

## Review on Korea Participation of Generation IV International Forum (GIF)

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### 1. Introduction

Generation IV International Forum (GIF) originates from US proposal of an initiative in 2000. The vision was to leapfrog LWR technology and collaborate with international partners to share R&D on advanced nuclear systems[1]. Nine countries and EU joined the initiative and Gen IV concept was defined via technology goals and legal framework. Two years study with more than 100 experts worldwide has evaluated nearly 100 reactor designs and down selected six most promising concepts. In 2005, the first signatures on Framework Agreement were collected and the first research projects were defined in 2006.

GIF governance structure is schematically shown in Fig. 1 and the relationship among each GIF bodies is also described in arrows.

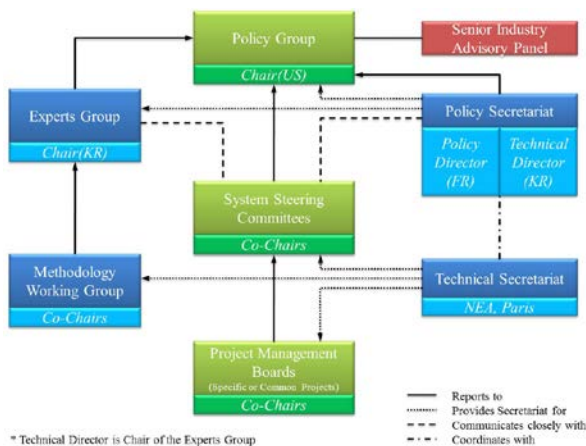


Fig. 1 GIF governance structure

GIF membership is maintained by the nine founding members (Argentina, Brazil, Canada, France, Japan, South Africa, South Korea, UK, and US) and subsequent members (Switzerland, Euratom, China, and Russia). In addition, OECD/NEA supports various GIF activities by providing secretariat service.

GIF systems include Sodium-cooled Fast Reactor (SFR), Very High Temperature Reactor (VHTR), Gas-cooled Fast Reactor (GFR), Super-Critical Water Reactor (SCWR), Lead-cooled Fast Reactor (LFR), and Molten Salt Reactor (MSR). Under each system, GIF members collaborate and cooperate in various projects.

GIF goals[2] are divided into four categories as described in below.

(1) Sustainability – Long term fuel supply, Minimize waste and long term stewardship burden

(2) Safety & Reliability – Very low likelihood and degree of core damage, Eliminate need for offsite emergency response

(3) Economics – Life cycle cost advantage over other energy sources, Financial risk comparable to other energy projects

(4) Proliferation Resistance & Physical Protection – Unattractive materials diversion pathway, Enhanced physical protection against terrorism

### 2. Status of Korea Participation

#### 2.1 Policy Group (PG) & Experts Group (EG)

In PG, Korea has two delegates and PG members are responsible for the overall steering of the GIF cooperative efforts, establishment of policies governing GIF activities, and interactions with third parties[3].

In EG, there are two experts participating and EG members are in charge of reviewing the progress of cooperative projects and of making recommendations to the PG on required actions. They advise the PG on R&D strategy, priorities and methodology and on the assessment of research plans prepared in the framework of System Arrangements.

Since 2013 PG/EG meeting, Korean expert has been nominated for the Technical Director (TD) and is now acting as a connection between PG and EG by chairing the EG and making the decision within EG.

#### 2.2 System Steering Committees (SSCs)

Korea is an official member of SFR and VHTR system. Under SFR SSC, there are five Project Management Boards(PMBs) as described below.

- (1) Safety and Operation
- (2) Advanced Fuel
- (3) Component Design and BOP
- (4) Global Actinide Cycle Int. Demo. (GACID)
- (5) System Integration and Assessment

Korea is participating all except GACID project and actively producing results in each project.

Under VHTR SSC, there are four PMBs as described below.

- (1) Hydrogen Production
- (2) Fuel and Fuel Cycle
- (3) Materials
- (4) Computational Method Validation & Benchmark

Korea is an active member of all projects.

### *2.3 Methodology Working Groups (MWGs)*

There are three MWGs, which are Economics Model (EMWG), Risk and Safety (RSWG), and Proliferation Resistance & Physical Protection (PRPPWG). Korea is participating as a member in all three MWGs.

### *2.4 Others*

Korea has one member of Senior Industry Advisory Panel (SIAP) which provides advice to the PG on system development from the perspective of industry, on issues related technology development, demonstration, and deployment, and commercialization of advanced nuclear energy systems.

There are several Task Force (TF) teams to satisfy the need of solution to the occasional issues. Currently, Korea is taking part in two TFs, Safety Design Criteria (SDC-TF) and Sustainability-TF. Especially, the chair of Sustainability-TF is Korean expert.

## **3. Pros and Cons**

Unlike other international collaborative projects, GIF recognizes the difference in development level and environment in each member countries and thus various national programs are encouraged not to conclude in one common result. Therefore within GIF frame, each member country pursues its own national R&D plan and the result of R&D is shared among member countries of interests. This unique characteristic yields advantages and disadvantages in the following areas.

### *3.1 Policy Decision*

Until recent nomination of Korean TD, GIF was led by the advanced member countries, mainly US, France and Japan and thus the direction was not fit to Korean situation. However with the new TD's role and activities in GIF frame, Korea earned more chance to participate in deeper collaboration resulting in more favorable conditions for national R&D. One example is that Korean expert took the chair of Sustainability-TF which is a notable area that Korea had long difficulties since the nuclear development. Another example is that the Korean regulatory body has started to move on to the advanced reactor systems in which they were less interested due to large LWR industry and this international movement is encouraging the Korean government as well.

However, lack of awareness on the importance of GIF issue caused negative feedback on frequent meetings abroad due to the limited experience of international collaboration on advanced system R&D and its results. The necessity of the meeting participation is underestimated and sound funding is not ensured.

One of the disadvantages is that extra burden is charged on the responsible persons in PG/EG and TD although there is no direct and quantitative influence on national R&D.

### *3.2 System Deliverables*

In contrary to the policy, direct and quantitative R&D results are shared under SFR and VHTR SSC in terms of deliverables. Korea provides the planned deliverables to other countries and obtains the deliverables of missing items in national program from other member countries. In this way, strong and weak areas of R&D are compensated. R&D on radioactive environment or material is a good example which Korea is inhibited to handle.

However, similarly to the previous discussion, extra time and effort without funding is a burden to the participating experts. Attendance to the frequent meetings is indispensable to decide how to effectively share each member's data and results.

### *3.3 Methodology Research*

The results of methodology research are indirectly applied to the national R&D, but in quantitative manner. Economics, Safety, and PRPP evaluate the developing system design and suggest different viewpoints to the system developer. In case of RSWG work, the analysis on SFR system may support licensing procedure of Korean SFR in future and SDC-TF work may provide the similar support as well.

On the other hand, sustainability methodology work may improve the current situation related to the radioactive material handling in Korea. The chair has been assigned to Korean expert and there are considerable possibilities of finding a breakthrough to solve Korean situation.

The methodology itself can be neutral and applicable to all system but the result comes out individually and in relative value. As long as GIF allows each member countries freewill to develop their own reactor system, the result from methodology research will only be used to compare with other systems. Furthermore the quality of the evaluation depends on how much information to be used and opened to other countries. Many countries including Korea are reluctant to share the core technology and technique. Therefore, the quality or level of the result from methodology evaluation will be a question.

## **4. Suggestion**

As mentioned in previous section, the understanding of importance of international collaboration including GIF will be the key to enhance Korea R&D competitiveness. To maximize the benefit from GIF participation, change is needed in two areas, support team and funding. Additional support team to handle the

administrative works as well as the communication in governmental level will help the experts to focus on their R&D and produce results. Similar to the OECD/NEA's role as a technical secretariat, Korean participants need a secretariat and advisory service covering various issues of interests. The special support team may provide not only the language and communication support, but technical and legal assistance plus industrial advice.

Regarding the funding, the extra resources for the meeting attendance will be enough to support GIF participants. Since the research is funded by national program anyhow, the only financial difficulty lies in arranging the budget for business trip.

## **5. Conclusion**

Korea is one of the founding members of GIF and actively participating in various areas. In 2013, TD was assigned to Korean expert and Korea is endeavoring to enhance the benefit of participation since this turning point.

In this paper, pros and cons of engaging with GIF were briefly introduced and items to maximize the benefit were suggested. For further involvement in GIF, a stronger support based on understanding of the effect of international collaboration will be essential.

## **Acknowledgement**

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