
Post-Fukushima Reforms within the Japanese Nuclear Power Sector

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Abstract

The Fukushima nuclear incident of 2011 served as an external shock that prompted Japan to reform its nuclear energy sector. The collusive relationship between the regulators within the Japanese government and the regulated power industry, as well as the lack of institutional independence of the regulatory agency, had derailed Japanese efforts to reform the sector for decades. The Fukushima crisis exposed these deeply-entrenched flaws in the system, causing public distrust and anger toward the government and the nuclear power sector. This paper discusses the institutional reform measures the Japanese government introduced in the wake of the Fukushima crisis to recover public confidence and revamp the sector to prevent future disasters. The paper also discusses the challenges the Japanese government faces on its road to a successful implementation of nuclear sector reforms.

Keywords

Japan, nuclear energy, Fukushima, institutional reforms

1. INTRODUCTION

Japan's path to industrialization and modernization has been linked with nuclear energy consumption for several decades. Due to its lack of natural resources and energy self-sufficiency, Japan relied heavily on fossil fuel imports to meet more than 80% of its primary energy needs since the early 1960s until the oil crisis in 1973, when the Japanese economy was hit hard by rising oil prices that skyrocketed from \$3 to \$12 a barrel (Macalister, 2011). Realizing its vulnerability to unreliable external factors, Japan embarked on diversifying its energy sources to improve its energy security.

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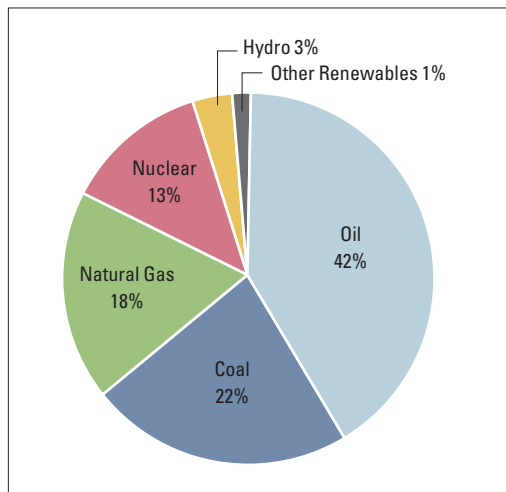
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Nuclear energy was proposed as a strategic priority for Japan to wean itself off of oil from the volatile Middle East (World Nuclear Organization, 2012).

As of 2010, the nuclear industry accounted for 13% of Japan's energy consumption and 27% of its supply of electricity, according to the US Department of Energy, making Japan the largest consumer of nuclear power after the US and France (US EIA, n. d.). The Japanese government planned to increase its contribution to primary energy to 40% by 2017 and to 50% by 2030 to further diversify its energy sources and reduce greenhouse gas emissions (World Nuclear Organization, 2012).

FIGURE 1. Japan's Total Energy Consumption



Source: EIA International Energy Statistics

However, Japan's nuclear policy underwent a pivotal shift after the Fukushima Daiichi nuclear meltdown on 11 March, 2011, which was triggered by the Tōhoku earthquake, with a magnitude of 9.0, and the accompanying tsunami. This dual natural disaster disabled the power supply and cooling system of three Fukushima Daiichi reactors (Fukushima Report:Key Points, 2012), resulting in a nuclear meltdown. This crisis was given the maximum rating of seven on the International Nuclear Events (INES) scale (Fukushima Report:Key Points, 2012), placing it on par with the Chernobyl disaster in 1986. The Japanese people still suffer from various repercussions of the disaster including health risks caused by excessive radiation exposure, economic disruptions, the destruction of their homes and villages, and the loss of their families (Norris, 2012).

The Diet conducted a series of investigations immediately after the crisis. The Chairman of the Nuclear Accident Independent Investigation Commission announced that the crisis was exacerbated by a series of human and institutional errors, such as "collusion between the government, regulators and companies, a lack of governance along with the conformist conventions of Japanese culture" (Fukushima Report:Key Points, 2012).

The Japanese public also demonstrated stronger anti-nuclear sentiment after the incident. According to an opinion poll conducted by *the Kyoto News* at the end of March 2011, 39.5% of respondents said that they would like to see a new energy policy that calls for reducing the number of nuclear power plants (Ota, 2012). This percentage soon rose to 47% by mid-May, largely due to the Japanese government's slow response to the crisis (Ota, 2012).

In response to this criticism, the then Prime Minister Naoto Kan announced Datsu-Genpatsu, a nuclear energy phase-out, in July. In addition, the Japanese government introduced measures to reform its nuclear power sector by implementing a series of institutional reforms, such as the establishment of the Nuclear Regulatory Authority (NRA), the introduction of more stringent measures towards nuclear crisis management, and the nationalization of the Tokyo Electric Power Company (TEPCO), the largest power company in Japan, which accounts for 27% of the country's total power generation (US EIA, n. d.).

This paper discusses these reform efforts and their achievements in detail. The paper proceeds as follows. The background section (the second part) discusses several problems within the nuclear power sector. The third part examines what institutional reform measures the Japanese government has introduced in the wake of the Fukushima incident, and evaluates their achievements and shortcomings. The fourth part discusses the obstacles the country faces on its road to successful reform of the sector. The conclusion summarizes the entire discussion.

2. BACKGROUND

The Fukushima crisis exposed various flaws entrenched within the Japanese nuclear sector, such as a complacent institutional culture, collusion between the government, the Nuclear and Industrial Safety Agency (NISA) and TEPCO, an inefficient crisis management system, and a lack of regulation and oversight within TEPCO.

2.1. “Nuclear Village” and the Flaws in the Regulatory Culture

The “Nuclear Village” (*Genshiryoku Mura*) refers to the small and exclusive circle of institutional and individual pro-nuclear advocates composed of nuclear utilities companies, regulators, and the bureaucracy (Kingston, 2012). These actors constitute a Japanese version of an iron-triangle, and thus benefit from “mutual rewarding of construction projects, lucrative positions, and political support” (Onishi & Belson, 2011). Within this symbiotic and collusive network, parties share a common interest of ensuring the continued dominance of the nuclear sector, resulting in destructive solidarity that marginalizes any possible dissent (Onishi & Belson, 2011). This institutional culture has killed any voice advocating reforms in the nuclear sector that would threaten profit-maximization (Onishi & Belson, 2011).

The entrenchment of this pro-nuclear coalition is illustrated by the collusion between NISA and TEPCO through “Descent from Heaven” (*Amakudari*). Senior bureaucrats of NISA, upon retire-

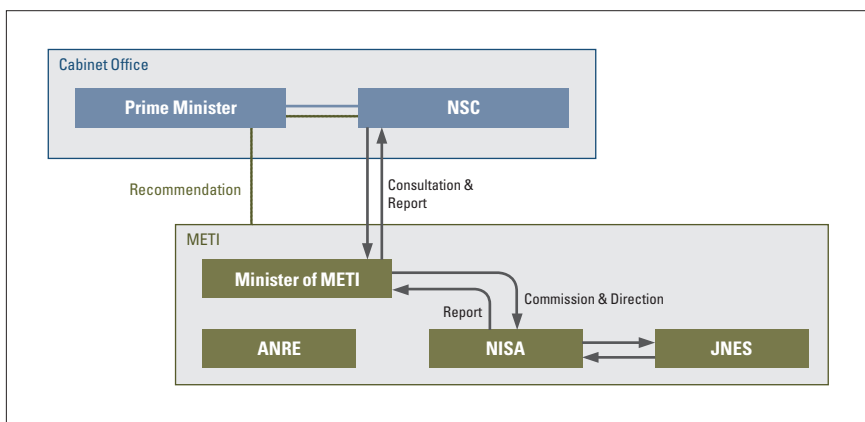
ment, are often offered executive jobs at the very power companies they once oversaw. As the largest electrical utility in Japan, TEPCO is the most desirable company for retiring officials (Kingston, 2012). This material incentive to secure their future employment positions may have led senior bureaucrats to resist reforms that would upset power companies like TEPCO (Jomo & Walker, 2012). This collusive culture seems to have resulted in corrupt relations between regulators and the regulated nuclear industry, and to a lack of supervision (Amakudari Spells More Contracts, 2008), a key reason for the malfunction of the nuclear power plants and subsequent nuclear meltdown at Fukushima.

Moreover, the oversight or regulations of the nuclear sector have been neglected as regulators, who are part of the Nuclear Village, often rubber-stamped industry requests despite their knowledge of severe safety lapses in some nuclear facilities (Kingston, 2012). This practice created the so-called “Nuclear Power Safety Myth,” a sense of complacency that prevented the parties in the nuclear power sector from predicting the possibility of a severe nuclear accident and developing precautionary nuclear safety measures and crisis management procedures (Ota, 2012).

2.2. Institutional and Structural Failures of Regulatory Bodies

In Japan, three major regulatory agencies governed the nuclear sector: the Japan Atomic Energy Commission (AEC), the Japanese Nuclear Safety Commission (NSC), and NISA, which planned and deliberated energy policies and regulated nuclear operators (Figure 2) (Sato, 2011). Being cabinet commissions, AEC and NSC were mainly involved in the planning, deliberation, and recommendation of nuclear policies, but lacked legal enforcement power (Sato, 2011).

FIGURE 2. Nuclear Regulatory Agencies in Japan



Source: Figure 19 in Wang, Chen, & Xu (2013)

This left NISA as the dominant agency enforcing legislation and providing oversight in the nuclear energy sector. Yet, NISA was placed under the direct supervision of the Ministry of Economy, Trade and Industry (METI) (Government of Japan Nuclear Emergency Response Headquarters,

2011), which caused a conflict of interests, given that METI values economic growth and advocates nuclear power while NISA's role is to serve as a regulatory agency for the nuclear power sector.

The relationship between METI and NISA can be characterized as regulatory capture, meaning that regulators deviated from their original functions of regulating the industry to defend public interests and instead deferred to the private agenda of the industry or sector they regulated (Kingston, 2012). Due to the "Nuclear Village" phenomenon explained in the previous section, NISA's bureaucrats often had vested interests in the nuclear sector, resulting in NISA's adoption of a pro-nuclear stance and leniency in its main function as the regulator of nuclear operators (Bell, 2012). NISA handled the cover-ups of TEPCO's safety records and maintained a deliberately lax attitude in implementing safety regulations and preventive measures, for the sake of facilitating nuclear operators' smooth operation of their plants (Bell, 2012).

Prior to the Fukushima crisis, NISA had the knowledge that high tsunami levels above the safe region could potentially damage the seawater pumps and cut off electricity, but did not make any attempts to revise regulations to introduce higher standards, failing to enforce anti-seismic back-checks (Fukushima Nuclear Accident Independent Investigation Commission, 2012). In an industry where incidents of this sort can be fatal, it is fundamental for a nuclear regulatory agency to enforce strict regulations, but all three regulatory agencies in Japan failed to perform their functions as independent watchdogs of the nuclear power sector and stewards of public safety and interests.

2.3. Flaws in Nuclear Crisis Management

A large part of the Fukushima crisis can be attributed to the deficiencies in crisis management on the part of TEPCO, regulators, and the government. One fatal problem was the disruption of the chains of command during the crisis caused by ambiguous boundaries delineating the responsibilities of the parties involved (Fukushima Nuclear Accident Independent Investigation Commission, 2012). The standard protocol was for NISA to take the lead role as designated in the Act on Special Measures Concerning Nuclear Emergency Preparedness (The Cabinet Secretariat, 1999), and regional nuclear emergency response teams to serve as the contact between the government and TEPCO (Fukushima Nuclear Accident Independent Investigation Commission, 2012).

This did not happen in reality however, as the government intervened directly by authorizing Prime Minister (PM) Kan to head down to the crisis area to give directions, bypassing the regional response team to set up the TEPCO-Kantei response team (Fukushima Nuclear Accident Independent Investigation Commission, 2012). This confused the chain of command, wasting the time of the on-site operators that could have been better spent on damage mitigation and containment, and causing further disorder and substantial confusion in an already dire emergency situation (Fukushima Nuclear Accident Independent Investigation Commission, 2012).

Furthermore, existing emergency response plans by NISA, TEPCO, and the Fukushima Prefecture were inadequate to cope with the massive scale of the nuclear crisis (Fukushima Nuclear Accident Independent Investigation Commission, 2012). Despite the Niigata earthquake in 2007 serving as

a lesson on the importance of adopting more stringent nuclear accident prevention measures, NISA maintained its existing countermeasures, assuming low probability of a complex disaster. TEPCO and the Fukushima Prefecture's emergency response systems were implemented on the assumption that a nuclear disaster would not occur concurrently with other disasters such as earthquakes or tsunamis (Fukushima Nuclear Accident Independent Investigation Commission, 2012).

TEPCO's organizational mindset can be seen as a key factor that led to poor crisis management (Ota, 2012). On one hand, it strongly influenced energy policy and nuclear regulations. On the other hand, it abdicated its own responsibilities and let METI take the responsibility on the front line (Fukushima Nuclear Accident Independent Investigation Commission, 2012). It also exploited the close ties it enjoyed with the regulators to circumvent any regulations possible (Hays, 2012).

The risk of a potentially severe accident never appeared in TEPCO's records of central risk management meetings (Meilhan, 2012). TEPCO explained such an omission by arguing that nuclear safety was supposed to be dealt with by its on-site plant department, and that nuclear safety was therefore not the main management's concern. However, TEPCO later admitted that it had chosen not to adopt stringent safety measures (Meilhan, 2012) as it feared that such efforts could spread concern about problems with the safety of current plants (Meilhan, 2012) and result in heavy economic and political repercussions, such as costly lawsuits and anti-nuclear backlash against the operation of its nuclear plants (Fackler, 2012). Such developments would undermine the company's cost-cutting efforts made over several years amid declining profits. Therefore, TEPCO chose to prioritize its retaining of financial profits over the risk-management system and safety of its facilities (Symonds, 2012). For instance, it reduced human capital costs, resulting in a lack of manpower to construct proper diagrams of piping and other instruments at the Daiichi plant (Timmer, 2012), which was one of the factors that led to a delay in venting at a crucial time during the accident.

3. REFORM MEASURES AFTER THE FUKUSHIMA INCIDENT

In response to these problems revealed by the Fukushima incident, Japan implemented several post-crisis reform measures: the establishment of the NRA as a new and independent regulatory body, the introduction of stricter regulations and measures in nuclear crisis management, and the nationalization of TEPCO, Japan's largest nuclear power plant operator.

3.1. Establishment of the Nuclear Regulation Authority (NRA)

One of the major criticisms of the handling of the Fukushima crisis was the absence of a clear chain of command and a single government body to govern the nuclear sector and coordinate nuclear emergency relief efforts. To respond to this criticism, Japan established a new regulatory agency, the NRA, by combining NISA, the NSC, and other nuclear-related departments on 19th September 2012 (Japan Gets a New Nuclear, 2012). This agency was also placed under the Ministry of Environment (MOE) to promote its transparency and accountability. With an annual budget of \$600 million (Conca, 2012), the NRA was tasked with the responsibility of initiating and enforcing safety

regulations, supervising security at nuclear sites, implementing safeguards for nuclear materials, and regularly monitoring radiation levels. Since its establishment, the NRA has pledged to prevent future nuclear disasters, restore public confidence, and create new standards for re-activating nuclear reactors. The authority's main job also includes spearheading relief efforts for future nuclear incidents and presenting a unified front that is able to respond to nuclear emergencies efficiently (Nagata, 2012a).

Making the NRA accountable to the MOE was a significant move designed to separate the regulatory agency from the nuclear industry it regulates. The MOE takes a more neutral stance towards nuclear energy than METI, and therefore the NRA would face less pressure from pro-nuclear factions and have greater freedom in exercising its regulatory power. The NRA was also given "Article Three Commission" status, which grants it greater independence and insulation from politics (Nagata, 2012a). As a result, it no longer answers to the Diet, so it will be difficult even for the PM to alter the agency's structure and composition. Moreover, unlike the old regulatory system under which other ministries had autonomy to decide on nuclear energy matters, the NRA and its secretariat will be the only government agency that is responsible for nuclear-related decisions. Since its foundation, the NRA has been actively drafting stricter safety rules and standards regarding the re-activation of nuclear reactors left idle after the Fukushima crisis. Despite having the autonomy to re-start these reactors, it has concentrated on creating stricter safety guidelines and decided to postpone the activation until next year to meet safety standards and safeguard public safety (Maeda, 2012). This move indicates the NRA's dedication to fulfilling its responsibilities as a promising regulatory agency in the nuclear sector.

However, critics have argued that this institutional reform is a mere "cosmetic" change. (Nagata, 2012b). They point out that the NRA secretariat consists of high-ranking officials who used to work in pro-nuclear agencies. Most were the same bureaucrats who worked in NISA (NRA Must Ensure Transparency, 2012). Moreover, the newly-appointed head of the NRA, Shunichi Tanaka, was a former executive of the Japan Atomic Energy Agency, which promotes nuclear energy. In addition, it has been revealed that four safety experts who are currently drafting new safety regulations in the NRA have each received ¥3 million to ¥27 million from nuclear operators over the past four years (Nuke Industry Funded NRA's Safety Experts, 2012). Therefore, the choice of these new appointees is controversial, and it is unclear whether these appointees would take an impartial stance or continue to advocate nuclear power in the NRA.

Even though the NRA was divorced from METI through the reform, it still faces external pressure from business lobbies that have vested interests in the nuclear energy sector. Japan's largest business federation has threatened to relocate overseas if the nuclear reactors remain inactive (Conca, 2012). This threat poses a dilemma between economic growth and nuclear safety. Given Japan's current dire economic situation, slowing its economic production for the sake of nuclear safety might not be a popular choice.

Moreover, the NRA is still inexplicably tied to the government although it supposedly obtained greater independence upon separation from METI. The agency is still answerable to the PM, whose

decision overrides that of the NRA (Conca, 2012). This is clearly illustrated by the recent heated debate over the reactivation of nuclear reactors in Ohi, wherein despite the NRA's opposition the PM decided to restart the reactors (McCurry, 2012). This hierarchical relationship still poses a problem as the government continues to face pressure and opposition from pro-nuclear factions. In fact, the PM announced the decision to backtrack from his administration's goal of eradicating nuclear energy due to pressure from business lobbies (Warnock, 2012).

3.2. Regulatory Strengthening by the NRA

As part of the reform measures, the NRA released nuclear safety guidelines that extend the nuclear evacuation radius from 10km to 30km, as well as clear evacuation procedures in case of a nuclear emergency (Nuke Regulator Sets Wider Safety Zones, 2012). These measures aim to streamline the NRA's previous confusing nuclear relief efforts and ensure that there will be sufficient evacuated zones for NRA officials to properly assess the extent of nuclear radiation. The NRA also enacted various new regulations that are aimed at increasing checks on the industry and tightening inspection safety procedures, such as requirements to monitor radiation levels and programs to analyze the safety of nuclear power plants. Some regulations cover financial resources to be dispensed to local governments to help beef up their emergency preparedness (Nagata, 2012a). Moreover, the NRA also revamped the nuclear power plant safety protocol to account for events as remote as terrorist attacks (Seth, 2012). The previous protocol failed to account for tsunami waves taller than six metres (Japanese Experts Warn, 2012). All these regulations were designed as precautionary measures in case another complex disaster of similar magnitude strikes. The government also requires facilities to pass two phases of stress tests issued by NISA and to obtain local government approval (US EIA, n. d.).

While it is too early to measure the success of these new regulations in terms of improving nuclear power plant safety in times of disaster, some of the effects have already been felt. The amendment of the nuclear regulation act led to the temporary closure of 60% of aged Japanese nuclear power plants for safety checks, of which more than half will eventually be closed due to the age limit (Japan Top Nuclear Reactor Says, 2012). Similar legislation was also enacted in the wake of the Three Mile Island disaster in 1979, which resulted in no nuclear power plants built after the incident (Behr, 2009). While it is highly unlikely that Japan will adopt such a policy (i.e. of not building any more power plants), this new measure is a major step towards enhancing the safety standards of the nuclear industry and preventing power companies, including TEPCO, from exploiting loopholes in the legislation to argue for the continual operation of old power plants facing higher risks of malfunctioning (Krolicki, DiSavino, & Fuse, 2011). Overall, the introduction of new guidelines, measures, and legislation will increase the safety standard of Japanese nuclear power plants and prevent another meltdown in case of a future crisis.

3.3. Nationalization of TEPCO

Under increasing public pressure to revamp the nuclear energy sector and facing the company's imminent bankruptcy, the government eventually decided to nationalize TEPCO (Tepco Shareholders

Agree, 2012). TEPCO's management, led by Chairman Tsunehisa Katsumata, secured an agreement from the government in May 2012 to inject ¥1 trillion (\$12.6 billion) in government capital in return for a 50.1% stake in the company (Obe, 2012b). The government also holds the right to increase its stake to 75% if the management fails to overhaul its operations. The government acquired just enough shares of the company to hold a majority stake. As a result it was able to avoid over-committing itself financially while retaining a vital say in the management of the company. Through nationalization, the government intends to promote transparency, accountability and safety.

This nationalization is expected to reduce the work-force of the company by 10%, cut costs by ¥3 trillion over the next 10 years, and divest TEPCO of its central assets including power plants (Obe, 2012a). Having the majority of the company's shares, the government has the power to elect board members and determine the company's business strategy. This move is seen as historic state intervention given that Japan's electric power industry has previously been run in the private market (Obe, 2012b). This case also marks the largest state intervention into a private non-bank asset since the US bail-out of General Motors in 2009 (Uechi, 2012).

The nationalization of TEPCO is likely to lead to shifts in TEPCO's missions. As a private company, TEPCO was mainly profit-driven and concerned with expanding its economic clout (Uechi, 2012). Upon nationalization, however, TEPCO management has begun to adopt a more people-centred approach, including making social responsibility one of its major goals. With greater governmental supervision, the nationalized TEPCO is likely to adhere to safety regulations more strictly and alleviate its inefficient corporate culture (Obe, 2012a).

TEPCO, however, is unlikely to see much improvement in its productivity under its current management. Even in good times, the corporate culture of TEPCO was notoriously customer-unfriendly, largely because of its previous status as a private firm that operated as a regional monopoly. As long as this remains in effect, TEPCO has little incentive to reduce costs or improve management, but will instead charge higher rates when in financial difficulty. Indeed, on May 11, the day after the government's massive capital infusion, TEPCO formally requested permission from METI to raise residential and other regulated electricity rates by an average of more than 10% (Kitazawa, 2012). This increase in electricity prices, coupled with inflation and the rising cost of living in Japan, will likely result in a public backlash, especially when many are suffering from various negative effects of the disaster.

Even though PM Noda demonstrated his eagerness to push through the nationalization reforms to restore public trust, it remains to be seen whether the Japanese government can continue on this path, given that the Japanese economy has yet to recover from recession and that the government already has a debt burden of more than twice the size of the slowing economy (Malkin, 2012).

The nationalization of TEPCO looks like a stop-gap measure that will not be feasible in the long-term. Ultimately, the government should promote healthy competition by eliminating monopoly in the energy sector. By doing so, the government can incentivize companies to step up their safety measures and ensure customer satisfaction in order to stay ahead of their competitors.

4. FUTURE CHALLENGES

Although the Fukushima crisis struck more than two years ago, the disaster has not reached full closure. Many remaining obstacles require urgent resolution by the Japanese government.

4.1. Regaining Public Trust

A series of cover-ups and slow release of information about the rising death toll and radiation levels, with opaque collection methodology during the crisis, revealed the government's inefficiency in demonstrating sufficient flexibility, openness, and transparency in its response to public concerns (Aldrich, 2012a). These problems severely weakened the confidence of the public in the Japanese government and its crisis-management capability (Masuda & Komiyama, 2012).

Thus, the Japanese government needs to regain public trust by listening to the demands of its increasingly proactive and demanding civil society. In the past, meetings between the Japanese government and the people were likened to rituals of assent (Gusterson, 2004). Interactions between scientists, authorities, and the citizens went through the motions of public debate but lacked genuine consensus-building, as there was little room for questioning and debate from the citizens regarding policy alternatives (Aldrich, 2012a). Japan also has an ingrained passive political culture characterized by deference to authority and a "strong antipathy to overt expressions of conflict in the name of maintaining social harmony" (Pharr, 2003). This political culture resulted in the consistent discouragement of dissenting views by the state and resultant muted disagreements regarding nuclear energy (Pharr, 2003).

However, the Fukushima disaster and lapses in the government's crisis management have energized segments of Japanese civil society to become more active and outspoken (Aldrich, 2012b). For instance, the Japanese are increasingly drawn to participating in anti-nuclear protests, such as the two-day Nuclear Free World conference held in Yokohama in mid-January, which drew close to 12,000 participants (Brown, 2012). Collective action through referendums and petitions is also increasingly prominent, with more than five million signatures obtained across Japan for petitions against nuclear power and the permanent shutting down of all nuclear plants (Brown, 2012).

Japanese politicians need to realize that the Japanese citizens no longer remain weak and non-participatory given that more and more people express their desire to play a more vocal role in Japan's nuclear policy after the Fukushima crisis (Aldrich, 2012a; 2012b). The government should move away from top-down decision-making processes and seek to step up efforts to involve the public in key decision-making matters regarding the direction of Japan's nuclear industry (Aldrich, 2012a; 2012b). For instance, the government can consider the use of consultative exercises or citizen juries to incorporate views from the grassroots level, which would facilitate two-way communication and regain public trust and confidence (Pfothenhauer, 2012). More importantly, the government should encourage domestic as well as international non-governmental organizations (NGOs) to assume more roles (NGOs Operating in Japan, 2012). NGOs that have professional expertise in nuclear-safety knowledge can assist the government by strengthening environmental regulations within

Japan's nuclear sector and providing warnings of violations to ensure that the nuclear energy sector abides by safety guidelines more rigorously. Furthermore, NGOs can also serve as alternative political channels of participation for citizens and help to enhance representation and add transparency to the nuclear policy-making process.

4.2. Pressure From Strong Business Lobbies

While Japan has begun to pay more attention to alternative energy sources to reduce its reliance on nuclear power, the country still faces formidable challenges from its powerful lobbies in the nuclear sector. The Japanese government has had to yield to the opposition from the sector in many instances. For example, PM Noda approved the immediate restart of two reactors at Ohi nuclear power plant (after less than just two months of nuclear power hiatus, and despite widespread safety fears and public dismay) due to pressure from businesses “concerned about summer power cuts and disruption to manufacturers” (McCurry, 2012). More recently, the government withdrew its plan to end nuclear power by 2040, just one week after the announcement of such a plan was made (Deppe, 2012). This immediate change was largely a result of immense pressure from the business lobbies, including the powerful Japan Business Federation (*Keidanren*), to discard the 2040 deadline. It argued that higher electricity fees and an unstable power supply would erode Japan's competitiveness (Bullis, 2012). With the parliamentary elections ahead in 2013, PM Noda had to court business interests and secure the industry's support to be re-elected (McCurry, 2012).

Given the strong influence of the business lobbies and their impact on politics, one can hardly expect that Japan can reduce the use of nuclear energy tremendously without facing strong opposition from the business lobbies. Instead of planning for the radical reduction of nuclear energy, the government should promote the renewable energy industry as a sector with great potential, and one that can present a huge opportunity for Japan to revive its economy through the creation of green-jobs and investment (DeWit, 2012). The government can also promote greater energy efficiency by drafting compulsory power reductions as well as providing financial subsidies to promote conservation efforts among businesses. By providing businesses with financial incentives to implement energy saving measures, it is hoped that businesses will gradually wean themselves off their heavy and costly reliance on nuclear power.

4.3. Shift From Nuclear to Renewable Energy

After witnessing the detrimental damage of the Fukushima nuclear crisis, the government has since pledged to reduce its reliance on nuclear energy. Currently, Japan's main nuclear reactors are responsible for providing of 30% of the country's electricity (World Nuclear Association, 2013). Therefore, Japan needs to develop other sources of energy to sustain the needs of the country. The idea of expanding renewable energy has gained much momentum due to its environmental friendliness and lower associated risks and levels of harm. The Japanese government plans to increase renewable energy to 30% of the future energy mix as part of its plan to promote sustainable energy systems (McCurry, 2012).

However, renewable energy remains expensive. It is estimated that Japan will need to invest ¥43.6 trillion yen (\$548 billion) in various types of renewable energy and 5.2 trillion yen in power grids if nuclear energy were to be phased out completely (Inajima & Okada, 2012). Moreover, wind and solar plants require large amounts of fossil fuels in the building process, meaning that Japan would not meet a stated target to cut its greenhouse emissions by 25% by 2020 (Inajima & Okada, 2012). TEPCO incurred large debts during the nuclear meltdowns, depriving itself of financial resources to switch to renewable energy. After nationalization, it is less feasible for it to invest or build renewable energy (Yamaguchi, 2012).

With the issues of cost, feasibility, and environmental consequences inextricably linked, there can be no perfect solution to Japan's energy woes. Renewable energy is expensive, fossil fuels are harmful to the environment, and nuclear energy can be catastrophic, as the Fukushima case shows. Given the costs and benefits associated with each type of energy, the Japanese government should adopt a mix of these to reduce cost and risks. Over-reliance on one source increases Japan's vulnerability to sudden external shocks, as seen with the Fukushima crisis.

5. CONCLUSION

The repercussions of the Fukushima crisis exposed the country's ingrained cultural conventions of "reflexive obedience; reluctance to question authority; groupism and insularity" (Fukushima Nuclear Accident Independent Investigation Commission, 2012) and lax oversight as the fundamental causes of this disaster. With the deepening erosion of public confidence and trust, the Japanese government was pushed to implement various reform measures. These included the "separation of national, economic and political interests in promoting nuclear power from the regulatory function" (Pfothenauer, 2012) to promote transparency and accountability of the nuclear sector. The NRA was established as the regulatory power with more independence from the government, nuclear industry, and the business sector. Moreover, the government introduced new regulations and stringent guidelines that govern the nuclear power sector. Japan also nationalized TEPCO in order to make it more accountable for the safety and security of the broader society.

This study also discussed what these institutional reforms have achieved and what challenges Japan is still facing. Institutional change alone is insufficient to provide a significant change to the nuclear industry. Institutions are ultimately operated by human agency, and the success of the NRA will depend on the mindset and willingness of government officials and bureaucrats to bring about fundamental change. Moreover, the right kinds of incentives should replace the materialistic incentives that had previously driven actors in the nuclear power sector. These new incentives should be provided to the power industry sector and business lobbies to lead them to commit to reform measures and induce their shift away from nuclear energy toward renewable energy. In continuing its institutional reforms to revamp the nuclear energy sector, the Japanese government should also engage the public and civil society organizations as stakeholders in policy processes that determine the future of the nuclear sector.

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