

# UNDERSTANDING JAPAN'S NUCLEAR POWER DILEMMA AND ASSESSING ITS FUTURE TRAJECTORY

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## INTRODUCTION

In the Japanese language, nuclear power plants are called 'atomic energy power plants'. They refer to the word '*Genshi*' which means atomic, instead of using the word '*Kaku*' which means nuclear.<sup>1</sup> This may seem like a fairly insignificant observation, but the choice of words more often than not has remarkable connotations. The choice of words in Japanese language appears to be deliberate in order to create a clear distinction between nuclear weapons (where *kaku* is used) and nuclear power for peaceful purposes (where it is referred to as *genshi*). Subtle differences in words could imply different emotions, especially in the context of Japan, which is the only country in the world to have experienced the brutality of nuclear weapons and hence chooses to use a less distressing word.

With the Fukushima nuclear disaster in 2011, Japan once again experienced the dangers of nuclear technology. Since then the Japanese government has been under immense pressure with regard to issues of its energy policies. While the

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1. Scott Wilson, "Haruki Murakami's Solution to Nuclear Power Debate: Just Call It 'Nuclear Power'", *Japan Today*, April 10, 2015, <https://japantoday.com/category/national/haruki-murakamis-solution-to-nuclear-power-debate-just-call-it-nuclear-power>. Accessed on December 24, 2019.

**While the Japanese government wants nuclear power to play an important role in the national energy basket, the resumption of operations of nuclear power reactors, following approval by the Nuclear Regulation Authority, seems to be exceedingly slow.**

Japanese government wants nuclear power to play an important role in the national energy basket, the resumption of operations of nuclear power reactors, following approval by the Nuclear Regulation Authority, seems to be exceedingly slow. This seriously affects the clean energy goals that Japan hopes to achieve by 2030, by increasing the share of coal powered electricity.

Amidst this challenge, there is also widespread cynicism regarding nuclear power among the Japanese public that has been calling for a phase-out of nuclear power. Opposition parties have been trying to exploit these sentiments to garner public support for the next elections. In addition, there is the huge financial strain of not only the clean-up costs of the Fukushima accident but also to make up for the lost energy supply.

In this context this paper aims to assess the various challenges faced by Japan and its possible future nuclear energy trajectory. To do so, the paper is divided into three parts. The first part sets a background by tracing the development of nuclear power in Japan and outlines the major developments in civil nuclear energy from the 1940s to 2011. The second part will focus on the Fukushima accident in 2011. It will study how the accident happened, its effects and the efforts made by the government to deal with the crisis. The third part will study the effect of Fukushima on the future of energy policies in Japan and tries to understand if the rising civil activism can translate into policy change.

## **PART A: TRACING THE DEVELOPMENT OF JAPAN'S CIVIL NUCLEAR PROGRAMME: 1945-2000**

### *Understanding the Reasons that Led Japan to Develop Civil Nuclear Energy*

It was astonishing for many when Japan—a seismically active country—decided to develop a civil nuclear energy programme within a decade

of witnessing the horrors of a nuclear war. There were several compelling reasons why Japan developed its civil nuclear programme. Primarily, it was due to the lack of natural resources. During the post-war period, Japan relied heavily on imported oil and coal. Developing a civil nuclear programme, therefore, was seen as necessary to create an indigenous energy resource, reduce energy dependency and provide supply stability. The war also had a dire effect on the economy. It is said that the Second World War pushed back about 50 years of development in Japan.<sup>2</sup> To make up for this, Japan embarked upon an ambitious course to develop the economy.

This was witnessed in the income doubling plan during the 'Golden 60s'. However, for the economy to revive, it was imperative to fulfil the soaring demand for electricity. Post-war Japan depended on hydroelectricity and coal to generate electricity, which did not suffice. Hydroelectric plants, which generated much interest among the Japanese policymakers, then faced several challenges such as high operational costs, maintenance issues, regular droughts, lack of sites for dams, etc. This did lead also to a search for alternate energy sources.

At that time, Prime Minister Yoshida Shigeru put forth the 'Yoshida Doctrine'. The doctrine stated the importance of rapid economic development fuelled by technological advancement. Nuclear energy found prominence here. In addition, in the 1940s, the electrical system in Japan was in its early development stage and families were allowed only a couple of lightbulbs.<sup>3</sup>

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2. Craig Nelson, "The Energy of a Bright Tomorrow": The Rise of Nuclear Power in Japan", *Origins*, vol. 4, issue 9, June 2011, <https://origins.osu.edu/article/energy-bright-tomorrow-rise-nuclear-power-japan>. Accessed on February 2, 2020.

3. Olga Belogolova, *National Journal*, "Why Japan Can't Quit Nuclear Power", *The Atlantic*, February 14, 2020, <https://www.theatlantic.com/politics/archive/2013/02/why-japan-cant-quit-nuclear-power/437028/>. Accessed on February 22, 2020.

Thus, the parable of abundant electricity through nuclear energy which was 'too cheap to meter', had a strong appeal and brought in hope that this would be the energy revolution that Japan so critically needed.

Furthermore, Japan also had the institutional capacity to develop a nuclear power industry. It was one of the countries that had embarked on projects to develop nuclear weapons during the Second World War. Further research on nuclear technology, however, was banned by the United States after the War, including research and development of nuclear technology for peaceful purposes such as for medical applications. With the end of American occupation of Japan in 1952, the scope for the development of nuclear R&D emerged once again. However, it only developed with the 'Atoms for Peace' programme introduced by US President Dwight Eisenhower.

The Atoms for Peace Programme was first announced in 1953 in a speech at the United Nations by Eisenhower, but came into fruition in 1957 with the establishment of the International Atomic Energy Agency (IAEA). Through this programme, the US disseminated nuclear technology to friendly countries.<sup>4</sup> The Programme had multiple strategic objectives. Primarily, it was designed to regulate nuclear energy. It aimed to prevent the proliferation of nuclear weapons technology and apply the expertise for peaceful purposes such as electricity generation, medical applications, etc. The programme was also designed to cultivate friendship with other countries and demonstrate the material benefits of allying with the United States. In 1955, Japan signed an atomic energy cooperation agreement with the US. Apart from providing assistance to Japan to develop their civil nuclear programme, it aimed at rebranding the image of nuclear power as not just destructive but also beneficial.

### *Japan's 'Kaku Arerugi' or Nuclear Allergy*

Unsurprisingly, the Japanese people had developed a social condition called *Kaku Arerugi* or Nuclear Allergy.<sup>5</sup> Nuclear technology remained a taboo and

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4. M. J. Medhurst, "Atoms for Peace and Nuclear Hegemony: The Rhetorical Structure of a Cold War Campaign", *Armed Forces and Society*, 23(1), pp. 571-93. Accessed on January 20, 2020.
  5. Daniel P. Aldrich, "Post-Crisis Japanese Nuclear Policy: From Top-Down Directives to Bottom-Up Activism", *East West Center*, n. 103, January 2012, <https://www.Eastwestcenter.Org/Sites/Default/Files/Private/Api103.Pdf>. Accessed on January 22, 2020.

so the idea of developing a civil nuclear power programme was not met with public support. In addition, even before Japan could sign a formal agreement with the US, the *Daigo Fukuryū Maru* or the Lucky Dragon Number 5 accident furthered fears about nuclear power. On March 1, 1954, a fishing boat called 'Lucky Dragon Number 5', with twenty-three men aboard got contaminated by a nuclear fallout from a thermonuclear weapons test by the United States in the Bikini Atoll. All the men aboard fell ill and suffered from acute radioactive sickness and one of them even died because of it. In addition, sixteen tonnes of contaminated tuna from the same boat had been sold in various markets before the vessel reached Tokyo. Fears of invisible poison alarmed the people and an atmosphere of fear and panic once again gripped Japan.<sup>6</sup> Newspapers, both locally and internationally, reported the incident extensively. A newspaper called *Asahi* reported that the Japanese people had thus suffered from nuclear bombs for the third time.<sup>7</sup> This incident triggered immense protests against nuclear weapons globally. It was in this context, in order to placate the Japanese government—along with other strategic objectives as discussed earlier—that the US government offered nuclear technology to Japan. During this time, the first anti-national nuclear movement was created in Japan known as *Gensuikyō*. This petition against nuclear weapons gained over 20 million signatures.

The situation in Japan worried the US president, Dwight Eisenhower, who sent a memorandum to the Secretary of State asking "what things can we and should we do to improve our prospects in that region?" The then acting Secretary of State Robin Murphy replied, "The Japanese are pathologically sensitive about nuclear weapons. They feel they are the chosen victims of such weapons ... in the long run, scientific interchange is the best remedy for Japanese emotion and ignorance and we intend to push such projects ... the most important thing we can do to help is to treat Japan as a full, free-world counsels. This is essential if we are to count upon the use of Japanese bases and their cooperation in any future conflict..."<sup>8</sup>

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6. Craig Nelson, n. 2.

7. Noriko Manabe, *The Revolution Will Not Be Televised: Protest Music after Fukushima* (UK: Oxford University Press, 2015), p. 37.

8. Ibid.

While the US was placating the Japanese government and planning the construction of several nuclear power plants, popular protests and petitions continued.

### *Managing Dissent*

To manage dissent and garner the support of the public, the Japanese government developed several approaches. Soft control tools such as providing subsidies, incentives and creating favourable narratives of nuclear power were undertaken. Other examples included conducting annual fairs in Yokohama where only communities that hosted nuclear power plants could sell their products. In order to address concerns about food contamination that had affected the farmers and fishermen's business significantly, jobs were offered to the fishermen community for giving up their sea rights in certain areas.<sup>9</sup> The government also created a programme called *Dengen Sanpō* or "The Three Power Source Development Laws." Under this programme, money was collected from an invisible tax on all electricity use across the country. This funded about US\$ 20 million per annum to communities that agreed to host nuclear power plants.<sup>10</sup> In addition, the government organised public relations campaigns in order to create a positive image of nuclear technology.

As discussed in the beginning of the paper, the Japanese government uses two different words for nuclear energy. *Kaku* in the context of nuclear weapons and *Genshi* in the context of civil nuclear energy. It could be argued that this is not deliberate and is just a translation muddle as they do not make such distinction in the English language. But this is perhaps because this distinction is directed inwards at its domestic audience. Internationally, using 'atomic' or 'nuclear' in different contexts does not have the same effect since 'atomic bomb' and 'nuclear bomb' in the English language is used interchangeably. In this regard, Hiroaki Koide, assistant professor of nuclear

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9. Daniel P. Aldrich, "With a Mighty Hand", *newrepublic.com*, March 19, 2011, <https://newrepublic.com/article/85463/japan-nuclear-power-regulation>. Accessed on February 3, 2020.

10. *Ibid.*

engineering at the Kyoto University Research Reactor Institute, stated in an interview with Hiroshima Peace Media Center, that “The government calls what Japan does as ‘*genshi ryoku kaihatsu*’ (atomic energy development), but they refer to what Iran does as ‘*kaku kaihatsu*’ (nuclear development). But in English they both use the word ‘nuclear.’ The government of Japan has used different terms for the two, but ‘*kaku*’ (nuclear power) and ‘*genshi ryoku*’ (atomic energy) are the same.”<sup>11</sup> Semantics, in this regard, plays an

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important role in creating narratives and implying emotions. This was well recognised by the Japanese leaders, especially at a time when they wanted to develop their civil nuclear programme, amidst widescale protests. Dr. Alex Rosen, in this regard, states, “In the process of producing weapons-grade plutonium, huge amounts of energy were generated—energy which could be used to produce electricity. The worldwide promotion of ‘peaceful’ nuclear energy was intended to whitewash the bad image of nuclear technology and clear the way for a broad public acceptance. In Japan, this idea was taken up well—especially by politicians and companies anticipating influence, power and big profits. In Japan, politics and economy were traditionally closely connected. In the case of nuclear power, however, the proximity between companies, politicians and comptrollers soon exceeded every acceptable limit. But first, public scepticism had to be placated. The proponents of nuclear energy knew about the importance of semantics in Japanese thinking, and therefore first modified the language: While the word ‘nuclear’ in ‘nuclear bomb’ had been translated with the Japanese word ‘*kaku*’ (‘core’), the word ‘*genshi-ryoku*’ (‘nuclear power’) was chosen for ‘peaceful’ nuclear energy.

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11. Yumi Kanazaki and Yoko Yamamoto, “Fukushima and Hiroshima: Impact on the A-bombed city, Part 3”, *Hiroshima Peace Media Center*, July 25, 2011, <http://www.hiroshimapeacemedia.jp/?p=28547>. Accessed on March 2, 2020.

Only due to this linguistic differentiation was it possible to contextually separate the civil from the military nuclear industry in the heads of many Japanese, even though both industries were closely enmeshed in reality ..."<sup>12</sup>

The United States also played an important role in influencing the Japanese public to change their perceptions and attitude towards nuclear power. Recently declassified documents reveal that the CIA played an important role in swaying the public opinion in favour of nuclear energy.<sup>13</sup> They did this in cooperation with the crème de la crème of Japanese society, including politicians and media moguls. Psychological operations and public perception management programmes included movies and travelling exhibitions that propagated the potential benefits of nuclear energy. Newspapers frequently featured articles that described modern societies powered by nuclear energy, featuring technological innovations such as nuclear powered cars and electronics. The growing interest in nuclear energy even began reflecting in popular culture. An example of this is the '*Tetsuwan Atomu*' comics, literally translating to iron-armed atom or as Astro Boy in other parts of the world. Interestingly, nuclear weapons are evidently absent in the series. Instead, the theme revolved around peaceful use of nuclear power as the series illustrated a nuclear powered fantasyland.<sup>14</sup>

### *Development of Civil Nuclear Capabilities*

Efforts at managing dissent and creating positive narratives of nuclear power proved to be considerably effective. The government's success rate at building power plants amidst the protests was considered to be around 50 percent. That is, for every two attempts made by the government to construct nuclear power plants, one went through.<sup>15</sup> Even the public attitude

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12. Dr. Alex Rosen, "Yin and Yang—why Japan accepted nuclear energy despite Hiroshima and Nagasaki", IPPNW, <https://www.ippnw.eu/print/en/abolition-of-nuclear-weapons/artikel/aa4d551dedbd49773584c5a89842cbee/yin-and-yang-why-japan-accepted.html>. Accessed on May 1, 2020.

13. Richard Krooth, Morris Edelson and Hiroshi Fukurai, *Nuclear Tsunami: The Japanese Government and America's Role in the Fukushima Disaster* (United States: Lexington Books, 2015), p. xv.

14. Craig Nelson, n. 2.

15. Daniel P. Aldrich, n. 9.

towards nuclear power programme was slowly beginning to change.

By 1955 Japan began its national nuclear programme with the passing of the Atomic Energy Basic Law. This law stipulated three principles: democratic methods, independent management, and transparency as the foundation of nuclear research activities. The Japan Atomic Energy Commission (JAEC) was set up in 1956 along with several other related organisations such as the Nuclear Safety Commission (NSC), the Science and Technology Agency, Japan Atomic Energy Research Institute (JAERI) and the Atomic

Fuel Corporation.<sup>16</sup> Because of the limits on export of nuclear technology by the US in the earlier days, Japan initially took the help of Great Britain who helped in the construction of the first commercial nuclear power reactor in Japan in Tokaimura in 1956.<sup>17</sup> The construction of the British designed Magnox reactor began in 1961 and was completed in 1965. In 1966 Japan officially began commercialising nuclear generated electricity. Japan also soon shifted its focus to US designed light-water reactors.

Research and development in nuclear technology too developed rapidly in Japan. Eventually, Japanese companies purchased plant designs from the US and received licences to build similar designs with the help of Japanese companies. Soon enough they were developing their own designs and manufacturing technologies.<sup>18</sup> By 1973, Japan had five nuclear reactors. However, over seventy percent of its energy continued to come from oil. Thus,

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16. "Nuclear Power in Japan", world-nuclear.org, <https://www.world-nuclear.org/information-library/country-profiles/countries-g-n/japan-nuclear-power.aspx>. Accessed on March 25, 2020.

17. Kennedy Maize, "A Short History of Nuclear Power in Japan", powermag.com, March 14, 2011, <https://www.powermag.com/blog/a-short-history-of-nuclear-power-in-japan/>. Accessed on March 30, 2020.

18. n. 16.

when the OPEC countries imposed a global oil embargo, Japan was subjected to the oil shock. Realising the vulnerability of high oil dependency, nuclear energy started gaining greater support. This provided Japan further impetus to develop its civil nuclear programme. Furthermore, nuclear power became less competitive in the 1970s and 1980s, as inflation and interest rates rose due to the oil crisis.<sup>19</sup>

Although development in civil nuclear energy was swift, it was not free of challenges. In the 1970s and 1980s the nuclear industry was in a state of flux. The Three Miles Island nuclear accident in 1979 and the Chernobyl nuclear accident in 1986 had once again set off concerns of nuclear safety. The Japanese government however continued its backing for civil nuclear power. To ensure that their energy policy was not affected by the crises, they underplayed the graveness of the accidents. For example, at the 12th Group of Seven Summit, which was chaired by Tokyo two days after the Chernobyl accident, Japan tried to tone down discussions about the accident. Declassified records show that references to concerns of “radiation” were deleted from the draft of the G7 summit. But, the final statement spoke about how nuclear power would be “an energy source that will be ever more widely used in the future.”<sup>20</sup> In the 1990s several accidents took place at the nuclear facilities which the authorities tried to hush up. This again led to more protests as public trust in nuclear technology was beginning to erode.

However, Japan was able to successfully deal with public mistrust as their civil nuclear programme burgeoned. By 2010 Japan had 55 operational, commercial nuclear power reactors, which produced about one-third of the country’s electricity. Japan also became the world’s third largest producer of nuclear power. With a successful experience in civil nuclear energy, Japan had ambitious plans for the future. However, the fateful accident at the

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19. “Responses after Chernobyl and Fukushima—Comparative Analysis of Germany and The Netherlands as Amplified Examples”, *Laka.org*, March 5, 2012, <https://www.laka.org/info/publicaties/2012-chernobyl-fukushima.pdf>. Accessed on February 5, 2020.

20. “Japan downplayed Chernobyl concerns at G-7 for energy policy’s sake, documents show”, *The Japan Times*, December 20, 2017, <https://www.japantimes.co.jp/news/2017/12/20/national/history/japan-downplayed-chernobyl-concerns-g-7-energy-policys-sake-declassified-documents/>. Accessed on January 28, 2020.

Fukushima Daiichi nuclear power plant in 2011 did not only undo Japan's accomplishments in civil nuclear energy but also impacted the global nuclear energy industry drastically.

### **PART B: THE FUKUSHIMA DAIICHI NUCLEAR DISASTER**

On March 11, 2011, the Tōhoku earthquake measuring a magnitude of 9.0 hit Japan's northeast coast. The impact of the earthquake was so huge that it shifted the earth on its axis. Fortunately, the eleven reactors in four different nuclear power plants that were operating in that expanse could brave the earthquake.<sup>21</sup> No significant damage was done to the nuclear power plants and all the reactors automatically shut down. However, soon after, the plants at Fukushima were struck by one of the largest tsunamis to ever occur in the history of the planet. Over 19,000 people died because of the tsunami which also caused severe damage to several towns in the region.<sup>22</sup> The Fukushima Daiichi power plant which is situated in that area too became vulnerable to it, because of the insufficient sea wall surrounding the power plant. It disabled the power supply and the cooling system of three reactors in the power plant. Typically, even if the power supply does not transmit electricity, the emergency generators work as a backup to supply power. However, the tsunami had knocked even the generators out of action.<sup>23</sup> This led to three cores significantly melting and hydrogen explosions. Numerous aftershocks followed. Fortunately, this did not create any more significant damage to the power plants.

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21. "2011 Japan earthquake and tsunami: Facts, FAQs, and how to help", worldvision.org, <https://www.worldvision.org/disaster-relief-news-stories/2011-japan-earthquake-and-tsunami-facts>. Accessed on December 26, 2020.
  22. "Fukushima Daiichi Accident", World-Nuclear.org, <https://www.world-nuclear.org/information-library/safety-and-security/safety-of-plants/fukushima-daiichi-accident.aspx>. Accessed on February 10, 2020.
  23. Naoto Kan, *My Nuclear Nightmare: Leading Japan through the Fukushima Disaster to a Nuclear-Free Future* (New York: Cornell University Press, 2017), p. 4.

**The Fukushima accident was rated 7 on the International Nuclear Event Scale. It is the only accident to be given the high classification, apart from the 1986 Chernobyl nuclear accident.**

**Although thousands of people died because of the earthquake and the tsunami, there were no casualties due to the accident at the nuclear power plant.**

*Effects of the Fukushima Nuclear Accident*

The Fukushima accident was rated 7 on the International Nuclear Event Scale. It is the only accident to be given the high classification, apart from the 1986 Chernobyl nuclear accident. Although thousands of people died because of the earthquake and the tsunami, there were no casualties due to the accident at the nuclear power plant. Several studies have pointed out that there are no cases of radiation induced cancer due to the accident. The findings of the 2014 report by the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) and the World Health Organisation also state that

there is no evident increase in cancer rates because of the Fukushima accident.<sup>24</sup> However, the health effects of the Fukushima nuclear disaster are disputed. Currently, there are many ongoing studies trying to determine if the accident had any veiled health effects.

Meanwhile, there is little doubt that the psychological effect of the accident on the people has been dire. Trauma from the calamities, anxiety due to the dislocation, separation from family, and fear of radiation caused immense distress to the residents. In this regard Shunichi Yamashita, a Japanese medical scientist, stated: "We know from Chernobyl that the psychological consequences are enormous. Life expectancy of the evacuees dropped from 65 to 58 years—not (predominantly) because of cancer, but because of depression, alcoholism and suicide. Relocation is not easy, the stress is very big. We must not only track those problems, but

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24. "Increase in Cancer Unlikely following Fukushima Exposure—Says UN Report", Unisvienna.org, April 2, 2014, <http://www.unis.unvienna.org/unis/en/pressrels/2014/unisous237.html>. Accessed on February 18, 2020.

also treat them. Otherwise, people will feel they are just guinea pigs in our research."<sup>25</sup>

The nuclear disaster also had environmental repercussions. It resulted in hydrogen-air chemical reactions which led to the release of highly radioactive material in the surrounding area.<sup>26</sup> However, since the radiation diffused quickly, the amount of radioactive dosage that the wildlife in the area received decreased speedily.<sup>27</sup> A large amount of water too was contaminated with radioactive isotopes. This contaminated water was released into the Pacific Ocean. However, considering the inherent resilience of the ecosystem and the quick diffusion of radioactive isotopes, radio-ecologists do not expect it to cause severe ecological danger or cause damage to the food chain.<sup>28</sup>

The economic consequence of the accident was quite harsh too. It is estimated that the direct costs of the accident will be approximately US\$ 15 billion in clean-up in the next two decades and more than US\$ 60 billion in refugee compensation.<sup>29</sup> Apprehension regarding residual radiation also posed a challenge to the mostly agriculture-based economy in the region. Worried about contaminated produce, in the ensuing months, about 54 of Japan's trading partners employed trade embargoes on Japan.<sup>30</sup>

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25. "Studying the Fukushima Aftermath 'People Are Suffering from Radiophobia'", *Spiegel International*, August 18, 2011, <https://www.spiegel.de/international/world/studying-the-fukushima-aftermath-people-are-suffering-from-radiophobia-a-780810.html>. Accessed on February 20, 2020.

26. Dylan Sarkisian, "Effect of Fukushima Nuclear Disaster on Japanese Ecosystems", [large.stanford.edu](http://large.stanford.edu/courses/2017/ph241/sarkisian1/), February 20, 2017, <http://large.stanford.edu/courses/2017/ph241/sarkisian1/>. Accessed on February 18, 2020.

27. Ibid.

28. Ibid.

29. James Conca, "Shutting Down All of Japan's Nuclear Plants after Fukushima Was a Bad Idea", *Forbes*, October 31, 2019, <https://www.forbes.com/sites/jamesconca/2019/10/31/shutting-down-japans-nuclear-plants-after-fukushima-was-a-bad-idea/#456d88f919a4>. Accessed on January 29, 2020.

30. Elliot Waldman, "The Unlearned Lessons of Japan's Fukushima Nuclear Disaster", *World Politics Review*, March 20, 2019, <https://www.worldpoliticsreview.com/insights/27673/the-unlearned-lessons-of-japan-s-fukushima-nuclear-disaster>. Accessed on February 20, 2020.

### *Lapses that Led to the Nuclear Accident*

Naoto Kan, the former Prime Minister of Japan, in his book, *My Nuclear Nightmare*, states:

...it was my understanding at the time that the accident (in Chernobyl) occurred because the reactor was old and Soviet technology was inadequate. Because Japan possessed unparalleled nuclear technology and superior experts and engineers, I believed that a Chernobyl-type accident could not occur at a Japanese nuclear power plant. To my greatest consternation, I would come to learn that this was a safety myth created by Japan's 'Nuclear Village' (a vast and powerful network of vested interests).<sup>31</sup>

Rightly so, he raises the question of whether the Fukushima nuclear accident was avoidable. Natural calamities have occurred even before where nuclear power plants are sited, without causing significant damage, for example, the tornado in 1998 that hit the expanse where Davis-Besse nuclear power plant was situated, or Hurricane Andrew in 1992 on the Turkey Point Plant in Florida. In both cases, the emergency generators were able to keep the equipment functioning until the personnel could fix it.<sup>32</sup> More recently, Hurricane Harvey in Texas and Hurricane Dorian in Florida illustrated how nuclear power plants can brave natural calamities.<sup>33</sup> Even in the case of the most grave nuclear accident, the 1986 Chernobyl nuclear disaster, the incident is largely linked to the misadministration and corruption in Soviet Russia. This raises the question of whether nuclear energy is inherently dangerous, or are these accidents a result of carelessness and negligence?

Indeed, major probes into the Fukushima accident revealed several lapses in the system. This could be better understood by examining the Swiss Cheese

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31. n. 23, p. 2.

32. John Sullivan, "Can U.S. Nuclear Plants Handle a Major Natural Disaster?" *ProPublica*, March 13, 2011, <https://www.propublica.org/article/can-u.s.-nuclear-plants-handle-a-major-natural-disaster>.

33. James Conca, "Hurricane Harvey Makes the Case for Nuclear Power", *Forbes*, September 1, 2017, <https://www.forbes.com/sites/jamesconca/2017/09/01/hurricane-harvey-makes-the-case-for-nuclear-power/#1c50af43625f>. Accessed on October 15, 2019.

Model of Accident Causation. This model examines how safety systems can fail. It does so by comparing human systems to numerous slices of Swiss cheese that are set next to each other. The slices of cheese represent layers of defence. These layers of defence or safety barriers could be policies, physical security systems, etc. Every system, however, could have defects or weak points, which could lead to flaws in the functioning of the overall system. These are called latent conditions and active failures and could be in the form of bad designs, lacunae in administration or recklessness by the operators. Most often, the holes in the cheese are not aligned. Thus, even if one system fails, the probability of a hazard is mitigated by the different layers of defence systems or different slices of the cheese. The different layers or defence systems thus should be able to prevent a single point of failure. However, there can be cases where all of these defence systems fail, leading to a catastrophe.<sup>34</sup> This applies to the Fukushima nuclear disaster as well where several lapses cumulatively led to the unfortunate accident.

**Located in the Pacific Ring of Fire, Japan is prone to earthquakes and volcanoes. Aware of this, the Japanese authorities had assured the citizens that no power plant would be constructed on top of active faultlines. However, advancement in studies on active faultlines over the years unearthed more active faultlines.**

The first latent condition was the siting of the nuclear power plant. Located in the Pacific Ring of Fire, Japan is prone to earthquakes and volcanoes. Aware of this, the Japanese authorities had assured the citizens that no power plant would be constructed on top of active faultlines. However, advancement in studies on active faultlines over the years unearthed more active faultlines. Researchers constantly drew attention to the high likelihood of tsunami levels stretching beyond the levels that was assumed during the time of the construction. Tokyo Electric Power Company (TEPCO), the operators of the

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34. "Identifying error Swiss cheese model", YouTube, January 16, 2019, <https://www.youtube.com/watch?v=JRCMxfBULB4>. Accessed on February 21, 2020.

nuclear power plants at Fukushima, however, disregarded these warnings.<sup>35</sup>

The second latent condition was the age of the Fukushima Daiichi power plant. The first unit was built in 1968 and was set to be decommissioned in 2010. However, the Japan Nuclear and Industrial Safety Agency (NISA) granted permission to extend its operation by TEPCO for another ten years. Furthermore, many laxities by TEPCO were identified in having concealed several minor safety issues from the state regulators.<sup>36</sup> TEPCO even confessed to having not taken stronger safety measures in the fear of drawing lawsuits.<sup>37</sup>

Linked to this point is another latent condition of lack of transparency and accountability. Two weeks before the natural disasters struck Japan, several organisations, such as the Fukushima Environmental Protection Organisation and the Green Fukushima Future, presented petitions to TEPCO to divulge guarded information on plant safety.<sup>38</sup> In 2012 the official report of the Fukushima Nuclear Accident Independent Investigation Commission was released. It stated that

...the Commission concludes that there were organizational problems within TEPCO. Had there been a higher level of knowledge, training, and equipment inspection related to severe accidents, and had there been specific instructions given to the on-site workers concerning the state of emergency within the necessary time frame, a more effective accident response would have been possible...<sup>39</sup>

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35. The National Diet of Japan Fukushima Nuclear Accident Independent Investigation Commission, "The official report of the Fukushima Nuclear Accident Independent Investigation Commission", 2012, p. 27, [https://www.nirs.org/wp-content/uploads/fukushima/naaic\\_report.pdf](https://www.nirs.org/wp-content/uploads/fukushima/naaic_report.pdf). Accessed on February 24, 2020.

36. Georgui Kastchiev, Ed Lyman, Mycle Schneider, et al., "An Account of Events in Nuclear Power Plants Since the Chernobyl Accident in 1986", [large.stanford.edu](http://large.stanford.edu), May 2007, p. 26.

37. Martin Fackler, "Japan Power Company Admits Failings on Plant Precautions", *New York Times*, October 12, 2012, <https://www.nytimes.com/2012/10/13/world/asia/tepcu-admits-failure-in-acknowledging-risks-at-nuclear-plant.html>. Accessed on January 22, 2020.

38. n. 13, p. xvi.

39. n. 35.

The report also stated that the measures that were in place in case of a severe accident (SA) were feeble as they only accounted for internal errors and did not consider external factors such as natural calamities, although it is a widely known fact that Japan is prone to such natural calamities.<sup>40</sup>

*Crisis Management: The Eventual Steps taken by the Japanese Government*

In the aftermath of the accident, the Japanese government made vigorous efforts to manage the crisis. A few days after the accident, the government announced a larger evacuation zone around the nuclear facility due to the radioactive contamination that was being released into the atmosphere. About 150,000 residents were evacuated from the surrounding areas. The clean-up programme too began soon. First, measures were taken to cool down the facility by removing heat from the reactors and dealing with the overheated spent fuel ponds. The task to prevent the release of radioactive materials soon began. The Japanese government even revised laws and the 'Reconstruction Agency' was established in 2012. A 10-year time frame was set for reconstruction. Most of the infrastructure that was damaged by the earthquake has now been repaired.<sup>41</sup>

The Green Zone, where protective gear is not required, has considerably extended to cover 96 percent of the plant site.<sup>42</sup> Food products such as rice that is grown in the Fukushima prefecture were tested for radioactive contamination. Since 2015, all the produce has proven to have less than the standard amount of radioactivity. The same was proven for the marine products from the Fukushima prefecture.<sup>43</sup>

Another body that was set up was the 'Nuclear Regulation Authority' (NRA) in 2012. NRA was set up to be independent, unlike the previous organisation that worked along with the Ministry of Economy, Trade and

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40. n. 35.

41. "Efforts for Reconstruction of Tohoku", reconstruction.go.jp, <https://www.reconstruction.go.jp/english/>. Accessed on January 23, 2020.

42. Turner Jackson, "3Q: The future of nuclear energy in Japan", energy.mit.edu, May 29, 2019, <http://energy.mit.edu/news/3q-the-future-of-nuclear-energy-in-japan/>. Accessed on February 20, 2020.

43. n. 41.

Industry (METI). The newly formed NRA enforced what it called “the world’s most stringent requirements” for nuclear reactors to resume operation.<sup>44</sup> All nuclear facilities thus underwent stringent checks and adopted strict safety measures. The government, which had shut down all the nuclear power plants while these measures were in check, was ready to resume the operations of some reactors which had cleared safety prerequisites.

### **PART C: EFFECT OF FUKUSHIMA ON FUTURE ENERGY POLICIES**

Immediately after Fukushima, the mood of the nation was naturally anti-nuclear. The 2011 Energy White Paper which was approved by the Japanese Cabinet stated that there was public distrust of nuclear safety because of the Fukushima accident, and called for a reduction in their dependency on nuclear power.<sup>45</sup> Subsequently, 50 nuclear power reactors were shut down. Eventually, the government declared that they would phase out nuclear power plants by 2040, after the plants complete their operating lifespan. The immediate policy responses to Fukushima, however, evolved subsequently with changing leadership. In 2014, reversing the previous government’s decision, Prime Minister Shinzo Abe’s government declared that nuclear power generation would be restarted, once again, after getting approval by the regulators.<sup>46</sup> The New Energy Plan in 2014 which was approved by the Liberal Democratic Party Cabinet stated that nuclear power was “the country’s most important power source.”<sup>47</sup> The new policy even allowed the construction of new reactors.

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44. “Japan Commercial Guide”, International Trade Administration, <https://www.export.gov/article?id=Japan-Nuclear-Decommissioning>. Accessed on January 24, 2020.

45. Tsuyoshi Inajima and Yuji Okada, “Nuclear Promotion Dropped in Japan Energy Policy after Fukushima”, Bloomberg.com, October 28, 2011, <https://www.bloomberg.com/news/articles/2011-10-28/nuclear-promotion-dropped-in-japan-energy-policy-after-fukushima>. Accessed on February 27, 2020.

46. “Three years after Fukushima, Japan forges ahead with nuclear energy,” DW.com, April 11, 2014, <https://www.dw.com/en/three-years-after-fukushima-japan-forges-ahead-with-nuclear-energy/a-17560046>. Accessed on January 27, 2020.

47. “Japan reverses its withdrawal from nuclear power”, DW.com, April 13, 2014, <https://www.dw.com/en/japan-reverses-its-withdrawal-from-nuclear-power/a-17563405>. Accessed on January 27, 2020.

As of 2016, the biggest source of energy for Japan comes from fossil fuels (82 percent), followed by renewable sources (16 percent) and 2 percent from nuclear energy. The government is focused on rebalancing its energy basket and has set a target of reducing the share of fossil fuels to 56 percent and increasing the share of renewable sources to 22 percent and nuclear energy to 22 percent. These are extremely ambitious plans and would require fervent restoration and renovation of nuclear power. To achieve this, it would not only require to restart the existing power plants but also to construct new ones.<sup>48</sup> The Japanese government's impetus to revive its nuclear energy industry could be understood by examining several important factors, which could also help us in understanding the future trajectory of nuclear energy in Japan.

## **FACTORS THAT DETERMINE THE FUTURE TRAJECTORY OF NUCLEAR ENERGY IN JAPAN**

### *Japan's Energy Crisis*

One of the major reasons that Japan developed its civil nuclear energy programme, as discussed earlier, was because of its lack of domestic energy resources. Thus, when it suspended the operations of all its reactors after the Fukushima accident, it once again faced the same problem. Japan's domestic energy resources meet less than 15 percent of its total primary energy use.<sup>49</sup> The loss of its nuclear capacity has led Japan to modify its energy mix. This new energy mix places oil and natural gas at the forefront, which has further led to import dependency. Japan, thus, has become the world's largest importer of LNG, second largest importer of fossil fuel and third largest net importer of oil.<sup>50</sup> This has not only created dependency, but is also proving to be uneconomical, in addition to making Japan vulnerable to the geopolitics of energy.

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48. n. 42.

49. "Japan is the second largest net importer of fossil fuels in the world", US Energy Information Administration, November 7, 2013, <https://www.eia.gov/todayinenergy/detail.php?id=13711>. Accessed on January 29, 2020.

50. n. 3.

**The Fukushima accident had a grave effect on the country's economy. As Japan shut down its reactors, it had to import energy resources from other countries to fill the energy void. This led to Japan facing the worst trade deficit in its history.**

*Clean Energy Factor*

Fukushima pushed back Japan's plans to boost renewable energy in its energy basket. Dependency on fossil fuels to meet the urgent energy requirements after the accident has brought in the problem of increasing carbon emissions. Coal and Natural Gas amount to 74 percent of Japan's energy supply.<sup>51</sup> Japan wants to increase its share of renewables from the current 16 percent to about 24 percent by 2030. In planning to do so, it wants to increase nuclear energy output to about 22 percent from its current 3 percent (as per 2017).<sup>52</sup> This is

further linked to health issues. According to a study undertaken by Matthew Neidell, Shinsuke Uchida and Marcella Veronesi, the replacement of nuclear energy by fossil fuels after Fukushima led not just to increasing electricity prices but also to public mortality.<sup>53</sup> In some cases the increase in energy prices led to decrease in energy consumption which further increased death rates during extremely cold weather. Another cause for mortality stemmed from the burning of coal which causes respiratory problems. According to one study the combined number of deaths due to these factors are higher than the number of casualties from the earthquake and tsunami in Japan in 2011.<sup>54</sup> In this regard, David Weinstein from Columbia University states that "If Japan had decided to keep all [unaffected] nuclear reactors open in 2012 and had met its energy needs by proportionally reducing coal, oil, LNG and other energy sources, I estimate that this policy would have saved 9,493 lives based on the air pollution of that year alone." Although the instinctive reaction to shutting down nuclear reactors after Fukushima

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51. "Japan plans carbon emission cuts, more nuclear energy", *The Asahi Shimbun*, June 10, 2019, <http://www.asahi.com/ajw/articles/AJ201906100044.html>. Accessed on January 30, 2020.

52. Ibid.

53. n. 29.

54. n. 29.

seems understandable, the effects of it, however, have been dire.<sup>55</sup>

### *Economic Revival*

The Fukushima accident had a grave effect on the country's economy. As Japan shut down its reactors, it had to import energy resources from other countries to fill the energy void. This led to Japan facing the worst trade deficit in its history. From 2011-13 the cost of energy imports in Japan was US\$ 40 trillion and a trade deficit of US\$ 227 billion from April 2011 to March 2014.<sup>56</sup> In addition, the average electricity price also shot up to 25 percent in households and to 38 percent in industries.<sup>57</sup>

Some studies indicate that if Japan had continued with the decision of phasing out nuclear power, as the earlier government had envisaged, it would have ravaged the economy further. According to the Japanese Institute of Energy Economics, the fossil fuel imports would have set off an outflow of national wealth equivalent to 0.6 percent of Japan's gross domestic product.<sup>58</sup>

Furthermore, as there is a gradual increase in interest in nuclear energy by many countries around the world, the government and the nuclear industry hopes to export nuclear energy technology and infrastructure to these foreign markets. This would also help private companies in the nuclear energy field in Japan, which were leading nuclear technology and energy suppliers in the past. In addition, China and Russia have made rapid strides in providing

**In 2017 Japan and the US signed a Memorandum of Understanding to promote the global leadership roles of both the countries in the field of civil nuclear energy. Developing nuclear energy, thus, has once again become important to resuscitate Japan's economy.**

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55. n. 29.

56. Manuel Herrera, "Nuclear energy challenges in Japan", *Global Risks Insight*, July 5, 2019, <https://globalriskinsights.com/2019/07/japan-nuclear-energy/>. Accessed on March 3, 2020.

57. "Japan's Energy 2018, 10 Questions to understand the current energy scenario", *Ministry of Economy, Trade and Industry Agency for Natural Resources and Energy*, June 2019, p. 3. Accessed on January 31, 2020.

58. n. 3.

nuclear technologies to newer markets at lower costs and creating spheres of energy dependency. The rising dominance of China and Russia in this field has thus raised concerns among several countries. This is perhaps why in 2017 Japan and the US signed a Memorandum of Understanding to promote the global leadership roles of both the countries in the field of civil nuclear energy. Developing nuclear energy, thus, has once again become important to resuscitate Japan's economy.

### CHALLENGES

While developing a sound strategy to revive nuclear power to make up for the energy deficit crisis and economic recovery, Japan has several challenges that it has to deal with effectively. Linked to each other, these disparate challenges require distinct and well-thought-out strategies.

#### *Political Divergences*

The current Japanese government makes it abundantly clear that it considers nuclear energy to be an important component of its energy basket. However, their efforts to promote this objective is met with dissension and controversy. The opposition party has been taking advantage of the fears around nuclear technology and is using anti-nuclear rhetoric to consolidate public support in order to win the next elections. Apart from disapproval by the opposition party, disagreement within the party too has been a challenge. The new Environment Minister of Japan, Shinjiro Koizumi, has called for abandoning nuclear power for safety concerns. This could set him on a difficult course with the pro-nuclear ruling party.<sup>59</sup> In addition, despite the efforts by the government to restart the nuclear reactors, the progress has been very slow. They are delayed either because of the stringent safety regulation clearances or because of the several lawsuits that are calling to do away with nuclear power plants. At the same time,

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59. Justin McCurry, "Japan should scrap nuclear reactors after Fukushima, says new environment minister", *The Guardian*, September 12, 2019, <https://www.theguardian.com/world/2019/sep/12/japan-should-scrap-nuclear-reactors-after-fukushima-says-new-environment-minister>. Accessed on December 28, 2019.

old reactors are being decommissioned, which delays the much needed increase in nuclear output.

Restarting nuclear reactors is a complex process. In principle, approval from the NRA should suffice to start the reactor. However, there are political nuances to it as well. These utilities need the local government's authorisation under the Safety Agreement. This is based on trust and good faith between local governments and the utilities, and is not legally binding. In this regard, certain issues, such as evacuation for one is an impediment for restart-ups. This is because evacuation plans are not a subject of NRA licensing process. Thus, there is no clarity as to in whose dominion the appropriateness of evacuation plans lie, or even as to who determines it.<sup>60</sup>

### *Clean Up*

Nine years since the accident, a lot of clean-up work in the nuclear facility and around it has been done. Yet, a lot more remains. It appears to be a long-drawn-out process, as experts cite at least several decades to complete the job. Lake Barrett, senior advisor to TEPCO in this regard states, "It's of the magnitude of putting a man on the moon... Unless there's an acceleration, I would not be surprised if it takes 60 years or so."<sup>61</sup> Considering the complexities of the clean-up process and the scale of the project, more sophisticated and specialised technologies would be required. In this step, TEPCO and the Japanese government are now developing next generation robotics, to venture into parts of the facilities where humans cannot go due to high levels of radiation. But several challenges subsist even in this endeavour. Robots sent in earlier were damaged severely due to the high gamma radiation, and so a lot more research and development is required to develop the technology, taking into consideration the numerous complexities. Again, there lies the

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60. Tatsujiro Suzuki, "Nuclear Energy Policy after the Fukushima Nuclear Accident: An Analysis of 'Polarized Debate' in Japan", *intechopen.com*, February 6, 2019, <https://www.intechopen.com/online-first/nuclear-energy-policy-after-the-fukushima-nuclear-accident-an-analysis-of-polarized-debate-in-japan>. Accessed on January 31, 2020.

61. James Martin, "A rare look at the meltdown inside Fukushima Daiichi Nuclear Power Plant", *Cnet.com*, March 4, 2019, <https://www.cnet.com/news/inside-fukushima-daiichi-nuclear-power-station-nuclear-reactor-meltdown/>. Accessed on December 13, 2019.

problem of dealing with the contaminated water. While 62 out of the 63 radioactive elements have been successfully removed, the solution to remove one element called tritium—a radioactive isotope of hydrogen—is yet to be found. The decision to release the water into the sea also involves many complications. For example, it would not be taken well by the local fishermen who took years to revive their industry after the accident. In addition, South Korea has expressed concern over the effect it would have on its seafood. There also exist challenges such as lack of storage space for spent fuel and lack of storage of contaminated water, among others.

### *Anti-Nuclear Sentiments*

One of the biggest challenges that policymakers in Japan are facing today is lack of public trust. Unsurprisingly, and for well-founded reasons, nuclear fear has once again gripped the country. A poll that was undertaken in 2015 by Japan Atomic Energy Relations Organization reflects this fear. The results of the poll reveal that almost 50 percent of the respondents said that nuclear energy should be abolished gradually, and another 14.8 percent said that it should be abolished immediately. Only about 10 percent of the respondents believe that nuclear energy use should be continued and less than 2 percent of the respondents thought that it should increase.<sup>62</sup> In 2016, another survey was conducted by the Japanese newspaper, *Asahi Shimbun*. The results of this survey were even more disapproving of nuclear power, where 57 percent of the respondents were against the restarting of nuclear power plants even if they fulfilled all the safety requirements, and 73 percent of the respondents supported the phasing out of nuclear power altogether. Another 14 percent backed the immediate shutdown of the nuclear power plants.<sup>63</sup>

The lack of honesty by TEPCO officials which was revealed in the inquiries after Fukushima is one of the major causes for the lack of public confidence in the nuclear industry. Anti-nuclear protests drew out for a long time after the Fukushima accident. Newer, innovative initiatives also developed in

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62. Anne C. Cunningham (ed.), *Revisiting Nuclear Power* (Greenhaven Publishing LLC, 2017), p. 21.

63. *Ibid.*, p. 22.

this process. An example of this is the 'Safecast Project', which focuses on 'citizen science'. This inclusive set-up encourages citizens to participate in data collection, calculation and analysis in various fields such as ecology and biodiversity. Using modern, web-based platforms they carry out research themselves. Their research findings challenge the facts and figures given by the government and utilities such as TEPCO, the reliability of whose data collection and analysis methodology has been disputed.<sup>64</sup>

This stems from the lack of transparency of the power utilities and has damaged the credibility of TEPCO immensely. In this regard, Naomi Hirose, the former president and the current executive vice chairman of Fukushima Affairs at TEPCO, at an event in MIT Energy Initiative (MITEI) said, "Gaining public trust is the most important but challenging issue for TEPCO. To fulfil our responsibility to the people affected by the accident, we disclose all data related to the decommissioning operations to the public."<sup>65</sup>

Dissent in Japan, however, is a complex matter with several nuances. While the larger public mood is anti-nuclear they have not mobilised it forcefully.<sup>66</sup> While the protests were in full swing after the Fukushima accident, they have slackened over the years. This is perhaps because the efficacy of protests depends on the social and cultural attributes of the dissenters and the tools used by the officials. However, it could also be linked to other factors such as non-responsiveness from the government. An article in *Japan Times* by Mizuho Aoki covers various aspects of the anti-nuclear protests in Japan. One of the subjects she interviewed for the piece states, "I have a sense of crisis about the current state of things. I guess people are tired of speaking up, as nobody (in the government) seems to listen to them."<sup>67</sup> However, interestingly, the anti-nuclear factor was also not reflected in the elections. While most polls

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64. Daniel P. Aldrich, "Post-Crisis Japanese Nuclear Policy: From Top-Down Directives to Bottom-Up Activism", *East West Center*, n. 103, January 2012, pp. 7-8, <https://www.eastwestcenter.org/sites/default/files/private/api103.pdf>. Accessed on January 22, 2020.

65. n. 42.

66. Mizuho Aoki, "Down but not out: Japan's anti-nuclear movement fights to regain momentum", *The Japan Times*, March 11, 2016, <https://www.japantimes.co.jp/news/2016/03/11/national/not-japans-anti-nuclear-movement-fights-regain-momentum/>. Accessed on February 2, 2020.

67. Ibid.

**The Fukushima accident also revealed important realisations to both sides of the nuclear debate. To the ones supporting nuclear power, it exposed the dangers of nuclear technology and made clear that the slightest recklessness could lead to a big catastrophe, while, on the other hand, it invalidated the claims of anti-nuclear proponents, who exaggerated the effects of a nuclear accident.**

indicate the anti-nuclear mood in Japan, when it came to elections, citizens voted for Shinzo Abe as their new Prime Minister in 2012, despite his popular pro-nuclear stance. This raises questions whether the election represented a choice that the Japanese people had to make between immediate economic recovery over long-term safety concerns. It could, however, also be reflective of other factors such as leadership, management capabilities, etc.

Post-Fukushima, Japan faced a huge dilemma whether to do away with nuclear or not. They had no easy choices and were faced with complex trade-offs. While public sentiment was anti-nuclear, doing away with nuclear energy completely would pose severe challenges to their economy and

energy policies. The Japanese government eventually decided to continue to employ nuclear power in their energy basket, despite the anti-nuclear sentiment among the public. This, however, does not mean that public opinion was not considered by the Japanese authorities. The fact that all reactors are temporarily shut down since the Fukushima accident, and are being resumed only after clearing extremely stringent safety checks and regulations, demonstrates that the Japanese government has acknowledged the concerns of its citizens well, while taking pragmatic steps to protect the nation's economy.

### *Lessons from Fukushima*

As unfortunate as the Fukushima accident was, it did however provide adequate lessons to the world. It brought in the realisation that there is no space for even minor carelessness and laxity. It reset the safety norms followed by other countries. Immediately after Fukushima, all the

countries with civil nuclear capabilities reviewed their safety systems and re-examined their emergency preparedness plans. Some even halted their operations until their safety checks were tested and verified. In addition, it brought to light the importance of transparency by authorities to maintain credibility, and thus, by extension, to garner public support. The Fukushima accident also revealed important realisations to both sides of the nuclear debate. To the ones supporting nuclear power, it exposed the dangers of nuclear technology and made clear that the slightest recklessness could lead to a big catastrophe, while, on the other hand, it invalidated the claims of anti-nuclear proponents, who exaggerated the effects of a nuclear accident.

## CONCLUSION

The Japanese people are known to have a strong and indomitable spirit which they have demonstrated numerous times in the past. For example, within two decades of being attacked by nuclear bombs they were able to use the same technology to generate power and fuel their development. The Japanese government's decision to start the torch in Fukushima for the 2020 Olympics (since postponed by one year due to Covid-19) only goes to show the continuity of this spirit. It attempts to illustrate how the country has bounced right back within a decade of the unfortunate Fukushima accident. The Japanese government also deserves credit for acknowledging the mistakes and dealing with them transparently. The efforts made by the government after the Fukushima accident to increase safety measures and rebuild and reconstruct the damage have been commendable and beneficial to the nuclear industry worldwide.

The future of nuclear energy in Japan appears to be optimistic. The Japanese government recognises that doing away with nuclear energy is unrealistic. In this regard, Isshu Sugawara, member of the House of Representatives in the Diet and former Trade Minister, says that "There are risks and fears about nuclear power... But 'zero-nukes' is, at the moment and in the future, not realistic."<sup>68</sup> Currently, a

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68. n. 59.

**Completely phasing out nuclear energy is not a practical solution. This would not only lead to drastic increase in electricity prices, increasing burden on households by US\$ 10 billion (US\$ 115 per household), but would also lead to loss in jobs. The Institute of Energy Economics Japan (IEEJ) estimates that this would set an annual US\$ 11 billion decline in corporate tax revenue.**

new nuclear reactor is under construction in Japan and this indicates a sanguine future for nuclear energy in the country. Considering the absence of an alternate indigenous source of energy for Japan and the importance of nuclear energy for economic and environmental reasons, it would be difficult for Japan to do away with nuclear energy completely. Completely phasing out nuclear energy is not a practical solution. This would not only lead to drastic increase in electricity prices, increasing burden on households by US\$ 10 billion (US\$ 115 per household), but would also lead to loss in jobs. The Institute of Energy Economics Japan (IEEJ) estimates that this would set an annual US\$ 11 billion decline in corporate tax revenue.<sup>69</sup>

However, other factors could impact the nuclear discourse that Japan has embarked on. Political uncertainty and leadership is one such important factor that could determine the future of nuclear energy in Japan. If the Social Democratic Party of Japan comes to power in the next election—which is due to be conducted in 2021—and continues with its decision of phasing out nuclear power, it would completely change the nuclear discourse. In addition, Japan is mired in several complex challenges that it needs to deal with effectively. Garnering public support for one requires increased communication with the citizens. Nuclear issues are shrouded in confidentiality, thus the inscrutability and secrecy of the unknown tends to fuel fear. More transparency and information dissemination could go a long way in quelling the fears of the public and garnering support. It would do Japan well to revisit the principles of democratic methods, independent management and transparency upon which the Atomic Energy Basic Law was premised.

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69. n. 3.

Japan should also focus on other renewable sources of energy. A balanced, mixed energy basket of renewable sources would help Japan in achieving its climate change goals and power its economic development while minimising energy vulnerability.

Although it appears that the future of nuclear energy in Japan is positive, changing circumstances could change this trajectory. It would, however, be sardonic if the country that hosted the naissance of the world's first climate pact to reduce greenhouse gas emissions, the Kyoto Protocol, scales back on its most important source of achieving its green commitments.