PUBLIC ATTITUDE OF THAI RESIDENTIAL TOWARD NUCLEAR POWER PLANTS: A PERSPECTIVE

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Abstract— This paper deals with the new perspective structure of public attitude towards nuclear power plants in Thailand. Special emphasis is on the issues of public attitude in relation to public knowledge, perceived benefits and perceived risks. Knowledge has been considered as a key factor for changing people's risks and benefits perception of attitude toward nuclear power technology. In the past, some studies indicated the positive effect of knowledge in changing public attitude. This study reviewed the past research about public attitude formation, changed in risks-benefits perception by the public knowledge on nuclear power and explained the new framework of relationship. The structural equation model is used to construct the relationship among factors. Each latent variable was developed from previous studies in nuclear power or renewable energy field. From the structural model of this analysis, the important findings will be reflected in the public attitude improvement strategy for the nuclear power program in Thailand.

Keywords— Public knowledge, Perceived benefits, Perceived risks, Public attitude, Nuclear power.

I. INTRODUCTION

In 21st century, many countries around the world have debated on future energy policy for sustainable energy and reduction of environmental impact. Energy policy is critical to track climate change because energy generation and use for transportation, applications, amount to the major source of greenhouse gasses being released into the atmosphere. The role of nuclear power in protecting energy supplies has been voiced since the OPEC oil crisis in the 1970s [1]. Interest in nuclear power technology has been reconsidered as a result of the swing of fossil fuel prices, concerns about the security of energy supplies, and global climate change.

The advanced nuclear reactor for power generation has been designed for simpler and safer operation with lower cost in operation than currently operating power reactors. Public health and safety risks are some of the major concerns that freeze the industry since the accidents at Three Mile Island, Chernobyl and Fukushima. The advancement of power reactor technology may help break the current deadlock over nuclear power. In that case, nuclear power technology could reduce greenhouse gas emissions and contribute its higher benefit for society [2]. However, many scholars reported that public knowledge has been a key factor that effects public attitude toward nuclear power both direct and indirect ways [3, 4, 5]. The report showed that not only the benefit of nuclear technology, nuclear safety, disposal of radioactive wastes but also the risks perception of nuclear technology need to be addressed in an effective and credible way if the necessary public support is to be obtained [6].

Thailand is a country that plan to operate nuclear power plants in 2030 [7]. The responsible government agencies have been conducting campaigns to provide proper information on nuclear power to the communities in the candidate areas of nuclear power plants. Only a few responses from the public were received after these activities which are not enough for the government authorities to make a proper decision. Therefore the purpose of this study is to develop the public attitude model to reveal the structure of public acceptance toward nuclear power in Thailand. It plans the methodology from a comprehensive empirical survey of Thai public attitudes towards future nuclear power energy in Thailand will be used. Furthermore, the survey findings will illustrate some of the difficulties associated with the attempts to identify and interpret a singular 'public opinion' for designing a remedial policy to improve public acceptance.

II. NUCLEAR POWER SITUATION

2.1. Current status of world nuclear power

Nuclear power's share of worldwide electricity production rose from less than 1 percent in 1960 to 16 percent in 1986 and that percentage has held essentially constant for almost two decades from 1986 to 2005. In 2006, nuclear power's share dropped to 15 percent and in 2007 it dropped another percentage point to 14 percent [8]. In 2014, there were 436 nuclear power plants (NPPs) in 29 countries, which contributed 11.5% of world electricity production [9]. Recently, 48 countries have proposed to operate 322 NPPs within 15 years [10] which will contribute 15 – 20% of world electricity production [9].

2.2. Policy background: the role of nuclear power in Thailand energy policy

According to the government policies on electricity generation, the framework of the Thailand Power Development Plan (PDP) formulated in line with the Energy Efficiency Development Plan (EEDP) and the Alternative Energy Development Plan (AEDP) was

approved by the National Energy Policy Council (NEPC) as follows: 1. Energy Security: dealing with an increase in power demand taking into account of fuel diversification to lessen the dependency of one particular fuel. 2. Economy: maintaining an appropriate cost of power generation and implementing energy efficiency. 3. Ecology: reducing environmental and social impacts by lessening carbon dioxide intensity of power generation.

The latest PDP2015 shows that the government tries to reduce the fossil fuel and increase the renewable energy and nuclear power, the detail is shown in Fig.1.

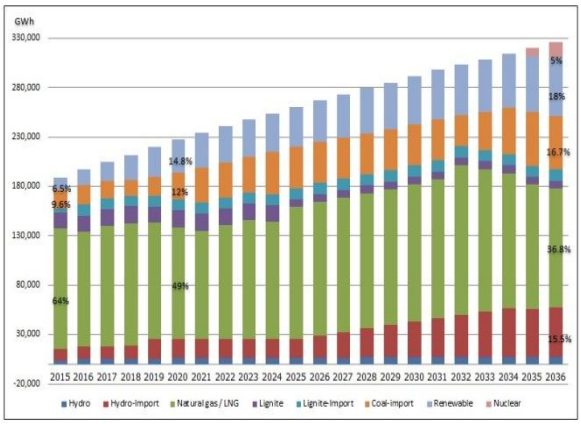

Fig. 1 PDP2015 projection of energy generation by fuel types(EPPO, [7])

III. LITERATURE REVIEW AND THEORETICAL BACKGROUND

3.1. Public Knowledge and related studies

Knowledge is the set of information that supports attitude toward anything. Cappurro [11] and Glassey [12] introduced that there were 3 components of knowledge: empirical knowledge, scientific knowledge and practical knowledge. Public knowledge, public opinion and acceptance of nuclear power technology have previously been paid attention in social academic research [3, 13, 14]. It has known that early researches in public knowledge and attitude were conducted in the field of psychology. Recently, researchers in other fields other than psychology have done numerous studies on public knowledge and attitude of nuclear power technology. However, there was a few research in electricity production from nuclear technology showing the positive relationship between public knowledge and perceived benefits from NPPs usage [3, 15] and the positive effect of public knowledge on public attitude toward NPPs [16, 17]. On the other hand, The studies found the negative relationship of public knowledge to perceived risks of NPPs usage [3, 15, 18]. However, many studies such as Lee, Scheufele and Lewenstein [19], Chen, Lin and Cheng [20] and Park and Ohm [13] showed that public knowledge about renewable energy technology could affect both positively and negatively the perceived benefits and risks usage. Therefore, based on the previous studies, the current study was hypothesized as follows:

H1 : Public knowledge has positive effects on the perceived benefits of nuclear electricity technology.

H2 : Public knowledge has negative effects on the perceived risks of nuclear electricity technology.

H3 : Public knowledge has positive effects on the public attitude toward electricity production from nuclear power plant.

3.2. Perceived Risks, Perceive Benefits and related studies

The risks and benefits perception are the external factors that can influence the evaluation and justification process of human behavior, especially the possible danger of technology and its effect on changing human's living. Many scholars showed the negative relationship between risks and benefits [21, 22]. Many theories on attitude also indicated that the acceptability of a technology is controlled by the beliefs of people and the values of the technology. Perceived risks is the external negative factor such as dangers or uncertainties of potentially harmful environmental conditions that impacts to human behavior. Risksare the potential for realization of unwanted, negative consequences [23]. On the other hands, perceived benefitsare opposite the external positive factors that also impact to human behavior such as perceived advantage in environmental aspect, economic competitiveness and social problem solving.

Previous studies in nuclear energy technology showed that the perceived benefits of NPPs usage had positive effect to public attitude toward NPPs while perceived risks of NPPs usage had negative effect to public attitude toward NPPs. For example, Choi, Kim and Lee [3] reported that perceived benefits of NPPs usage had positive effect to Korean attitude toward NPPs and perceived risks of NPPs usage had negative effect to Korean attitude toward NPPs on individual viewpoint. Judith and Linda [24] and Judith, Linda and Wouter [25] showed that the Dutch who have more perceived benefits of NPPs usage than perceived risks or focused on Egoistic Value had positive attitude toward NPPs and supported NPPs project. On the other hand, they had negative attitude toward NPPs and rejected NPPs project once they had more perceived risks than benefits of NPPs usage or focused on altruistic value and biospheric value. Moreover, Kim et al. [4] studied public attitude toward NPPs of 19 countries which are the member of IAEA. The study showed that the perceived benefits of NPPs usage resulted in positive effect to the public attitude toward NPPs and perceived risks resulted in negative effect.

However, after the Fukushima accident, the perceived benefits and perceived risks of NPPs usage still had positive and negative effect consecutively to public

attitude toward NPPs [26]. In addition, Park and Ohm [13] found the relationship between perceived benefits and risks of renewable energy usage, and public attitude before and after the Fukushima accident. Therefore, the current study hypothesized:

H4: The perceived benefits has positive effect to public attitude toward NPPs

H5: The perceived risks has negative effect to public attitude toward NPPs

3.3. Proposed Conceptual Framework (Fig.2)

The analysis of the above literatures has provided the ground work for the development of the conceptual model based on the suggested hypotheses (H1-H5). The conceptual model is proposed and shown in Fig. 2.

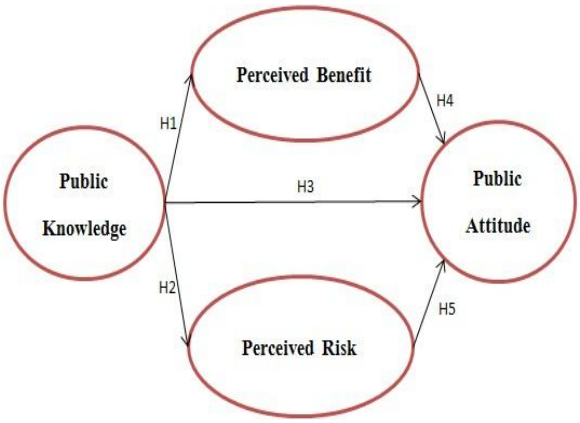

Fig. 2 the conceptual framework model

VI. METHODOLOGY

This researchaims tomodelthe structureof the factorsinfluencingthe public attitude toward nuclear power plantin Thailand, sothe researchers wish to determine the detailsand procedures from the methods below:

4.1. The study's approach

The researchers conducted both quantitative and qualitative research from primary and secondary data. The researchers determined the following steps for this study:

4.1.1. Primary and Secondary Data Research

Primary data is collected from the surveyed population and involves face to face interviews or discussions with members of the surveyed community [27]. Secondary data can comprise published research, information from internet websites, media reports, and data which has been cleaned, analyzed and collected for a purpose other than the needs assessment.

4.1.2. Quantitative Research Study

Quantitative research will be undertaken by collecting a questionnaire from the target sample. The main instrument in this study is the questionnaire developed from those ones used in previous studies in nuclear technology and renewable energy research. The questionnaire consisted of two main parts. The first part collects general information of the respondents such as gender, age, education, living area and income. The second part gathers opinion information of the samples and each question is related to the observed and latent variables in this study. All respondents answered each item in the second part by marking on a 7-point likert scale (from 1: strongly disagree to 7: strongly agree). The public knowledge in nuclear technology adopted sixteen items previously used by Kim et al. [4], Park and Ohm [13], Stoutenborough et al. [17] and Klick and Smith [28]. The perceived benefits of nuclear power plants usage included thirteen items validated by Park and Ohm [13], Judith and Linda [24], Siegrist et al. [26] and Judith et al. [25]. The perceived risk of nuclear power plants usage consisted of fifteen items from Kim et al. [4], Judith and Linda [24] and Siegrist et al. [26]. The public attitude toward NPP was examined by eleven items from Kim et al. [4], Siegrist et al. [26] and Bhanthumnavin and Bhanthumnavin [29]. The questionnaires are tested its reliability and validity as follows:

4.1.2.1 To clarify and increase the validity of the survey questionnaire, it is examined by 5 professional experts in nuclear technology innovation and electricity production studies. The questionnaire items will be reviewed and revised, where the ambiguity or redundancy are found. In addition, several poor items, which are not able to satisfy the threshold value of item-to-total will be eliminated by calculating Cronbach's alpha. Therefore, all Cronbach's alpha values of the final pre-testing are acceptable (more than 0.7; Cronbach [30]).

4.1.2.2 During the trial period, questions will undergo and continual review for their clarity and ability to the meet the objectives of the research.

4.1.3. Qualitative Research Approaches

Qualitative research will involve confirming the model of quantitative research. It is a collection of in-depth interviews with 10 professional experts in nuclear technology, government policy and NGOs in electricity field.

4.2. Population and Sampling

We explore objective questions through data from the population in this study included 20,452,075 Thai electricity users [31]. The sample size was identified by the method of Yamane [32], so the total sample size in this study was 400 people. Stratified random sampling technique is used in this study. The total sample size was split into 77 provinces of Thailand depending on electricity user ratio.

4.3. Data Collection

4.3.1 Primary Data

Primary data will be from a collection of survey from people l in 77 provinces of Thailand. The survey will conduct in June - July 2016.

4.3.2 Secondary Data

Secondary data will be collected by studying theories related to the research from various sources of information, including books, articles, research papers, instruction manuals, etc., in order to develop the conceptual framework and theories used in the study.

4.4. Data Analysis and Statistics Used

4.4.1. The analysis of quantitative data will be conducted by using statistical analysis as follows:

4.4.1.1. An analysis will be conducted by descriptive statistics by characterizing the frequency, percentage, mean and standard deviation.

4.4.1.2. Analysis will be conducted by using structural equation analysis (SEM) to determine the relationship of the factors influencing public attitude toward nuclear power plants in Thailand.

4.4.2. The qualitative data analysis in this study will be used to confirm the results of the quantitative analysis by the interviews the experts in nuclear technology, government policy and NGOs in electricity field.

CONCLUSION

The research on the relationship between factors effecting public attitude toward nuclear power in developing countries especially Thailand is very limited. This paper investigates the new framework model and proposes a modification specifically with regards to the knowledge factor, the perceived benefits and the perceived risks for the integration of these constructs into the model in the context of Thailand.

However, the research presented has some limitation because the proposed framework is only based on literature review in nuclear energy and renewable energy fields. Therefore, future research would focus on empirical validity and reliability of this perspective.

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