

# ANNUAL REPORT 2019



## **THE GENERATION IV INTERNATIONAL FORUM**

Established in 2001, the Generation IV International Forum (GIF) was created as a co-operative international endeavour seeking to develop the research necessary to test the feasibility and performance of fourth generation nuclear systems, and to make them available for industrial deployment by 2030. The GIF brings together 13 countries (Argentina, Australia, Brazil, Canada, China, France, Japan, Korea, Russia, South Africa, Switzerland, the United Kingdom and the United States), as well as Euratom – representing the 28 European Union members – to co-ordinate research and development on these systems. The GIF has selected six reactor technologies for further research and development: the gas-cooled fast reactor (GFR), the lead-cooled fast reactor (LFR), the molten salt reactor (MSR), the sodium-cooled fast reactor (SFR), the supercritical-water-cooled reactor (SCWR) and the very-high-temperature reactor (VHTR).

## **NUCLEAR ENERGY AGENCY**

The OECD Nuclear Energy Agency (NEA) was established on 1 February 1958. Current NEA membership consists of 33 countries: Argentina, Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Luxembourg, Mexico, the Netherlands, Norway, Poland, Portugal, Korea, Romania, Russia, the Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States. The European Commission and the International Atomic Energy Agency also take part in the work of the Agency.

The mission of the NEA is:

- to assist its member countries in maintaining and further developing, through international co-operation, the scientific, technological and legal bases required for a safe, environmentally sound and economical use of nuclear energy for peaceful purposes;
- to provide authoritative assessments and to forge common understandings on key issues as input to government decisions on nuclear energy policy and to broader OECD analyses in areas such as energy and the sustainable development of low-carbon economies.

Specific areas of competence of the NEA include the safety and regulation of nuclear activities, radioactive waste management and decommissioning, radiological protection, nuclear science, economic and technical analyses of the nuclear fuel cycle, nuclear law and liability, and public information. The NEA Data Bank provides nuclear data and computer program services for participating countries.

The Nuclear Energy Agency serves as technical secretariat to GIF.

## Foreword from the Chair



It is a great honor for me to pen this foreword to our Annual Report about the progress of Generation IV reactor systems and collaborations on the developments. The Gen-IV reactor systems are the next generation for the sustainable use of nuclear energy from the current light water reactors of Generation III or III+.

Since 2001, the Generation IV International Forum (GIF) promotes international R&D collaboration for the development of six types of Gen-IV reactor systems, using sodium, lead, gas, molten salt, and supercritical water. With the right level of international policy support, and ambitious R&D funding, the objective is to reach commercial deployment of the most advanced systems from the 2030s onwards. These systems follow common development goals: safety and economics are two key goals together with sustainability and proliferation resistance and physical protection, which are principles followed by GIF since the beginning. Today, the relevance of these goals remains essential to achieve breakthrough in nuclear energy.

I am the sixth Chair in the 20 years of GIF history since January 2019, succeeding Mr François Gauché of France. GIF directions were set in 2019 as follows:

“We have roadmaps to develop Gen-IV reactor systems and methodologies to assess their compliance to the GIF goals. We will also need to show how these advanced nuclear technologies can integrate into and support future clean energy systems.” Current priorities of GIF are: 1) Safety and regulation: Continue the development of international safety design criteria to facilitate future licensing activities; 2) Market opportunity and challenges: Integration of Gen-IV systems (flexibility, economics) and renewable energy systems in clean energy systems; 3) R&D collaboration: Enhancement of international R&D collaboration; 4) Attracting the young generation.

These priorities are led by our three outstanding vice chairs; Ms Alice Caponiti (United States) for safety and regulation, Mr Sylvestre Pivet (France) for market opportunity and challenges, and Mr Jong Hyuk Baek (Korea) for R&D collaboration.

Given the importance of international safety standards for the licensing of Gen-IV reactor designs, GIF has developed Safety Design Criteria and Guidelines. To take this work further, GIF is also engaging with the nuclear safety community at the international level (with the OECD Nuclear Energy Agency [NEA] and the International Atomic Energy Agency [IAEA]). For example, risk-informed and performance-based approaches, reduction of emergency planning zones (EPZ) for small modular reactors (SMRs) discussed at the IAEA are great concerns to GIF about the early deployment of Gen-IV reactors.

GIF is also convinced that stronger co-operation is needed between R&D bodies and the private sector. This is especially important in order to integrate future market opportunities and constraints at the design stage. On this point, a significant value of the Gen-IV systems is to contribute to the reliable clean energy systems through new sources of flexibility. Higher temperatures of sodium, lead, or gas allow coupling of electricity production with heat storage or hydrogen production as part of a hybrid energy system. Some Gen-IV systems could broaden the flexibility of existing nuclear reactors, for instance load-following capabilities.

Especially from the GIF directions, we will show GIF outputs to the world, policy makers, and industries more than before in order to promote the opinions to make progress with the Gen-IV reactor systems in difficult and complex energy market situations, expanding renewable energies, concerns for safety after the Fukushima Daiichi nuclear power plant accident (1F accident), and the increasing violent weather issues coming caused by global warming. We had several opportunities to express our opinions and results to the world. The CEM10 side event of nice future initiative in Vancouver, Canada was a good occasion for GIF. We also joined the IAEA worldwide meeting of “Climate change and Role of Nuclear Power” in Vienna and gave a keynote presentation.

In parallel to these world conferences, GIF had several workshops with private sectors, the GIF meeting in Canada in May 2019, the GIF meeting in China in October 2019, and also in Paris in February 2020 to identify collaborations on promoting the Gen-IV reactor developments and deployments including SMRs. I believe that these workshops will contribute to the higher opportunity of Gen-IV reactors in the energy market.

This annual report covers our overall activities in 2019 about six reactor systems and also cross-cutting issues of Task Forces and Working Groups. I expect that this annual report is meaningful for all of readers to refer our GIF activities and to find a good relation and collaboration with us.



Dr Hideki Kamide, GIF Chair, representing GIF at the 10<sup>th</sup> Clean Energy Ministerial (CEM 10) in Vancouver, Canada in May 2019

Hideki Kamide  
GIF Chair