

Analyzing Anti-nuclear Public Opinion in Taiwan after Japan 311 Earthquake

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Abstract

Japan 311 earthquake/tsunami and the following nuclear disaster in Fukushima create a strong anti-nuclear public opinion in Taiwan. Thus, the government was forced to seal Taiwan's fourth nuclear power plant at Dragon Gate, wavering its final decision. Nonetheless, the immediate damage caused by the nuclear disaster is far less than earthquake/tsunami. Why should people be scared by the nuclear disaster rather than the huge destructiveness of earthquake/tsunami? Indeed, the real danger after a nuclear disaster is the long-term health risks caused by radiation, but the health risks of unhealthy diet and lifestyle are actually far greater than those from radiation. Since people can accept unhealthy diet and lifestyle, why cannot they accept nuclear power plant? Moreover, the climax of anti-nuclear public opinion in Taiwan was not reached at the immediate aftermath of 2011 3/11 earthquake/tsunami but three years later in 2014. Why was it? This article addresses all these puzzles and argues that anti-nuclear public opinion in Taiwan is the product of lack of knowledge and political manipulation. With more information and without political ideology, the anti-nuclear public opinion in Taiwan will be changed. This argument is later confirmed by the internet questionnaire survey.

Keywords: public opinion, nuclear disaster, natural disaster, political manipulation

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Introduction

On March 11, 2011, a 9.0 magnitude earthquake in North-east Pacific Ocean led a huge tsunami up to 40.1 meters high smashed Japan. As a result, one of Fukushima nuclear power plant's nuclear reactor was damaged, leading the leakage of radioactive substances. (Japan fire Department General Services Administration 2011). In contrast to the other two major nuclear disasters in the history, 1979 US Three Mile Island nuclear disaster and 1986 Chernobyl nuclear disaster in Ukraine, which were caused by errors of operators and improper design, Fukushima nuclear disaster was caused by gigantic natural disaster. Even a well designed and operated nuclear power plant are thought unable to withstand the power of nature, although reports afterward suggest that poor emergency response procedures are the real cause of Fukushima nuclear disaster. Thus, after Fukushima nuclear disaster, anti-nuclear movements raised around the globe, and Taiwanese anti-nuclear protesters eventually formed an overwhelming public pressure that forced the government to seal Taiwan's fourth nuclear power plant at Dragon Gate, wavering its final decision.

However, the immediate casualties caused by the Fukushima nuclear disaster were far less than that of 311 earthquake/tsunami (about 20,000 victims) (Central News Agency 2014). Why should the Taiwanese public be scared by nuclear disaster rather than earthquake and tsunami? Since the earthquake and tsunami are the main cause of the casualties, Taiwanese public should focus on how to evacuate people from low-lying coastal areas, strengthen the seawall to withstand tsunamis, and strengthen the structural design of civilian buildings. Indeed, the real danger after a nuclear disaster is the long-term health risks caused by radiation, but the health risks of harmful diet and lifestyle are actually far greater than those from radiation. High-fat, high-sugar, high-salt, high-calorie, and high-protein diet; smoking, drinking, staying up all night and lack of exercise, all these are harmful and led to cancer, cardiovascular diseases, cerebrovascular diseases and diabetes, which are the main cause of death in modern society (Zhang & Lin 2007). Thousands of Taiwanese die from the diseases mentioned above every year. Since Taiwanese people can accept unhealthy diet and lifestyle, why cannot they accept nuclear power plant? Moreover, the climax of Taiwanese anti-nuclear public opinion was not reached at the immediate aftermath of 311 earthquake/tsunami. After Fukushima nuclear disaster, Taiwan did not announced a complete shutdown of nuclear power plant like Japan and Germany. Rather, Taiwanese anti-nuclear movement suddenly raised three

years later in 2014, in conjunction with the large-scale pro-independence student movement against the Cross-Strait Services Trade Agreements. Former chairman of Taiwan's pro-independence Democratic Progressive Party (DPP), Mr. Lin Yi-hsiung, also announced hunger strike to press his anti-nuclear agenda at this moment. Why was it? Why did not he take this action three years earlier?

This article addresses all these puzzles and argues that, Taiwanese anti-nuclear public opinion is the product of unknowing and political manipulation. With more information and without political ideology, Taiwanese anti-nuclear public opinion will change. This argument is confirmed by the internet questionnaire survey of this article. After obtaining more information, the proportion of respondents who hold an anti-nuclear position dramatically dropped from 50% to only 10%, and, as anticipated, these diehard Taiwanese anti-nuclear activists have a strong pro-independence ideology.

1. Literature Review

According the literature up to date, we can classify two main reasons behind anti-nuclear public opinion: the first, the impact of major nuclear disasters, and the second, 'Not in My Back Yard' (NIMBY) mindset.

Regarding the impact of major nuclear disasters, there are considerable studies suggested that, when major nuclear disasters like Three Mile Island and Chernobyl occurred, anti-nuclear public opinion gained momentum. A study by Visschers and Siegrist (2012) found, after the Fukushima nuclear disaster, Swedish public is more aware of the possible danger of nuclear power plant, and their trust on nuclear power decreased (Liang 2014: 75). Another study by Slovic and Peters (2006) also found, after major nuclear disasters, the public have more concern about the dangers of nuclear power (Liang 2014: 51). Another Study by Irwin, Allan and Welsh (2000) also found, after the nuclear explosion of Hiroshima and Nagasaki in War World II, the general public got a strong impression of nuclear weapon's destructiveness and thus hold a negative attitude toward nuclear power (Liang 2014: 47–48). Adam and Van Loon (2000) also suggested, through the reports of nuclear-disaster events like Chernobyl, the general public tended to magnify the danger of nuclear power plants (Liang 2014: 18). Studies done by Jian He-lin (2013), Lai Yu-song (2013) and others also have similar findings. Nonetheless, the impact of major nuclear disasters does not tell the whole story and is logically flawed. After major aviation, maritime, and traffic accidents,

people do not give up travelling. Then, why should people want to give up nuclear power after major nuclear disasters?

The 'NIMBY' mindset is that when there is an unpopular public facility (like refineries, electricity substations, mobile phone base stations, graveyard, sewage treatment plants, temples, towers and garbage incineration plants, etc) located in some people's residential area, they generally want that facility relocated to other place. This mindset applies to nuclear-related facilities. For example, Taitung anti-nuclear waste demonstration is held to protest the Taitung nuclear waste storage site over the protester's residential area (Liang & Lee 2014: 428–431). Another study done by Chong Qiu-yuan and Tang Jing-ping also found that people tended to reject nuclear facilities in their neighbourhood (2014: 1–3). Studies by Cai Xuan-ting (2010: 79–82), Su Xing-hui and Yang Zong-xian (2011: 61–63), Chen Wang-kun, Lin Wen-yin and Lin Chung-chua (2011: 35–38), Lee Wing-chin (1998: 33–44) all have similar findings as well. Still, the NIMBY mindset is not sufficient in explaining the anti-nuclear public opinion. None-nuclear unpopular public facilities generate the 'NIMBY' mindset among the local resident, but this mindset does not cause a nationwide opposition to these facilities. Why should nuclear-related facilities be the only one to reject not only by the locals but also the entire general public?

Given that the impact of nuclear disasters and the NIMBY mindset cannot fully explain why general public tend to treat nuclear-related issues specially, another explanation, incomplete information, is more convincing. Study by Su Xiao-chen, Wu Ching-li, Liao Yan-jie, and Tsao Chen (2014) argued that, nuclear power can be classified as a 'hard' issue, which requires a lot of efforts to fully understand. Unfortunately, people do not take the initiative to obtain information to make their judgment, and thus their attitude toward nuclear power, in fact, is affected by the brief information they have. Polls can thus be manipulated by different narrative of the questionnaire to produce specific results. The study found that, if people are asked directly: 'Do you support the construction of Taiwan's fourth nuclear power plant?' about 70% of respondents answered 'NO'. However, if people are told: 'If Taiwan's fourth nuclear power plant is dropped, electricity price will rise by five percent, do you support the construction of that nuclear power plant?' or 'If Taiwan's fourth nuclear power plant is certificated to meet international nuclear safety standards by foreign experts, do you support the construction of that nuclear power plant?' Only 40% and 50% of respondents still answered 'NO' (2014: 75–96). Jin Ling-ling's study also have similar findings. Given the Government's security guarantee and enough compensation for local people, the people of Daren Township did not oppose a nuclear waste storage located in their township (2012: 1–39). Incomplete information

seem to explain the anti-nuclear public opinion, but Su, Wu, Liao, and Tsao's studies only offers two more information; Jin's research only applied to residents of a specific township. If more information are provided; and wider range of people are surveyed, can a study get the same finding? This needs further validations.

Yang Shih-yueh's study (2014) offered clues for further information about nuclear power. Yang's study summarized anti-nuclear arguments into three categories: natural disasters caused nuclear disasters, health risks of radiation, and high costs of nuclear power. However, the danger of nuclear power is much less than the danger of daily life. Statistics show the casualties caused by nuclear disasters are far fewer than natural disasters; the health risks of radioactive contamination are in fact trivial compared to unhealthy diet of high-fat, high-salt, high-sugar, high-calorie, and high-protein, and unhealthy lifestyle of smoking, drinking alcohol; nuclear power is much cheaper than any other way of power generation even the cost of waste management is included. In addition, renewable energy is poor in efficiency and cannot provide stable power generation. Thermal power-based electricity is the only alternative to nuclear power in this regard but causes serious air pollution. The combination of renewable energy and thermal power is more polluting and expensive, producing more diseases, crimes, and suicides. Yang therefore argued that, nuclear power is not particularly dangerous, rather, the risk of nuclear power is deliberately highlighted (2014: 111–126). Yang's study did provide clues, but whether these extra information can change people's mind still requires further surveys.

In addition, Yang's study also suggested why the risk of nuclear power is deliberately highlighted in Taiwan? Political ideology is an important factor (2014: 125–126). For example, in 2014, pro-Taiwan independent DPP former chairman, Lin Yi-hsiung, took the pro-independent student movement protesting Cross-Strait Service Trade Agreement as his platform to announce hunger strike against nuclear power. Cross-Strait Service Trade Agreement is actually an issue irrelevant to nuclear power, but Lin Yi-hsiung succeed in directing these protesters to support his anti-nuclear agenda because they have one thing in common: pro-independent ideology. In this regard, Tian Li and Yan Gui-lan's study also have similar finding. Anti-nuclear groups seek other social movements and other political forces for aid to achieve their own anti-nuclear purposes (2014: 15–16). He Ming-xiu's study also show's that in 2002, DPP failed to abolish Taiwan's fourth nuclear power plants because of their poor strategy, poor timing, and poor social mobilization (2002: 86–137). In other words, the anti-nuclear opinion cannot be free from political manipulation, the resources availability of social movements, and log-rolling of political interests of different groups (He 2003: 1–4). Wang Zhen-huan's study had similar findings as

well (1989: 71-108). Given the aforementioned studies, a hypothesis can be reached: Taiwanese people with strong pro-independent ideology will be the diehard anti-nuclear activists. They will discard realities and stick to their original anti-nuclear position anyway. However, this hypothesis still requires an empirical test.

2. Research Design: Structure of Questionnaire

From the literature review above, the provision of information is the key to understand Taiwan's anti-nuclear public opinions, and this notion leads to the hypothesis of this study: The lack of nuclear related information is the main reason of Taiwan's anti-nuclear public opinion. With more information and without the political ideology, Taiwan's anti-nuclear public opinion will change. The existing literature have provided clues but yet been tested. Therefore, based on these clues and information, this study forms a questionnaire by gathering further information and then distributes this questionnaire through electronic way to verify the hypothesis of this study.

In accordance with the hypothesis of this study, the questionnaire starts with the question asking the respondents' positions on nuclear issues. The continuation of the fourth nuclear plant is to be decided through a referendum, thus, the questions are designed based on this policy choice.

2.1. Questionnaire Section 1

The purpose of the first section of the questionnaire is to verify once again the finding of existing studies: whether the additional information of security guarantees and price rise affects respondents' positions on nuclear power.

1. What is your position on the sealed fourth nuclear power plant?

(A) Abandon the construction and rebuild it into a non-nuclear power plant (B) Complete the construction and then supply power.

Respondents who chose B will end the questionnaire; who chose A will continue the questionnaire.

2. If the sealed fourth nuclear power plant can pass all the security check by international nuclear authority, what is your position on the power plant?

(A) Abandon the construction and rebuild it into a non-nuclear power plant (B) Complete the construction and then supply power.

Respondents who chose B will end the questionnaire; who chose A will continue the questionnaire.

3. If the sealed fourth nuclear power plant can pass all the security check by international nuclear authority but the government still chooses to abandon it or rebuild it into non-nuclear power plant, then the electricity price will be increased by 15%. What is your position on the sealed fourth nuclear power plant?

(A) Abandon the construction and rebuild it into a non-nuclear power plant (B) Complete the construction and then supply power.

Respondents who chose B will end the questionnaire; who chose A will continue the questionnaire.

2.2. Questionnaire Section 2

The next section of the questionnaire is formed based on the relevant open source statistics which show that the destructiveness of natural disasters is far greater than that of nuclear disasters. If the hypothesis of this article is valid, after filling out this section of questions, there will be respondents change their position to favour nuclear power.

1. Do you know, until now, how many nuclear disasters have occurred?

(A) More than 100 (B) More than 50 (C) More than 10 (D) More than 5 (E) Less than 5

2. There are only three nuclear disaster, Three Miles Island (1979), Chernobyl (1986), and Fukushima (2011), in the history (Yong Zhiyong, He Qiying, 2012: 123). The nuclear disaster has occurred because of the earthquake, and in the past 20 years there are at least 6 major earthquakes, including Los Angeles earthquake (1994) Taiwan's 921 Ji-ji earthquake (1999), Japan's Hanshin earthquake (1995), Japan's 311 earthquakes (2011), Indonesia's tsunami (2004), Haiti earthquake (2010). How many people died in these natural disasters?

(A) Less than 100 (B) Less than 1000 (C) Less than 10,000 (D) Less than 100,000 (E) More than 100,000 people.

3. Over 550,000 people died in these natural disasters mentioned above (USGS 2010, USGS 2004, Harada et al. 2012, General Affairs Provincial Fire department

2008, National Fire Agency Accounting Office 2011, NISSE 2005, World Health Organization 2013: 66, NRC 2013). Do you know how many people died in Japan 311 earthquake/tsunami?

(A) At least 15,000 (B) At least 10,000 (C) At least 5000 (D) Less than 5000 (E) Not Sure.

4. There are about 15,000 died in the 311 earthquake/tsunami (Central News Agency 2014). Do you know how many people died directly because of the radiation in Fukushima nuclear disaster?

(A) At least 15,000 (B) At least 10,000 (C) At least 5000 (D) Less than 5000 (E) Not Sure.

5. Until today, No people died directly because of the radiation in Fukushima nuclear disaster (Central News Agency 2014) and neither in Three Miles Island nuclear disaster. The only nuclear disaster that actually cause casualties is Chernobyl nuclear disaster. Do you know how many people died directly because of the radiation in this event?

(A) At least 15,000 (B) At least 10,000 (C) At least 5000 (D) Less than 5000 (E) Not Sure.

6. Only 47 people died directly because of the radiation in the Chernobyl nuclear disaster (World Health Organization 2011: 99). Do you know if the same level of tsunami that causes the Fukushima nuclear disaster plant hits Taiwan, which part of Taiwan will suffer mass casualties?

(A) North shore of New Taipei City (B) North shore of Keelung City (C) North shore of Yilan County (D) All of the areas mentioned above (E) Not Sure.

7. North shores of New Taipei City, Keelung City, and Yilan County will be the major areas affected if the tsunami hits, and there will be hundreds of thousand casualties. If the proposed fourth nuclear power plant hit by an earthquake from the directions from either south-west, south or south-east, which is powerful enough to destroy the power plant, buildings in densely populated metropolis such as New Taipei City and Taipei City will collapse, hundreds of thousands or even millions people will become victims eventually. In such case, assuming that Taiwan's fourth nuclear plant passes all the security inspection of international nuclear safety authority and can also avoid the rise of electricity price, what is your position on that power plant?

(A) Abandon the construction and rebuild it into a non-nuclear power plant (B) Complete the construction and then supply power.

Respondents who chose B will end the questionnaire; who chose A will continue the questionnaire.

2.3. Questionnaire Section 3

The next section of questionnaire is formed through supplementary information from the media and official statistics to illustrate that unhealthy diet and lifestyle are far more dangerous than radiation. If the hypothesis of this article is valid, after filling out this section of questions, the respondents will change their position to favour nuclear power.

1. After a natural disaster, residents in the direct vicinity will immediately die from natural disaster. However, in the case of a nuclear disaster caused by natural disasters, after the immediate event, there will be radiation leaks which have long-term health concerns. In addition, the radiation spreads up to hundred kilometres. Some people say that if a nuclear disaster happens in Taiwan, the entire Taiwan will be destroyed and become uninhabitable forever. In this regards, do you know after atomic bombs dropped on Hiroshima and Nagasaki, what is the current status of these two cities?

(A) Abandoned and restricted to enter (B) Abandoned but permitted to enter (C) Sparsely populated (D) Became a small town with population less than 100 thousand people. (E) Not Sure.

2. A few years after the atomic bombs dropped in Hiroshima and Nagasaki, both cities started to rebuild, and nowadays, the two cities' population are one million and four hundred thousand respectively. Do you know, according to World Health Organization (WHO), to what extent the death rate of radiation related diseases of the population who been exposed to radiation increased after the Chernobyl nuclear disaster?

(A). Over 50% (B). Over 25% (C). Over 10% (D) Over 5% (E) Not Sure.

3. According to WHO, after Chernobyl nuclear disaster, the death rate of radiation related diseases of the population who been exposed to radiation only increased by 1% (World Health Organization 2011: 98-108). Do you frequently eat fried food, such as fried ribs, fried chicken, potato chips, French fries etc.?

(A) Almost every day (B) Three times per week (C) One time per week (D) One time every two weeks (E) One time per month (F) Almost none.

4. Do you prefer meat diet?

(A) Yes, prefer meats over fruits and vegetables. (B) No, eat equal amounts of meats, vegetables and fruits (C) No, prefer fruits and vegetables over meats (D) No, occasionally have meat diet (E) No, I am a vegetarian.

5. Do you eat grilled food? Including grilled meats or vegetables and etc.?

(A) Almost every day (B) Three times per week (C) One time per week (D) One time every two weeks (E) One time per month (F) Almost none.

6. Do you prefer more seasoned or saltier flavours? Like adding salt or soy sauce in your meal, or prefer preserved food or instant food?

(A) Almost every day (B) Three times per week (C) One time per week (D) One time every two weeks (E) One time per month (F) Almost none.

7. Do you frequently consume sweet foods such as soft drinks, bubble tea, cookies, candies, cakes and chocolate etc.?

(A) Almost every day (B) Three times per week (C) One time per week (D) One time every two weeks (E) One time per month (F) Almost none.

8. Which of the following description best fit your diet and exercise habits? (Note: The exercise habit should conform to the '333 sport standard' which means at least 3 exercise sessions per week, at least 30 minutes per session and archive heartbeat of 130 pulses per minute.)

(A) Eat to over full and seldom exercise. (B) Eat to over full and always exercise. (C) Eat to full and always exercise. (D) Eat to full and seldom exercise. (E) Eat to 80% full and always exercise.

9. Do you always sleep late due to engaging in activities such as web surfing, Karaoke, night riding, parties, clubbing, etc.?

(A) Yes, always sleep late due to my leisure habits. (B) Yes, sleep late three times per week due to my leisure habits. (C) Yes, sleep late once per week due to my leisure habits. (D) Yes, sleep late once fortnightly due to my leisure habits. (E) No, always sleep early with regular hours.

10. Do you smoke?

(A) Yes, a pack of cigarette every day. (B) Yes, a pack of cigarette per week. (C) Yes, a pack of cigarette fortnightly. (D) Yes, a pack of cigarette per month. (E) Yes, but seldom smoke. (F) No, I am not a smoker.

11. Do you like alcoholic drinks?

(A) Yes, drink every day. (B) Yes, drink three times per week. (C) Yes, drink once per week. (D) Yes, drink once per month. (E) Yes, but seldom drink. (F) No, I am not a drinker.

12. Do you chew betel nut?

(A) Yes, one package almost every day. (B) Yes, one package per week (C) Yes, one package fortnightly. (D) Yes, one package per month. (E) Yes, but seldom chew. (F) No, not at all.

13. Fried foods, diet with more meats and fewer vegetables, grilled food, saltier flavours, sweets, less exercise, stay up late, tobacco, alcohol, and chewing betel

nuts are all harmful to a healthy life and easily lead to cardiovascular diseases, cerebrovascular diseases, diabetes, and various cancers. Some studies show that, a bag of McDonald's fries will increase cancer risk by 500 times (Qiu, Tsai, 2015); more meat and less vegetable diet will increase 40% chance of developing cancer (Xie 2015); people addicted to eat grilled food suffer risk of oesophageal cancer 3.4 times higher than the average (Huang, Zhou 2015); people who eat two serves of instant noodles each week for five years will suffer 1.7 times higher probability of chronic kidney disease than the average (Apple Daily 2015); people addicted to eat sweets or drink soft drinks will increase metabolism rate by 9 times (Qiu 2015), and the chances of suffering from kidney stones by 25% more than the average (You & Lin 2013); in every four person who practices high-calorie diet and fewer exercise habits, one will suffer from increased chance of fatty liver by 18 times more than average (Zhang & Huang 2014); for people who sleep late in the long term, sleep less than seven hours per night or napping over three hours during day time, the risk of osteoporosis increases by 1.68 times and 1.52 times (Apple Daily 2015); smoking, drinking, chewing betel nut habits will led to higher chance of oesophageal cancer by 4.2 times, 7.6 times, 2.3 times respectively (Huangzi Lun Zhou 2015); comparing with betel nut chewer and none chewer, chewer's the probability of oral cancer is 28 times higher than none chewer's; if combining with the habits of drinking and smoking, the probability of having oral cancer is 123 times higher than average (Shen 2014); and each 10 grams of alcohol consume will increase 4% chance of having liver cancer (Liberty times 2015).The above information can be easily found in a wide range of newspapers, magazines and web medias. Do you know how many people die a year due to the above mentioned diseases in Taiwan?

(A) At least 15,000 people. (B) At least 10,000 people. (C) At least 5000 people. (D) Less than 5000 people. (E) Not Sure.

14. There are over 80,000 Taiwanese who die due to the diseases mentioned above every year. (Directorate-General of Budget, Accounting, and Statistics, 2013: 82). Those diseases caused by unhealthy diets or life styles are the major killers to Taiwanese. The death happens every day, and this risk is much bigger than a nuclear of disaster which might happen once few decades will create. However, general public don't ask to ban or restrict the food or diet related to above diseases. Then, assuming that Taiwan's fourth nuclear plant passes all the security inspection of international nuclear safety authority and can also avoid the rise of electricity price, what is your position on that power plant?

(A) Abandon the construction and rebuild it into a non-nuclear power plant (B) Complete the construction and then supply power.

Respondents who chose B will end the questionnaire; who chose A will continue the questionnaire.

2.4. Questionnaire Section 4

The fourth section of questionnaire is formed through the information from various international organizations and official statistics to demonstrate other means to generate electricity will in fact create more pollution and death than nuclear energy. If the hypothesis of this article is valid, after filling out this section of questions, there will be respondents change their position to favour nuclear power.

1. Though nuclear power plant will generate nuclear waste, there is no other pollution created during the function of nuclear power plant. However, decommission of nuclear power plant and disposal of nuclear waste is costly. Developed nation such as USA, Germany, Japan and France use nuclear plant to generate electricity. Do you know how much the average cost is when adopting nuclear power, according to International Energy Agency (IEA) and Organization for Economic Co-operation and Development (OECD)/Nuclear Energy Agency (NEA) when including the cost of nuclear power plant's decommission and disposal of nuclear wastes?

(A) \$200 US dollars per megawatt-hour. (B) \$100 US dollars per megawatt-hour. (C) \$50 US dollars per megawatt-hour. (D) \$10 US dollars per megawatt-hour. (E) Not Sure.

2. The average cost of nuclear power is around \$49 US dollars per megawatt-hour IEA, NEA 2010. Wind power is common in renewable energy and can be categorised as onshore and offshore types. Do you know how much the average cost is when adopting onshore wind power?

(A) \$200 US dollars per megawatt-hour. (B) \$100 US dollars per megawatt-hour. (C) \$50 US dollars per megawatt-hour. (D) \$10 US dollars per megawatt-hour. (E) Not Sure.

3. The average cost of onshore wind power is around \$49 US dollars per megawatt-hour (IEA, NEA 2010). Do you know how much the average cost is when adopting offshore wind power?

(A) \$200 US dollars per megawatt-hour. (B) \$100 US dollars per megawatt-hour. (C) \$50 US dollars per megawatt-hour. (D) \$10 US dollars per megawatt-hour. (E) Not Sure.

4. The average cost of offshore wind power is around \$101 US dollars per megawatt-hour (IEA, NEA 2010). Another common renewable energy is solar power, do you know how much the average cost is when adopting solar power?

(A) \$200 US dollars per megawatt-hour. (B) \$100 US dollars per megawatt-hour. (C) \$50 US dollars per megawatt-hour. (D) \$10 US dollars per megawatt-hour. (E) Not Sure.

5. The average cost of solar power is around \$215 US dollars per megawatt-hour (IEA, NEA 2010). Wind and solar power are always effected by weather. Therefore, their electricity output is unstable and need to be used in conjunction with coal-fuel power which are the main power supply. Do you know how much the average cost is when adopting coal-fuel power?

(A) \$200 US dollars per megawatt-hour. (B) \$100 US dollars per megawatt-hour. (C) \$50 US dollars per megawatt-hour. (D) \$10 US dollars per megawatt-hour. (E) Not Sure.

6. The average cost of coal-fuel power is around \$68 US dollars per megawatt-hour (IEA, NEA 2010). Comparing with coal-fuel/renewable energy compound, nuclear power is obviously more cost-efficient. Thus, banning nuclear power will raise the electricity prices and increase the household burden and production cost in every industries. If Taiwan-made products lose their competitiveness because of their rising price, economy will suffer, and unemployment rate will rise. This will in turn cause the increase of crime and suicide rates. Do you know how many people die as the results of crime or suicide every year in Taiwan?

(A) At least 3000 people per year. (B) At least 2000 people per year. (C) At least 1000 people per year. (D) Lower than 1000 people per year. (E) Not Sure.

7. According to the Taiwan's Ministry of Health and Welfare/Department and the Police Statistical Yearbook, about 4300 people died as the results of crime or suicide in 2012. (Directorate-General of Budget, Accounting, and Statistics 2013:82), which is far greater than the casualties (including directly and indirectly) of Chernobyl nuclear disaster. In addition to the higher cost, renewable energy also brings up more pollution. Among all forms of renewable energy, the average cost of onshore wind power is lowest. Regardless unstable power transition mechanism to supplying electricity to power hungry northern part of Taiwan from the south, and whether the weather condition can fulfil the requirement of onshore wind power. Do you know what the average distance will be when setting up wind turbines if Taiwan decides to use onshore wind power to replace its existing 3 nuclear power plants?

(A) 10,000 meters per wind turbine set. (B) 5,000 meters per wind turbine set. (C) 3,000 meters per wind turbine set. (D) 2,000 meters per wind turbine set. (E) Not sure.

8. The answer is 600 meters (Taiwan Power Company 2014(1); Taiwan Power Company 2014(2); Water Resources Agency 2012), and the residents along the entire Taiwanese coastal area will be exposed to noise over to 55dB, and according to German regulations, the minimum distance of setting up wind turbines is 2000 meters. Solar power is another renewable energy, but Taiwan does not have the desert landscape to build concentrated solar power plant. Solar photovoltaic power is the only option. Assuming that the weather condition is always ideal (which is impossible), if Taiwan decides to use solar photovoltaic power to replace its existing 3 nuclear power plants, do you know how much wasted water will be produced to build the required solar power panels?

(A) 1 billion tons (B) 500 million tons (C) 100 million tons (D) Not Sure.

9. In order to supply the same amount electricity of the 3 existing nuclear power plants, around 5,144 million square meters of solar power panel are required (Taiwan Power Company 2014(2); Ministry of Economic Affairs Bureau of Energy 2015). There will be 60.2 tons of waste water for just one square meter of solar wafer (Taiwan Semiconductor Manufacturing Company 2013), so the total wasted water for 5,144 million square meters will be 3.1 billion tons, which means each Taiwanese will get 135 tons of wasted water. Since the wind and the solar plant cannot supply electricity stably, and the public opinion is against nuclear plant, leaving fuel power plants the only option to be the backbone of electricity supply. The biggest pollution of fuel power plants is air pollution, do you know how much air pollution is caused by coal-fired power plant in Taiwan?

(A) 100 million tons (B) 50 million tons (C) 3000 million tons (D) 1000 million tons (E) Not sure.

10. There are 153,000,000 tons of air pollution per year produced by the coal-fired power plant in Taiwan, which equals to 900,000 years of Taiwanese nuclear waste (Lee 2015), and each person in Taiwan share 6.65 tons of this polluted air. If we continue using coal-fuel power, wind power, and solar power, Taiwanese people will suffer noise pollution, 3.1 billion tons of waste water and one 153,000,000 tons of polluted air. Study shows that if noise pollution increased by 10 dB, the risk for high blood pressure will be increased by 14% (Cai & Qiu 2008); the PM 2.5 air pollution produced by Taichung coal-fuel power plant alone cut the whole Taiwan people life span by 15 days (Hong 2015). Air pollution triggers respiratory related diseases that kill around 5,000 people per year in Taiwan (Ministry of Health and Welfare and Statistics Department 2015), which is far greater than the people died in Chernobyl nuclear disaster. Then, assuming that Taiwan's fourth nuclear plant passes all the

security inspection of international nuclear safety authority and can also avoid the rise of electricity price, what is your position on that power plant?

(A) Abandon the construction and rebuild it into a non-nuclear power plant (B) Complete the construction and then supply power.

Respondents who chose B will end the questionnaire; who chose A will continue the questionnaire.

2.5. Questionnaire Section 5

The final section of the questionnaire is about the personal information of the respondents. If the hypothesis of this article is valid, those die-hard anti-nuclear activists will also be pro-independent ideologists. As mentioned, Taiwan's anti-nuclear movement and the pan-green political groups are closely related, and their core value is Taiwan's independence (Zheng 2011, Formosa newsletter 2015). Those who still hold an anti-nuclear attitude after filling out all four sections of questionnaire will refuse to consider themselves as Chinese, even if the concept of 'China' is cultural and historic or simply Republic of China. Their ideological preference will be evident in their answers of the three key question (question 6,7 and 8) about national identity in section 5 (the remaining questions in section 5 are to cover the three key questions to avoid alarming the respondents to disrupt the result of this survey).

1. What is your age?

(A) Less than 20 (B) 21–30 (C) 31–40 (D) 41–50 (E) 51–60 (F) More than 61

2. What is your place of birth?

(A) North(Taipei, New Taipei City, Keelung City, Ilan County, Taoyuan City, Hsinchu County and Hsinchu) (B) Central (Miaoli County, Taichung City, Taichung County, Nantou County, Changhua County, Yunlin County) (C) South (Chiayi City, Chiayi County, Tainan City, Tainan County, Kaohsiung City, Kaohsiung County, Pingtung County, Miaoli County, Taichung City, Taichung County, Nantou County, Changhua County, Yunlin County) (D) East (Yilan County, Hualien County, Taitung County) (E) Offshore Islands (Kingmen, Matsu, Penghu) (F) Other.

3. Where do you live currently?

(A) North(Taipei, New Taipei City, Keelung City, Ilan County, Taoyuan City, Hsinchu County and Hsinchu) (B) Central (Miaoli County, Taichung City, Taichung County, Nantou County, Changhua County, Yunlin County) (C) South (Chiayi City, Chiayi County, Tainan City, Tainan County, Kaohsiung City, Kaohsiung County,

Pingtung County, Miaoli County, Taichung City, Taichung County, Nantou County, Changhua County, Yunlin County) (D) East (Yilan County, Hualien County, Taitung County) (E) Offshore Islands (Kingmen, Matsu, Penghu) (F) Other

4. What are the origins of your parent (Inter-ethnic marriage can multiple choose)?

(A) Aboriginal (b) Hakka (C) Holo (D) Mainlanders (E) Other

5. What language do you speak most often?

(A) Mandarin (B) Holo (C) Hakka (D) Aboriginal (E) Other

6. What is your national identity?

(A) Chinese (B) Chinese and Taiwanese (C) Taiwanese (D) Other

7. If 'Chinese' is considered as a cultural and history concept, what is your national identity?

(A) Chinese (B) Chinese and Taiwanese (C) Taiwanese (D) Other

8. If 'China' is Republic of China (R.O.C.), what is your national identity?

(A) Chinese (B) Chinese and Taiwanese (C) Taiwanese (D) Other

9. What is your occupation?

(A) Public Service/Teacher/Soldier/Police (B) Farmer (C) Worker (D) Business (E) Service (F) Freelancer (G) Still a student.

10. What is your current income?

(A) Above 100,000 NTD (B) 50,000–100,000 NTD (C) 30,000–50,000 NTD (D) Below 30,000 NTD (E) Unstable (F) No income at all.

11. Which political party in Taiwan do you prefer?

(A) Independence Party (B) Taiwan Solidarity Union (C) Democratic Progressive Party (D) Kuomintang (E) New Party

12. Who do you vote at 1996 presidential election?

(A) Lee Teng-hui (B) Peng Ming-min (C) Lin Yang-kang (D) Others (E) None (F) Younger than 20 years old at that moment.

13. Who do you vote at 2000 presidential election?

(A) Soong Chu-yu (B) Lien Chan (C) Li Ao (D) Hsu Hsin-liang (E) Chen Shui-bian (E) None (F) Younger than 20 years old at that moment.

14. Who do you vote at 2004 presidential election?

(A) Chen Shui-bian (B) Lien Chan (C) Others (D) Younger than 20 years old at that moment.

15. Who do you vote at 2008 presidential election?

(A) Hsieh Chang-ting (B) Ma Ying-jeou (C) Others (D) None (E) Younger than 20 years old at that moment.

16. Who do you vote at 2012 presidential election?

(A) Tsai Ing-wen (B) Ma Ying-jeou (C) Soong Chu-yu (D) Others (E) None (F)

Younger than 20 years old at that moment.

17. Who do you wish to vote at 2016 presidential election?

(A) Tsai Ing-wen (B) Hung Shiu-chu (C) Yang Zhi-liang (D) Chu Li-lun. (E) Wang

Jin-pyng (F) Younger than 20 years old at that moment.

3. Questionnaire Distribution and Results: Hypothesis Verified

Given the limits of time and money, the questionnaire of discussed in this article is was distributed through google form service by posting hyperlinks on difference Facebook groups such as student unions, universities, various kinds of associations. In addition, in order to tell whether ideological distortions did exist in nuclear issue, the questionnaire is was intentionally distributed in among anti-nuclear groups or pages to attract those die-hard anti-nuclear activists to fill up the questionnaire. The research also uses the snowballing method to ask the respondents to promote the questionnaire to used his/her friend. The questionnaire was distributed in the internet from 7 pm June 4, 2015 to 3 pm June 10, 2015 (see Appendix for distribution details) and, in the end, a total of 1,267 respondents was gathered. Their answers confirmed the hypothesis of this article. After receiving more information, those who oppose nuclear power dropped from 50% to only 10%, an these die-hard anti-nuclear activists are indeed pro-independent ideologist refusing to consider themselves as Chinese, even if the concept 'China' is cultural and historic or simply Republic of China.

The result of questionnaire section 1 confirmed the findings of existing research. Without any information 612 of 1267 respondents opposes nuclear power. Provided with information about nuclear safety, 221 of this 612 changed their mind and only 391 still opposed nuclear power. Provided with information about electricity price tag, 159 of this 391 changed their mind and only 232 of this 391 still opposed nuclear power (see Table 1).

Table 1. Result of Questionnaire Section 1

Question (respondents)	Answer (respondents, %)		
Q1 (1267)	(A) 612, 48.3%		(B) 655, 51.7%
Q2 (612)	(A) 391, 63.9%		(B) 221, 36.1%
Q3 (391)	(A) 232, 59.7%	(B) 159, 40.7%	

= Hypothesis Verified

The result of questionnaire section 2 verified the hypothesis of this article. Most of the respondents did not have a correct picture of nature and nuclear disasters. After filling out section 2 of questions, they got more information and 74 of the remaining 232 respondents who still oppose changed their mind, leaving only 158 respondents still opposed nuclear power (see Table 2).

Table 2. Result of Questionnaire Section 2

Question (respondents)	Answer (respondents, %)				
	(A)	(B)	(C)	(D)	(E)
Q1 (232)	23, 9.9%	6, 2.6%	32, 13.8%	41, 17.7%	130, 56.0%
Q2 (232)	34, 14.7%	45, 19.4%	15, 6.5%	19, 8.2%	119, 51.3%
Q3 (232)	154, 66.4%	25, 10.8%	8, 3.4%	7, 3.0%	38, 16.4%
Q4 (232)	61, 26.3%	15, 6.5%	13, 5.6%	74, 31.9%	69, 29.7%
Q5 (232)	60, 25.9%	10, 4.3%	12, 5.2%	77, 33.2%	73, 31.5%
Q6 (232)	36, 15.5%	8, 3.4%	5, 2.2%	157, 67.7%	16, 11.2%
Q7 (232)	158, 68.1%	74, 31.9%	(-)	(-)	(-)

= Hypothesis Verified

The result of questionnaire section 3 also verified the hypothesis of this article. Most of the respondents did not realize that their daily life are actually more dangerous than radiation until they filled out section 3 of questions: 25 of the remaining 158 respondents who opposed nuclear power changed their mind, leaving only 133 respondents still opposing nuclear power (see Table 3).

The result of questionnaire section 4 also verified the hypothesis of this article. Most of the respondents did not know the high price and pollution of renewable energy and the necessity of using fuel power as backbone of power grid. After filling out section 4 of questions, 4 of the remaining 133 respondents who opposed changed their mind, leaving only 129 respondents still opposing nuclear power (see Table 4).

Table 3. Result of Questionnaire Section 3

Question respondents	Answer (respondents, %)					
	(A)	(B)	(C)	(D)	(E)	(F)
Q1 (158)	29, 18.4%	4, 2.5%	19, 12%	72, 45.6%	34, 21.5%	(-)
Q2 (158)	48, 30.4%	17, 10.8%	10, 6.3%	37, 23.3%	46, 29.1%	(-)
Q3 (158)	15, 9.5%	15, 9.5%	26, 16.5%	30, 19%	35, 22.2%	37, 23.4%
Q4 (158)	30, 19%	54, 34.2%	49, 31%	11, 7%	14, 8.9%	(-)
Q5 (158)	9, 5.7%	18, 11.4%	20, 12.7%	24, 15.2%	40, 25.3%	47, 29.7%
Q6 (158)	13, 8.2%	16, 10.1%	21, 13.3%	27, 17.1%	33, 20.9%	48, 30.4%
Q7 (158)	16, 10.1%	29, 18.4%	22, 13.9%	20, 12.7%	28, 17.7%	43, 27.2%
Q8 (158)	22, 13.9%	8, 5.1%	21, 13.3%	78, 49.4%	29, 18.4%	(-)
Q9 (158)	32, 20.3%	25, 15.8%	32, 20.3%	18, 11.4%	51, 32.3%	(-)
Q10 (158)	10, 6.3%	6, 3.8%	5, 3.2%	3, 1.9%	11, 7%	123, 77.8%
Q11 (158)	10, 6.3%	2, 1.3%	8, 5.1%	5, 3.2%	62, 39.2%	71, 44.9%
Q12 (158)	5, 3.2%	1, 0.6%	1, 0.6%	8, 5.1%	6, 3.8%	137, 86.7%
Q13 (158)	67, 42.4%	16, 10.1%	20, 12.7%	10, 6.3%	45, 28.5%	(-)
Q14 (158)	133, 84.2%	25, 15.8%	(-)	(-)	(-)	(-)

... = Hypothesis Verified

Table 4. Result of Questionnaire Section 4

Question (respondents)	Answer (respondents, %)				
	(A)	(B)	(C)	(D)	(E)
Q1 (133)	13, 9.8%	12, 9.0%	55, 41.4%	4, 3%	49, 36.8%
Q2 (133)	11, 8.3%	7, 5.3%	53, 39.8%	9, 6.8%	53, 39.8%
Q3 (133)	15, 11.3%	48, 36.1%	9, 6.8%	7, 5.3%	54, 40.6%
Q4 (133)	52, 39.1%	13, 9.8%	8, 6.0%	6, 4.5%	54, 40.6%
Q5 (133)	18, 13.5%	18, 13.5%	37, 27.8%	8, 6%	52, 39.1%
Q6 (133)	62, 46.6%	12, 9.0%	5, 3.8%	9, 6.8%	45, 33.8%
Q7 (133)	14, 10.5%	7, 5.3%	4, 3.0%	41, 30.8%	67, 50.4%
Q8 (133)	37, 27.8%	10, 7.5%	14, 10.5%	72, 54.1%	(-)
Q9 (133)	45, 33.8%	18, 13.5%	3, 2.3%	10, 7.5%	57, 42.5%
Q10 (133)	129, 97.0%	4, 3.0%	(-)	(-)	(-)

= Hypothesis Verified

The results of questionnaire section 5 also verified the hypothesis of this article. The remaining 129 respondents are the die-hard anti nuclear activists and are indeed pro-independence ideologists. Over 60% of them refused to consider themselves as

Chinese; still over 60% of them refused to consider themselves as Chinese even if 'China' is defined as cultural and historical. Over 70% of them refused to consider themselves as Chinese even if 'China' is defined as Republic of China (R.O.C.) (see Table 5).

Table 5. Result of Questionnaire Section 5

Question (respondents)	Answer (respondents, %)						
	(A)	(B)	(C)	(D)	(E)	(F)	(G)
Q1 (129)	16, 12.4%	35, 27.1%	35, 27.1%	21, 16.3%	19, 14.7%	3, 2.3%	(-)
Q2 (129)	35, 27.1%	67, 51.9%	16, 12.4%	4, 3.1%	4, 3.1%	3, 2.3%	(-)
Q3 (129)	41, 31.8%	63, 48.8%	18, 14.0%	0, 0%	3, 2.3%	4, 3.1%	(-)
Q4 (129)	6, 4.7%	21, 16.3%	94, 72.9%	14, 10.9%	16, 12.4%	(-)	(-)
Q5 (129)	87, 67.4%	35, 27.1%	2, 1.6%	1, 0.8%	4, 3.1%	(-)	(-)
Q6 (129)	3, 2.3%	36, 27.9%	86, 66.7%	4, 3.1%	(-)	(-)	(-)
Q7 (129)	17, 13.2%	47, 36.4%	62, 48.1%	3, 2.3%	(-)	(-)	(-)
Q8 (129)	17, 13.2%	35, 27.1%	72, 55.8%	5, 3.9%	(-)	(-)	(-)
Q9 (129)	35, 27.1%	0, 0%	18, 14%	13, 10.1%	22, 17.1%	19, 14.7%	22, 17.1
Q10 (129)	17, 13.2%	19, 14.7%	31, 24%	19, 14.7%	22, 17.1%	17, 13.2%	(-)
Q11 (129)	1, 0.8%	2, 1.6%	16, 12.4%	9, 7.0%	0, 0%	101, 78.3%	(-)
Q12 (129)	29, 22.5%	2, 1.6%	3, 2.3%	4, 3.1%	30, 23.3%	61, 47.3%	(-)
Q13 (129)	16, 12.4%	8, 6.2%	2, 1.6%	0, 0%	27, 10.9%	30, 23.3%	46, 35.7%
Q14 (129)	36, 27.9%	19, 14.7%	2, 1.6%	35, 27.1%	37, 28.7%	(-)	(-)
Q15 (129)	20, 15.5%	44, 34.1%	2, 1.6%	35, 27.1%	28, 21.7%	(-)	(-)
Q16 (129)	33, 25.6%	30, 23.3%	6, 4.7%	3, 2.3%	35, 27.1%	22, 17.1%	(-)
Q17 (129)	36, 27.9%	5, 3.9%	1, 0.8%	4, 3.1%	8, 6.2%	75, 58.1%	(-)

= Hypothesis Verified

Conclusion

After the 311 Japan earthquake/tsunami and the following Fukushima nuclear disaster, the rise of Taiwan's anti-nuclear public opinion forced the government to seal Taiwan's fourth nuclear plant. However, in fact, the immediate damage caused by the nuclear disaster is far less than the earthquake and tsunami, and the health

risks of radiation leakage are much lower than that of unhealthy diet and lifestyle. In addition, renewable energy and fuel power compound are actually more polluting and expensive than nuclear power. Moreover, the peak of anti-nuclear public opinions in Taiwan was not reach right after Fukushima nuclear disaster but three years later. This article argues that this rise of Taiwan's anti-nuclear opinions is created by the lack of information and manipulation of political ideologies. If more information is provided and political ideologies can be excluded, the Taiwanese anti-nuclear public opinions will be changed. Following survey discussed in this article, this argument is confirmed.

If no related information provided, 48.3% of the respondents opposed nuclear power; if information related to nuclear safety is provided, 36.1% of respondents who originally opposed nuclear power plant change their mind; then, if information about potential rise of electricity price is provided – 40.7% of respondents who still opposed nuclear power changed their mind. When the questionnaire provided more information regarding the relative dangers of natural disasters and nuclear disasters, another 31.9% respondents who opposed nuclear power changed their mind. When the questionnaire further provided more information regarding the risks of unhealthy diet and lifestyle which are much greater than that of radiation, leaving another 15.8% respondents who opposed nuclear power switched sides. Finally, when the questionnaire provided more information regarding the high costs and pollution of renewable power and fuel power compound, another 3% of respondents opposing nuclear power switched sides. The end result of the survey shows that, after receiving more relevant information regarding nuclear power, only about 10.1% of the respondents still held their firm position against nuclear power, and these resolute anti-nuclear respondents do not consider themselves as Chinese, even if China is defined in cultural and historical context do not or as Republic of China. This proved that they are indeed pro-independent ideologists.

This article supported the findings of existing research. Anti-nuclear public opinions are indeed produced by insufficient information and political ideologies. This reconfirmation has important policy implications. In fact, nuclear power is a more beneficial option environmentally and economically, but this optimal power failed to obtain the support from the public. The questionnaire of this article provided information through four sections of questions and successfully changed most respondents' anti-nuclear opinions. This showed that the promotion of nuclear power was far from sufficient, and incorrect information has not been clarified. The accumulation of rumours and false information finally sealed the fourth nuclear

plan, and Taiwan paid a great price for this. Thus, it is very important to provide sound education and promotion before the referendum of fourth nuclear power plant. Surely, citizens should participate directly in major policy decisions like the future of the fourth nuclear plant. However, this decision has to be made under the sufficient information rather than blind populist impulses.

This research is certainly worth extending. Although this article further validated the previous research, the distribution of the questionnaire was snowballing sampling via electronic platform. Though fast, easy, and cheap, this electronic questionnaire only gathered around 1,300 respondents to complete the survey, and was limited in respondents' region, occupation, age, and gender. In the future, a larger scale of survey is required to increase the reliability and validity of the research. In addition, through the spread of this questionnaire, respondents will obtain more truth about nuclear power and can make the right decision. Nuclear energy is actually the least harmful and most economical energy. If general public can be aware of this fact, it will resolve nuclear power plant controversy which is tangled for years in Taiwan. We shall get rid of political ideology manipulation and return to more rational and professional discussions, so that Taiwan can retain its competitiveness and sustain its development.

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