

## A Study on prospect of Nuclear R&D Fund under the new Energy Roadmap in Korea and Policy Recommendations

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### 1. Introduction

In Korea, nuclear power has been important energy resource which enables to supply electricity economically and stably, and has played a pivotal role in national economic growth. Over the past 40 year, Korea has persistently pursued a nuclear promotion policy thereby becoming the advanced country in nuclear industry which can export nuclear power plant and accomplishing significant scientific and technological development in nuclear area. This Korea's success was result from continuous research and development program for nuclear science and technology based on stable R&D resources such as Nuclear R&D fund.

Nuclear R&D fund was established to secure nuclear R&D fund stably and to support continuous R&D activities by the atomic energy promotion act in 1996. The atomic energy promotion act requires nuclear utilities to bear levy of 1.2 Won per the production of 1 kWh by nuclear power plant as share in court. Therefore the quantity of Nuclear R&D fund depends on annual production of electricity from nuclear power plant.

On the other hand, Korea government recently announced a new energy policy (energy transition roadmap) to shift to renewable energy from nuclear and coal power. And The Ministry of Trade, Industry and Energy announced on December 14, 2017 a draft of the 8th Basic Plan for Long-term Electricity Supply and Demand. Under this plan, share of nuclear power will be reduced long term.

This study provides an overview of Nuclear R&D Fund and its prospect under the new energy roadmap in Korea. And in this study policy recommendations for calculation alternative for Nuclear R&D Fund are suggested for policy decision.

### 2. Methods and Results

The main objective of this study is to analyze the effects of government's new energy policy to Nuclear R&D Fund and to suggest alternative way to secure appropriate amount of fund. To this end, four results were provided as follow.

#### 2.1 Status of Nuclear R&D Fund

There are for major financial for nuclear R&D; Nuclear R&D Fund, Electric Power Industry Basis Fund, Nuclear Waste Fund and government fund. Among

them, the highest amount of investment was spent by the Nuclear R&D fund, totaling 153.6 billion Won as of 2017, accounting for 49.1 % of the total investment for nuclear R&D. As such, the Nuclear Fund is very important resource for continuous nuclear research and development activities. Since 1997, the total amount of Nuclear R&D Fund has been raised to 3.86 trillion Won, and this fund has been invested in nuclear safety, back-end fuel cycle, future nuclear system development and fusion reactor development etc.

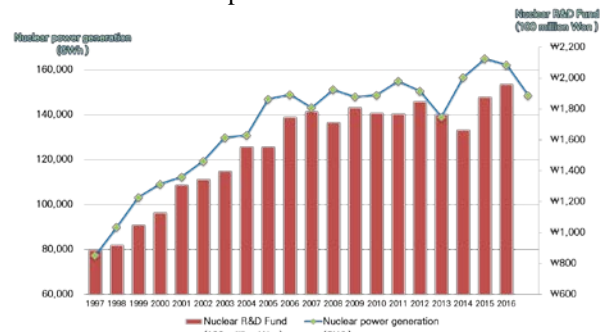


Fig. 1. Status of Nuclear R&D Fund

On the other hand, Nuclear R&D Fund is unstable resource and difficult to predict annual amount because this fund relies on the levy which varies depending on the amount of nuclear power generation. For example, after the Fukushima accident, the utilization rate of nuclear power plant has decreased due to the regulatory environment. As a result, the Nuclear R&D Fund has also reduced, resulting in a shortage of nuclear R&D resource.

The recently announced government's new energy policy is likely to reduce the proportion of nuclear power generation, which will result in long-term reductions in Nuclear R&D Fund.

#### 2.2 8th Basic Plan for Electricity Supply and Demand

'The 8th Basic Plan for Long-term Electricity Supply and Demand' is biennial plan which is announced every two years and include supply and demand outlook as well as overall power plant plans for the next 15 years between 2017 and 2031.

Under the new plan, new nuclear plant construction plans will be canceled except for Shin-Kori 5 and 6 and aged reactors will also be shut down without extending their operating license. Therefore Korea will reduce reliance on coal and nuclear power gradually, and the number of nuclear reactors in the country will decrease

from 24 to 18 by 2031, and the installed capacity of nuclear power plant would contract to 20.4 GW from 22.5 GW during the period.

Assuming that energy transition roadmap goes smoothly, only 6 nuclear power plants will operate and installed capacity of nuclear power plant would contract to 8,400 MWe after 40 years.

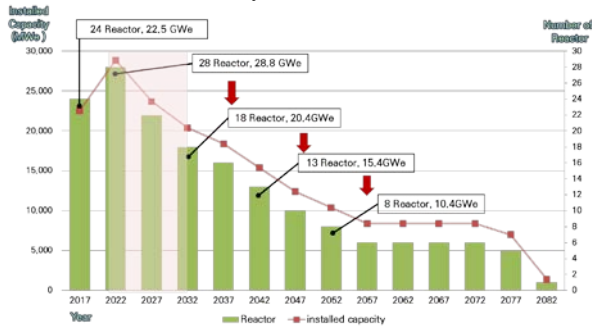


Fig. 2. Nuclear Reactor Fleet in Korea, 2017-2082 under energy transition roadmap

### 2.3 Prospect of Nuclear R&D Fund under the new Energy Roadmap

In this study, two kind of outlook of Nuclear R&D were analyzed as follow.

The first one is mid-term prospects of Nuclear R&D Fund based on the 8th Basic Plan for Long-term Electricity Supply and Demand. The mid-term prospects of Nuclear R&D Fund were derived by considering the forecast for power demand in this plan and assuming the share of nuclear power generation. The share of nuclear energy is assumed to be 30% until 2023, and it is assumed that the share of nuclear energy will decrease in proportion to the installed capacity of nuclear power plant, which has been decreasing since 2024, and it reaches 23.9% in 2030. In the mid-term prospects of Nuclear R&D Fund, it is expected that it will be able to secure the R&D Fund amount of 220 billion Won, which is the highest level in 2025. However, share in court of Nuclear R&D Fund will start to decline from 2026, and in 2031 it is expected to reach 180 billion Won, similar to 2010.

The second one is long-term prospects of Nuclear R&D Fund based on the energy transition roadmap. The long-term prospects were estimated by considering the expected capacity of nuclear power plant under energy transition roadmap and assuming the utilization rate of nuclear power plant to be 70 %, 75 %, 80 %, 85 %. We estimated annual nuclear power generation by using capacity and utilization rate of nuclear power plant, and the amount of Nuclear R&D Fund was calculated by this value. Assuming that the utilization rate of nuclear power plant is maintained 80%, it is expected that the Nuclear R&D Fund will decrease continuously from 2025 and will reach about 70 billion by 2063.

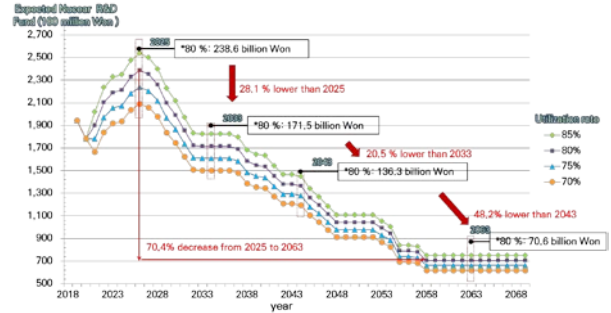


Fig. 3. Long-term prospects of Nuclear R&D Fund under the energy transition roadmap

### 2.4 Calculation alternative for Nuclear R&D Fund

The demand for future nuclear R&D will continue to increase for safety enhancement of nuclear power plant, safe management of spent nuclear fuel, development of innovative technology to cope with the fourth industrial revolution era. However, Nuclear R&D Fund is expected to decline in the long run as large portion of resources for nuclear R&D, therefore measure are needed to secure stable R&D resources. In this study, two kinds of measures were suggested as follow. The first one is to link the Electric Power Industry Basis Fund to the Nuclear R&D Fund. The second option is to raise the levy rate of Nuclear R&D Fund in proportion to the amount of reduced nuclear power generation. In this study, we compared the predicted value of Nuclear R&D Fund with the calculated value by using alternative measure.

## 4. Conclusions

Despite the need to secure financial resource for the nuclear R&D to innovate nuclear technology in preparation for the future society, Nuclear R&D Fund is expected to reduce in the long-term because of government's new energy roadmap. In this study, long-term prospects of Nuclear R&D Fund and two alternatives for securing stable R&D resources are presented. Considering the above results, we think that it is necessary to prepare policy for stable financial resource of nuclear R&D.

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