A Study on Status of the GIF and its Korea Activities for the development of the Generation IV Nuclear Energy System

S.Y. Chang[a,*], J.H. Lee[b], H.J. Park[c]
[a, c]*Divison of National Nuclear R&D Management, National Research Foundation of Korea, Daejeon 305-350, Korea*
[b]*Nuclear Policy Research Division, Korea Atomic Energy Research Institute, Daejeon 305-353, Korea*

**Corresponding author: chang@nrf.re.kr*

1. Introduction

The world is faced a serious crisis due to climate change and energy scarcity. This crisis has been accelerated due to indiscriminate use of energy. As a result, the global environment is being destroyed at such a rapid rate.

At this time, a growing number of countries and people are recognizing that nuclear energy is the only proven alternative energy source that can reduce the consumption of fossil fuels or replace them, generate minimal greenhouse gases, and provide massive volumes of reliable electricity. As such, nuclear power plants will continue to serve as the source of base load electricity around the world, while countries in the long term will likely expand the use of nuclear energy for purposes other than electric power sources, including heat for industrial processing, district heating, and means of hydrogen production.

In order to expand the utilization of nuclear energy corresponding international demand, it should be prerequisite to seek for the solutions to the unavoidable problems following the utilization of nuclear energy, for example, the problems related to the safe and environment-friendly management of spent nuclear fuels. Also, it is necessary to develop the nuclear hydrogen system actively as one of potent candidates for mass production of hydrogen, for the early entrance into the age of hydrogen economy when hydrogen is used as a substitute for fossil fuel.

The Generation-IV(Gen-IV) nuclear energy systems will provide significantly higher improvements in the sustainability, safety, economy, nuclear non-proliferation compared with existing nuclear systems. This improved nuclear energy systems are projected to be commercialized after 2030.

The advanced countries in nuclear energy such United States, France, Japan, and Korea have organized the Generation IV International Forum(GIF) and have carried out joint research for future nuclear energy systems.

2. GIF Membership, Organization and R&D Collaborations

Thirteen countries and organizations-Argentina, Brazil, Canada, France, Japan, the Republic of Korea, the Republic of South Africa, Switzerland, Euratom, People's Republic of China, Russian Federation, the United Kingdom and the United States-have joined together to form the GIF, the Technical Secretariat of which is provide by the NEA. Argentina, Brazil and the United Kingdom have signed the GIF Charter but did not accede to or ratify the Framework Agreement (FA).

The GIF is consisted of like this.

- Policy Group(PG) : Responsible for the overall steering of the GIF cooperative efforts, the establishment of policies governing GIF activities, and interactions with third parties.
- Export Group (EG) : Reports to the Policy Group, is in charge of reviewing the progress of cooperative projects and of making recommendations to the Policy Group on required actions.
- System Steering Committee (SSC) : plan and oversee the R&D required for the corresponding system.
- Project Management Board (PMB) : Established by the signatories to each Project Arrangements(PA) in order to plan and oversee the project activities which aim to establish the viability and performance of the relevant Generation IV system in the technical area concerned.
- Methodology Working Groups (MWGs) : Responsible for developing and implementing methods for the assessment of Generation IV systems against GIF goals in the fields of economics, proliferation resistance and physical protection, and risk and safety.
- Senior Industry Advisory Panel (SIAP) : To advise the Policy Group on long-term strategic issues, including regulatory, commercial or technical aspects.

As of 1 March 2010, System Arrangements have been signed by several Members for four systems (GFR, SCWR, SFR and VHTR). For the LFR and the MSR, collaborative R&D is currently pursued by interested Members under the auspices of provisional SSCs.

Four Project Arrangements (PAs) have been signed within the SFR system, and are effective: the Advanced Fuel (AF) PA; the Global Actinide Cycle International Demonstration (GACID) PA; the Component Design and Balance-Of-Plant (CDBOP) PA; and the Safety and Operation (SO) PA. Within the VHTR system, three PAs have been signed: the Fuel and Fuel Cycle (FFC)

PA; the Hydrogen Production (HP) PA; and the Material (MAT) PA. As regards GFR system, the Conceptual Design and Safety (CD&S) PA was signed in September 2009 and is now effective. For the case of the SCWR system, the Thermal-Hydraulics and Safety (TH&S) PA was signed on October 2009 and is effective.

3. Korea Participation in GIF R&D Projects

Korea has been a chartered member of GIF since 2000 and has played a significant role in the development of Gen-IV nuclear energy systems. Since 2006, Korea has participated in the co-development of Sodium-cooled Fast Reactor (SFR) and Very High Temperature Reactor (VHTR).

The SFR is a next generation nuclear reactor which initiates nuclear fission using high speed neutron of a high energy level. By using high speed neutron, spent nuclear fuel can be reused as a new fuel. It will achieve not only the most effective use of uranium support, but also reduce the toxicity of spent fuel by transforming it to a longer half-life, highly toxic radioactive elements to a shorter half-life, and less toxic elements.

The VHTR operating 950^{o}C can be used for the production of a large amount of hydrogen in a safe, clean and economical manner through direct separation of water using its high temperature level.

As of March 2011, Korea has signed six collaborative projects: Safety & Operation(SO), Advanced Fuels(AF), and Component Design & Balance of Plant(CDBOP) in SFR and Fuel & Fuel Cycle(FFC), Materials(MAT), and Hydrogen Production(HP) in VHTR.

4. Results and Discussion

To establish the basis for the activities concerning acquisition of advanced nuclear technologies, we need expand the foundation for the international cooperative research and development.

REFERENCES

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