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What are required for sustainable nuclear R&Ds in Korea?

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1. Introduction

In Korea, nuclear energy has played a great role on a national economic growth. Since 1978, nuclear power has contributed to supply more cheap and stable electricity to domestic industries and also to strengthen the national energy security thanks to lower electricity generation cost and much less supply risk than fossil fuels. Such a key role of nuclear energy in Korea has come from active and well organized nuclear R&Ds, which were the localization plan of nuclear power technology, the 5-year nuclear R&D program, and NuTech2015, etc. This paper reviewed former nuclear R&D programs and then searched viable directions of future nuclear R&D for enhancing its sustainability.

2. Review of past nuclear R&D programs

Korean nuclear R&D programs were really launched when KAERI (Korea Atomic Energy Institute) was established in 1959. At that time, TRIGA Mk II and III research reactors were major instrumentations to implement nuclear R&Ds such as radiation applications, reactor physics, and RI production & their utilization, etc.

The localization plan of nuclear power technology, which started in 1985 and was completed in 1995, was a representative one among Nuclear R&D programs in Korea. In 1990s, this plan much helped to make a good shape of national nuclear R&D programs. Owing to successful achievements from the localization plan, Korean Government made the 5-year nuclear R&D program a legal national plan in 1997. Since 1997, MSIT (Ministry of Science and ICT) has legally formulated CNEPP (the Comprehensive Nuclear Energy Promotion Plan) and the 5-year nuclear R&D plan every five years. MOTIE (Ministry of Trade, Industry and Energy) planed a R&D program for nuclear industry named NuTech2015 and NuTech2030.

In 2000s, Gen IV systems were studied through a multinational cooperation, and Korea also actively participated in their developments, especially SFR and VHTR.

As well as nuclear energy R&D, researches of radiation applications to health, medicine, agriculture and industry were activated based on a legal R&D program.

These R&D activities have made Korea a leading country in nuclear technology.

3. Policy environment surrounding nuclear R&D

Moon Administration's energy transition policy fundamentally implies a de-nuclear energy. This de-nuclear energy policy forces to shrink the role of nuclear energy, and also gives a negative impact on nuclear R&Ds in Korea.

Furthermore, Moon Administration has a fairly negative attitude to develop new or advanced nuclear reactors such as SFR, VHTR and pyro-processing technology.

Recently, MSIT formulated a new nuclear R&D program, so called Future Nuclear Technology Development Strategy responding to the energy transition policy. The Strategy mainly included R&Ds about nuclear safety enhancement, D&D (Decontamination and Decommissioning) and nuclear technology exports to cope with the Government's energy transition policy. Furthermore, MOTIE considers a renewal of NuTech2030 programs and MSIT is also reviewing the 5-year nuclear R&D plan to revise it.

R&Ds for development of SFR and Pyro-processing technology were reviewed in early 2018 by the review committee which consisted of related experts and anti-nuclear activists. The National Assembly called for forming the review committee in 2017. The review committee recommended that development of SFR and Pyro-processing technology should continue by 2020 when Korea-US joint study on those technologies will be completed and suggest their validity to be developed economically and proliferation-resistantly. Thereafter these R&Ds will be reevaluated whether they are viable to be further developed or not.

4. Recommendations for future nuclear R&Ds

A policy environment surrounding nuclear R&D implementation in Korea is not good under Moon Administration's de-nuclear energy policy.

However, the role of nuclear technology is still expected to reduce a greenhouse gas emission, to accelerate a national economic growth, to enhance a national energy security, and to strengthen a scientific and technological fundamental, etc.

Thus nuclear energy should be required to continue its contribution to future sustainable society through viable and practicable nuclear R&Ds.

Responding to emerging issues due to de-nuclear energy policy, several directions for sustainable nuclear R&D are suggested as follows;

- Nuclear safety studies on severe accident prevention and mitigation, remarkable safety enhancement of nuclear power plant in operation, and multi-unit risk assessment;
- D&D technologies to cope with nuclear power plant phasing-out;
- SMR and evolutionary LWR developments to drive a nuclear export;
- Radiation applications to human healthcare; and
- Promotion of nuclear technology spin-off and exploration of new nuclear utilization areas to overcome a prohibition of new reactor developments.

Finally it should be necessary to co-work with other disciplines to make a breakthrough in nuclear R&Ds.

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