

***COLLEGE STUDENTS' OPINIONS IN THE CITY OF HIROSHIMA
FOR/AGAINST RESTARTING NUCLEAR POWER PLANTS IN JAPAN***

by

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Abstract

This paper examines opinions of college students from Hiroshima regarding restarting nuclear power plants in Japan, based on their term-end essays ($N=395$, Response rate: 70.9%). This paper reveals a total of five findings as follows: three statistical verifications, background factors and one suggestion. First, 61.3% of the students were in favor of restarting nuclear power plants in Japan while 27.1% opposed restarting them and 11.6% had “no idea” on the matter. Second, those opposed were predominantly female. Third, the rates of “Oppose” decrease and “No idea” increase among upper-grade (i.e., junior and senior) students. Fourth, students that favor restarting the plants emphasized the importance of economic and employment impacts while students who oppose restarting were mainly concerned about radioactive contamination. Moreover, students who selected “no idea” tended to confess their difficulty in deciding. Fifth, the freedom of expression should be assured in classrooms; professors should let the students decide the important challenges in the energy and environment sectors in order to develop students’ personality and electoral democracy toward establishing a sustainable society.

Key Words

Restarting domestic nuclear power plants, Pros and cons

Freedom of expression in classrooms

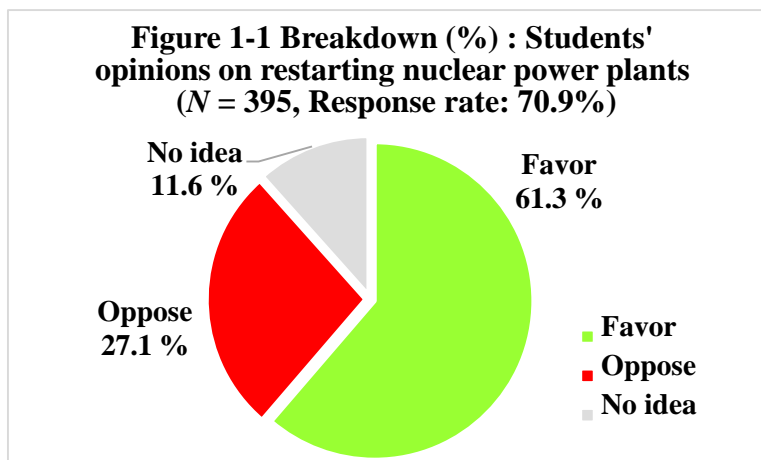
1 Overview

1.1 Background

This paper examines opinions of college students from Hiroshima regarding restarting nuclear power plants in Japan, based on their term-end essays.

First, the paper clarifies the worldwide misunderstanding that a majority of the Japanese have preferred the shutdown of nuclear power plants since the 2011 off the Pacific coast of Tohoku Earthquake (hereafter, the 2011 Earthquake). In addition, it is impulsive to consider that the people in Hiroshima, where President Barack Obama made a speech in 2016 appealing the abolishment of nuclear weapons, have opted for the absolute elimination of nuclear power.

Instead, the author's 2017 survey, as depicted in Figure 1-1, illustrates that 61.3% of the college students in Hiroshima favor restarting the nuclear power plants in Japan even after disasters such as the 2011 Earthquake or the nuclear bombing in Hiroshima in 1945.



Second, this paper addresses the gaps in existing literature. As per the author's research using theses and databases such as American Economic Associations' Journals, the *Energy Journal*, and the J-stage of journal archives in Japan, no prior research studies have focused on the opinions of students in Hiroshima.

Third, the author attempts to emphasize the importance of freedom of expression in classrooms. According to the confessions of students in the author's classes, many students in Hiroshima refrain from honestly expressing their opinions, mainly in obedience to coercive teachers across schools and universities. These teachers force their opinion of having a total ban on nuclear energy. The teachers' coercion and the students' self-control in order to achieve better academic grades, could deter the development of students' personality along with electoral democracy, and consequently hinder the efforts toward establishing a sustainable society. Therefore, the author suggests that freedom of expression should be assured in classrooms.

This paper reveals a total of five findings as follows: three statistical verifications, background factors and one suggestion. First, 61.3% of the students were in favor of restarting nuclear power

plants in Japan while 27.1% opposed restarting them and 11.6% had “no idea” on the matter. Second, those opposed were predominantly female. Third, the rates of “Oppose” decrease and “No idea” increase among upper-grade (i.e., junior and senior) students. Fourth, students that favor restarting the plants emphasized the importance of economic and employment impacts while students who oppose restarting were mainly concerned about radioactive contamination. Moreover, students who selected “no idea” tended to confess their difficulty in deciding. Fifth, the freedom of expression should be assured in classrooms; as facilitators of discussions, professors should let the students decide the important challenges in the energy and environment sectors in order to develop students’ personality and electoral democracy toward establishing a sustainable society that, this author thinks, mainly involves economic prosperity, conservation of bio-diversity, fulfillment of social justice and solidarity, and so on¹.

Thus, this paper will surely contribute to the further development of government policy-making and corporate strategic planning as well as academic and practical research in the energy and environment sectors. Last but not least, the author does not have any political intention to favor or oppose the use of nuclear energy.

1.2 Japan’s Question and the Author’s Research

Further explanation is needed for the third explicated reason, freedom of expression. First, since the 2011 Earthquake, Japan has faced the question of whether or not it should restart and depend on domestic nuclear power plants. The question of restarting is crucial for achieving a safe, stable, and economic energy supply that is environmentally friendly while also posing potential fatal risks and radioactive leaks, especially given Japan’s frequent seismicity.

Irrespective of the fatal risks, the restart is expected to play an important role in concurrently achieving domestic and global targets such as revitalizing the national economy, balancing central and local governmental budgets, increasing employment opportunities, easing economic disparity among generations and regions as well as combating global warming and preserving bio-diversity and natural resources, etc.

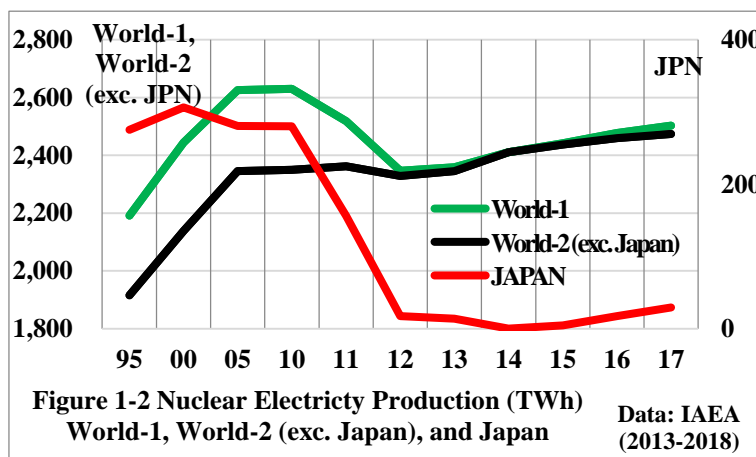
The question of restarting nuclear plants is, therefore, like finding a solution or solutions to simultaneous equations in the complicating domestic and global issues. Deciding what is important and what is not has been difficult for economic actors of the Government, companies, educational institutes, and citizens of Japan. The Government, especially, will make appropriate decisions and

¹ “The Sustainable Development Goals” defined by the United Nations are composed of 17 goals: 1 No Poverty, ---, 16 Peace, Justice and Strong Institutions, and 17 Partnerships for Goals.

further efforts to attain a sustainable society once it has declared further commitments to combat global warming such as the ratification of the Paris Agreement.

It is, of course, necessary to be well-informed for any persons or entities to make appropriate decisions on restarting Japan’s nuclear power plants; however, correct information regarding nuclear electricity production is not shared in Japan². Many Japanese, especially in the media misunderstand that nuclear electricity production has decreased worldwide.

According to serial data issued by the International Atomic Energy Agency (IAEA, 2013–2018), nuclear electricity production in the world increased by 5.3% in 2017 (2,502.88 TWh) from 2000 (2,443.85 TWh) despite a temporal decline around the year 2011 (Figure 1-2, World-1)³. Moreover, it is clearer to understand that nuclear energy production has been increasing worldwide for the last 15–20 years if we exclude Japan’s share of the total production (Figure 1-2, World-2); Japan’s share in the world has declined from about 10% (10.7% in 2010, for instance) to less than 1% after the 2011 Earthquake.



It is no wonder for any persons or entities in Japan that are opposed to the restart that do not know the trend of the production in the world mistakenly or blindly to suggest a total ban on nuclear power. That is why it is necessary for professors, journalists, business persons, and government officers who are engaged in energy and environment issues to share the correct information before they decide.

² The author has found many students in his classes misunderstood that President Obama also appealed the prohibition of peaceful use of nuclear energy in his 2016 speech in Hiroshima, owing to misguidances by other classes. See the References for the text of his speech.

³ Nuclear electricity production decreased by 4.8% from 2010 (2,629.82 TWh) to 2017.

2 Prior Research

As expressed in the Overview, this paper addresses gaps in existing literature because no prior research studies have focused on the opinions of students in Hiroshima. Therefore, it is appropriate to introduce three previous opinion polls (not research studies) on the issue of nuclear energy production in order to promote an understanding of the author’s research. The responses to the polls are classified as “Favor (in favor)” (support nuclear energy), “Oppose” (reject nuclear energy) and “No idea” and so on.

First, a 2016 Gallup poll in the US found that 54% oppose and 44% favor nuclear energy ($N = 1,019$, response rate: N/A). This result marked the first time that “Oppose” has exceeded “Favor” since the first opinion poll in 1994. However, the Gallup (2016) analysis stated that “energy prices and the perceived abundance of energy sources are the most relevant factors in attitudes toward nuclear power, rather than safety concerns prompted by nuclear incidents.”

Second, a domestic opinion poll conducted in March 2017 by Mainichi Newspapers Co., one of Japan’s largest national and center-left news agencies, found that 55% oppose and 26% favor nuclear energy production ($N = 1,597$, response rate: 63%).

Third, based on the responses to Question 8-1 (“How to make use of nuclear power in the future”) in a nation-wide poll conducted by the Japan Atomic Energy Relations Organization (JAERO) found that younger generations are not interested in energy issues compared with other generations ($N = 1,200$, aged 15–74 years, response rate: N/A). As an indicator, the dependence rate on nuclear energy accounted for around 25% of Japan’s total electricity production before the 2011 Earthquake.

Table 2-1 How to make use of nuclear power in the future (Question 8-1, Response Summary)

Options	Average	Teens	Twenties
Increase the dependence rate	1.0%	2.8%	0.7%
Keep the same dependence rate as before the 2011 Earthquake	5.9%	8.5%	6.7%
Gradually abolish the dependence rate to zero	49.4%	25.4%	47.0%
Stop restarting from now on	14.9%	11.3%	9.4%
Others or nothing above options	6.2%	14.1%	9.4%
No idea	22.6%	38.0%	26.8%

(The share of teenagers among responses = 5.9% and that of twenties = 12.4%.)

The answer “No idea” among teens accounts for 38.0% (male: 33.3%, female: 42.9%) while “Average” (aged 15-74) accounts for 22.6%. This means that it is necessary to keep sharing correct information with younger generations, such as college students, on the issue of restarting nuclear power plants in Japan through education.

3 Methods

Following the Overview, the student's opinions are examined based on the essays submitted by them at the term-end examinations. The methods specified below are the ones that were mainly used.

- Essay theme: "Express your opinion on restarting nuclear power plants in Japan with the reasons regarding why you favor or oppose the idea." Neutral answers such as "I have no idea. I belong to a neutral party" are also allowed.

- Target/Sample: 557 registered undergraduate students from the Hiroshima Shudo University, aged between 18 and 24 years in the spring of 2017 (April to August) and fall (September to January) terms. The author formerly worked for the University in Hiroshima from April 2015 until March 2018. The university website is <http://www.shudo-u.ac.jp>.

- Courses: Total four courses, comprising two basic and two advanced, at the Department of Environment Studies.

- (1) Basic courses: "Natural resources and energy issues" and "Introduction to environmental issues"

- (2) Advanced courses: "Policy studies of natural resources and energy" and "Policy studies for recycling society"

- Course outline: 90 minutes of each class during 15 weeks. Advantages, disadvantages, and worldwide trends of nuclear energy are explained at least twice in each class using several statistical data, reports, press releases, news articles, and campaign promises of political parties as well as pictures and videos taken by the author.

- Statistical data for the explanation (summary⁴):

- (1) Economy: unit cost (JP Yen / per KWh) in each power source, cost of maintaining or decommissioning nuclear reactors, radioactive contamination damages, impacts of demand boosting on national and local economies through employment opportunities and government subsidies,

- (2) Environment: development of the Paris Agreement, trends of CO₂ emissions in Japan and the

⁴ Those statistical data were also explained in the classes for discussions.

*Unit cost (JP Yen/KWh): Nuclear 10.1, coal-fired 12.3, photovoltaic 29.4 etc. (METI 2015).

*Number of staff: Mitsubishi Heavy Industries (MHI) has 3,521 staffs at Kobe Factory mainly for nuclear power plants manufacturing (MHI 2018). Kansai Electric Power Company (KEPCO) has around 1,300 staffs at Mihama Nuclear Power Station, and some of Mihama staffs are dispatched from supporting companies such as MHI (KEPCO 2018).

*Average annual salaries (JP Yen): MHI (8,429,198) and KEPCO (7,577,048). The higher salaries in contrast to national average (4,25,000) are expected to have much economic impacts.

*Emissions (g- CO₂/KWh; life cycle): coal-fired 943, photovoltaic 38, nuclear 20 etc. (FEPC).

world, unit amount of CO₂ emissions per KWh in each power source,

(3) Energy security: self-sufficiency ratio of energy in Japan and the OECD countries

●Sources (summary):

(1) International: European Commission, IAEA, World Nuclear Association;

(2) Domestic: government (Ministry of Environment, Agency for Natural Resources and Energy), companies (TEPCO: Tokyo Electric Power Company, Mitsubishi Heavy Industries), news media (NHK: Nippon Hoso Kyokai - Japan Broadcasting Corporation, Nikkei Inc.).

●Notice to students: In the syllabus and classes, the author ensured the following:

(1) to welcome any opinion as long as it is clear and constructive; and

(2) to decide the scores based on logicity, expertise, legality, and creativity.

●Answering method: Through descriptive answers. The paper size is B-4 and double-sided.

●Reference point: March 11, 2011 when the working of every domestic nuclear plant was temporarily stopped after the 2011 Earthquake. As an indicator, the rate of dependence on nuclear energy accounted for around 25% of the total electricity production before the 2011 Earthquake, while it currently accounts for around 2%.

●Definition for judgment: The author has set the main categories as follows: (1) Favor, (2) Oppose, and (3) No idea.

(1) Favor: Japan should maintain its dependence on nuclear energy.

However, Favor can be divided into the mid-sub categories as follows:

(A) Expand: the rate of the dependence should be expanded to more than 25%.

(B) Maintain: the rate should be maintained at around 25%.

(C) Decrease: the rate should be decreased to less than 25%,

(α) and the dependence should be kept within the range of 1–24% at the maximum in the future.

(β) and the dependence should be 0% in the future when alternative energy sources are guaranteed.

(2) Oppose: Japan should immediately and completely stop the dependence by shutting down nuclear power plants in operation and totally abolishing the plants forever.

(3) No idea: Typical answers are “I have no idea. I cannot decide it” or “I belong to a neutral party.”

●Advantages of the survey: Unlike the conventional opinion polls such as Gallup (2016) and JAERO (2018), the students tend to be well-informed in the lectures and answer seriously to secure better academic records.

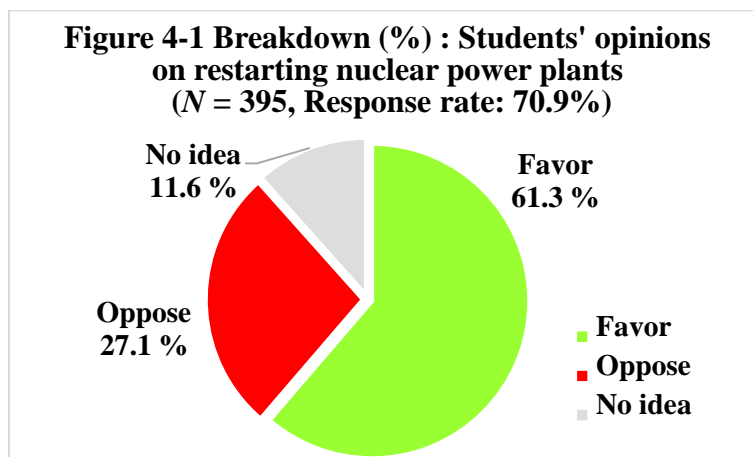
4 Results

4.1 Verification

Following the Methods, the author has already conducted three statistical verifications under the following conditions:

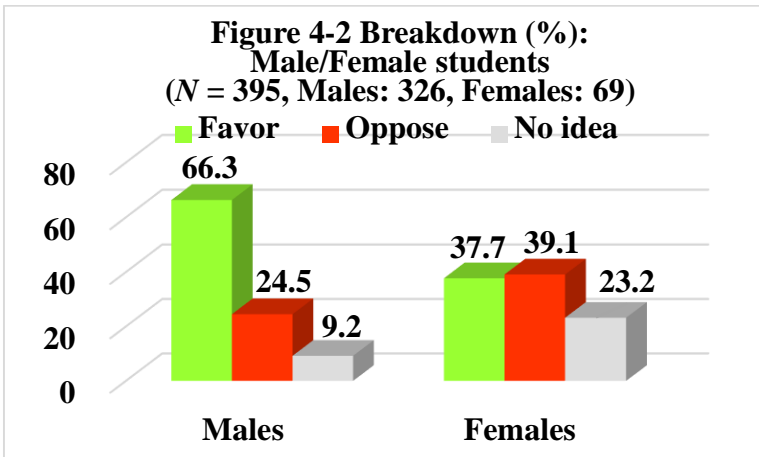
- Number of the answers: 395 out of the registered 557 students.
- Response rate: 70.9%⁵.
- Composition ratio of male/female in the 395 answers:
Male 82.5% ($N = 326$); Female 17.5% ($N = 69$).

First, Figure 4-1 (re-posted of Figure 1-1) illustrates the total results of the 4 courses. It shows that 61.3% of the students “Favor” restarting the nuclear power plants in Japan while “Oppose” accounts for 27.1% and “No idea” for 11.6%. Even though this result was adjusted to eliminate the gender-based differences in the composition ratio as if the number of both genders is 50:50, then “Favor” would be 51.9%, “Oppose” 31.9%, and “No idea” 16.2%.



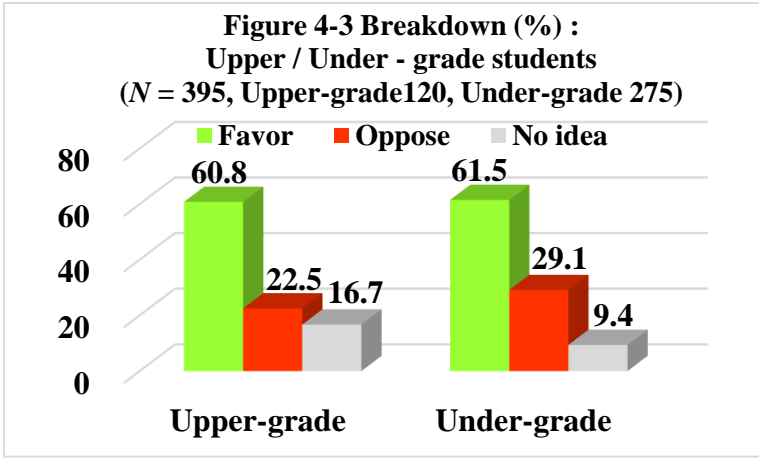
Second, Figure 4-2 also shows that the difference between male and female in the total results of 4 courses. “Oppose” is predominant among females: the rate of “Oppose” (39.1%) is higher than that of “Favor” (37.7%).

⁵ The rest of 29.1% includes dropouts from the courses or the University during the terms.



(Response rate: 70.9%)

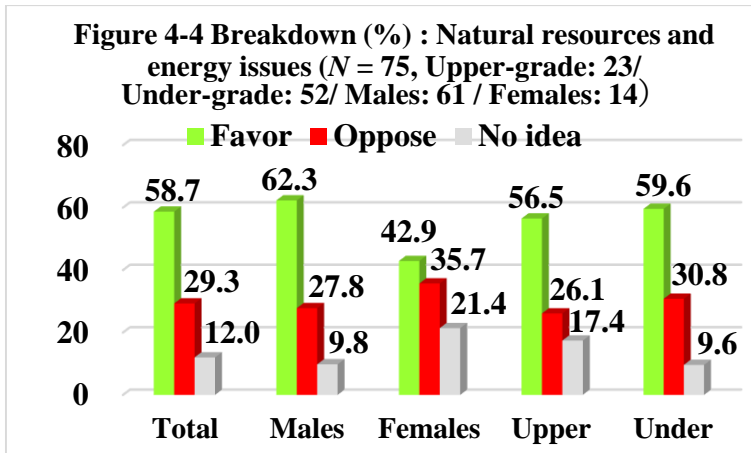
Third, Figure 4-3 also depicts the difference between upper-grade (juniors and seniors) and under-grade students (freshmen and sophomores) in the total results of 4 courses. The rates of “Oppose” decrease and “No idea” increase among upper-grade students. “Oppose” accounts for 29.1% among under-grade students while 22.5 among upper-grade ones. And “No idea” accounts for 9.4% among under-grade while 16.7% among upper-grade students.



(Response rate: 70.9%)

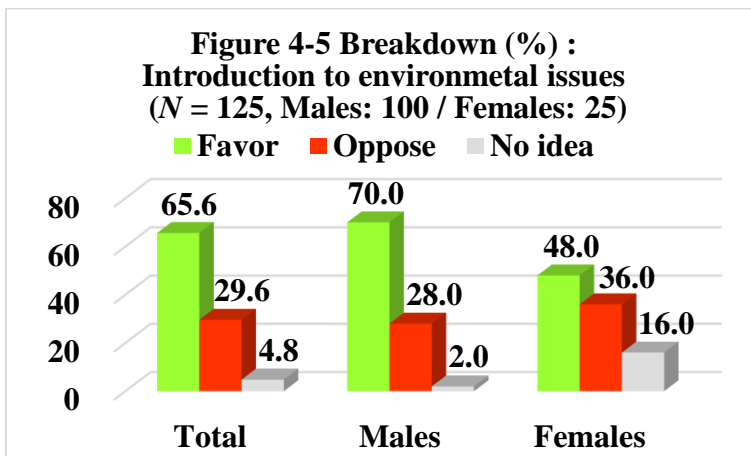
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Figure 4-4 illustrates the result of “Natural resources and energy issues,” a basic course. Of those that oppose a nuclear energy restart, 35.7% are female and 27.8% are male. The rates of “Oppose” decrease from 30.8% among under-grade students to 26.1% among upper-grade students, and “No idea” increases from 9.6% among under-grade to 17.4% among upper-grade students.



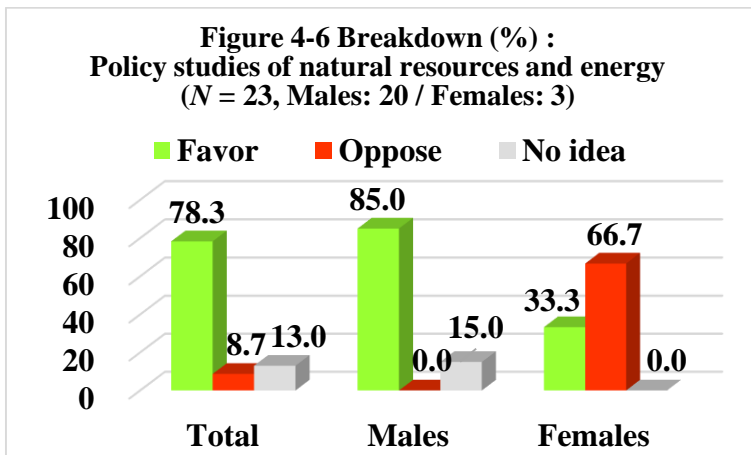
(Response rate: 64.1% of 117 registered students. Rounded)

Figure 4-5 shows the result of “Introduction to environmental issues,” a basic course only for freshmen. Female students “Oppose” by 36.0% while males do by 28.0%.



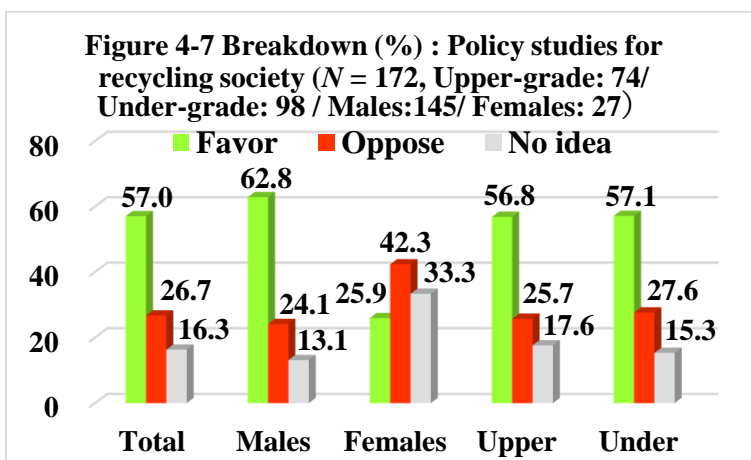
(Response rate: 73.1% out of 171 registered)

Figure 4-6 depicts the result of “Policy studies of natural resources and energy,” an advanced course, only for upper-grade students. “Favor” accounts for 85.0% among male students while “Oppose” for 66.7% among female students.



(Response rate: 51.1% out of 45 registered students)

Figure 4-7 shows the results from students of “Policy studies for recycling society,” an advanced course for sophomores, juniors, and seniors. Of those that oppose a nuclear energy restart, 42.3% are female and 24.1% are male. The rates of “Oppose” decrease from 27.6% among under-grade students to 25.7% among upper-grade students, and “No idea” increases from 15.3% among under-grade to 17.6% among upper-grade students.



(Response rate: 76.8% of 224 registered students. Rounded)

The results illustrated in Figures 4-1– 4-7 reveal three findings. First, 61.3% of the students “Favor” restarting the nuclear power plants while 27.1% “Oppose” and 11.6% have “No idea.” Even though this result was adjusted to eliminate the gender-based differences in the composition ratio, then “Favor” would be 51.9%, “Oppose” 31.9%, and “No idea” 16.2%.

Second, “Oppose” is the predominant answer among female students; i.e., the rate of “Oppose” (39.1%) is higher than that of “Favor” (37.7%).

Third, the rates of “Oppose” decrease and “No idea” increase among upper-grade students. As shown in Figure 4-3, “Oppose” accounts for 29.1% among under-grade students and 22.5% among upper-grade ones, and “No idea” accounts for 9.4% among under-grade and 16.7% among upper-grade students.

4.2 Background Factors

This section focuses on the reasons to choose “Favor,” “Oppose,” or “No idea.” First, all the students in “Favor” emphasized economic and employment impacts of restarting. There are no nuclear plants in Hiroshima City and Hiroshima Prefecture, but Chugoku Electric Company and its subsidiaries (regional major players in the energy sector) have their headquarters in Hiroshima City; in addition, many of the students hope to work or already work for these companies. Moreover, Chugoku Electric owns nuclear power plants in Shimane Prefecture, which is located north of Hiroshima Prefecture and also plans construction of nuclear power stations in Yamaguchi Prefecture, west of Hiroshima. This scenario explains why students in the author’s courses are faced with the question of whether or not Japan should restart domestic nuclear power plants.

A sophomore female student, for example, answered “We, college students, think highly of employment opportunities. The stopping of nuclear power stations may have disadvantages to the local economy. We are hoping for restarting.” Another sophomore male student replied “We have to admit restarting until we have enough renewable energy sources that can replace nuclear power.” In addition, a junior female student said “We have to depend on nuclear energy because the electricity production cost of nuclear energy is cheaper than those of renewable energies.”

On the other hand, students that “Oppose” were mainly concerned about radioactive contamination, referring to the difficulty of containing radioactive waste, to the effects on the unborn, and to other potential risks, especially given Japan’s frequent seismicity. A female student in the first year, for example, expressed her anxiety: It seems to be very difficult to relieve concern of radioactive contamination once people like Fukushima citizens suffer from great damages by nuclear accidents.” A junior female student answered “I am sure that citizens in Hiroshima City are encouraged by watching demonstrators who are marching on the street while insisting on “Oppose” the restarting nuclear plants in Igata City, Ehime Prefecture, which is located south to Hiroshima⁶.”

Moreover, students who chose “No idea” tended to admit their difficulty to decide. A freshman responded, “I cannot make up my mind because I am convinced by both opinions of “Favor” and “Oppose.” However, I have to decide before my graduation since I have joined the faculty of the

⁶ For further information and the picture, see Mainichi Newspapers (2016).

Environment Studies by my own decision.” A junior female student replied “I had been taught in Hiroshima City that nuclear energy should be banned totally and I had no chance to learn the advantages of nuclear energy. But once I have come to know that advantages, we should think it over whether or not to admit restarting.”

Therefore, as the fourth finding, it is safe to say that the main reason for being in “Favor” is the economic and employment impacts of the restarting. It is also evident that the issue of radioactive contamination plays an important role in choosing “Oppose.” Then, the students who selected “no idea” tended to confess their difficulty in deciding.

5 Concluding Remarks

Some topics and approaches remain to be explored. First, it is useful to compare the results obtained in Hiroshima with those in other regions in order to verify the universality or singularity of the results. Second, it is also worth researching whether or not students’ opinions change over time by surveying students as they progress from the junior to the senior grades. Third, more sophisticated statistical analyses are required to strengthen the validity and value of this research.

In addition to the three statistical verifications and background factors in the Results, the author would like to focus on the fifth point as suggestion. The results indicate that students tend to express their opinions honestly and seriously under some devised methods and conditions once they are free from being forced to accept the opinions of coercive professors.

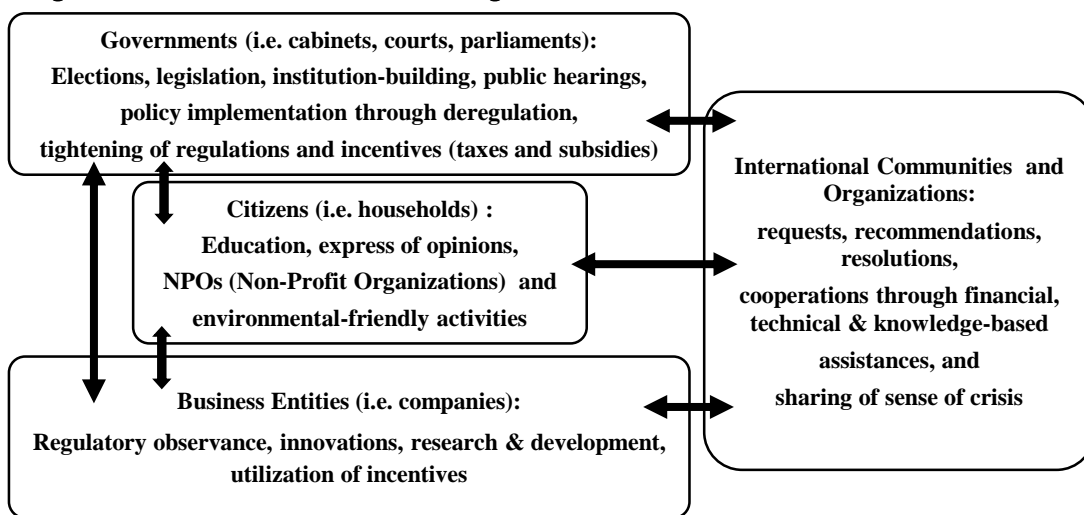
As the Overview shows, many students in Hiroshima refrain from honestly expressing their opinions, mainly in obedience to coercive teachers across schools and universities. Actually, the author repeatedly listened to complaints by students in authors courses. Those students have to follow some professors who are totally against nuclear energy lest that they should fail in the examinations even though those students are in favor of peaceful use of nuclear energy; the teachers’ coercion and the students’ self-control in order to achieve better academic grades could deter the development of students’ personality along with electoral democracy, and consequently hinder the efforts toward establishing a sustainable society.

Irrespective of the fatal risks, the restarting domestic nuclear power stations, as the Overview shows, is expected to play an important role in concurrently achieving domestic and global targets. Since deciding what is important and what is not has been difficult for economic actors of the Government, companies, educational institutes, and citizens of Japan, it could contribute to fulfilment of social justice and solidarity for sustainable society defined in the Overview to make efforts to find a

solution or solutions on this matter cooperatively and interactively within economic actors like epistemic communities, as Figure 5-1 shows. Freedom of expression in classrooms, then, could be the first step for the efforts.

Therefore, the author suggests that freedom of expression should be assured in classrooms: professors as facilitators of discussion should let the students decide the important challenges in the energy and environment sectors in order to develop students' personality and electoral democracy toward establishing a sustainable society.

Figure 5-1 Interactive actions among economic actors⁷



References

FEPC (Federation of Electricity Power Companies of Japan)

<https://www.fepc.or.jp/theme/energymix/content3.html> (Last access: 2019.3.17)

Gallup (2016) <https://news.gallup.com/poll/190064/first-time-majority-oppose-nuclear-energy.aspx> (Last access: 2018.11.11).

IAEA (2013-2018) *Nuclear power Reactors in the World*, 2013-2018 editions.

JAERO (Japan Atomic Energy Relations Organization) (2018) *2017 Annual Survey of Nuclear Use*.

KEPCO (Kansai Electric Power Company) (2018) *Annual Report 2018*.

Mainichi Newspapers (2016) <https://mainichi.jp/articles/20160311/k00/00e/040/202000c>, (Last access: 2019. 2.28).

Mainichi Newspapers (2017) <https://mainichi.jp/articles/20170313/k00/00m/010/101000c>, (Last access: 2019.2.28).

METI (Ministry of Economy, Trade and Industries) (2015) <https://www.enecho.meti.go.jp/>

⁷ For further information on Figure 5-1, see Tsujimoto (the author) (2018a).

committee/council/basic_policy_subcommittee/mitoshi/cost_wg/pdf/cost_wg_02.pdf

(Last access: 2019. 3.17).

Mitsubishi Heavy Industries (2018) *Annual Report 2018*.

New York Times (2016), <https://www.nytimes.com/2016/05/28/world/asia/text-of-president-obamas-speech-in-hiroshima-japan.html> (Last Access: 2018.11.11).

Tsujimoto, M.; Economic Growth and Air Pollution in the Persian (Arabian) Gulf States
Environmental Kuznets Curve Hypothesis, *Journal of the Japan Institute of Energy*, 97 (2018a).

Tsujimoto, M.; A Study on the Relation between Petroleum Price and CO₂ Emissions: for a
sustainable society, *Journal of Energy and Environmental Education*, 13 (2018b).

United Nations: <https://www.un.org/sustainabledevelopment/sustainable-development-goals>
(Last access: 2019.3.3).