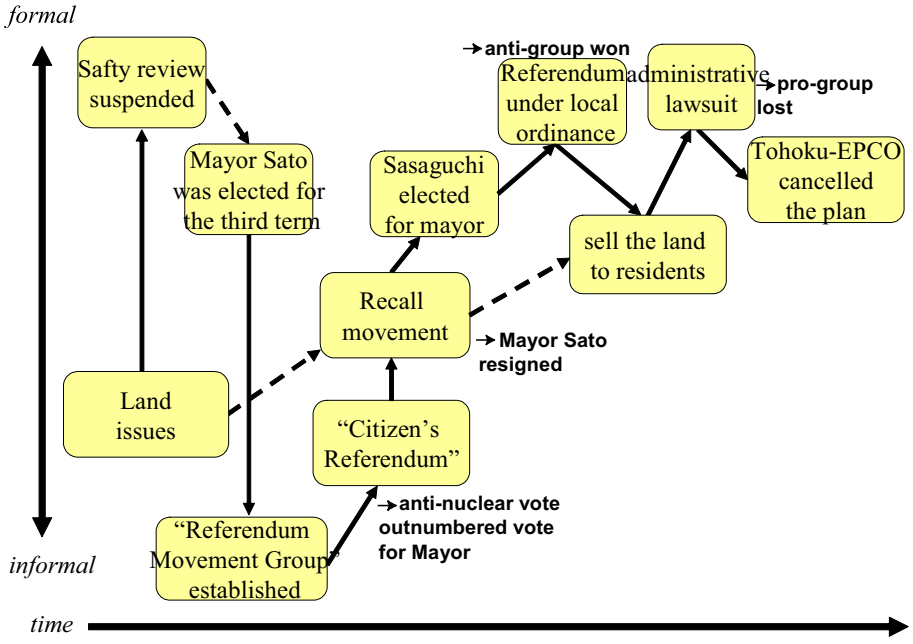

Fig. 1 The social decision-making process of the Maki-machi case[44]

The pro-nuclear group criticized the decision, and asked the local government auditor to conduct a special examination. But this request was rejected, and the pro-nuclear group also failed in lawsuits against the local government. The case was finally brought to the Supreme Court, in December, 2003, and the final ruling was against the pro-nuclear group. Shortly after the judgment, Tohoku-EPCO announced the cancellation of the project. Here we illustrate the consequences of these processes in Fig. 1.[45]

Analysis of the Case — Beyond the "Deadlocked" Situation

The citizen's referendum was managed by a citizen's group and had no legal authority. However, the result was considered valid since it was managed, in the mayor's opinion, in full fairness and with confidence. It was a completely informal process but its result had substantial impact on a town decision. It was the turning point of the whole decision-making process.

[44] *Solid arrows* indicate direct causal and chronological relationships and *dotted arrows* indicate not direct but influential relationships. The later ones also show the consequences of change of agenda caused by land issues.

[45] This figure shows a map of the events in Maki-machi. The *vertical axis* indicates how each event has "formal" (= institutional and legal) basis; the *horizontal axis* expresses the time series. *Solid arrows* show the direct causal links and *dotted lines* indicate background contexts.

In the Maki-machi case, the process of the nuclear power plant siting had been deadlocked for about 10 years because of the complicated political situation of the town. So, first of all, we have to shed light on the subtle local situation in which ordinary citizens lived. In the Japanese countryside, including towns such as Maki-machi, people cast their vote for the candidate while considering complicated local commercial, traditional, official and private relationships. These relationships are often connected with the conservative political party (LDP), because the party had the power to attract subsidies for social infrastructure improvements and agriculture for many years. In rural areas of Japan, residents tend to believe that financial support from the central government plays a critical role in rapid economic growth and is an effective tool to overcome local problems such as the shrinking population and structural recession of local industry. Indeed, inviting a nuclear power plant is certainly an option for a community to improve their economic well-being, as a huge amount of compensation (called "kofu-kin," which means subsidy money in Japanese) is given to a local community which accepts a nuclear power plant.[46]

However, some residents expressed concern over safety issues and some even joined the anti-nuclear movement. As a result, nuclear power plant siting created tension among residents. The town officials and economic executives belonged to LDP and supported the siting plan. They managed the politics and economy of the local community, and their power was quite strong inside the town. Of course, they did not force residents to obey them. This political and economic structure was based on a kind of unspoken rule. If people declare individual opinion, this can break down the integration of the community, and this invites severe retaliation for the dissenting individuals. So these complicated social relationships within the local community should have had very strong effects on their decision.[47] All actors inside the local community constrained each other.

Traditionally, people do not vote "for the policy," but "for the person."[48] The local business community had made it known that they supported the nuclear plant, and they were connected with the conservative political party. The issue receded into the background and it was difficult to get it established as an election issue. The traditional anti-nuclear movement also failed to obtain wide support from residents, because for ordinary citizens to declare an opinion against those in power is personally dangerous. They usually distanced themselves from "radical" political and social movements.

Meanwhile, the land issues of the planned construction area also blocked the progress of the siting procedure. People believed that the nuclear plant siting procedure had made rapid progress, and the issue receded from the minds of residents temporarily, however, internally professional politicians were still fiercely disputing the issues.

[46] For example, if a large size nuclear plant (1.3 million kW) is accepted, about 90 billion yen of subsidy money will be given to local government over 20 years at the start of commercial operation of the plant.

[47] Nakazawa (2005) explains this situation with the term "local regime," inspired by the analysis studies of community power structures in the US.

[48] An interviewee pointed out that Mayor Sato said, "Please trust me, please believe my personality," in his election campaign.

The settlement of the land issues triggered the construction procedures again. Mayor Sato and the conservative party took the opportunity to integrate the two cliques inside the party to promote the siting process vigorously. They thought that their internal conflict was the only problem left. Some people in the town felt anxiety about nuclear technology, perhaps influenced by accidents that had occurred in the deadlocked period (for example, Chernobyl), but they perhaps would not discard their pro-nuclear policy because of political constraints. Traditional anti-nuclear groups thus could not stop the process because of the lack of broad voter support.

The citizen's referendum was the challenge. The members of the referendum group said that they were motivated by a simple question: "Was public opinion sufficiently consulted before the decision to restart the siting procedure?" But it was difficult for them to secure credibility and legitimacy as they did not have any formal or legal basis on which to claim such legitimacy. In addition, there was a concern that they could be seen as a biased group (i.e., opponents of the nuclear project) where complicated confrontations between "pro" and "con" factions existed.

The important factor is the careful and delicate considerations and arrangements made by the referendum movement group. They took people's anxiety into consideration and made some important arrangements to mitigate this. They consistently set up the target "to reflect public opinion by either-or vote." They focused only on the issue of nuclear plant siting, and maintained neutrality between pro- and anti-nuclear sides—a point they explained repeatedly and explicitly. This means that the campaign was an absolutely *ad hoc* movement, and was free from any other political fight. Furthermore, as we mentioned above, they made arrangements to keep voters' privacy and to reduce their anxiety. Their efforts lightened the political pressures embedded in the complicated local power structure.

But who did design these appropriate considerations and arrangements? How and why was the group able to do that?

Effects of the "Relevant Marginal Actor" on Decision-making Processes

Considering the complicated structural and social factors in this case, we need to consider a new concept to look at the actors involved. We would suggest the concept of the "relevant marginal actor" to answer this question. It is inspired by the concept of "relevant outsiders" proposed by Matsumoto et al. with reference to the development and diffusion of a wind power plant.[49] In their paper, they proposed the notion of relevant outsiders to explain breakthroughs in path-dependent deadlocked situations. According to that study, in Japan, a myth which argued that the wind conditions of Japan were not suitable for wind power generation spoiled the development of native Japanese wind turbine technology.[50] This myth was believed

[49]Matsumoto et al. (2004).

[50]For example, Mitsubishi Heavy Industry Company had the biggest portion of the wind turbine market from 1980s to the beginnings of 1990s, but has now lost much of this. The Japanese domestic market is almost completely overtaken by foreign (mainly European) manufacturers.

by stakeholders and concerned experts alike. But in some recent cases, people who were unaware of these contexts and were inspired by other independent ideas, played a key role in the development and siting of wind power plants. Matsumoto calls these marginal but strategic actors "relevant outsiders," and pointed out their unique role in overcoming locked-in situations.

Regarding this, we will consider the commonalities and differences between "relevant outsider" and the well-known concept of "relevant social group" in the SCOT program. We can observe a certain level of commonality between these two concepts. According to the SCOT program, the difference in interpretation of technological elements between different relevant social groups ("interpretive flexibility") plays a critical role in the shift of technological trends. In this way, the effects of the "relevant outsider" seem to follow a similar mechanism. Stepping into the details of our case, however, an important difference arises between the two because what characterizes "relevant outsider" is its strategic ignorance rather than a different interpretation springing from "interpretive flexibility" in general. In the wind turbine case quoted above, for example, traditional stakeholders like engineers, bureaucrats and other experts in the energy technology/policy fields had considered wind power technology as a unpromising because of the myth (i.e., wind conditions in Japan are not suitable for efficient wind power generation). They estimated its potential contribution to "energy supply" by various technical measures such as estimated capacity utilization rate, number of suitable plant site, stability of generated electricity, effects on the power grids and so on. For them, it absolutely represented "energy technology". But for the "relevant outsider" who didn't know well about energy issues and the estimation of wind power technology in the expert world, the wind turbine was recognized as a symbol of an environmental friendly society.

Secondly, there is a difference in the definition of the "relevant" actor. In the SCOT argument, it is the group in society which has particular properties (i.e., young or elder, male or female, social class and so on) and is relevant to technology as users or consumers. The group plays a critical role in the dynamics of technological development and diffusion of technologies.[51] This group is distinguished by generally categorized, objective social properties. On the contrary, Matsumoto's "relevant outsider" is defined by a social function to be fulfilled in each particular social context. Therefore, the critical properties which make the actor "relevant" tend not to be general. Rather, it would be subtler, but unique conditions.

As for the social function of marginal agents, similar mechanisms can be observed in our case. Individuals in the referendum movement group were not affiliated with either the anti-nuclear group or the pro-nuclear group, so people regarded them as distant from the longstanding power struggle over the issue. They were the "new faces" in local politics.[52] Of course, many of them were old residents of the town, and well known there for their businesses. As mentioned above, the leader of the group, Takaaki Sasaguchi, was the president of a very popular local sake brewery. Every local resident recognized him as an important person in the

[51] See Pinch and Bijker (1987).

[52] Sasaguchi used this expression in his company's web site.

local community. But he was relatively free from any political stigma because he had not joined in any previous political fight. So the referendum was somewhat protected from political pressure from both sides.[53] This independence can also be explained by the fact that the group was able to fund the referendum on its own. If the referendum was sponsored by any political faction, it would have been seen as biased as well.

Moreover, they were also free from the "common sense" shared by traditional citizen activists. There were several anti-nuclear citizen movements in the town, but almost all of them were involved in the protest campaign against the national and local governments and the electric power company. They also had the idea of a local referendum, but they only called for it to politicians. The referendum group's lawyer, Tamio Takashima, said:

> "It was unimaginable to carry out the local referendum by ourselves. We had only called for it to the local governments and the town council."

In Maki-machi, but also in other areas of Japan, traditional anti-nuclear activists shared his beliefs. They had never considered the possibility of a citizen's, self-managed referendum. This shows the big difference between the traditional anti-nuclear movement and the referendum movement group.

In terms of these social characteristics, they were relative outsiders in the local political situation. They were marginal actors in the traditional decision-making process. But they were not ignorant of politics. Learning the lessons from their own experiences as self-employed businessmen, they understood the complicated background of the decision-making processes very well, and knew of the many difficulties: people's anxiety about privacy, complex social relationships, the strong power of the conservative political party, and so on. So they made many external and operational arrangements throughout the referendum. At the same time, they were independent from traditional political factions because of their independent funding source. Therefore, they were able to design the process on their own terms.[54]

For example, both stakeholder actors and ordinary residents were obsessed with the hostility and conflict between pro- and anti-nuclear sides, but the referendum group introduced the idea that "to confirm the public opinion" should come before everything. Like other democratic societies, "democratic" is the last word in political controversy in this country. The group put greater emphasis on the democratic process. So finally even the pro-nuclear group could not help but accept the result of the referendum although they said that "a referendum without any legal basis is inconsistent with representative democracy." Their argument was concerned with

[53] On the contrary, not only pro-nuclear groups but also traditional anti-nuclear groups took offense against the referendum movement group. Nakazawa (2005) introduces an episode; a member of the anti-group protested to the referendum movement group shortly after it was established. He said, "If cons ballots lost the vote, we will not be able to continue the movement. In that what will you do?" In fact, there was no official relationship between the anti-group and referendum movement group until the cancellation of the plant plan.

[54] Though they have been the traditional supporters of the conservative party for their own business benefit and every resident knew or could guess this; they were not activists of the political activities. So, people considered them to have a neutral stance, in our impression.

institutional and formal procedures, but the result showed the actual public opinion. In this entire process, we can observe the strategic thinking of the citizens' group. They succeeded in utilizing their own social characteristics to become a marginal key agent of the process. So we can call them a relevant marginal actor.

The effects of these characteristics were critically important in the whole decision-making process. In other words, they changed the interpretation of the critical points of the siting decision-making process and utilized participatory methods. This social function is similar to the effect of "relevant social group" in the case analyzed by the SCOT program. It means that a relevant marginal actor would be crucial for the trials to work well when someone tries to apply the referendum strategy elsewhere, or to institutionalize some other approaches to enhance the degree of public participation, public trust and effectiveness in decision-making processes.[55]

Concluding Remarks

Based on what is described above, we draw some implications for better understanding of, and improvement in, the quality of the decision-making process in technology policy.

As mentioned at the outset, we looked at the social decision-making process, incorporating both formal and informal processes in this case study. In our analysis, the informal processes seem to have played a significant role. Though the citizen's referendum of Maki-machi had no legal basis, this process functioned well as an alternative to the formal one which could not work because of the local political context.

Of course, it is best when the formal process works properly and so we tend to consider the improvement or revision of the implemented formal processes. However, generally speaking, every formal process encounters serious unexpected problems when it is actually applied. Because the formal process is institutionalized and fixed, it has little flexibility to adapt to the context and situation of each case. The informal process, which we reviewed, is an *ad hoc* participatory process to handle specific needs in the complicated context of the local area. It is notable that this consequence was produced not by any expert dispatched from the central government or other established actors but spontaneously by local residents.

This shows us the limits of institutional decision making or consensus building. Of course, it is very important that we pay attention to the continuous improvement of institutional decision making. However, it would be better to perpetually combine the informal, flexible *ad hoc* process with the formal one.

We should not only review both the formal and informal processes, but also analyze them carefully. Indeed, informal processes have been studied in political science and other fields, but researchers tend to deal with it as something vulnerable to external influence. Ordinary people tend to consider it as some kind of "backroom

[55]Of course, if there are no dead-locked situations, a relevant marginal actor is not essential to utilize some kind of participatory method. But, in fact, those participatory methods are usually used as the tools to resolve controversial, hostile and dead-locked situations. So, its functions are not negligible in most cases, in our opinion.

deal" or irregular case. In fact, no decision-making process consists only of formal elements, and we found a very effective informal process in Maki-machi. Therefore we would argue that we should give attention to the interface between formal and informal processes.

Based on this particular case, we can find the social functions of the sociological arrangements in the local community which break through the traditional political and social situations characterized by the confronting ideas, considerations and efforts of local actors. These factors constitute the local context. Local contexts had been built up over many generations, so that it may seem impossible to change. If stakeholders try to break through it, they usually cannot be free from the tacit "common sense" of the local community and politics. Similarly, if someone tries to transplant some kind of decision-making method from outside of the community without deep insight into the local context, they cannot change the situation.

The relevant marginal actor plays a critically important role in the breakthrough of deadlocked situations. The relevant marginal actor is an outsider with respect to traditional politics, but who understands local contexts because they are not an outsider relative to the local community.[56] Of course, these functions come from the structural and contextual factors of the whole social decision-making process, and are not designed intentionally by some particular actor. Probably it is very difficult to produce them at will. However, we need to take these elements into account in considering decision making and utilization of participatory methods. At the very least, we can collect decision-making process cases relating to local controversy about (energy) technologies similar to Maki-machi and can analyze them. Based on these knowledge databases, we will be able to typify cases and to propose some practical options to ongoing cases.[57]

We should also pay attention to the pitfall of the "success - failure" dichotomy.[58] We often judge the social or academic importance and value of decision-making cases by only the outcome and the method. This judgment is strongly influenced by the stance of the observer. Once we determine whether it was successful or not, we often cease observing. This means that complicated but important factors in the cases could escape notice. In this case study, we indicate several critical social factors which enabled the informal process to work well. It is important to do in-depth analysis to extract elemental factors to enrich our knowledge of the function and characteristics of participatory methods and to improve the decision-making processes involved.

[56] Wynne (1996) conceptualized the knowledge which created, accumulated and could be applied to local community as the "local knowledge". For his analysis on risk issues, also see Wynne (1987).

[57] Rowe and Frewer (2000) suggest two aspects which enable the evaluation of various kinds of participatory processes. They propose "acceptance criteria" and "process criteria". In our Maki-machi case, referendums got very good evaluations in both of these two aspects. Abelson et al. (2003) proposes frameworks to examine the relationships between the consequences of decision-making processes and various aspects of the local situation. She also introduces and examines the cases of decision-making process on public health issues in Ontario, Canada in Abelson (2001).

[58] As for the detailed analysis of this pitfall with particular reference to a complex relationship between renewable energy development and global environmental problems, see Matsumoto (2005). For an account which considers beyond the success or failure dichotomy, also see Matsumoto (2006), Chap. 6 Conclusion: Beyond Success or Failure.

We should carefully discuss the adoption and institutionalization of the latest participatory methods. Considering the importance of the structural factors mentioned above, we should not ignore the differences in the local situation that depend on specific historical and regional contexts. For example, there is the possibility that if we introduce a method to several different social contexts on the same issue, the processes can create quite dissimilar consequences. We need to identify the factors creating such dissimilarity, and specify the conditions which are relevant to each method and issue through further case studies. This is applicable not only in a power plant siting context but also to other various issues at the science-technology-society interface.

Finally, we would argue that further sociological STS case studies can provide a new way of thinking, which may help to identify the conditions in which the particular participatory method works well. It can be complementary to the knowledge of mainstream public participation studies.[59] As mentioned at first, if insufficient knowledge is available to identify the conditions which enable the participatory method to work well, we may not only fail to utilize its potential, but also make matters worse. We believe that further sociological STS case studies could significantly link studies on public controversy and those in public engagement at the science-technology-society interface.

Acknowledgements We thank all the interviewees in Maki-machi for their kind cooperation with our study. This study is based on the output of the research project, "Social Decision Making Process for Energy Technology Introduction" (2003–2005), which received a grant from the Socio-Technology System Division of the Japan Science and Technology Agency (JST).

Appendix

List of Interviewees

- Naoto Ito (Reporter of the "Niigata Nippo" local newspaper) (2004.6.14)
- Takaaki Sasaguchi (Former Leader of "A group to hold the referendum on Maki nuclear plant," Former Mayor of Maki-machi) (2004.6.14)
- Tamio Takashima (Lawyer, Former Staff Member of "A group to hold the referendum on Maki nuclear plant") (2004.6.14)
- Mitsuo Ishida [Former Chairperson of "Nuclear Issue Panel of Maki-machi" (Pro-Nuclear Group)] (2004.6.15)

Chronology of Maki-machi Case

End of 1960s	Maki-machi nuclear power plant planned by Tohoku Electric Power Corporation (Tohoku-EPCO)

[59] Irwin (2006) pointed out that the curious coexistence of the 'new' participatory process and 'old' technocracy which was based on so-called 'sound science' in UK science governance. He pointed out the importance of not only the promotion and defense of public participation but also the critical investigation of it.

	Purchased land without disclosing the official objective
1969	Local news paper (Niigata Nippo) revealed the siting plan Tohoku-EPCO requested the cooperation of the Niigata prefectural government and Maki-machi local government
May, 1971	Tohoku-EPCO officially announced the siting plan
December, 1977	Local consent secured (Maki-machi council approved the siting plan)
June, 1979	Designated by national government as an important power plant plan
December, 1980	Mayor of Maki-machi agreed with the siting plan
November, 1981	Governor of Niigata prefecture agreed with the siting plan National government listed the Maki nuclear power plant in the national power plant development plan
January, 1982	Tohoku-EPCO applied for the national safety review process
September, 1983	Tohoku-EPCO withdrew their application It is revealed that several parts of the site were not secured One issue was the uncertainty of ownership between town government and a Buddhist temple. The other was a small parcel of land owned by an anti-nuclear group
During 1980s	No progress throughout 1980s during which local conservative political parties were split on nuclear issues
Early 1990s	Land issue finally settled
August, 1994	Mayor Kanji Sato was reelected and started promoting the nuclear plant again. But the number of votes gained by anti-nuclear candidates was larger than that of Mayor Sato
October, 1994	"A Group for public referendum on Maki nuclear power plant" was established
February, 1995	Although Mayor Sato tried to get the approval of the town council to sell the land, which is owned by town to Tohoku-EPCO, the council meeting was blocked by a residents' protest demonstration, and he failed in the transaction.
January, 1995	Citizen's referendum was conducted Registered voters 22,858 / Total number of votes 10,378 (voting rate 45.4%) Yes 474 / No 9,854 / Invalid 50 (95% of vote went to "No") Number of "No" votes exceeded number of votes for the last reelection of Mayor Sato (9,006)
October, 1995	Public referendum ordinance passed but later amended to allow mayor to decide the date
December, 1995	Recall mayor movement initiated by citizens Number of signatures exceeded the minimum number specified by the law Mayor Sato resigned before recall vote
January, 1996	Takaaki Sasaguchi (leader of the referendum group) elected mayor

June, 1996	Town council approved the ordinance for public referendum on Maki nuclear plant
August, 1997	Referendum on "Maki Nuclear Power Plant" conducted under the local referendum ordinance Registered voters 23,222 / Total number of votes 20,503 (voting rate 88.3%) Yes 7,904 / No 12,478 / Invalid 121 (60% of vote went to "No")
August, 1999	Mayor Sasaguchi sold the land to citizens who strongly supported the result of the referendum (it meant opposition to the nuclear plant)
April, 2000	A Pro-nuclear group took legal action arguing that land sale was not legally effective
December, 2003	Supreme Court made final decision, pro-nuclear group lost Tohoku-EPCO officially announced the cancellation of the Maki-machi nuclear power plant plan [Made by the authors, based on the information from our interviews, Imai (2000) and Niigata Nippo Press Bureau (1997)]

References

Abelson, J. (2001). Understanding the role of contextual influences on local health-care decision making: case study results from Ontario, Canada. *Social Science & Medicine*, *53*, 777–793.

Abelson, J. et al. (2003). Deliberations about deliberative methods: Issues in the design and evaluation of public participation processes. *Social Science & Medicine*, *57*, 239–251.

Hecht, G. (1998). *The radiance of France: Nuclear power and national identity after World War II.* Cambridge: The MIT Press.

Imai, H. (2000). *The local referendum—beyond the 'audience' democracy.* Iwanami Shoten, Tokyo: Iwanami Shinsho (in Japanese).

Irwin, A. (2006). The politics of talk: Coming to terms with the 'new' scientific governance. *Social Studies of Science*, *36*(2), 299–320.

Jasper, J. (1992). Three nuclear energy controversies. In D. Nelkin (Ed.), *Controversies: Politics of technical decisions*, (3rd edn.). Sage: Newbury Park.

Juraku, K., Ohkawa, Y., & Suzuki, T. (2005). Social decision making process for siting of nuclear power plants in Japan—case studies on Maki-machi and Hokkaido. *Shakai Gijutsu Ronbun-syu* (*The Journal of the Research of Science and Technology for Society*), Shakai Gijutsu Kenkyu-kai (The Association of the Research of Science and Technology for Society), pp. 165–174. Tokyo (in Japanese).

Juraku, K., Ohkawa, Y., Suzuki, T., & Sakura, O. (2006). Social decision making process for siting of nuclear power plants in Japan—case studies on Maki-machi and Hokkaido. *Proceedings of the 9th international conference on public communication of science and technology.* Seoul.

Kaplan, L. (2000). Public participation in nuclear facility decisions: Lessons from Hanford. In D. L. Kleinman (Ed.), *Science, technology and democracy.* New York: State University of New York Press.

Kiba, T. (2003). *Chishiki Shakai no Yukue: Petit Senmonka Sho-ko-gun wo Koete* (*For the knowledge society in future: Beyond the petit experts syndrome*), Nihon Keizai Hyoron-sya, Tokyo, 2005 (in Japanese).

Kingdon, J. W. (1995). *Agendas, alternatives and public policies* (2nd edn.) New York: HarperCollins.

Kobayashi, T. (2004). *Dare-ga Kagaku-Gijutsu ni Tsuite Kangae-ru no Ka?: Consensus Kaigi to iu Jikken* (*Who does think about science and technology: A trial of consensus conference*). Nagoya, Japan: Nagoya Univ. Press (in Japanese).

Lin, K. (2006). Inequalities, knowledge and public deliberation: Three consensus conferences in Taiwan. *Proceedings of the east asian science, technology and society: an international journal conference*. Taipei.

Matsumoto, M. (2002). *Chi no Shippai: Kagaku-Gijutsu ha Naze Shakai ni Totte Shippai ka* (*The failure of the science-technology-society interface*). Iwanami Shoten, Tokyo (in Japanese).

Matsumoto, M. (2005). The uncertain but crucial relationship between a 'new energy' technology and global environmental problems. *Social Studies of Science*, *35*(4), 623–651.

Matsumoto, M. (2006). *Technology gatekeepers for war and peace.* Basingstoke: Palgrave Macmillan.

Matsumoto, M., Nishide, T., & Ohi, N. (2004). The path-dependency of renewable energy technology and the role of relevant outsiders. *Proceedings of international workshop on social decision making process for energy technology introduction*, pp. 19–31. Tokyo.

Nakazawa, H. (2005). *Jumin Touhyo Undo to Local Regime: Niigata-ken Maki-machi to Kongen-teki Minsyu-syugi no Hosomichi, 1994–2004* (*Local referendum movement and local regime: Maki-machi of Niigata prefecture and a narrow lane for the radical democracy, 1994–2004*), Harvest company, Tokyo. (in Japanese).

Nelkin, D. (1992). Science, technology, and political conflict: Analyzing the issues. In D. Nelkin (Ed.), *Controversies: Politics of technical decisions*, (3rd edn.). Sage: Newbury Park.

Niigata Nippo Press Bureau (1997). *"Genpatsu" wo Kobanda Machi; Maki-machi no Min-i wo Ou* (*A town reject the nuclear power plant; A reportage on the public opinion of Maki-machi*). Iwanami Shoten, Tokyo, (in Japanese).

Oyama, K. (2002). *Energy governance no Gyosei-Gaku* (*The study of public administration of energy governance*). Tokyo: Keio University Press (in Japanese).

Pickett, S. E. (1999). To overcome the wall around the "village" of nuclear technology: a comparative study on the consensus building process in Japanese and US cases. *Energy Forum*, *2*, 32–36. Tokyo (in Japanese).

Pinch, T. J., & Bijker, W. E. (1987). The social construction of facts and artifacts: or how the sociology of science and the sociology of technology might benefit each other. In W. E. Bijker, T. P. Hughes, & T. Pinch (Eds.), *The social construction of technological systems*, pp. 17–50. Cambridge: The MIT Press.

Rowe, G., & Frewer, L. J. (2000). Public participation methods: A framework for evaluation. *Science, Technology & Human Values*, *25*(1), 3–29. Cambridge: MIT Press.

Smith, L. G., Nell, C. Y., & Prystupa, M. V. (1997). The converging dynamics of interest representation in resources management. *Environmental Management*, *21*(2), 139–146.

Stirling, A. (2005). Opening up or closing down? Analysis, participation and power in the social appraisal of technology. *Japan Journal for Science Technology and Society*, *14*, 63–83.

Thurston, W. E., MacKean, G., Vollman, A., Casebeer, A., Weber, M., Maloff, B. et al. (2005). Public participation in regional health policy: a theoretical framework. *Health Policy*, *73*, 237–252.

Wynne, B. (1987). *Risk management and hazardous wastes.* Berlin: Springer.

Wynne, B. (1996). Misunderstood misunderstandings: Social identities and public uptake of science. In A. Irwin, & B. Wynne, (Eds.), *Misunderstanding science? The public reconstruction of science and technology*, pp. 20–46. Cambridge: The Cambridge University Press.

Yearley, S. (1992). Green ambivalence about science: Legal-rational authority and the scientific legitimation of a social movement. *British Journal of Sociology*, *43*(4), 511–532.