Public acceptance of nuclear power among Malaysian students

Anas Muhamad Pauzi\textsuperscript{1,}\textsuperscript{a), juniza Md Saad\textsuperscript{1}, Asyraf Arif Abu Bakar\textsuperscript{1}, Abdul Hannan Damahuri\textsuperscript{1}, Nur Syamim Mohd Syukri\textsuperscript{1}}

Nuclear Engineering & Energy Group, Institute of Sustainable Energy, Universiti Tenaga Nasional, Jalan IKRAM-UNITEN, 43000 Kajang, Selangor, Malaysia

\textsuperscript{a}anas@uniten.edu.my

Abstract. Malaysian government's aim to include nuclear energy for electricity generation has triggered various reactions from all especially the public. The objective of this study is to have a better understanding on the knowledge, sources of information of nuclear power and sources of energy chosen by Malaysian in 20 years’ time. Besides that, we want to examine the level of acceptance and perception of Malaysian towards nuclear energy and we want to identify the correlation between public perceptions with the acceptance towards nuclear power in Malaysia, and also to study the differences between perception and acceptance of nuclear power with gender and educational level. For this research methodology, the research questions are given orally or through paper-pencil and also social networking site such as Facebook or through electronic media application such as WhatsApp and Google docs. The data were analysed using a SPSS version 22.0 (Statistical Package for the Social Sciences). Results showed that more than 50% of the respondents have the knowledge of nuclear energy. A part of from that, only 39 % are confident government can afford to build NPP in Malaysia and 41 % disagree nuclear energy is the best option for future energy. From analysis using SPSS 22 we estimate negative perception will give a negative acceptance in term of support towards the use of nuclear energy in power generation in Malaysia. There are also slight correlation that the higher the level of education of Malaysian, the more negative the perception of Malaysian in accepting nuclear energy as source of power in Malaysia. Therefore in shaping a positive acceptance of NPP in Malaysia, the authorities need to educate the people with the knowledge of nuclear in order to overcome the negative perception towards nuclear power.

1. Introduction

Nuclear energy have become more popular for certain country in order to diverse its energy production. Besides, nuclear energy can be used to overcome the rising pollutions that causes by releasing carbon dioxide from the burning fossil fuel to generate electricity. Unfortunately, apart from being safe, clean and efficient source of energy, nuclear energy also been bedeviled as an extremely dangerous and highly polluted energy source among general public [1].

H. M. Visschers and L. Wallquist [2] and also the OECD [3] state that public attitudes had constantly molded the arrangement of nuclear power since the late 1960s. However, after a few nuclear accidents and growing environmental concerns regarding the safe storage of radioactive waste, these events had gradually reduced acceptance levels of nuclear power in the western world up to the
turn of the century. In the beginning of 21st century climate change had entered nuclear debate and gave an environmental advantage for nuclear technology as the acceptance level in the US and Europe showed a rise in opinion polls. Unfortunately after nuclear accident in Fukushima, general public began to be hesitant of the nuclear power. The same thing happens in Switzerland as the public are showing fewer acceptances directly after Fukushima accident.

C. Sun and X. Zhu [4] discussed that even though it is clear that nuclear power offered more benefits, but due to uncertainty of nuclear energy and “not in my backyard”(NIMBY) perception, local citizen in China resist the nuclear power program in their neighborhood which is being indicated by anti- nuclear movement in Jiangmen in 2013. As public attitudes towards nuclear energy keeps changing over time, Y. Kim et al. [5] found that limitation of previous studies in taking perspective on people attitudes also contributes into this consideration. Previous studies limited their consideration into accept or reject, without taking reluctantly accept, which means acceptance of the use of nuclear energy without a friendly attitude towards it because of a high level of dependence on nuclear energy, and a lack of alternative energy sources within that country as part of the consideration even though the proportion of those who “reluctantly accept” is fairly large.

G. He et al. [5] in public participation and trust in nuclear power development in China observed that Chinese citizen still have high expectant in governmental authorities in term of nuclear information assistance, quick response to nuclear crisis and country’s commitment towards nuclear future even after several nuclear accidents such as Three Miles Island (1979), Chernobyl (1986) and recently Fukushima (2013) accident in Japan.

The purpose of public acceptance research is to alleviate the potential conflict between technological development and social development by investigating characteristic of public awareness. At present, the methodology of spreading assumption has been altogether different from that past in China. People can get to the assortment of against nuclear energy through the Internet, TV show and other media. Execution of an arrangement of the framework, for example, hearings and open enactment makes people in general take part in social issues habitually, and the administration will broadly counselled and receive the general supposition amid the choice making methodology [7].

Public acceptance give a great impact on the nuclear development policy, technology, economy and other issues related to nuclear energy. Government have to consider this issue in decision making as if there is a controversy even a conflict on nuclear power among the people, it will create the tremendous social cost. This can be seen in Germany when the government announced “abandon nuclear program” after Fukushima accident, this has caused a huge economic losses to a country [7,8].

1.1. Nuclear power knowledge

Basically, knowledge of nuclear power suggest on how much people actually know about nuclear power, nuclear technologies, and its operation or inspection of nuclear facilities. With high level of knowledge about nuclear power, people are enabled to value the advantages and consequences of nuclear energy instead of misinterpreting the risks and being anxiety of nuclear power generation. Besides, individual willingness to gain knowledge and a certain educational level as well as government policy factor in such that there should be more opportunities for accessing knowledge and learning about nuclear power and technology must be taken into consideration in increasing public knowledge about nuclear power [6].

Even though it is clear that knowledge of nuclear power is necessary in preparing a country in implementing nuclear power plant, G. He et al. [7] examined that generally Chinese citizen is ineffectively educated about nuclear security and risk management of nuclear power since the first nuclear power plant was connected to the Chinese power grid in 1991 and governmental authorities seldom educate and exposed any nuclear incidents or accidents to the publics.

Therefore in the process of developing nuclear power, knowledge of nuclear power and technologies should be continuously publicize to the public and also should be able to accomplish people requirement in nuclear information. As a result, it could enhance public confidence about
nuclear energy and technology, thus enlarge the public acceptance of nuclear power in some extent by improving the safety of nuclear power plant and establishing the quantitative safety goals suitably [7]

1.2. Nuclear power development status in Malaysia

Since 2009, a Nuclear Power Development Steering Committee driven by Kementerian Tenaga, Teknologi Hijau dan Air (KeTTHA) has been conducting various studies towards preparing a Nuclear Power Infrastructure Development Plan (NPIDP) [8]. During that particular period, Malaysia was determined to be very enthusiastic towards developing nuclear power generation as deliberated in the Economic Transformation Programme (ETP), Entry Point Project (EPP) 11: Deploying Nuclear Energy for Power Generation. Hence, Malaysia Nuclear Power Cooperation (MNPC) was established in January 2011 as Nuclear Energy Programme Implementing Organization (NEPIO) in Malaysia, as recommended by International Atomic Energy Agency (IAEA). Huge mission was assigned to the MNPC to establish comprehensive groundworks for a successful, sustainable, safe, secure and peaceful national nuclear power programme within time, on budget and in a transparent manner. Figure 1 shows the summary of Government Decisions at 2012.

![Figure 1. Summary of Government Decisions [9].](image)

However, in March 2017, the Minister in the Prime Minister’s Department, Dato Sri Nancy Shukri said that Malaysia is ready for nuclear power and it could have its own nuclear power plant by 2030 by focusing the development in the Peninsula Malaysia due to its high power consumption. Despite of numerous difficulties faced by the government as well as MNPC to make a decision on the timing to embark on the nuclear power project, the primary challenge is still to convince the public on safety, viability and cost effective of nuclear power for the country. Public perceptions towards necessity of having nuclear power is highly necessary in order for government’s political decision making and to identify the basic and ground issues that affect the community or public [10].

Recently, the said government endeavor had been critically debated among Malaysian people as there are pros and cons with regards to this development. Each one of them has concrete proof for each of statement and everyone contributes their thoughts and finding for the better understanding.
Therefore, this study was conducted to evaluate on the reaction and the readiness of Malaysian students should a nuclear power plant is being considered in the near future.

2. Methodology

The structure of questionnaire is divided into six categories based on the current influential areas related to nuclear energy raised by Malaysian. The categories were as follows: 1. Demographic information; 2. Knowledge of nuclear power; 3. Sources of energy that would be used in Malaysia in 20 years’ time; 4. Nuclear power information sources; 5. Perception of nuclear power; 6. Acceptance of nuclear power. The targeted respondents were chosen based on their education level. The questionnaires were distributed to four (4) different groups; secondary school students, foundation/diploma students, degree students and postgraduate students. Data were collected from Sekolah Menengah Kubang Bemban in Kelantan, Universiti Kebangsaan Malaysia (UKM) and Universiti Tenaga Nasional (UNITEN), both in Selangor. A total of 280 random respondents participated in this study. Social networking media were also being used in distributing the questionnaires to the respondents. The questionnaires were uploaded in Google docs form and the link was circulated in Facebook and WhatsApp.

The data collected was simulated using SPSS Statistic version 22.0 software. The data were then analysed in three (3) different methods based on the objective of this study. Pearson Correlation test is used to analyze the correlation between public perception and acceptance towards nuclear power in Malaysia. This method is suitable to be used for examining the relationship between two variables in linear fashion, which positive value indicates the constructive relationship and vice versa. In addition, one-way Analysis of Variance (ANOVA) test and Turkey’s Post Hoc analysis were utilized to determine the difference between perception and acceptance of nuclear power with regards to education level proportions. For the final objective, the three test (T-test) method is used to study the difference between perception and acceptance of nuclear power with regards to gender proportions.

3. Results and discussion

Figure 2 shows the demographic breakdown according to gender, age group and education level for the 280 respondents participated in the study. Data were collected at a school in Kelantan which is Sekolah Menengah Kubang Bemban and two educational institutions in Selangor, Universiti Kebangsaan Malaysia (UKM) and Universiti Tenaga Nasional (UNITEN). The data were well distributed and would be used to determine the polarity of perceptions.

![Figure 2. Demographic information (a) Gender, (b) Age, and (c) Education level.](image-url)
Figure 3 provides understanding on the knowledge of the respondent about nuclear power. Basically, the majority of the respondents have minimal knowledge about nuclear energy. The 5% respondents, primarily derived from the high school respondents, are not even aware about the trefoil warning symbol that symbolized ionizing radiation which demonstrates a very low level of knowledge in relation to nuclear.

![Figure 3. Knowledge on NPP](image)

Figure 4 shows the result of the statistical test using SPSS regarding perceptions toward nuclear power from survey questions regarding their perceptions towards nuclear energy by referring to past nuclear accidents. The result shows that majority of the respondents 42.9% and 50.7% have medium high and high negative perception towards Malaysia building its first nuclear power plant and only 1.1% shows positive perception. Meanwhile, Figure 5 shows slightly different level of acceptance where 45.7% of respondents have medium low acceptance, while only 8.6% support Malaysia to build its first nuclear power plant (NPP).

![Figure 4. SPSS Statistical test on Negative perception toward nuclear power plant (NPP)](image)
Figure 5. SPSS Statistical test on Acceptance toward nuclear power plant (NPP)

Comparing to other conducted surveys reported by H. Hassan [10] as depicted in Table 1 and Figure 6 shows that the nuclear accident in Fukushima in 2011 had significantly influenced public opinions for Malaysia to build its first nuclear power plant (NPP). The acceptance percentage was dropped sharply by 68 % in 2011 to 17%. It can be suggested that lack of information about nuclear power and its impact towards the country influence public opinion about the use of nuclear power plant in Malaysia.

Table 1. Comparison of Acceptance towards NPP in Malaysia between 2009-2012 [10] and 2017.

| Title | Year | Institution | # Respondents | Result |
|-------|------|-------------|---------------|--------|
| The Level of Public Acceptance of Nuclear Power as a Source of Electric Power Generation in Malaysia | 2008-2009 | UKM | 504 | i. Agree: 74%  
ii. Disagree: 22%  
iii. Neutral: 4% |
| Siri Jelajah Malaysia – Program Kesedaran dan Penerimaan “I Love Nuclear” | 2010 | NUKLEAR MALAYSIA | 4000 | i. Support: 85%  
ii. Reject: 7%  
iii. Neutral: 8% |
| The SERIKANDI Plan | 2011 | UNITEN | 42 | i. A good alternative: 17%  
ii. Will consider: 64%  
iii. Bad idea: 19% |
| MANUPA | 2012 | UKM | 565 | i. Support: 47%  
ii. Not sure: 7%  
iii. Not ready: 17%  
iv. Does not support: 29% |
| Public Perception of Nuclear Power among Malaysian Student | 2017 | UNITEN | 280 | i. High acceptance: 8.6%  
ii. Medium acceptance: 72.1%  
iv. Low acceptance: 19.3% |
Figure 6. Public acceptance towards NPP between 2009-2012 [11] and 2017.

T-test was conducted to study correlation between gender and NPP acceptance. The result shows no significant difference between perception and gender of respondent. Meanwhile, study regarding correlation between education level and NPP acceptance using Analysis of Variance (ANOVA) test shows that there are slight differences between perception and educational level \( [F (3, 276) = 3.329, \ p < 0.05] \) but no significant difference between acceptance and educational level as \( [F (3, 276) = 1.680, \ p= 0.171, \ p > 0.05] \). Next, a Turkey’s Post Hoc test revealed that significant differences could only be seen in the perception of high school and degree students, while postgraduate shows no correlation.

4. Conclusion
Based on this study, only two groups which are high school and degree students make a difference in public perception of nuclear power. Degree students have more negative perception towards nuclear power compared to high school students. The Analysis of Variance (ANOVA) test conducted shows slight trend where the higher educational level, the more likely they have negative perception towards the idea of implementation of nuclear power plant.

The study has open-up an opportunity to those who concerned to know the current status and also serves as an update of the level of public perception and acceptance of nuclear technology in Malaysia.

5. References
[1] Tick H O, Shen Y P, Shing C C 2010 Energy policy and alternative energy in Malaysia: Issues and challenges for sustainable growth Renewable and Sustainable Energy Reviews 14 pp. 1241–1252.
[2] Visschers H M, Wallquist L 2013 Nuclear power before and after Fukushima: The relations between acceptance, ambivalence and knowledge J. of Environmental Psychology 36 pp. 77-86.
[3] OECD 2013 Public Attitudes Towards Nuclear Power (NEA No. 6859, Accessed 19th Dec 2017, https://www.oecd-nea.org/ndd/pubs/2010/6859-public-attitudes.pdf).
[4] Sun C, Zhu X 2014 Evaluating the public perceptions of nuclear power in China: Evidence from a contingent valuation survey EnergyPolicy 69 pp. 397–405.
[5] Kim Y, Kim W, Kim M 2014 An international comparative analysis of public acceptance of nuclear energyEnergy Policy 66 pp. 475–483.
[6] He G, Mol A P J, Zhang L, Lo Y Public participation and trust in nuclear power development in China Renewable and Sustainable Energy Reviews 23 pp. 1–11, 2013.
[7] Li C J, Zhang C M, Chan Y, Zuo J, Chen J 2013 The Study on Safety Goals and Public
Acceptance of Nuclear Power. *Energy Procedia* **39**, pp. 415 – 422.

[8] Kidd S 2013 Nuclear power Economics and public acceptance *Energy Strategy Reviews* **1** pp. 277-281

[9] Malaysia Nuclear Power Corporation 2014 Nuclear Infrastructure and Institutional Arrangements for the Development and Deployment of Sustainable Nuclear Energy Systems – Experience of MNPC, as a Dedicated NEPIO (INPRO Dialogue Forum on Int. Collaboration on Innovations to Support Globally Sustainable Nuclear Energy Systems, ed. Jaafar M Z, IAEA Vienna) pp. 26.

[10] Fauzan Amin Misnon, Yeoh Siong Hu, Irman Abd. Rahman and Samudi Yasir 2017 Malaysia Public Perception Towards Nuclear Power Energy-Related Issues (American Institute of Physics)

[11] Hasfazilah Binti Hassan 2012 Penerimaan Orang Awam Terhadap Pembangunan Loji Kuasa Nuklear Di Malaysia (MANUPA) Menerusi Laman Sosial Facebook (thesis BSc. Universiti Kebangsaan Malaysia).