PUBLIC ATTITUDES TOWARDS NUCLEAR POWER AND CLIMATE CHANGE: UK-JAPAN COMPARISON AFTER TEN YEARS OF FUKUSHIMA NUCLEAR ACCIDENT

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Overview

This paper explores public attitudes towards nuclear power and climate change in the UK and Japan based on web based online survey conducted in 2020, 10 years after Fukushima nuclear accident. Both countries have set ambitious decarbonization goal and retain the nuclear power as an option to reduce CO_2 emission in the power sector. Yet, the public attitudes of the two countries toward nuclear power had been different even before the Fukushima nuclear accident. We identify the difference in attitudes toward utilization of nuclear power between the two countries as well as the differences in perceptions of the related issues, including climate change and government regulation. The results of our survey suggested that UK-Japan respondents have similar concerns about climate change, but the issues needed to be addressed to obtain conditional support for nuclear power as a climate change measure, would be different in the UK and Japan.

Introduction

As countries around the world work toward decarbonization, national energy mix in power supply has been an important issue for policymakers. While many countries have tried to increase the share of renewable energy supply, some countries have nuclear power as an option to decarbonize the power sector. Yet, it has been difficult to increase the share of nuclear power generation, due to the high investment cost and the risk of lower prices in the liberalized wholesale electricity market. The cost has been further increased due to the safety measures required after the Fukushima nuclear accident in March 2011. To rely on nuclear power generation, public attitudes are also important, as there has been a concern about safety as well as radioactive waste.

UK and Japan are the countries that still has nuclear power as an option, but the energy policy and the public attitudes are different. In the UK, with an ambitious goal of decarbonization, government has shown a strong commitment to build new nuclear power plants, in addition to increasing renewable energy supply and phasing out of coal fired power plants. With Feed-in-tariff Contract for Difference (FIT-CfD) to support low carbon technologies, construction of new nuclear power plant, Hinkley Point C, started in 2016. Although the government has been struggling to promote subsequent plans for new nuclear power plants, its commitment looks unchanged, as evidenced by Ten Point Plan released in 2020.

In Japan, the government indicated to decrease the country's dependency on nuclear power after the Fukushima nuclear accident; yet, it also aims to maintain about 20% share of nuclear power generation in 2030 as an important baseload generation, as indicated by its strategic energy plan. The government intended to restart the existing nuclear power plants if the safety is confirmed, yet only a few reactors restarted. The amount of generation from renewable energy supply, especially photovoltaic, has been recently increasing thanks to the feed-in-tariffs, but its share in generation output has been still small. The country has also relied on coal-fired generation, even though it announces the plan to abolish the inefficient coal-fired power plants. In October 2020, the prime minister declared the net zero emission target by 2050, and since then, decarbonization has been emphasized in energy policy circle. However, there has been no explicit statement to promote new nuclear power plants.

The difference in energy policy as well as political environment toward nuclear power between the two countries may in part be rooted in public attitudes toward nuclear power and related issues such as climate change. There is a study that compares the results of surveys on public opinions regarding nuclear power conducted by different research groups in the UK and Japan. Poortinga and Aoyagi (2013a) and Poortinga et al. (2013b) compiled the results of several surveys conducted independently in the UK and Japan a couple of years before and after the Fukushima nuclear accident (during 2005 through 2013). These studies suggest, among others, that the UK had a higher proportion of people who accept nuclear new build if it helps combat climate change, as compared to Japan. Although it is understandable that the Fukushima nuclear accident made many Japanese people pessimistic about relying on nuclear power, these studies also revealed that such a difference had existed even before the accident. On the other hand, the proportion of people who thought that the world's climate was changing was rather similar in the two countries.

However, there might have been a change in the public attitudes toward nuclear power and climate change by now, a decade after the accident. The impact of the accident was so huge that it is still difficult for many of the Japanese people to accept nuclear power. On the other hand, the growing concern about global climate change in recent years might have convinced them to reconsider the role of nuclear power as low carbon technology. They may perceive the benefit of nuclear power to contribute to decarbonization and it might outweigh the perceived risks of nuclear power. Even though the problem of COVID-19 dominated the media coverage in 2020, the declaration of net zero target by the prime minister in October 2020 might have raised their interest in global warming issues ever before. In addition, the retail electricity market in Japan was fully liberalized in April 2016, so that people can choose electricity suppliers, as in the UK since 1998. As of 2020 the share of new entrants is about 15% for residential customers. These observations motivated us to update the analysis of public attitudes toward nuclear power and climate change in the UK and Japan. In addition to see if the difference in the public attitudes in the two countries remain the same, we will look into the related issues such as government regulation to derive possible explanation for the difference between the two countries if it remains.

The rest of this paper is organized as follows: Next section describes our 2020 survey. Then, we present the results of the survey and compare those with the results of earlier study. Lastly, we discuss the major findings and future research.

Methods of 2020 Survey

We will analyze the public attitudes toward nuclear power between the UK and Japan and investigate the differences in their perception of the potential benefits or contributions of nuclear power to energy and environmental policy as well as the risks of nuclear power and climate change. For this purpose, we conducted a web based online survey for people aged 20 years and older in the UK and Japan during November 24 – December 2 in 2020, and collected 2,060 and 3,092 adults weighted the sample to make it representative of the UK and Japan, respectively. Summary of the respondents (gender, age, and area of residence) are shown in Table 1.

Table 1: Summary of the respondents

(%)

Gender	UK	Japan
Male	48.6	48.1
Female	51.4	51.9
Prefer not to say	0.0	0.0

Age	UK	Japan
20-29	17.7	12.0
30-39	16.9	15.1
40-49	18.2	17.9
50-59	16.9	15.0
60+	30.3	40.0

(%)

The region of UK	
North East	4.9
North West	12.4
Yorkshire and Humberside	8.6
West Midlands	9.3
East Midlands	7.5
East Anglia	8.1
South West	9.0
South East	14.6
Greater London	12.4
Wales	4.7
Scotland	7.0
Northern Ireland	1.6

(%)

The region of Japan	
Hokkaido electric power area	4.3
Tohoku electric power area	7.1
Tokyo electric power area	35.5
Chubu Electric Power area	12.2
Kansai Electric Power area	16.5
Hokuriku Electric Power area	4.1
Chugoku Electric Power area	5.9
Shikoku Electric Power area	3.1
Kyusyu Electric Power area	10.2
Okinawa Electric Power area	1.1

The region of Japan corresponds to areas of regional electricity network operators.

Unlike the previous studies, the survey was conducted with the same set of questions for both countries at the same time. This would increase comparability of the results between the two countries. We included some of the questions that were asked in the earlier studies to compare the results, so that we can examine the changes in attitudes over time.

Results

Attitudes toward climate change

Poortinga et al. (2013) confirmed that a large share of respondents believes in the reality of climate change in both UK and Japan. In our survey we asked whether they are concerned about climate change. A larger proportion of respondents are concerned about climate change both in the UK and Japan as shown in Figure 1. It is interesting to note that the proportion of respondents in the UK who are not at all concerned is about twice more than that of Japan. Overall, however, there seems to be no difference in the level of concerns about climate change between the two countries.

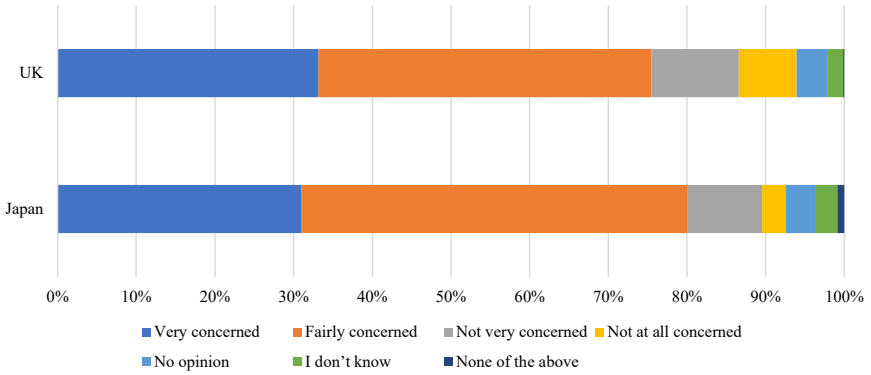

Figure 1: Concern about Climate Change (2020 Survey)

We also asked several questions on the perception of climate change, and as shown in Table 2, the sum of proportions of respondents who agree and slightly agree with each of the statements are very similar (the difference is less than 10%) between the two countries, except for the statement that "it is my responsibility to help do something about climate change," where the proportion is higher in the UK by more than 20% points.

Table 2. Agreement with Statement on Climate Change (2020 Survey)

(%)

		Agree	Slightly Agree	Neither Agree Nor Disagree	Slightly Disagree	Disagree
Extreme weather events have become more frequent in the UK in the past ten years	UK	48.4	26.8	17.7	4.5	2.6
	Japan	43.8	35.9	16.2	3.2	1.0
Climate change is likely to have a big impact on ordinary people like me	UK	32.6	32.3	22.7	7.8	4.6
	Japan	28.5	43.9	21.4	5.2	1.0
My local area is likely to be affected by climate change	UK	23.8	27.3	32.8	10.5	5.6
	Japan	19.3	35.5	32.1	11.4	1.7
It is my responsibility to help do something about climate change	UK	39.4	32.9	19.3	5.1	3.2
	Japan	12.9	32.4	36.7	12.8	5.1
The seriousness of climate change is exaggerated	UK	9.7	13.4	18.1	19.0	39.8
	Japan	9.3	20.7	25.3	29.3	15.4

Related to the difference in perception of the own responsibility with respect to climate change, it is interesting to compare it with the responses to the question asking the necessity of "technological development" vs. "behavioral change". In both countries, the proportion of the respondents who think that they need to rely on technological development of cleaner energy sources in addition to changing their behaviour, is higher than the proportion of respondents who think that they need to rely on technological development because changing their behaviour on such a large scale is not feasible. It is interesting, however, that the difference in the proportions of respondents who select the first statement and those who select the second statement is much smaller in Japan than in the UK.

Table 3. Change needed to our general lifestyle and consumption habits to stop the effects of climate change happening (2020 Survey)

(%)

	UK	Japan
1. We need to dramatically alter our behaviour to be more energy efficient, but solutions to climate change must come through the development of clean energy source.	55.3	44.6
2. Changing our behaviour on such a large scale is not feasible, therefore, we need to rely on technological development of cleaner energy sources.	28.1	35.1
3. Neither behaviour change nor widespread use of cleaner energy technology will stop climate change happening	10.7	8.8
4. Climate change is not a problem at all	2.5	2.5
5. None of the above	3.4	9.0

Since climate change is a part of general environmental issues and it is well known in the literature that people who possess higher environmental values are less likely to favor nuclear power (e.g. Corner et al, 2011) we asked about the opinion on prioritizing environmental protection over economic growth. The proportion of respondents who gives priority to protecting the environment over the economic growth is higher in the UK than in Japan by 20% points. The result of an earlier survey (World Value Survey; WVS) showed that it was the case also in 2005.

Attitudes toward nuclear

(1) Conditional acceptance of new nuclear power plants

About a half of respondents in the UK indicate their support for constructing nuclear power plants if it would help to tackling climate change (conditional acceptance), and it is 30% points higher than in Japan, as shown in Figure 2. We also confirmed a similar result for other condition that it would help to improve energy security (i.e. a reliable supply of affordable energy). With this condition, about a half of the respondents in the UK accept new nuclear power plants, while it is less than 30% in Japan, as shown in Figure 3.

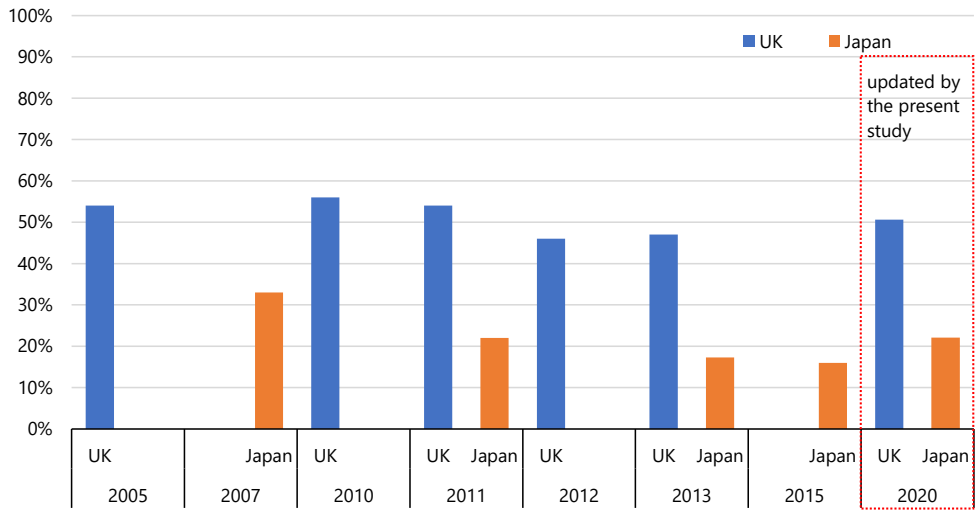

Figure 2: Agreement with the statement "I am willing to accept the building of new nuclear power stations if it would help to tackle climate change" (% strongly/tend to agree)

Note: Data up to 2015 are taken from other survey conducted by different research groups in the UK (Poortinga et al, 2014) and Japan. (National Institute of Environmental Studies, 2015)

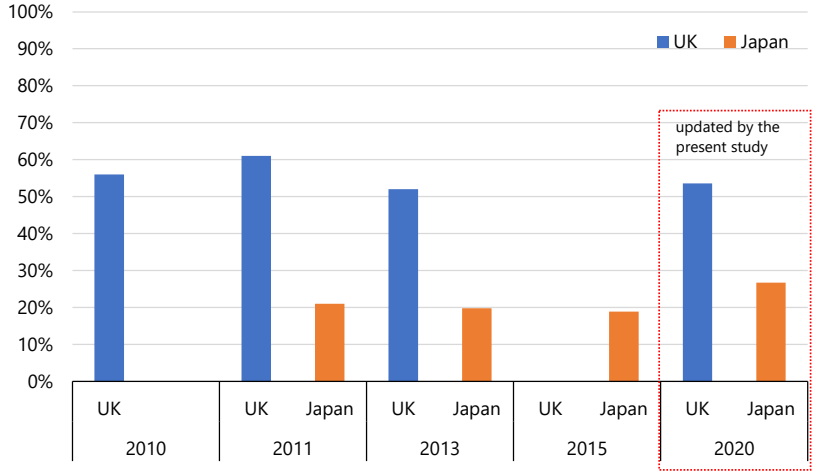

Figure 3: Agreement with the statement "I am willing to accept the building of new nuclear power stations if it would help to improve energy security" (% strongly/tend to agree)

Note: Data up to 2015 are taken from other survey conducted by different research groups in the UK (Poortinga et al, 2014) and Japan. (National Institute of Environmental Studies, 2015)

The results of conditional support for new nuclear power plant to tackle climate change are largely unchanged from those of earlier studies since 2005. Although Poortinga et al (2013) suggested that Japanese public had been less supportive for nuclear power even before the Fukushima nuclear accident, the proportion of the respondents who indicate the conditional support was decreased after the accident. Since then, that proportion remains stable up until 2020.

The difference in public attitudes to nuclear new build would be that framing the nuclear power as a part of the solutions to climate change has not been well accepted in Japan. It was pointed out by earlier studies that in the UK, a more people tend to accept new nuclear power plants, if they are interpreted as the means to tackle the energy policy issues, such as climate change and energy security. Figure 4 shows the distribution of shares of different opinions about nuclear power without any statements of the conditions (unconditional attitudes). We compared the results of survey in 2013 with our results in 2020. The distribution of the opinions in the UK in 2020 is largely unchanged as compared to that of 2013. The shares of respondents who select "We should increase the number of nuclear power stations" and "We should continue using the existing nuclear power stations and replace them with new ones when they reach the end of their life" together account for less than 40%. It is only slightly less than 20% in Japan and almost the same with the share of conditional acceptance of new nuclear power plants to tackle climate change. The proportion of respondents who think that (without any conditions) they should increase the number of nuclear power stations, and those who think they should continue using the existing nuclear power stations, and replace them with new ones when they reach the end of their life is also in sum total about 20% in Japan.

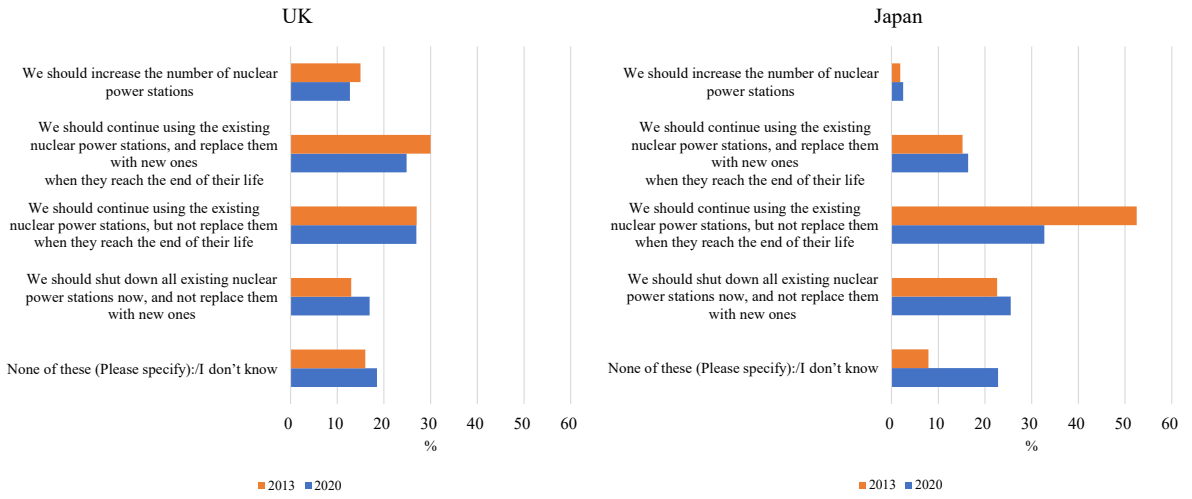

Figure 4: Which, if any, of the following statements most closely describes your own opinion about nuclear power in the UK (left) /Japan (right) today?

Note: Data for 2013 are taken from other survey conducted by different research groups in the UK (Poortinga et al, 2014) and Japan. (National Institute of Environmental Studies, 2015)

(2) Nuclear power and the alternative means to combat climate change

Yet, another possible reason for the difference in attitude toward nuclear power would be that Japanese public tend to have higher expectation for alternative means to combat climate change, than in the UK. As Corner et al (2011) pointed out, concern about climate change and energy security only increase acceptance of nuclear power once other (preferred) options have been exhausted. Since people in Japan have a higher expectation for developing alternative clean energy technology, it is worth examining the relationship between conditional acceptance and perception of other energy options.

As in the earlier study we asked whether they agree with the statement "We shouldn't think of nuclear power as a solution for climate change before exploring all other energy options," and the results are shown in Figure 5. The proportion of respondents who strongly agree and tend to agree with the statement became smaller in Japan as compared to the UK by more than 10% points. In the previous surveys, it was only slightly lower than in the UK. This result is a bit surprising, given the relatively less supportive attitude of Japanese public towards nuclear power as compare to the UK. It is also interesting to note that in Japan it was decreased in 2020 as compared to the previous surveys. This question might be a bit confusing to respondents, particularly with an online survey.

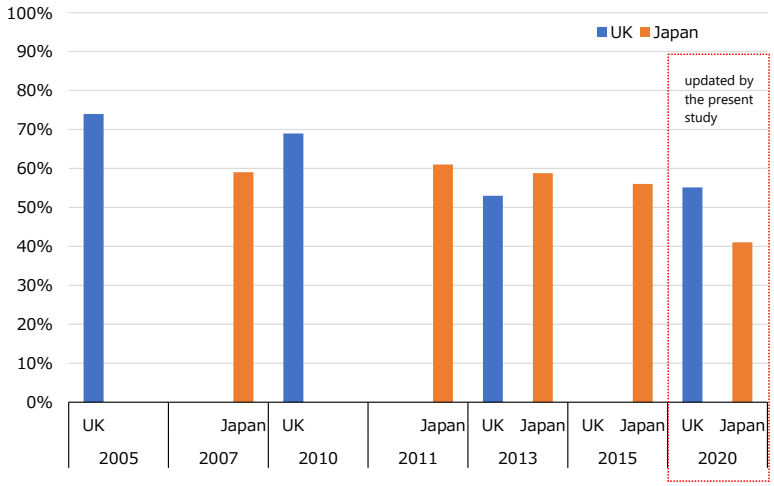

Figure 5: Agreement with the statement "We shouldn't think of nuclear power as a solution for climate change before exploring all other energy options"

Note: Data up to 2015 are taken from other survey conducted by different research groups in the UK (Poortinga et al, 2014) and Japan. (National Institute of Environmental Studies, 2015)

We also asked whether they agree with the statement "Reducing energy use through lifestyle changes and energy efficiency is a better way of tackling climate change than nuclear power," and the results are shown in Figure 6. The proportion of respondents who strongly agree and tend to agree with the statement was a bit smaller in Japan as compared to the UK. Compared to the results from the previous surveys, those proportions are decreased in both countries. It might be because people were forced to stay home longer during the period of the survey in 2020 due to COVID-19 pandemic and might have thought it's harder to reduce energy consumption at their home.

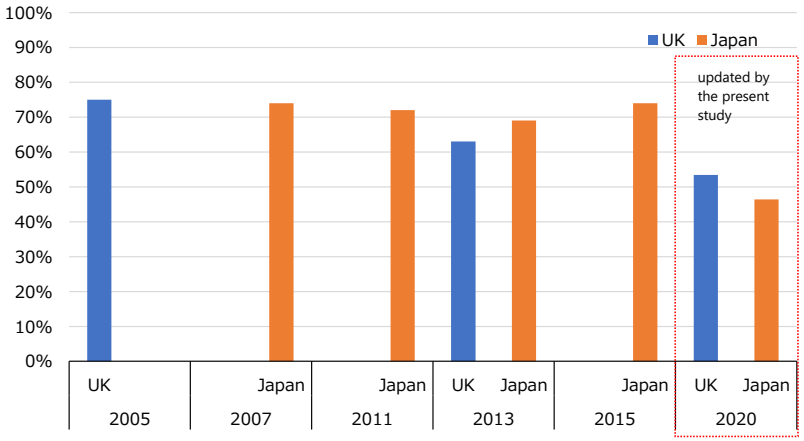

Figure 6: Agreement with the statement "Reducing energy use through lifestyle changes and energy efficiency is a better way of tackling climate change than nuclear power"

Note: Data up to 2015 are taken from other survey conducted by different research groups in the UK (Poortinga et al, 2014) and Japan. (National Institute of Environmental Studies, 2015)

(3) Nuclear power and renewable energy sources in energy mix

The proportions of respondents who agree and slightly agree with the statement that "The UK/Japan needs a mix of energy sources to ensure a reliable supply of electricity, including nuclear power and renewable energy sources" and "We need nuclear power because renewable energy sources alone are not able to meet our electricity needs" are also higher in the UK than in Japan by more than 10% points, as shown in Figure 7. In Japan, these proportions are higher as compared to that of conditional acceptance of new nuclear power plants as shown in Figure 2. The difference between the two countries is smaller as compared to the results of the conditional support for new nuclear power plants. For example, the proportion of respondents who agree with the statement that their country needs a mix of energy source including nuclear and renewable energy sources to ensure a reliable supply of electricity is higher in the UK (62%) only by about 15% points.

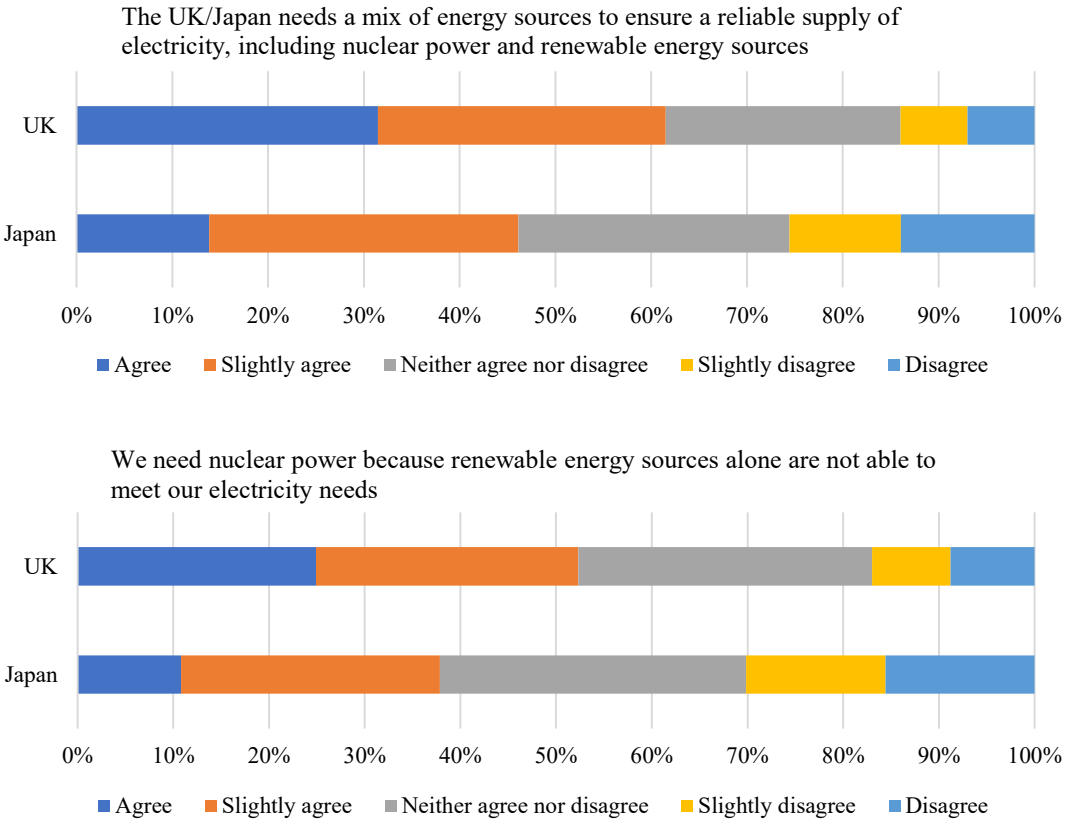

Figure 7: Nuclear power and renewable energy sources in energy mix (2020 Survey)

The benefit of having nuclear in energy mix may be affected by the perception of relative cost of renewable energy sources over nuclear power generation. It is particularly important as the countries witnessed a rapid decrease in cost of renewable energy sources in recent years. Figure 8 shows the distribution of the respondents who agree or disagree with the statement that "The cost of renewable energy is becoming cheaper than nuclear power." Somewhat larger proportion of people in the UK thought that renewable energy has cost advantages over nuclear power. It is interesting that a more people in Japan still think that renewable energy has higher cost than nuclear. This perception of relative cost may be contributing to accepting the existing nuclear power in energy mix.

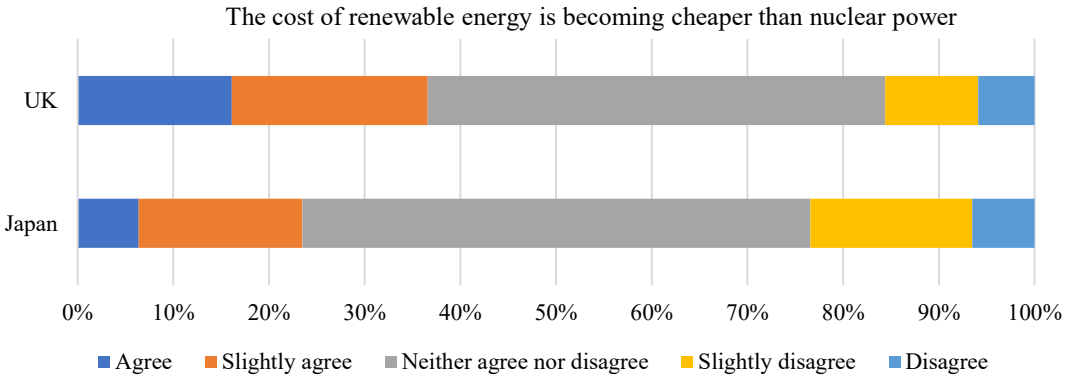

Figure 8: Perception of relative cost of renewable energy sources as compared to nuclear power (2020 Survey)

(4) Perception of benefits of nuclear power

The level of concern about climate change does not directly explain the difference between the two countries in public attitudes toward nuclear power, such as conditional acceptance of new nuclear power plants. It is possibly the

case that perception of the potential benefit of nuclear power as a part of the solutions to climate change is lower in Japan than in the UK. We asked the questions regarding the perception of potential benefits of nuclear power as reliable source of energy and affordable energy as well as helping combat climate change. Public perception of benefits of nuclear power is generally higher in the UK as compared to Japan. The difference between the two countries is the largest for the perception that nuclear power as safe energy. As shown in Table 4, a relatively smaller proportion of respondents agree (including "slightly agree") with the statement that nuclear power generation will help combat climate change (about 30% in the UK and 20% in Japan). This indicates that, in the UK, at least for some fraction of the respondents who indicated the conditional acceptance of new nuclear power plants, the nuclear power was not considered to help combat climate change.

Table 4. Perception of the Benefits of Nuclear Power Generation (2020 Survey)

(%)

		Agree	Slightly Agree	Neither Agree Nor Disagree	Slightly Disagree	Disagree
Nuclear energy provides a reliable source of energy in the UK/Japan	UK	27.9	25.4	30.5	8.1	8.2
	Japan	13.4	30.0	27.4	12.9	16.3
Thanks to the expansion of nuclear power generation, the energy supply will be secured in the long term for the UK/Japan	UK	19.7	24.3	38.1	7.9	10.0
	Japan	13.1	27.4	33.3	11.1	15.2
Nuclear energy offers affordable energy for the UK/Japan	UK	20.8	24.9	37.3	8.7	8.3
	Japan	11.3	26.0	33.8	13.7	15.1
Nuclear power generation will help combat climate change in the UK/Japan	UK	14.9	17.9	38.9	12.1	16.2
	Japan	6.8	15.8	40.9	18.8	17.7
Nuclear energy provides a safe source of energy in the UK/Japan	UK	11.2	22.5	33.5	15.2	17.5
	Japan	3.7	12.2	27.6	27.3	29.2

(5) Perception of risks of nuclear power and trust in nuclear regulation

The proportions of respondents who are very concerned about various risks of nuclear power plants are generally higher in Japan than in the UK, as shown in Table 5. The difference is higher for the risk of accident and natural disaster to cause accident. This is not surprising as Japan had experienced the Fukushima nuclear accident triggered by Tsunami about 10 years ago.

Table 5. Concern about Risks of Nuclear Power Generation (2020 Survey)

(%)

		Very concerned	Fairly concerned	Not very concerned	Not at all concerned	I don't know
The risks of an accident at a nuclear power station	UK	27.7	38.4	23.4	6.5	4.0
	Japan	46.6	36.9	11.8	2.4	2.4
The risks of a natural disaster triggering a nuclear accident	UK	32.8	35.0	20.6	6.8	4.9
	Japan	45.6	36.4	12.6	1.9	3.5
The risks associated with the storage of nuclear waste at an underground storage site	UK	35.7	36.7	18.7	5.0	3.8
	Japan	45.8	36.6	12.1	2.1	3.4
The risks associated with the storage of nuclear waste overground at a nuclear power station	UK	38.3	37.8	15.2	4.3	4.5
	Japan	45.9	36.9	11.6	1.9	3.8
The risks of terrorists targeting a nuclear installation in the UK	UK	32.5	33.1	23.0	5.5	5.9
	Japan	32.7	36.4	21.9	3.5	5.5

Moreover, the level of confidence in government's regulation of nuclear power seems to be higher in the UK as compared to Japan. As compared to the results of survey in 2013, the proportion of respondents who agree with the statement that their government adequately regulates nuclear power is almost the same in each country, as shown in Figure 9. Trust in government regulation might have been lower in Japan as compared to the UK even before the Fukushima nuclear accident, as was revealed by earlier studies, where somewhat different questions were asked in the UK and Japan. The proportion of respondents in Japan who agreed with the statement that "I feel that current rules and regulation are sufficient in control nuclear power" was about 20% in 2007, while the proportion of respondents who agree with the statement that "I feel confident that the British government adequately regulates nuclear power was about 30% in 2005 and about 40% in 2010. In the UK, the level of confidence in the ability of government to regulate nuclear power is perceived as higher than the ability to tackle other policy issues (climate change and COVID-19), while in Japan it is generally lower not only in nuclear power regulation but also in other areas.

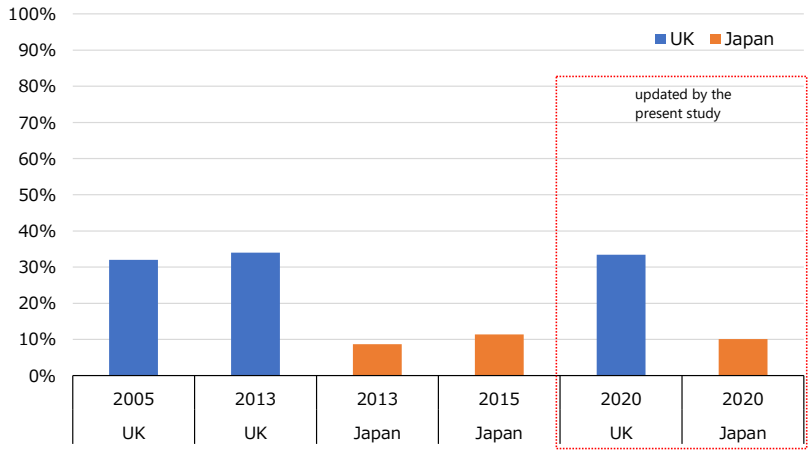

Figure 9: Confidence in rules and regulation to sufficiently control nuclear power

Note: Data up to 2015 are taken from other survey conducted by different research groups in the UK(Poortinga et al, 2014) and Japan. (National Institute of Environmental Studies, 2015)

In Japan, the proportion of the respondents who think that nuclear power generation has become safer by taking measures based on the lessons learned from the Fukushima Dai-ichi nuclear accident is lower than in the UK, as shown in Figure 10.

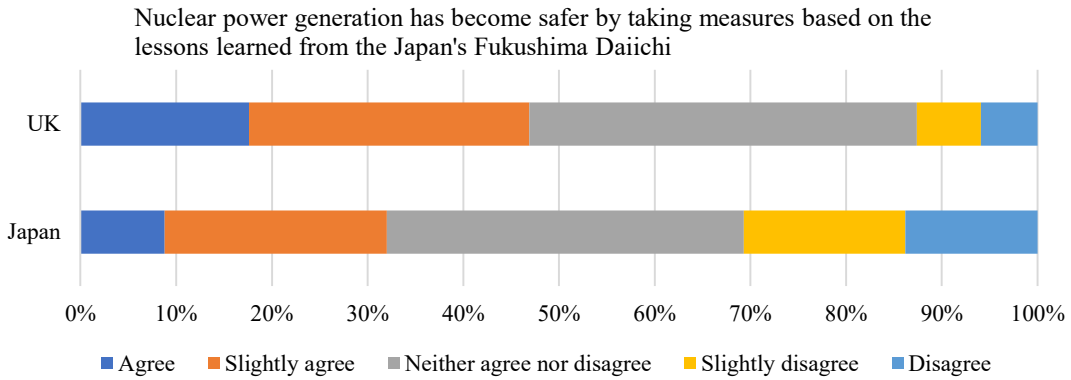

Figure 10: Perception of the lessons learned from the Fukushima nuclear accident (2020 Survey)

Discussion and Future Research

We confirmed that, as indicated by earlier studies, about 50% of respondents in the UK support building new nuclear power plants if those plants help tackling climate change or improve energy security, and that these proportions have been rather stable. In Japan, although slightly increased from the previous surveys, only about 20% of respondents support building new nuclear power plants with the same condition on climate change and these proportions are the same as those who indicate “unconditional acceptance” toward new nuclear power plants.

The level of concerns about climate change among the Japanese people is not necessarily lower than those of the UK, however, the proportion of the respondents in Japan who prefer alternative means other than nuclear power in order to tackle climate change is lower than those in the UK. Related to this, the respondents in Japan are less willing to change their lifestyle to tackle climate change than those in the UK. In addition, the proportion of respondents in Japan who recognize their own responsibility to help do something about climate change is lower than in the UK. These results suggest that there might be some other conditions for people in Japan that would lead them to accept new nuclear power plants. Perhaps, for example, people in Japan may be reluctantly accept new nuclear power plants, if they think those plants help tackling climate change without changing their lifestyle.

It is also obvious that people in Japan have greater concern about the risks of nuclear power plants and the level of trust in government regulation of nuclear power among the Japanese people is lower than those of the UK. It is important to reassure people in Japan by showing that new nuclear power plants are to be adequately regulated with respect to safety.

Although both the UK and Japan have an option to rely on nuclear power to achieve the net zero emission (carbon neutral) target, the results of our survey suggested that the issues needed to be addressed to obtain conditional support for nuclear power as climate change measures, would be different in the UK and Japan. This would be an important implication for both countries to utilize nuclear power in the long term.

Future research needs to investigate the effectiveness of reframing nuclear power as means to combat climate change, or to achieve net zero emission target. We need to analyze determinants of public attitudes in the UK and Japan toward nuclear power and climate change, to figure out under what situation people are likely to conditionally accept new nuclear power plants. It would be interesting to examine whether applicability of the notion of conditional acceptance is restricted to a specific country or not.

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