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Evaluating the public perceptions of nuclear power in China: Evidence from a contingent valuation survey

Chuanwang Sun [a,b,*], Xiting Zhu [c]

[a] China Center for Energy Economics Research, School of Economics, Xiamen University, Xiamen, Fujian 361005, China
[b] Collaborative Innovation Center for Energy Economics and Energy Policy, Institute for Studies in Energy Policy, Xiamen University, Xiamen, Fujian 361005, China
[c] School of Economics, Xiamen University, Xiamen, Fujian 361005, China

HIGHLIGHTS

- We firstly evaluate the WTP for avoiding nuclear construction in China.
- The study is based on the CV survey data after the Fukushima accident.
- More understanding of nuclear energy could improve public acceptance.
- Decision-makers should improve policy transparency and public involvement.

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ABSTRACT

After the Fukushima nuclear accident, more and more attention has been paid to the safety issues of nuclear power in China, even though it is a clean and necessary substitution to coal power. Due to the consideration about the uncertainty of nuclear safety, the local citizens may resist the nuclear power programs in their neighborhood, as indicated by the anti-nuclear movement in Jiangmen 2013. This phenomenon is often related to the public perceptions of "not-in-my-back-yard" (NIMABY). The explosion of anti-nuclear movements will impose adverse effects on the nuclear power decision-making in China. Based on the Contingent Valuation Method (CVM), we evaluate the public Willingness-To-Pay (WTP) for avoiding the construction of nuclear power plants in their neighborhood. Moreover, we analyze whether more information about nuclear energy could improve the public acceptance. Our results show that the comprehensive information will decrease the public risk perception of nuclear power and increase the public support for nuclear power policy. This paper further suggests that China's decision makers should improve policy transparency and encourage the public involvement of nuclear energy decision making.

1. Introduction

As a result of the rapid economic growth and coal-dominated energy structure, China has overtaken the United States and become the biggest CO_2 emitter since 2006 (Lin and Sun, 2010). To mitigate the potential threats of climate change and cope with the increasing demand of energy, non-fossil resources are considered as the major supply to meet the country's future needs for electricity (Li and Lin, 2013). In 2009, the Chinese government declared that the proportion of non-fossil energy in primary energy consumption should increase to 15% by 2020. However, there are several practical constraints associated with the cost and techniques for energy such as hydropower, solar energy and wind power in China. Hence, considering the remarkable economic advantages compared to other clean energy resources, the Chinese government has given the nuclear power the top priority for development (McVeigh et al., 2000). The first commercial nuclear power plant in Mainland China was Qinshan nuclear power plant in Zhejiang province, southeast of China, which was built in the mid-1980s. With the rapid expansion of nuclear power in recent years, China currently has 17 nuclear power reactors in operation, 30 reactors under construction, which are mainly located in the eastern or southern regions.[1]

* Corresponding author at: China Center for Energy Economics Research, School of Economics, Xiamen University, Xiamen, Fujian 361005, China. Tel.: +86 5922186076; fax: +86 5922186075.
E-mail address: scw@xmu.edu.cn (C. Sun).

[1] For example, Guangdong Daya Bay Nuclear Power Plant, Lin'ao Nuclear Power Plant, Jiangsu Tianwan Nuclear Power Plant and Fujian Ningde Power Plant.

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In China, from the perspective of the public, nuclear power is yet a controversial energy, which has many vulnerable characteristics in the aspect of nuclear safety. After the Fukushima nuclear accident—the worst nuclear accident since the Chernobyl, the public began to be more serious about nuclear energy, particularly in the view of its uncertainty to global society. Many countries, such as Japan, Germany and Switzerland, have to slow down or even completely make a cessation of nuclear plant construction. China has also been influenced, and the government has announced to suspend the approval of new nuclear power projects.

Meanwhile, the Fukushima accident notably affects the public perceptions about nuclear energy. The anti-nuclear concern is often centered on the location of nuclear power plants. Residents near the nuclear power plants are worried about the potential danger from the nuclear radiation, which is often associated with cancer. Thus, people would oppose to locate nuclear power plants in their neighborhood. The opposition is relevant to the "not-in-my-back-yard" (NIMBY) strategy (Wolsink, 2000) indicating that people always oppose constructing a range of "locally unwanted" facilities such as incinerators, landfills and nuclear power plants in their neighborhood (Hubbard, 2009). Hence, people are willing to pay to avoid building a nuclear power plant nearby and prefer to choose other costly alternative power generating sources (Kim et al., 2013).

Facing the rising demand of electricity as well as the commitment to tackle with climate change, China is in urgent need to promote the nuclear power. As a result, the Chinese government has restarted a new round of nuclear power construction quickly since October 2012 after the Fukushima accident. However, triggered from the Nimbyism, the anti-nuclear movements outbreak in many places. For instance, the citizens' protest march against Jiangmen uranium plant in Guangdong Province is one of the most famous anti-nuclear cases after the Fukushima accident. The nuclear power project in Jiangmen had been canceled because of the public opposition in July 2013. The project was the first industrial park that planned in South China for nuclear fuel production.[2] However, since the planned site was only 30 km away from the city center, and local residents who were not been fully informed about the plan in advance, took actions to protest against the project for the unknown health and environmental risks. The abortion of the nuclear program could be attributed to the failure of consulting the public in China.

China has started to take both social stability and public acceptance into consideration in nuclear energy policy-making (Du et al., 2009; Lin and Liu, 2013; Sun and Lin, 2013; Lin and Ouyang, 2014). But the success of Jiangmen residents may expect similar protests to a nuclear project planning. The anti-nuclear movements would affect the nuclear policy and the development process, thus may cause negative consequences for China's commitment to the global CO_2 emission targets. In contrast to China's case, nuclear energy is well accepted, even popular in France. Its successful experience indicates that promoting policy transparency and encouraging residents' participation in nuclear policy-making are effective, which could decrease the public resistance to nuclear power and keep the steady pace of nuclear development. Therefore, it is necessary to analyze whether it also applies to China that providing more information to the public would reduce their protest to the nuclear power.

Based on a face-to-face survey of China's Public Perceptions of Nuclear Power (CPPNP),[3] we use the Contingent Valuation Method (CVM) to evaluate China's public Willingness-To-Pay (WTP) to stop a nuclear power plant developed in their neighborhood for the first time. By comparing the values of WTP between two groups—people who were informed and uninformed of the pros and cons of the nuclear power, we analyze whether policy transparency has an impact on social acceptance. We further suggest some policy recommendations by focusing on how to improve information transparency and public involvement, both of which help to address public resistance and promote the acceptance of nuclear power (Wang and Chen, 2012).

Our study contributes to the previous research in the following three aspects. (1) We evaluate the social value of WTP to avoid the nuclear power on the perception of "not-in-my-back-yard" (NIMBY) by applying the bidding mechanism of Dichotomous-Choice questions method in CVM; (2) we firstly investigate the social acceptation and attitude to nuclear power in China based on the data from a nationwide face-to-face survey, which is more informative under the background that the Chinese government has signaled to recommence the approvals for new plants after the Fukushima accident; and (3) confronting the public's resistance and concerns about the risks of nuclear energy, several recommendations have been suggested for decision-makers in developing nuclear power, which will positively affect social behaviors and public perceptions. The results of this study could be used by researchers as well as policy makers for promoting the development of nuclear power in China.

The remainder of this study is organized as follows. Section 2 presents the literatures. Section 3 provides the Contingent Valuation Method model and the description of survey data. Section 4 presents the analysis of results. Section 5 provides the main findings. Policy suggestions are recommended in Section 6.

2. Literature review

2.1. Social acceptance of nuclear power

With the global warming and unstable energy supply, nuclear power is expected to be a promising alternative energy in China. Although the nuclear power technology is advanced enough to ensure nuclear safety to a certain extent, people are still worried about the nuclear security and environmental issues, especially after the Fukushima nuclear accident. The "public acceptance of nuclear power" is simply the general public's attitude towards the nuclear development, the importance of which has been paid substantial attentions in recent years and many studies have been conducted on this issue. Kidd (2013) found that public acceptance was partly responsible for the underlying cost problem observable in the western world. Richardson et al. (2013) discussed the safety-related issues associated with the use of nuclear power and indicated how this had led to progress following accidents and incidents where the public confidence had been eroded. Song et al. (2013) indicated that perceived efficacy was most strongly related to social acceptance of nuclear power plants by examining the effects of perceived efficacy, perceived risk, communication quality, and trust on social acceptance of nuclear power plants in South Korea. Bronfman et al. (2012) validated a causal trust-acceptability model for electricity generation sources and the model showed that social acceptance of an energy source was directly caused by the perceived risk and social trust in regulatory agencies.

When the Fukushima accident happened, a lot of researches focused on the comparison of social attitudes before and after this accident. Srinivasan and Gopi Rethinaraj (2013) found that expect for technical fixes such as enhanced engineering safety features and better siting choices, the critical ingredient for safe operation of nuclear reactors lied in the quality of human training and transparency of the nuclear regulatory process. Wang and Chen (2012) conducted an analysis to study the relation between non-transparency and Japan's nuclear safety regulatory failure. They

[2] The project was the featuring facilities for uranium conversion and designed to hold a capacity of 1000 t of uranium in 2020, involving a total investment of RMB 37 billion (US$ 6101.3 million).

[3] CPPNP, supported by China Center for Energy Economics Research at Xiamen University, is a nationwide face-to-face survey focuses on the public perceptions of nuclear power.