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Keio University

Study of the Ideal Share of Japan's Energy Mix (Power Source Composition Ratio)

— The Effects of Multifaceted Factors have been Determined—

An international joint research group including Professor Toshihiro Okubo of the Keio University Faculty of Economics conducted a household survey on the energy mix in Japan (Keio household panel survey), and by performing various analyses on the preferences for and factors concerning power generation methods, identified the social, economic, and psychological factors that influence the energy mix. The group's paper was published in *Energies*, an international academic journal of energy engineering, on June 8.

1. Main Points of Research

- To study Japan's energy mix (power source composition ratio; supplying electricity to the whole of society through various methods of generating electricity), the ideal shares of renewable energy, fossil fuels (oil, coal, and natural gas), and nuclear power were surveyed and analyzed through a household survey (Keio household panel survey [KHPS, JHPS]).
- From a multifaceted analysis on the background of people's subjective preferences for power generation methods, it was found that not only the social and economic circumstances of the individual or household but factors such as individual psychological characteristics, noncognitive traits, the deep psychology of individuals such as past experiences (experiences and emotions at the time of the Fukushima nuclear power plant accident), regional characteristics, and geographical factors such as the location of power plants (the effect of "distance") also had a significant impact.
- While traditional social surveys only discussed the basic characteristics of individuals (gender, age, and education) and academic research has attempted to draw conclusions using only some of the factors, this study showed that explanations can be given not only through individual characteristics but also objectively through multifaceted factors.

2. Background of Research

Although nine years have passed since the accident at the Fukushima Daiichi Nuclear Power Plant caused by the Great East Japan Earthquake, the situation surrounding nuclear power generation is still severe and many issues remain, including problems with resuming operations at the power plant and problems with water treatment. On the other hand, Japan's demand for electricity has been supplemented by depending on other power generation methods (mainly fossil fuels); however, as efforts to decarbonize progress following the introduction of the Paris Agreement, fossil fuels have been receiving international criticism

because of their large emissions and the environmental damage they cause.

In Germany and other countries, the issues of nuclear power and energy mix have been widely discussed, and there are public debates over their pros and cons. The people themselves are searching for solutions and these are leading to political movements and policies. While securing cheap power sources is essential for economic activities to take place, at the same time, the risks associated with nuclear power and the environmental impact of fossil fuels are significant. Furthermore, due to the many natural disasters that occur in Japan, the risks associated with nuclear power plants are even higher.

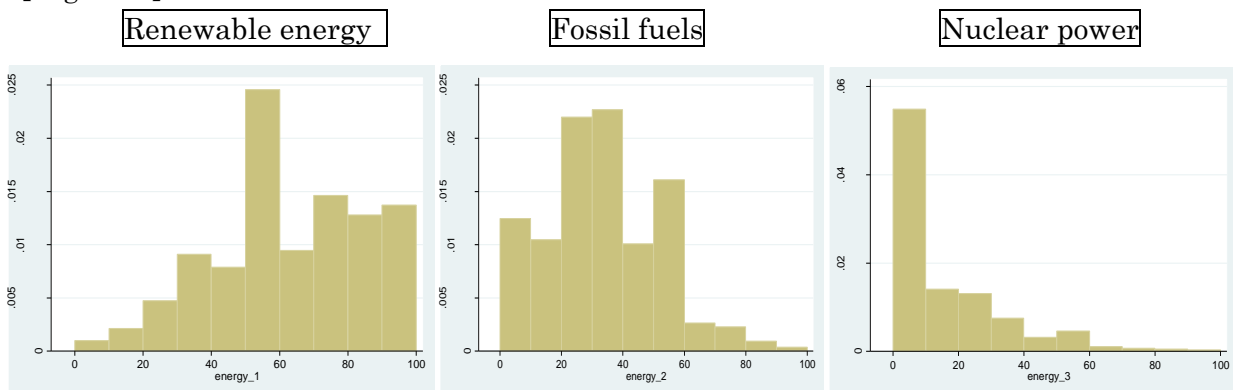
Even under these circumstances, public debate in Japan addressing these issues are insufficient and momentum is low. In this study, therefore, a survey and analysis of how the public thinks about energy and what they consider to be the ideal source of energy supply was carried out. The current study is an extension of a previous study (Rehdanz, Schröder, Narita, and Okubo, 2017) that showed the relationship between energy preferences and the location of nuclear power plants in Japan.

3. Content of Research and Results

In this study, questions regarding the energy mix were asked first of all using the Keio household panel survey (KHPS, JHPS), with instructions that each individual ensures that his/her ideal energy mix for nuclear power, fossil fuels, and renewable energy totals 100%. The distribution of responses for each source of energy is shown below.

It was found that for renewable energy (figure 1 left), a relatively large number of people answered 50% or more, while for fossil fuels (figure 1 center) and nuclear power (figure 1 right), a comparatively high number of people responded between 20% to 40% and 0% to 10%, respectively.

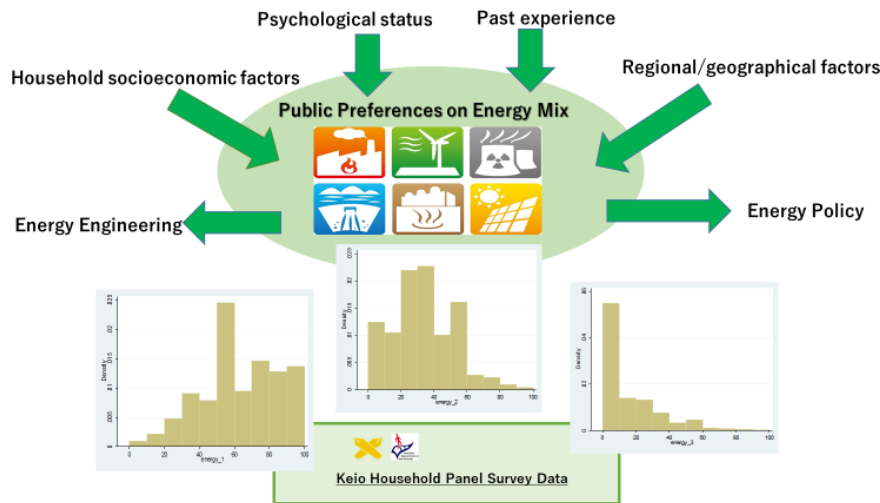
【Figure 1】



Moreover, a regression analysis was carried out between the individual characteristics (gender, age, occupation, income, etc.) and household characteristics (number of family members, residential area) to analyze the factors. Single men and those with higher income were more likely to prefer nuclear power, while families with children and women tended to favor renewable energy. Furthermore, preference for fossil fuels were seen among older people. Additionally, when noncognitive traits (risk; preferences on liberty, equality, etc.; morals; attitude toward others; lifestyle; etc.) and political stance (political party supported, etc.) were

also taken into consideration in the regression analysis, it was found that these factors had a significant impact as well. Past experiences (experience of and anxiety about power outages following the Great East Japan Earthquake, distrust of nuclear power plants) and distance from a nuclear power plant were also seen to have an impact (figure 2).

【Figure 2】



4. Research to Date and Future Developments

To date, the members of this joint research project have conducted research on energy economics using the same Keio household panel survey (KHPS, JHPS), and in a previous study (Schröder, Rehdanz, Narita, and Okubo, 2015), future energy demand was predicted and a trend that the number of people per household in Japan will decrease due to the declining birthrate while the total amount of electrical power used will increase was found. Another study (Rehdanz, Welsch, Narita and Okubo, 2015) analyzed the decline in well-being due to the accident at the Fukushima nuclear power plant in terms of geographical distance. In the future, there are plans to deepen exchange with researchers in the science and engineering fields in order to collaborate more with people in these areas, and there are also plans to combine the data acquired through this study with various data obtained in scientific fields and carry out further studies.

<References>

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<Details of original paper>

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