



**3<sup>rd</sup> International Conference  
on Public Policy (ICPP3)  
June 28-30, 2017 – Singapore**

**Panel T08 P07 Session 2**

**Deliberation on risk and NIMBY facility**

**Risk Discourses and Governance of High-Level Radioactive  
Waste Storage in Taiwan**

Mei-Fang Fan

Institute of Science, Technology and Society

National Yang-Ming University, Taipei, Taiwan

[mffan@ym.edu.tw](mailto:mffan@ym.edu.tw)

June 30th 2017

# **Risk discourses and governance of high-level radioactive waste storage in Taiwan**

## **Abstract**

Policy scholars have indicated that the quality of the solution to a perceived social problem depends on the adequacy of its framing. This paper examines how policy stakeholders and local residents frame the issue of the dry storage facility at Jinshan Nuclear Power Plant, New Taipei, the limits of institutional mechanisms in decision-making processes, and the implications of the informal participatory activities facilitated by environmental nongovernmental organisations (ENGOS). This paper shows how policy stakeholders and local residents frame the controversial project differently and discusses competing knowledge claims among policy actors. Taipower's experts focus on the safety of the dry storage facility and emphasise that their scientific survey and impact assessment have considered the potential impacts of tsunamis and mudslides. Conversely, ENGOS and local activists tend to maintain the precautionary principle and express their concerns about the uncertainty of radioactivity risks to the environment and public health as well as unknown consequences. The controversy of nuclear waste storage in Taiwan illustrates the problems of a knowledge gap and the top-down procedures of nuclear waste governance as well as the challenges that Taiwan

faces in becoming a nuclear-free country. The nationwide citizen forum undertaken by the national Stop Nukes Now organization reveals the high level of reflection on controversial nuclear waste disposal and site selection issues. This example demonstrates ENGOs efforts to challenge the ‘social–technical divide’ and technical experts’ prior definition of the ‘problems’ and selection of a ‘solution’.

Keywords: risk discourses, governance, participatory democracy, radioactive waste, policy framing

## **Introduction**

Nuclear waste disposal and nuclear decommissioning have become some of the most important issues for nuclear countries. The nuclear disaster in Fukushima called attention to nuclear hazards and has revived antinuclear campaigns in Taiwan (Ho, 2014). The Democratic Progressive Party (DPP) government has vowed to phase out nuclear power by 2025. The two reactors of the Jinshan Nuclear Power Plant in Shimen, New Taipei City are scheduled to be decommissioned in 2018 and 2019, respectively. The spent fuel rods produced in the plant’s lifespan of 40 years are to be moved to a dry cask storage facility because the spent fuel pools at the power plant are unable to store all the rods. Taiwan’s dry cask storage facility is now being built as a midterm

storage site at the nuclear power plant. The state-run Taiwan Power Co. (Taipower) plans to store high-level radioactive waste in steel cylinders surrounded by concrete shells placed indoors as a temporary solution until a permanent depository is constructed. The Atomic Energy Council (AEC) has approved the first phase of the dry storage facility project at the first nuclear power plant in Shimen, New Taipei City. However, the New Taipei City government has not yet issued a soil conservation certificate.

The controversy of the dry storage facility involves the complexities of nuclear backend management and the importance of social acceptance. In the past, decommissioning issues have tended to emphasise the technical aspects, whereas the social and environmental impact assessment and concerns have been neglected. Studies have indicated that decommissioning involves various problems, including land reuse of the nuclear power plant site, job opportunities for nuclear power plant employees, the local economy, nuclear waste storage, and environmental impact assessments. Transparent information and local participation in policy processes has become the key to the success of decommissioning projects (Pasqualetti, 1988, 1989; Pasqualetti & Pijawka, 1996; Bond et al., 2004).

An increasing number of studies have emphasised that decision-making processes should be established on the basis of social discussions and local participation. Policy

scholars have indicated that the quality of the solution to a perceived social problem depends on the adequacy of its framing. Discourse analysis based on social constructivism acknowledges that interest in policy problems is developed during the policy-making process through the discursive practice of idea generation and exchange (Braun, 1999). Discourse analysis focuses on the discourse between policy actors and explains how such a discourse is produced to compete with other actors (Dryzek, 1997), which is useful for understanding policy controversies (Schön & Rein, 1994). Faced with social controversy and opposition caused by complex technological conflicts, a review of the framing dilemmas in policy discourse and process dynamics is required for developing regulatory policies.

This study examined how policy stakeholders and local residents frame the issue of the dry storage facility at Jinshan Nuclear Power Plant, the process of consultation and the limits of institutional mechanisms in decision-making processes, and the implications of citizen forum activities facilitated by environmental nongovernmental organisations (ENGOS). The research methods adopted include documentary analysis and in-depth interviews. After a brief discussion of the concept of risk governance and discourse analysis in policy studies, this paper analyses the differences in discourse and the competing knowledge claims of relevant policy actors as well as the dynamics of policy disputes. Problems concerning the top-down procedures of nuclear waste

management and policy implications are discussed.

## **Risk governance and discourse analysis**

Risk governance includes a multifaceted and multifactor risk process as well as the consideration of contextual factors such as institutional arrangements, political culture, and various perceptions of risk (Renn, 2005). The idea of risk governance cannot be reduced to calculable quantitative risk, but must be interpreted broadly. It refers to situations characterized by uncertainty, ignorance, complexity, and irreducible perspectives (De Marchi, 2015). Renn and Klinke (2015) argued that the legitimacy of the risk governance process depends on the capability of management agencies to resolve complexity, characterize uncertainty, and handle ambiguity by means of communication and deliberation. The concerns of stakeholders and the public are integrated into the risk appraisal phase through concern assessment. Stakeholder and public participation are an established part of risk management.

Risk governance took a participatory turn in the late 1990s. This appears to be an important move towards the democratisation of technological decision-making; however, a notional divide remains between the treatment of the technical and social aspects of radioactive waste management, which raises questions about the types of choices for which affected communities are unable to debate fully the technical options

(Bergmans et al., 2015). Jasanoff (2010) argues that risk governance in democratic societies necessarily works from the bottom up and is based on aggregating communal knowledge, experience, preferences, and concerns. Jasanoff (2010: 31-34) emphasises in favour of four focal points for the 'technologies of humanity' that can inform risk governance: framing, vulnerability, distribution, and deliberative learning. First, policy scholars emphasise that the quality of a solution to a perceived social problem depends on the adequacy of its framing. Second, traditional approaches to risk analysis view individual or social groups as passive objects, and their exposure is assessed through technical and expert calculation, thereby neglecting the perceptions of the affected population and historical experience. Third, distributive effects and inequity are critical factors that evidently affect people's responses to harmful scenarios. Fourth, societies can actively reflect on ambiguity and assess the strengths and weaknesses of alternative explanations by constructing institutions of civic deliberation. Jasanoff (2003) further argued for developing a culture of governance that empowers citizens to participate in the regulatory process for science and technology.

Funtowicz and Ravetz (1992) proposed the idea of postnormal science, referring to situations in which 'facts are uncertain, values are disputed, stakes high, and decisions urgent'. They argued that the participation of citizens and stakeholders is crucial not just in legitimizing the role of expertise in complex decision-making processes but also

in the quality of knowledge-making. Discussing the notion of coproduction, Jasanoff (2004) claimed that natural and social orders are produced together, which means that scientific knowledge both embeds and is embedded in social practices, identities, norms, discourses, instruments, and institutions. Jasanoff argued that ‘expertise has legitimacy only when it is exercised in ways that make clear its contingent, negotiated character and leave the door open to critical discussion’ (Jasanoff, 2003: 160). Jasanoff argued that, in decision-making processes, citizens should be characterized as being entitled to several ‘knowledge rights’, including the right to challenge policy decisions and the right to participate and offer expertise (Jasanoff, 2012: 27–30).

Hajer (1995) adjusted Foucault’s concept of power and knowledge for understanding complex environmental policy controversy and stated that discourse analysis illuminates the social and cognitive bases of how policy problems are constructed (Hajer, 1995: 15). The notion of ‘storylines’ is a central concept of Hajer’s framework. Groups of actors being drawn to particular storylines as they reflect common interests results in the formation of ‘discourses coalitions’ (Hajer, 1995: 12-13). Hajer defined discourses coalitions as ‘the ensemble of 1) a set of storylines, 2) the actors who utter the story lines, and 3) the practices in which this discursive activity is based. Storylines are seen here as the discursive cement that keeps a discourse coalition together’ (Hajer, 1995: 65), thereby providing arguments for how these rationalities are



upheld within policy discourse. For Hajer, discourse coalitions are linguistics based rather than interest based. Instead of traditional allegiances, the employed storylines and practices determine the coalition. Examples of opposing discourse coalitions can be seen in contemporary debates about renewable energy. New discourse coalitions have arisen through discursive strategies adopted in policy debates, and the traditional distinction of green groups has been refuted by the renewable energy debate (Stevenson, 2009: 514). Each storyline involves a different account of what is true and what counts as the representation of reality. Different discourse coalitions could draw on opposing knowledge claims as central elements in their distinctive storylines. Storylines play a critical role in positing actors, adding credence to the claims of certain groups and rendering those of other groups as less credible. Storylines also serve to create social and moral order within a given domain as devices through which actors are positioned and ideas of blame, responsibility, and urgency are attributed (Ockwell & Rydin, 2006: 384).

## **The research and context**

In the early 1970s, the government carried out ‘Ten Major Infrastructure Projects’ (1970-1979) and nuclear power stations were one of the important construction projects. The worldwide inflation and depression caused by the Middle East War in 1973 led to

the policy of developing nuclear energy to maintain a stable energy supply and continuous economic growth. The first nuclear power plant in Chinshan, Taipei County, was started to be constructed in 1971 and run commercially in December 1978, and was considered to be the solution to energy crisis and the symbol of the development of high technology and the force of the country. The No.2 and No.3 nuclear power plants started to run in 1981 and 1984.

The decision to develop nuclear energy and the construction of the three nuclear power plants did not cause local residents' opposition or the public suspicion of potential risks. The top-down decision-making model during the martial law era was seen as bringing efficiency, political stability and rapid economic development. People became passive recipients without doubting the legitimacy under the propaganda of 'national benefits'. Spent fuel is temporarily stored in the pools of the three nuclear power plants: No.1 (1978~), No.2 (1981~) and No.3 (1984~). Most low-level nuclear waste has been stored on Orchid Island since 1982. The government has promised to remove nuclear waste from Orchid Island because of strong local and indigenous opposition, but permanent site for low-level nuclear waste facility has not yet found.

Taipower's proposal for the spent fuel interim storage at Jinshan Nuclear Power Plant passed environmental impact assessment in June 1996. In 2005, the Institute of Nuclear Energy Research, which is subordinated to the AEC, successfully tendered for the

construction. Taipower published the *Report of Environmental Impact Assessment and Difference Analysis* and passed an environmental impact assessment in August 2008.

The EIA (Environmental Impact Assessment) committee established expert committees on the issues of nuclear safety and health risks, conducted a consultation meeting composed of local government, civic groups and stakeholders, and requested that the interim facility store the nuclear waste for no more than 40 years, after which it should be removed to the permanent disposal site.

Taipower obtained a construction certificate from Taipei County in September 2010 and started to construct the dry storage facility in October 2010. The first phase of the dry storage facility was completed in February 2013. In August 2013, before Taipower prepared to undertake an operational test of the storage facility, local residents and environmental groups went to the entrances of Jinshan Nuclear Power Plant and the Executive Yuan to protest against the project and asked Taipower to remove the nuclear waste. Local residents were worried about the risks of leakage and concerned that the dry storage facility might become a permanent disposal site. Although the facility has passed an examination by the AEC, the New Taipei City government has not yet issued a soil conservation certificate for operation because of the concern due to uncertainties, potential negative impacts, and strong opposition from the mayor of New Taipei City. A second-phase project is scheduled to expand the current site to

accommodate the fuel rods currently stored in cooling ponds. Taipower's decommissioning plan, which is planned to require 25 years for completion, is currently under review by the AEC.

The population of Shimen Township is approximately 12,733. Most residents are older adults and children, because many younger people migrated to urban areas for better job opportunities. The main occupations are agriculture and fishing; however, the New Taipei City government is currently trying to promote tourism. When the nuclear plant was constructed during the 1970s, local residents tended to consider that the project could provide economic development and local industrialization. A series of protest marches organized by the anti-nuclear organization have taken place since the 1990s, advocating 'Save Energy, Say Goodbye to Nuclear Energy' and 'No Nuke, Living in Taiwan Safely'. The development of the anti-nuclear movement has led to the change of nuclear policy from the expansion of nuclear energy to the goal of a non-nuclear country.

Documentary research, in-depth interviews, and a focus group discussion were conducted. The documentary research mainly involved examining relevant journal articles and supplementary materials such as reports regarding the nuclear waste controversy and propaganda material from environmental group campaigns. The local residents of the nuclear power plant, members of nonprofit organisations, local

representatives and township leaders, and civil servants from the Shimen District Office of New Taipei City were interviewed during March–April 2016. In addition, we also interviewed the nuclear engineering, radiation protection, and health experts that had participated in antinuclear citizen actions as well as North Coast Antinuclear Action Alliance members. For this study, we hosted a stakeholder workshop on nuclear waste regulation and monitoring mechanisms; scholars from various academic disciplines and former officials of the AEC were invited to participate in the workshop to promote discussions and share arguments from different perspectives.

## **Competing framing and knowledge claims regarding the dry storage facility**

This section focuses on the key narratives and core concerns of the stakeholders and local residents. At least three discourses underlie the debate about the dry storage facility, namely scientific uncertainty and safety issues, health risks and the possibility of accidents, and compensation.

### ***Scientific uncertainty and safety issues***

Taipower has emphasised the safety and technological assurance of the dry storage

facility, indicating that other countries have run dry storage facilities for many years. Taipower have indicated that they have strict regulatory standards to ensure safe storage. Concerns over safety involve the suitability of the site, medium-term storage, the type of steel used, the detailed design, the capacity to remove the nuclear waste from the barrels, and the transportation plan. One legislator considered whether a humid storage design might be a more suitable option and questioned how Taipower made the decision to adopt a dry storage facility, which might not suit the humid climate and high salinity near the northern coast of Taiwan (Chen, 2015).

The site of the dry storage facility is adjacent to mountain slopes, a stream, and a nearby geological fault; a Taiwanese nuclear engineering expert who formerly conducted risk analysis for an American nuclear power company indicated that the geological conditions in Taiwan are quite different from those in America, and he doubted whether the American experience and regulations are applicable to Taiwan. He also raised the following doubts and concerns: 'it is unknown whether there is a risk of leakage when the storage barrels experience decay due to the sea wind; considering the particular circumstances of the northern coast of Taiwan, indoor storage would be more appropriate than outdoor storage; no techniques are currently available to monitor spent fuel rods after they have been moved to the barrels of the dry cask storage facility; thus high safety standards are necessary; current experiments into radioactive waste storage

are short term, and the follow-up safety of the facility is not guaranteed. Can the results of a 10-year experiment be extrapolated for 40 years?’ (interviewee, P1)

Doubts about the safety of steel barrels involve question about sufficient safety standards and the body responsible for setting them. Yilan Charlei Chen Foundation, an active antinuclear environmental group, also expressed concerns about the project’s ‘inappropriate design’. ENGOs have expressed concerns about the storage techniques and the materials, weights, and thickness of the barrels. They have noted a warning from the American Nuclear Regulatory Council that the welding beads of 304L-steel barrels may corrode due to sea salinity. After corroding, a barrel might cause radioactive leakage, and moisture entering the barrel might cause explosions (Tang & Lin, 2013). Environmental groups were also concerned that, because no complete monitoring design was included, the circumstances inside the barrels would be uncertain. They noted that the technical operators might risk radioactive exposure when they opened the barrels after 40 years and that Taiwan lacks the necessary techniques for removing the spent fuel rods and handling materials (Environmental Information Center, 2017).

Environmental activists mentioned the accidents caused by transportation and corrosion and the uncertainty of nuclear waste facilities in other countries. Accidents involving barrels falling down during transportation, or collapses caused by earthquakes, would lead to radioactive leakage and destructive disaster. The ENGOs

expressed concerns that the dry storage facility would become ‘an outdoor high-level radioactive waste dump’ for at least 40 years. The nuclear engineering expert opined that a dry storage facility can only be maintained for decades and a permanent site for high-level radioactive waste storage is required. However, because site selection faces various difficulties and local opposition, Taipower cannot easily accomplish this goal in the short term.

Taipower operates with a culture of scientific positivism and argues against claims of uncertainty regarding scientific matters, which is ineffective at resolving the complexity. Environmental activists and counter-experts challenge the expertise of Taipower and highlight the limits of scientific knowledge regarding the risks and environmental impacts of the storage facility project.

Since the DPP took office on 20th May, 2016, the new head of the AEC has faced these challenges of nuclear waste storage. In response to the scientific challenges and the precautionary position held by the environmental groups, the head of the AEC maintained that environmental groups’ doubts are ‘reasonable’ and stated that ‘all nuclear waste will be stored in dry, indoor facilities’, Taipower will be asked to present a revised proposal, and the government will make an effort to enhance information transparency and public communication (Lin & Chang, 2016).



### ***Health risks and the possibility of accidents***

An empirical study revealed considerable divergence among local perceptions of the impact of the nuclear waste repository and dry storage facility. Three types of narrative and discourse were identified. First, those who oppose construction were concerned about the negative impacts on health and ecology. They tended to think that the nuclear power plant has had long-term negative health impacts (interviewees, L10) and that it relates to cancer (interviewees, L2). One local resident even mentioned that: ‘When we go to see the doctor, they always ask whether you live next to the nuclear power plant? Otherwise, why each of you got bone ache?’ (interviewees, L8) Another indicated that because exposure to the nuclear power plant is unavoidable, people may be reluctant to have children (interviewees, L7). Local residents provided detailed narratives about the adverse impact of the nuclear power plant on their daily lives and the environment:

It has affected our health. Crops do not grow and they die... Every time it rains, the vegetables wither. In the past, we caught a lot of fish and needed scales to weigh them, but now we can only catch a few fish. (interviewees, L11)

After nuclear power plant was built, the number of fish has decreased; they have become rare and have vanished. (interviewees, L8)

Those who perceived the negative impacts of the nuclear power plant tended to express anxiety about the uncertainty and impacts of the dry storage facility. The main concern was that an earthquake or a tsunami could damage the storage facility and might cause a radioactive leakage accident. One local resident said: ‘I do not know much about this. But if an earthquake or a tsunami happened, the dry storage facility might be destroyed, which could lead to a leak... I am afraid of an earthquake or a tsunami like the one that caused a disaster in Japan.’ (interviewees, L3). Another woman mentioned the following:

If a tsunami happened, it could cause a radioactive leak. Where should people here go? I am afraid that people cannot survive. It is dangerous, and everyone is worried. But what can we do? When the dry storage facility was being constructed, local residents did not say much; how can we say something now that the construction is finished? (interviewees, L13)

Environmental groups worry the barrels might be corroded and cause radioactive leakage, which would lead to food and water pollution and affect public health. Moreover, the dry storage facility site is near Taipei City, which has a dense population. If an accident occurs, seven million people would experience health risks (Huang, 2015).

Although the AEC and Taipower indicated that nuclear waste would be removed from the nuclear power plant in the future, local residents and activist remain worried

that the dry storage facility might become a permanent nuclear waste site. People worry that Taipower will be unable to deliver, because it has not yet found a permanent disposal site for low- and high-level radioactive waste. The head of the Shiman District mentioned that ‘people hope that the AEC or Taipower can set a specific timetable and not delay the site selection work and wait for the situation to change. Local residents will be forced to accept nuclear waste if a permanent radioactive waste facility site still cannot be found.’ The former head of the township also pointed out: ‘Taipower must clarify whether they can accomplish their goal.’ Local residents expressed similar concerns; one woman said, ‘nuclear waste might always be stored there. Taipower and the government saying they will remove it is one thing, but doing it is another thing’ (interviewees, L2). ‘Taipower said that nuclear waste will be stored there for decades’ (interviewees, L1). ‘If they think that they can dump here, then why would they need to remove it’ (interviewees, L3).

Second, some residents think that there is no direct relationship between health problems and the nuclear power plant. As one woman said, ‘The impact of nuclear power plant is not obvious and I do not feel the impact. Because most residents are older adults with various levels of illness, I do not feel the particular impact of nuclear power plant.’ (interviewees, L3) An older woman mentioned, ‘I do not think of the impact because there is no news of radioactive leakage.’ (interviewees, L4) Another

woman said, 'Cases of cancer can be found everywhere, and I do not hear of cases caused by the nuclear power plant.' (interviewees, L13) Because these residents did not experience obvious negative impacts of the nuclear power, they tended not to worry the impact of the dry storage facility. As one said, 'Even if there is a radioactive leakage accident, the amounts will not be much. I feel that we do not need to worry too much because the dry storage facility has been built.' (interviewees, L4)

Others considered that people's illness may be amplified by the nuclear power plant. People who have chosen to live in a place with contested, uncertain, risky facilities might downplay the environmental risk to make sense of their life narratives (Fan, 2009). Wynne et al. (1993: 46) studied local perceptions of the nuclear industry in West Cumbria, UK; public recognition of the risks involved in living in the Sellafield area was 'often covered, or mellowed, by layers of rationalization.' Similarly, residents who are less concerned about radiation risk put considerable faith in science, because they must rationalize to themselves and to people they talk to why they live next to a nuclear power plant. Another man seemed to be fatalistic:

Because the nuclear power plant has been here for a long time, I think it is durable if no earthquakes or something like that happen. It only has risks, but we do not need to quarrel and be sad.... At least no accidents have happened; it has not caused people to die, so we do not need to be afraid of this. Because the dry storage facility has been built, let's not to argue about this anymore. (interviewees, L4)

Third, other residents expressed themselves bluntly, showing that many local residents have no choice but to live with the nuclear power plant and dry storage facility:

Take Fukushima for example: people found it terrible when the nuclear disaster happened. It was terrible when it happened, but normal life has returned... People have no choices. In fact, what can you do when you fear? Will you move out? It is impossible; what you can do is to expect that the nightmare won't happen. (interviewees, L6)

Seley and Wolpert (1983) argued that it would result in an unequal impact on those who are forced to move because of a new nuclear waste facility. Immeasurable psychological hardship may be caused, especially among long-term residents and old people, even if the financial compensation is provided for a new home or business. Their argument resonates with this case.

### ***Diverse perspectives regarding compensation***

This section examines local residents' attitudes towards the huge amounts of compensation offered by Taipower and the implications for the existing discourse on compensation. The payment offered by Taipower has been used for local development or can be distributed to local permanent residents. Different understandings of compensation and the types of transactions taking place between the local residents and Taipower seem to underlie the disagreement. This section discusses whether

compensation can address local residents' perceived loss.

Residents who believed that the nuclear power plant had long-term negative impacts on their health and the environment tended to consider the compensation offered by Taipower as incommensurate with the damages. As one older woman said, 'The compensation is not much. How can one life be equal to this money?' (interviewees, L3) Another woman mentioned, '... compensation is called our *life money*. The compensation for our electricity bill is what Taipower promised to provide when the nuclear power plant came. But we haven't received extra *life money* yet. We haven't received compensation for the nuclear waste.' (interviewees, L8) Some local residents thought that the compensation was less than that offered by Taipower to Orchid Island residents, where most low-level radioactive waste has been temporarily stored.' (interviewees, L3, L11, L12, L13) Local residents heard that the compensation will decrease after the nuclear power plant is decommissioned in 2018. One interviewed residents said: 'Have you heard that the compensation will be reduced? I know this from the TV news; our local leader will go to express our dissatisfaction. Even when the nuclear power stops running, the nuclear waste will still be here. How can the compensation decrease? Taipower will still make huge profits. People in other places do not let Taipower store nuclear waste, only we silly residents let them do this.' (interviewees, L11)

The compensation has been linked to one kind of discrimination and is seen as a tool to encourage local residents to accept the nuclear power plant and dry storage facility. As one woman stated: ‘People receive the compensation and cannot blame Taipower. They do not know [how] to fight against the authority. You only can listen to them (Taipower), right?’ (interviewees, L13)

By contrast, several residents regarded the compensation as reasonable and accepted the project pragmatically. One man said, ‘I think the compensation is a kind of payback for the nuclear power plant’s negative impacts on the local community. Because the power company got some profits, they give some rewards to the local community. We have received the benefits of electricity, which can provide what we need. I don’t think it is necessary to argue over this.’ (interviewees, L4) A bed and breakfast owner said that money cannot solve the problem.

I don’t think the No. 4 nuclear power plant should be built by providing local residents with compensation. In fact, we could live in a simple way, and use more expensive electricity rather than from the dangerous plant and hoping that earthquake doesn’t happen in this area. The mindset for economic development has sacrificed the environment. (interviewees, L6)

## **Public distrust of the closed expert system**

### ***Limits of the institutional mechanisms***

The doubt of environmental activists and local residents regarding the dry storage facility reflects their considerable distrust of Taipower, the AEC, and the nuclear energy regulation culture. Public participation remains limited by the core power structure and closed expert system. The development project passed the EIA in 2008 under the condition that two expert consultation committees, composed of local government, civic groups, and stakeholders, would be established to consider the issues of nuclear safety and health risks. In addition, nuclear waste could be stored for 40 years and then must be removed. The EIA committee was composed of experts and government officials; the representatives of ENGOs and local residents were permitted to participate in the commission to voice their opinions, but they had no voting rights. At the beginning of EIA processes, the main discussion agenda and concerns tended to be the technical assessment, geological survey, and radioactivity monitoring. Issues of nuclear safety and health communication became crucial concerns among members of the EIA committee. However, few committee members had different opinions and opposed the development proposal. Because of the decision by majority, the opposition of these few committee members was unable to stop the development project.

According to the AEC's current regulatory procedure for the construction of the dry storage facility, a public hearing must be held during Taipower's application for the construction licence. However, the public hearing held by the AEC in October 2007



was very controversial because some observers considered that it was only a formality. This caused criticism regarding information asymmetry, the limits of agenda-setting, processes, and time. Local representatives, village heads, officials from the Taipei County government, and two national ENGOs were invited to attend the hearing for a dialogue with Taipower. The participants from the ENGOs and local representatives expressed their concerns, and Taipower tried to communicate with them. However, because the head of Taipei County government opposed the plan, he made a statement and left without engaging in the dialogue. The public hearing was simply a legitimization exercise with no influence on the decision-making.

The conditions of the EIA's decision stipulated that expert committees must be convened to address the nuclear safety and health risks of the dry storage facility. Two expert committees were composed of experts and scholars recommended by the New Taipei City government, the AEC, and Taipower. The goal of the committee was to seek professional consensus, and the AEC consulted the representatives of local government, relevant agencies, civic groups and stakeholders to make the policy decision. The discussions of the two expert commissions were oriented towards technical details. Although some representatives recommended by the public had different views, experts reached consensus on some topics (e.g., emergency measures, more research into health and radioactivity, and health monitoring; Chen, 2017). The commission asked Taipower

to provide a comprehensive response to the questions and doubts raised in the meeting, but the conclusion and suggestions are not binding. After several committee meetings, local residents and environmental groups still doubted the project and the New Taipei City government held the opposition position. Local representatives remain worried that the storage site might become a permanent site for radioactive waste.

### ***Distrust of regulatory institutions***

Local residents pointed out that there is little information accessible regarding the dry storage facility, and that the public hearing was very limited. One woman pointed out that information was not transparent and most details are disclosed by civic groups (interviewees, L6). Another woman said, ‘there are few job opportunities, and many working young men did not receive the information and did not have the opportunity to attend the public meeting.’ (interviewees, L7) Local residents’ distrust is evident, as one said: ‘Taipower has tried to persuade us that this nuclear waste facility is safe. Even if the information or data is a disclosure, I do not believe the AEC. If it is safe, why don’t the governmental officials live here? Why does no one dare to live close to the facility? The reason is very simple.’ (interviewees, L6)

Residents felt that the language Taipower used was too complicated to understand, because many residents did not study this subject and did not understand data analysis

(interviewees, L1). The central government has an existing policy for the dry storage facility. As on said, 'The policy rhetoric and languages they used seem very complex, but sounds very simple. It is not really beneficial to us. We feel it is to pacify us; Taipower and the government do not let us know the reality because if they make it clear, local residents will fear, protest, and leave.' (interviewees, L3)

However, local residents pointed out that the head of the village tended to support the government. One woman pointed out that 'even the representative could not help to change the situation; how can the head of the village? The head of the village only cares about himself.' (interviewees, L12) Some residents believed that Taipower privately provided benefits to these village heads to ask them to support the nuclear power plant (interviewees, L11, L12, L13). The local residents pointed out the inadequacy of Taipower's communication and propaganda.

Taipower said that they give us iodine every year. But if an accident happens, as a very old woman, I may already die before I find it. I sometimes forget where I put the iodine. What is it for? (interviewees, L13)

If I heard the alarm, I would be nervous and would forget where to find the iodine. Taipower say something, but we are very old and forget easily. I will forget how many tablets to take when I get nervous. (interviewees, L8)

One member of the Wild at Heart Legal Defence Association considered members of the AEC's safety analysis review commission to have conflicts of interest and doubted

whether the AEC could declare the list of the commission members. The ENGOs pointed out that the contractor, the Nuclear Research Institute, is a subordinated unit of the AEC. They doubted the integrity of the AEC's role in supervising and reviewing the safety of the storage. Among the 12 commission members, six AEC reviewers were from the Nuclear Research Institute. Among the six external experts, one was a researcher from the Nuclear Research Institute, three were retired officials from the AEC, and two were professors who had conducted research projects funded by the AEC.

Environmental groups and counter-experts have noted the problem of incomplete supervision and the quality of Taipower's contracted projects. One nuclear expert argued that an independent committee or institution should be responsible for the nuclear waste management rather than the AEC; moreover, this independent committee should not be influenced by political parties. The committee should consist of professionals from various areas, including nuclear engineering, geology, hydrology, civil engineering, materials science, chemistry, and social science (interviewees, P1).

Faced with strong opposition among local environmental groups' in the site selection process for a permanent nuclear waste facility, the Executive Yuan passed a draft of the Administrative Institution Radioactive Waste Regulation Center Establishment Act in November 2016. The Administrative Institution Radioactive Waste Regulation Center will comprise 11–15 directors. The board of the directors will

include people with integrity, members of civic groups, and local residents, who must constitute at least one third of the board. The Administrative Institution Radioactive Waste Regulation Center will be responsible for the site selection for a permanent nuclear waste facility, and it will supervise nuclear waste management.

The participatory mechanisms are expert-led; the public have little opportunity to participate in the meetings and the process makes no substantive difference to their situation. ENGOs and scholars have provided critiques of the ‘public participation and expert representation’ policy of the Environmental Protection Agency:

Professor C: I think there is no need to have ‘expert representations’. For deliberation activities, experts could provide their opinions sometimes, and the public can acquire a level of knowledge similar to the professional level as long as they have the opportunity to participate in the discussion.

The ENGO: Experts can easily be affected by interests, whereas the public are more concerned about the environment. Experts might have executed some research project or received funding. If the experts are officially recommended, they might be led to reach the conclusion that their sponsor prefers. According to my experience, the public tend to recommend experts who have many questions, but they will not be selected as the representatives. Therefore, the public tend to regard the official participatory tool as a trick.

The engineering consultant of the ENGO: If the Nuclear Research Institute receives research funding from Taipower, how can it be impartial? Experts in nuclear safety assessment tend to be researchers from the Nuclear Research Institute and professors at National Tsing Hua University. How can they impartially review Taipower’s project? Some even serve as Taipower trustees.

The ENGO: Experts must avoid conflicts of interests. Those who have received funding

must not be allowed to serve as reviewers of the radioactive waste project.

This demonstrates the limited public participation in expert panels. Moreover, this raises the important question of how to ensure impartiality of expert reviewers and avoid the nomination of experts who have undertaken research projects funded by Taipower because their professional and research capabilities are based on their accumulated research experiences. Another issue is whether the resident and ENGO representatives can reflect the public's concerns and thoughts because ENGOs and experts have their own priorities.

### *ENGO citizen forums*

The DPP took office in May 2016 and have promised more communication with ENGOs to address environmental issues. The Citizen Participation Forum was established by the AEC to make information transparent and enhance communication. The AEC invited ENGOs and the public to participate in the Citizen Participation Forum to discuss issues of nuclear safety, environmental radioactivity regulations, and monitoring and decommissioning. The ENGOs hoped that this would not just be a policy consultation, and they requested the publication of the documents Taipower submitted to the AEC and those of the review committee meeting.

To reach consensus on nuclear waste disposal, the national Stop Nukes Now

organisation sponsored eight citizen forums based on the concept of deliberative democracy from March to October in 2016. The citizen conferences were held in the northern and southern coastal areas where three nuclear power plants are located as well as Orchid Island, Taitung, which is a potential site for permanent low-level radioactive waste storage. Forums have discussed whether to send nuclear waste abroad for storage, the criteria and processes that should be used for the selection of a permanent national nuclear waste disposal site, which government agency should be responsible, and how affected local residents should participate in the process. Stop Nukes Now held a press conference on October 15th, 2016, to present their consensus, urging the government to conduct citizen deliberations on nuclear waste issues and allow the public to oversee and participate in issues related to nuclear waste disposal and management. They also suggested that the government should respect local knowledge and emphasise the principles of environmental justice. The consensus document called for local residents directly affected by waste disposal facilities to be granted a veto or additional 'weighted' votes in a local referendum that would determine participants through proximity to facilities rather than along county lines (Gerber, 2016; Chu, 2016). Through the citizen forums, young people expressed their opinions on public policies constructively and communicated rationally with others to reach consensus in the spirit of deliberative democracy. Over time, such practices will foster a culture in which lay people are

willing to participate in politics and engage in deliberation (Chu, 2016).

## **Conclusion**

This study shows how policy stakeholders and local residents framed the controversial project differently and discussed the competing knowledge claims of policy actors. Taipower's experts emphasised the safety of the dry storage facility and claimed that their scientific survey and impact assessment had considered the potential impacts of tsunamis and mudslides. However, ENGOs and local activists tended to maintain the precautionary principle and express their concerns about the uncertainty of radioactivity risks to the environment and public health, and their concerns about unknown factors. ENGOs and local activists noted the lack of long-term investigation into the health and sociopsychological impacts of nuclear power plants. They questioned the credibility of the safety design of the dry storage facility and suggested that another, safer site should be found. Some local residents and ENGOs were concerned that the government had not scheduled the complete site selection of a permanent repository and the removal of nuclear waste.

Decisions to construct the dry storage facility in the existing No. 1 and No. 2 nuclear power plants and governance institutions were limited by bureaucratic authoritarianism, which emphasised scientific positivism but failed to appropriately respond to disputes



originating from society, local concerns, and values. The project passed its environmental impact assessment with the obligation to establish committees on nuclear safety and health risks. Various participatory mechanisms were implemented in central and local governance, including public hearings for the construction license, expert committees on nuclear safety and health risks, and New Taipei City's Nuclear Safety Supervision Committee. While the consultation processes provide opportunities for concerned members of ENGOs to voice their opinions, the mechanisms were expert-focused, and the committee's advice had no binding influence on the storage facility project or Taipower's methods of operation. As researchers have noted, many these participatory initiatives are mainly driven by a need to secure legitimacy and increase acceptance for solutions that have been already technologically agreed upon (Blowers & Sundqvist, 2010). Participation in formulating nuclear waste policies is still limited to a top-down participation and negotiation platform, in which local people are limited to the roles of being notified, being informed, and passively receiving invitations from the government to express their opinions and concerns. Nuclear waste governance remains advisory-based and involves a top-down mechanism that impedes decision-making and participation by residents.

Because of the limits of the participatory mechanism and public distrust of technocratic authority and expert committees, environmental groups established

nationwide deliberative public forums on nuclear waste disposal and site selection criteria to facilitate discussions on nuclear waste, especially in places where nuclear power plants are located or places that might become potential sites to host nuclear waste storage facilities. Public forums conducted by ENGOs provided an opportunity for young people to learn to deliberate and communicate with others who might have competing points of view. A high level of reflection on the controversial nuclear waste disposal and site selection issues was exhibited at the citizen forums, which has potential to contribute to knowledge creation and the shaping of political discourse. The practice showed ENGOs making efforts to challenge a notion of ‘social–technical divide’, in which technical aspects are generally brought into the public domain only after technical experts have defined the ‘problems’ and decided on a ‘solution’ (see Bergmans et al., 2015).

The complex interest network of nuclear regulatory and research institutions has weakened the credibility of scientific knowledge production and reduced the release of risk information. Science and society are no longer exclusive from each other but are interactive and coevolve (Nowotny et al., 2001). Opposition actors challenge the dominant mechanistic worldview through critical focus on the contingency of scientific facts (Wynne, 2001). Effective public participation requires early involvement, two-way communication among stakeholders, and consideration of social concerns and

values in addition to scientific facts (Bond et al., 2004). Bergmans et al. (2015) argued that we must acknowledge the prior framing of long-term radioactive waste management and the associated commitments in terms of legislative frameworks, R&D programmes, and experts' 'closing down' of the problem (Stirling, 2005), which limits the scope for citizen influence on the resulting sociotechnical 'configuration'. The government must recognize the entangled nature of the technical and social aspects of the nuclear waste controversy and broaden stakeholder and local participation in technological, environmental, and health risk assessment; they must engage in institutional innovation towards technological democracy and policy change that is responsive to the local risk perceptions and the social and cultural rationale.

## References

- Bergmans, A., Sundqvist, G., Kos, D. and Simmons, P. (2015). The participatory turn in radioactive waste management: deliberation and the social-technical divide. *Journal of Risk Research*, 18(3) : 347-363.
- Blowers, A. & Sundqvist, G. (2010). Radioactive waste management – technocratic dominance in an age of participation. *Journal of Integrative Environmental Science*, 7: 149-155.
- Bond A., Palerm J., Haigh P. (2004) Public participation in EIA of nuclear power plant decommissioning projects: a case study analysis, *Environmental Impact Assessment Review*, 24 (6), 617–641.
- Braun, D. (1999). Interests or ideas? An overview of ideational concepts in the public policy research. In D. Braun and A. Busch (eds.) *Public policy and political ideas*. Northampton, MA: Edward Elgar. Pp. 11-29.
- Chen, I. T. (2015). The American lab suggest Taiwan humid storage facility and

- legislative critiques of concealment. Liberty Times. Available at <http://news.ltn.com.tw/news/life/breakingnews/1225239>.
- Chu, Li-Shin. 2016. Taiwan Promotes Public Forum for Strengthening Democratic Momentum. <http://www.taiwanngo.tw/files/16-1000-31121.php?Lang=en>
- De Marchi, B. (2015.) Risk Governance and the Integration of Different Types of Knowledge. In Paleo, U. F. (ed.) *Risk Governance*, London: Springer. pp. 149-165
- Dryzek, J. (1997). *The politics of the earth Environmental discourse*. New York: Oxford University Press.
- Environmental Information Center (2017). The spent fuel dry storage facility has potential risk and high uncertainty. <http://e-info.org.tw/node/97603>
- Fan, Mei-Fang (2009). Public Perceptions and the Nuclear Waste Repository on Orchid Island, Taiwan. *Public Understanding of Science*, 18(2): 167-176.
- Funtowicz, S. O. and Ravetz, J. R., (1992). Three types of risk assessment and the emergence of postnormal science, in Krimsky, S. and Golding, D. (eds.), *Social theories of risk: 251–273*. Westport, Connecticut: Greenwood.
- Gerber, A. (2016). Nuclear waste forums' results revealed. Taipei Times. <http://www.taipetimes.com/News/taiwan/archives/2016/10/16/2003657277>.
- Hajer, M. A. (1995). *The politics of environmental discourse: Ecological modernization and the policy process*. New York: Oxford University Press.
- Ho, M.-S. (2014). The Fukushima Effect: Explaining the Recent Resurgence of the Anti-nuclear Movement in Taiwan, *Environmental Politics* 23(6): 965-983.
- Jasanoff, S. (2003). Technologies of humility: Citizen participation in governing science. *Minerva*, 41, 223–244.
- Jasanoff, S. (2004). Ordering knowledge, ordering society. In S. Jasanoff (Ed.), *States of knowledge: The co-production of science and social order* (pp. 13–45). New York, NY: Routledge.
- Jasanoff, S. (2010). Beyond calculation: A democratic response to risk. In A. Lakoff (Ed.), *Disaster and the politics of intervention* (pp. 14-40). New York, NY: Columbia University Press.
- Jasanoff, S. (2012). The politics of public reason. In F. Dominguez Rubio & P. Baert (Eds.), *The politics of knowledge* (pp. 11–32). New York, NY: Routledge.
- Lin, M. and Chang, S. C. (2016). All nuclear waste to be housed indoors: atomic energy

minister. Focus Taiwan (2. June 2016) Available at <http://focustaiwan.tw/news/aeco/201606020029.aspx>

Nowotny, H., Scott, P., & Gibbons, M. (2001). *Re-thinking science: knowledge and the public in an age of uncertainty*. Cambridge, MA: Polity.

Ockwell, D. & Rydin, Y. (2006). Conflicting discourses of knowledge: Understanding the policy adoption of pro-burning knowledge claims in Cape York Peninsula, Australis. *Environmental Politics*, 15(3): 379-398.

Pasqualetti, M. J. (1988). Decommissioning at ground level: Sizewell and the uncertainties of faith. *Land Use Policy*, 5(1): 45-61.

Pasqualetti, M. J. (1989). Introducing the geosocial context of nuclear decommissioning: Policy implications in the US and Great Britain. *Geoforum*, 20(4), 381-396.

Pasqualetti, M. J., & Pijawka, K. D. (1996). Unsiting Nuclear Power Plants: Decommissioning Risks and Their Land Use Context. *The Professional Geographer*, 48(1), 57-69.

Renn, O. and Klinke, A. (2015.) Risk Governance and Resilience: New Approaches to Cope with Uncertainty and Ambiguity. In Paleo, U. F. (ed.) *Risk Governance*, London: Springer. pp. 19-41.

Schön, D. and Rein, M. (1994). *Frame Reflection: Toward the Resolution of Intractable Policy Controversies*. New York: Basic Books.

Seley, J. and Wolpert, J. (1983). Equity and Location. In R. Kasperson (ed.) *Equity Issues in Radioactive Waste Management*. Mass.: Oelgelschlager, Gunn & Hain.

Stevenson, R. (2009). Discourse, power, and energy conflicts: Understanding Welsh renewable energy planning policy. *Environment and Planning C: Government and Policy*, 27: 512-526.

Stirling, Andrew (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.

Tang, C. L and Lin, S. P. (2013). The materials used at the dry storage facility might

corrode. Liberty Times. Available at  
<http://news.ltn.com.tw/news/politics/paper/704790>.

Wynne, B. (2001). Creating public alienation: Expert cultures of risk and ethics on  
GMOs. *Science as Culture*, 10(4): 445-481.