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Nuclear energy in the Post-Fukushima Era: Research on the developments of the Chinese and worldwide nuclear power industries



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ABSTRACT

The nuclear accident that occurred in Fukushima, Japan has broadly affected the rapid development trend of the worldwide nuclear industry, causing many countries, including China, to adjust their nuclear policies. However, as the impact of the accident is fading away, nuclear policies are differentiating worldwide. Hence, analysing nuclear policies in different countries and their trends after the Fukushima accident has a practical significance of promoting the effective and safe development of the nuclear power industry. This paper focuses on the nuclear accident in Fukushima, Japan, and its wide impact. First, the changes of the developmental policies and the trends of the nuclear powers, including China, are summarised just after the accident in Fukushima occurred. Next, the nuclear power development of the nuclear powers and China in the last two years is analysed with real data. Finally, this paper systematically predicts the developmental direction of the global nuclear industry according to the actual nuclear development status in each country.

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1. Introduction

Since the late 19th century, efforts have been made by countries to reach an international consensus against energy and environmental problems caused by excessive human activities. Large-scale application of nuclear energy and the explosive growth of renewable energy sources make it possible for global economics and environmental protection to transition from the current dependence on fossil fuels [23]. As one of the most potential and practical sources of new energy, nuclear energy has an irreplaceable advantage not only in terms of low costs and carbon dioxide emissions but also regarding operating stability compared to traditional fossil energy and renewable energy [4,18]. However, the safety problem of nuclear energy has always been a critical issue, focused on by all countries [27,19].

On March 11, 2011, an earthquake of 9.0 on the Richter scale occurred in east Japan, resulting in a tsunami that caused the explosion of units in the Fukushima nuclear power plant [22]. Thereafter, the electricity price rose markedly because of power shortages caused by the accident, which seriously impacted the nation's economy and people's lives [9] and shocked nuclear industries worldwide [5,24]. After the Fukushima nuclear accident, the rapid development trend of the global nuclear industries was affected. Additionally, many nuclear powers, including China, adjusted their nuclear power policies [7]. Hence, analysing nuclear power policies and their trends after the Fukushima accident has a practical significance in promoting the effective and safe development of the nuclear power industry.

The paper focuses on the extensive and far-reaching influence of the Fukushima nuclear accident in Japan. First, the paper describes the nuclear development changes and trends in the nuclear powers just after the Fukushima nuclear accident (in the year of 2011). Next, the nuclear power development of the nuclear powers and China during the last two years is analysed with real data (in the year of 2012 and 2013). Finally, the developmental direction of the global nuclear industry is predicted herein based on each country's actual nuclear development status (in 2014 and beyond).

2. Status of nuclear power policy changes in countries after the Fukushima accident

2.1. Status of the world's overall nuclear policy changes

After the Fukushima nuclear accident in Japan, all countries that had nuclear plants throughout the world took immediate action or declared an adjustment of their nuclear development policy based on the domestic development status of nuclear power and the current nuclear policy. In the process, different countries implemented different coping strategies [6]. Some countries, such as the U.S.A. and France, basically support all of their existing power stations and the nuclear industry as a whole. Other countries, Germany in particular, made dramatic changes in their nuclear policy out of concerns for reactor safety [7]. Some countries that once intended to introduce nuclear power have already suspended their nuclear power development plans. Fig. 1 summarises the situation of the world's nuclear policies just after the Fukushima accident.

As shown in Fig. 1, the attitudes for nuclear power around the world have divided after the Fukushima nuclear accident. Some countries, such as USA, Canada, Western Europe countries, China, Russia, and India, pay more attention to security and slow down the speed of development of nuclear power as the Fukushima accident, but never give up affirmatively. While a part of countries in the Middle East, North Africa, South Asia and South America, because of the requirements of economic development, are still seek to develop nuclear power on the basis of the original plan. However, Spain, Portugal and Japan indicate to maintain the status quo. Sweden and Germany would gradually reduce nuclear power.

To summarise the world's nuclear policy changes after the Fukushima nuclear accident, the changes can be roughly divided into four categories (as presented in Table 1): 1) continue developing nuclear power, 2) make use of existing nuclear power plants, 3) gradually reduce nuclear power, and 4) gradually withdraw from nuclear power.

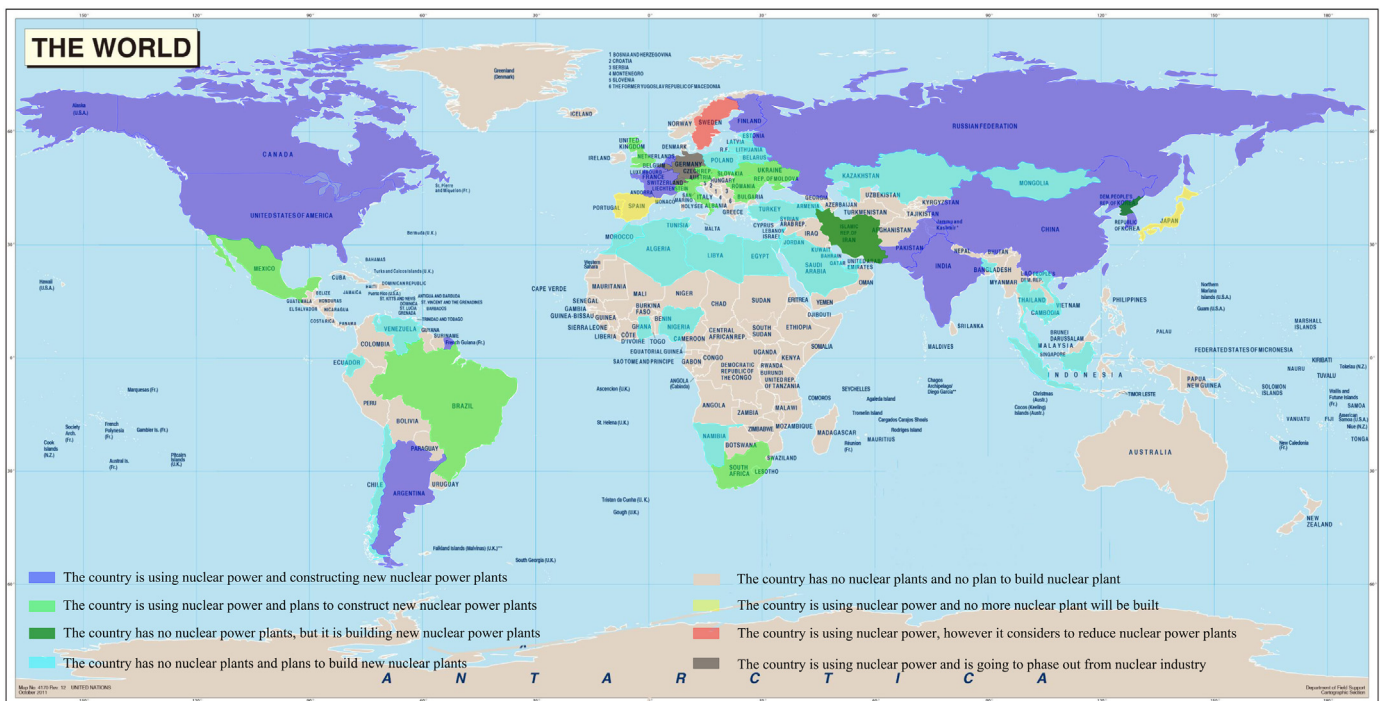


Fig. 1. The changes of world's nuclear policy after the Fukushima accident. Note: Sourced from various resources and compiled by the authors.

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