# Environment about Japan and Germany Nuclear Energy Report

## Introduction

 All around the world, policymakers have maintained a firm stance on the decision to increase nuclear power generation, with countries such as Germany choosing to temporarily shut down their older nuclear reactors to re-evaluate the safety of all the nuclear power facilities. Besides, the political responses to the Fukushima accident reveal the variations in the decisions of political leaders, as a contextual vacuum arises with respect to the possible influences of the political responses to the policies made to promote the safety of nuclear power facilities (Escobar Rangel and Lévêque, 2014).

 This paper retrieves its course from the responses of different countries, societies and communities to the Fukushima accident. With more specificity, the paper looks into the differences in responses to nuclear energy use after the Fukushima tragedy from the perspectives of Japan and Germany. In completing its course, the discussion provides a summary of the events of the Fukushima accident, and an overview of the energy distribution dynamics in Japan before, during and after the disaster. The impact of the policy decisions after the Fukushima disaster are analyzed in light of the ongoing concerns to promote environmental conservation, as stipulated in the Paris agreement. Of more significance, however, is the analysis of the contrasting decisions of Japan and Germany with regard to nuclear energy use after the Fukushima accident. In as much as the responses of countries differed significantly in the wake of the 2011 Fukushima nuclear power plant accident, trends indicate that increased emphasis on the safety of nuclear energy use would eradicate the risk of the recurrence of similar accidents in the future.

## Background

Friday 11th March, 2011, 2:46 PM, an earthquake of magnitude 9.0 hits East Japan, an earthquake that could later be named the Great East Japan Earthquake of 2011 (Kitada, 2016). The earthquake caused the greatest tsunami to ever be witnessed in this area. The effects of this earthquake culminated into the disastrous Fukushima Daiichi Nuclear Accident, which occurred at Japan’s leading nuclear power plant. The disaster turned out to be the second worst nuclear accident in the history of nuclear power generation.

Fukushima is located on the Pacific Coast of Japan, with the Fukushima nuclear power plant sitting in the northeastern part of the Fukushima prefecture, approximately 60 miles south of Sendai. This facility was made of six boiling water reactors that were constructed between 1971 and 1979. Of the six reactors, it is estimated that three reactors were operational during the time of accident, with the fourth reactor acting as a temporary storage for the fuel rods that had been spent.

The Fukushima nuclear power plant was operated by the Tokyo Electric and Power Company (TEPCO). In their report, TEPCO stated that the tsunami waves caused severe damages on the back-up generators at the nuclear power plant. Having managed to successfully shut down the three operational reactors, the subsequent loss of power instigated a failure of the cooling system, hence marking the beginning of the disaster. The accident led to the damage of four nuclear power reactors.

Soon after shutting down the reactors, TEPCO engineers were working towards preventing the release of radioactive materials, with their focus being on the contaminated water that had leaked from the three units. However, the rising residual heat within these reactors caused the fuel rods to overheat, hence melting down partially, thus leading to the eventual release of radioactive materials. The falling radioactive materials drilled large holes at the floors of the containment vessels, hence exposing the nuclear materials in the cores. This led to explosions that accrued from the build-up of pressurized hydrogen gas.

As a consequence, over 100, 000 people were evacuated from their homes to ensure that the explosions did not cause any radiation sickness or deaths. Reports indicate that the accident caused a paralysis on the Japanese economy, with transport crippled due to concerns of the presence of radioactive emissions in the atmosphere. Furthermore, official figures illustrate that over 1,000 deaths were confirmed from the evacuation, further casting fears on the risks of the radiation if the evacuation had not been conducted.

According to World Nuclear Association (2017), Japan needs to import more than 85% of its energy requirements. The first commercial nuclear power plant in Japan became operation in 1966, and the national strategy to minimize the energy shortages were addressed through nuclear energy. However, the Fukushima disaster led to the review of this strategy, as policy makers began to consider the potential impact of similar cases in the future. In Japan, over 30% of the electricity is provided by the main nuclear power reactors, and the estimates were that by 2030, the reactors will be able to produce between 50% and 55% of the country’s energy. Today, Japan has only 42 operable reactors, though reports indicate that the country is potentially able to restart the development of other reactors that are inoperable. As of 2015, seven reactors had been restarted since the Fukushima accident, with restart approvals waiting on a further 21 reactors.

Just like Japan prior to the Fukushima accident, Germany retrieved nearly 25% of its electricity from nuclear energy, using 17 reactors. Today, Germany has only eight reactors, which contribute 14% of the country’s electricity (World Nuclear Association, 2017). Approximately 43% of Germany’s electricity today is acquired from coal, in form of lignite. In 1998, Germany’s coalition government prioritized the phase out of nuclear energy, benchmarking it as a future policy. However, the phase-out was cancelled in 2009, but after the Fukushima accident, the government re-introduced the phase-out, thus shutting down eight reactors immediately. There are varying public opinions on the use of nuclear power, with opinions showing that the government has no plans to phase out coal electricity generation, which contributes 40% of the country’s electricity. Consequently, the wholesale electricity prices remain significantly lo in Germany in comparison to those in Europe.

## Methodology

This study adopts a qualitative research design, hence using data from secondary sources to acquire a bulk of literature of the topic under discussion. The qualitative research design is most suitable for this study, as the resources involved in conducting quantitative studies are beyond the reach of the researcher. The discussion employs the eligibility criteria to test the validity of the articles included in the study. As such, the eligible articles in this study include peer-reviewed articles written in English and dating not earlier than 2011. This criterion is applicable in the study, as it draws a line that defines the range and scope of the study within the key subject of the study, which is the Fukushima accident that occurred in 2011.

The primary data acquired from secondary sources are used as inferences in strengthening the findings of this study. With more specificity, the research design does not randomize the choice of articles used, instead focuses on the thematic constructs of nuclear energy, Fukushima accident, public opinions and reactionary tendencies of Japan and Germany towards nuclear energy after the Fukushima accident. The qualitative data used in this study enriches the study with depth and detail, as it enables the researcher to look deeper from the analysis ranks used by previous researchers.

## Results

The greenhouse gas emissions in Japan have been increasing gradually since the year 2011. In 2013, Japan produced an equivalent of 1.207 billion metric tons of carbon dioxide, representing an increase of 2.8% from the previous year and 7.8% higher than the volumes produced in 2010, the year before the Fukushima accident (Lee, Kim and Lee, 2017). The Japanese utilities kept their reactors offline following the compulsory shutdowns in the wake of the Fukushima disaster. Instead, electricity in Japan has been generated through fossil fuels, as the nuclear power capacity reduced by 94% from the year 2010. This is a sharp contrast to the use of energy from other sources, particularly oil and natural gas increased by 5% and 20% respectively over the same period.

On the other hand, the demand for energy in Germanys stood at 595TWh in 2016, with the country producing electricity amounting to approximately 648TWh (World Nuclear Association, 2017). Germany had a net export of 54TWh. Lignite remains to the largest contributor of electricity in Germany, with over 150TWh, while hard coal and nuclear energy provide 112TWh and 85TWh respectively. Gas, offshore wind and onshore wind provide 81TWh, 65TWh and 12TWh to Germany’s total electricity output respectively. Today, Germany is ranked as one of the biggest importers of gas, coil and oil. Besides, the country has limited domestic resources for electricity, which include renewable and lignite, which is the largest source of energy.

In many aspects, the Fukushima disaster has been compared to the 1986 Chernobyl Accident in Soviet, Ukraine. The resulting reactions of the world have been documented by Sawada (2012), who stated that the Fukushima disaster prompted a review of the national energy policies in several countries. Prior to the accident, only 30 countries had nuclear energy, produced from 442 nuclear power reactors. They contributed to over 14% of the world’s electricity. As of 2012, Kitada (2016) documents, the number dropped to 11%, with 15 services exiting the service. Germany and Japan were the main countries that registered the reduction of nuclear power reactors. Currently there are 435 reactors spread in 31 countries, with 68 more under construction.

Japan pulled back its nuclear ambitions following the disastrous Fukushima accident. Consequently, a large-scale inspection was conducted to introduce safety regulations to oversee the operations of the nuclear power plants. A number of the reactors have been kept offline, with political leaders tasked with approving restart of the programs. On the other hand, eight of the oldest reactors were shut down in Germany following the Fukushima accident. The focus shifted towards adopting renewable energy, hence replacing nuclear energy through a phase-out program expected to end by 2022.

Study findings illustrate that the reactions following the Fukushima accident did not only affect Germany and Japan. In Switzerland, the government passed a decision not to build any new reactors, hence estimating that the nuclear production will have been phased out by 2034. Switzerland is the only country that went for a referendum to determine whether the country should have more nuclear power reactors (Siegrist, Sütterlin and Keller, 2014). Despite the decision by majority of the Swiss citizens to have more reactors, the Fukushima accident changed the trajectory of public opinion, as the government chose to phase out the program, citing safety challenges.

As Visschers and Siegrist (2012) explain, not all the countries were scared by the Fukushima accident. In France, for instance, the investment in nuclear power has increased significantly over the last five years. The US, being the largest producer of nuclear power, reaffirmed its position to adopting nuclear power as the main source of electricity by improving the safety precautions with regard to this power source.

## Discussion

The disaster caused by the Fukushima accident of 2011 on the prefectures, towns and villages is still being analyzed by scientists. However, the incident ignited political fallout in Japan, which went beyond the country’s borders. In Germany, the Chancellor Angela Merkel referred to the event as one which transformed the history of the neo-industrialized world (Visschers & Siegrist, 2012). Throughout history, nuclear energy has grown gradually. However, robust growth in this form of energy was realized after the Second World War, as countries raced towards attaining superior positions in the global economic index. Majority of the nuclear reactors available in the world today were built between the 1960s and the 1970s (Kitada, 2016). As of 1975, France had over 75% of its electricity from nuclear reactors. Stagnations in nuclear power production were witnessed in catastrophic events such as the 1979 Three Mile Island accident, the 1986 Chernobyl accident, and most recently the Fukushima accident.

The immediate reactions of both Germany and Japan were similar after the Fukushima accident. In Japan, the country’s political fallout led to the passage of an order that stopped the activities in all nuclear reactors. This stagnation was consistent, until in 2013, when concerns were raised about the increased carbon dioxide emissions that accrued from the use of non-renewable energy sources. With parliament’s approval, a number of nuclear reactors were opened in Japan, but with new safety regulations (Escobar Rangel and Lévêque, 2014). Today, the country plans on increasing the number of operable nuclear reactors, thus illustrating a shift in the policy towards the risks involved in the use of nuclear energy. The choice by Japan to continue the use of nuclear energy is informed by the increased shortages of energy demands, and the limited resources to produce alternative energy (Lee, Kim & Lee, 2017).

 In Germany, the Fukushima accident came in the wake of a 2009 lifting of a phase-out program aimed at ending the use of nuclear power as a source of electricity. However, the Fukushima accident prompted the re-introduction of the phase-out program, as the country’s leadership was forced to consider the safety risks presented by the old nuclear reactors. As a consequence, Germany shut down eight of the nuclear reactors, and re-introduced the phase-out program, which aims at ending Germany’s nuclear energy dependence by 2022. Germany uses coal as the main source of electricity, though massive investments have been made to ensure that clean and renewable energy sources are used in attaining the 2022 energy vision.

The issue of nuclear waste management remains one that is yet to be resolved in many countries playing host to nuclear reactors. In Germany, the final disposal site for nuclear waste was identified in Gorleben, situated far off near the border of the former East Germany. On the other hand, Japan manages the storage of High Level radioactive wastes, with its low level radioactive waste situated at Rokkasho village in the Aomori Prefecture.

The public opinions in both Germany and Japan have changed since the Fukushima. In Japan, the public attention has generally been tilted towards understanding the risks involved in the use of nuclear energy (Siegrist, Sütterlin & Keller, 2014). Several nuclear power plant host communities in Japan have exhibited hostility towards the government as it bids to solicit cooperation to continue the production of electricity from these sites. In Germany, the levels of awareness among the populace have constantly led to the disapproval of nuclear energy. The events at Fukushima in 2011 only strengthened the resolve of the public to implement alternative energy sources, hence the re-introduction of the nuclear energy phase-out program.

## Conclusion

 This year marks the sixth anniversary since the accident at the Fukushima nuclear power plant in Japan. In marking this anniversary, several articles have been written to analyze the effects of the disaster, and the progress realized in Japan and around the world in line with nuclear safety since the occurrence. Even more, the event underscored the significance of all countries to remain vigilant in ensuring safety when using nuclear energy. In as much as the immense human impact of these events remain to be remembered, the role that nuclear energy plays in bridging the deficiencies in the energy demands of industries and populations around the world leaves more questions than answers on the need to eradicate the use of this form of energy on the basis of the outcomes of the Fukushima tragedy.

## References

Escobar Rangel, L., & Lévêque, F. (2014). How Fukushima Dai-ichi core meltdown changed the probability of nuclear accidents?. *Safety Science*, *64*, 90-98.

Kitada, A. (2016). Public opinion changes after the Fukushima Daiichi Nuclear Power Plant accident to nuclear power generation as seen in continuous polls over the past 30 years. *Journal Of Nuclear Science And Technology*, *53*(11), 1686-1700.

Lee, S., Kim, M., & Lee, J. (2017). Analyzing the Impact of Nuclear Power on CO2 Emissions.*Sustainability*, *9*(8), 1428.

Sawada, T. (2012). Lessons Learned from the Fukushima Daiichi Accident. *TRENDS IN THE SCIENCES*, *17*(1), 1\_79-1\_83.

Siegrist, M., Sütterlin, B., & Keller, C. (2014). Why have some people changed their attitudes toward nuclear power after the accident in Fukushima?. *Energy Policy*, *69*(7), 356-363.

Visschers, V., & Siegrist, M. (2012). How a Nuclear Power Plant Accident Influences Acceptance of Nuclear Power: Results of a Longitudinal Study Before and After the Fukushima Disaster. *Risk Analysis*, *33*(2), 333-347.

World Nuclear Association. (2017). *Nuclear Power in Germany - World Nuclear Association*.

World Nuclear Association. (2017). *Nuclear Power in Japan | Japanese Nuclear Energy - World Nuclear Association*.