

The Generation IV International Forum: Achievements

Hideki Kamide*
GIF Policy Group (PG) member
Director General, Advanced Fast Reactor Cycle System R&D Center
Japan Atomic Energy Agency (JAEA)

*** On behalf of Kazumi Aoto, Vice-Chair of GIF PG**

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About GIF

- *The GIF was founded in July 2001 as a co-operative international endeavour to carry out the R&D needed to establish the feasibility and performance capabilities of the next generation nuclear energy systems.*
- *Gen IV concepts defined via technology goals and legal framework.*
 - *Thirteen Members signed its founding document, the GIF Charter, which was extended in Jul. 2011.*
 - *Technology Roadmap 2002 was updated in Jan. 2014.*
 - *The technology goals provided the basis for identifying and selecting six nuclear energy systems for further development.*
 - *Framework Agreement (FA) was extended in Feb. 2015.*

GIF's Membership

	Argentina*
	Brazil*
	Canada
	People's Republic of China
	Euratom
	France
	Japan

	Republic of Korea
	Russian Federation
	Republic of South Africa
	Switzerland
	United Kingdom*
	United States

*Non-active member

GIF Technology Goals

■ *Sustainability*

- *Long term fuel supply*
- *Minimize waste and long term stewardship burden*

■ *Safety & Reliability*

- *Very low likelihood and degree of core damage*
- *Eliminate need for offsite emergency response*

■ *Economics*

- *Life cycle cost advantage over other energy sources*
- *Financial risk comparable to other energy projects*

■ *Proliferation Resistance & Physical Protection*

- *Unattractive materials diversion pathway*
- *Enhanced physical protection against terrorism*

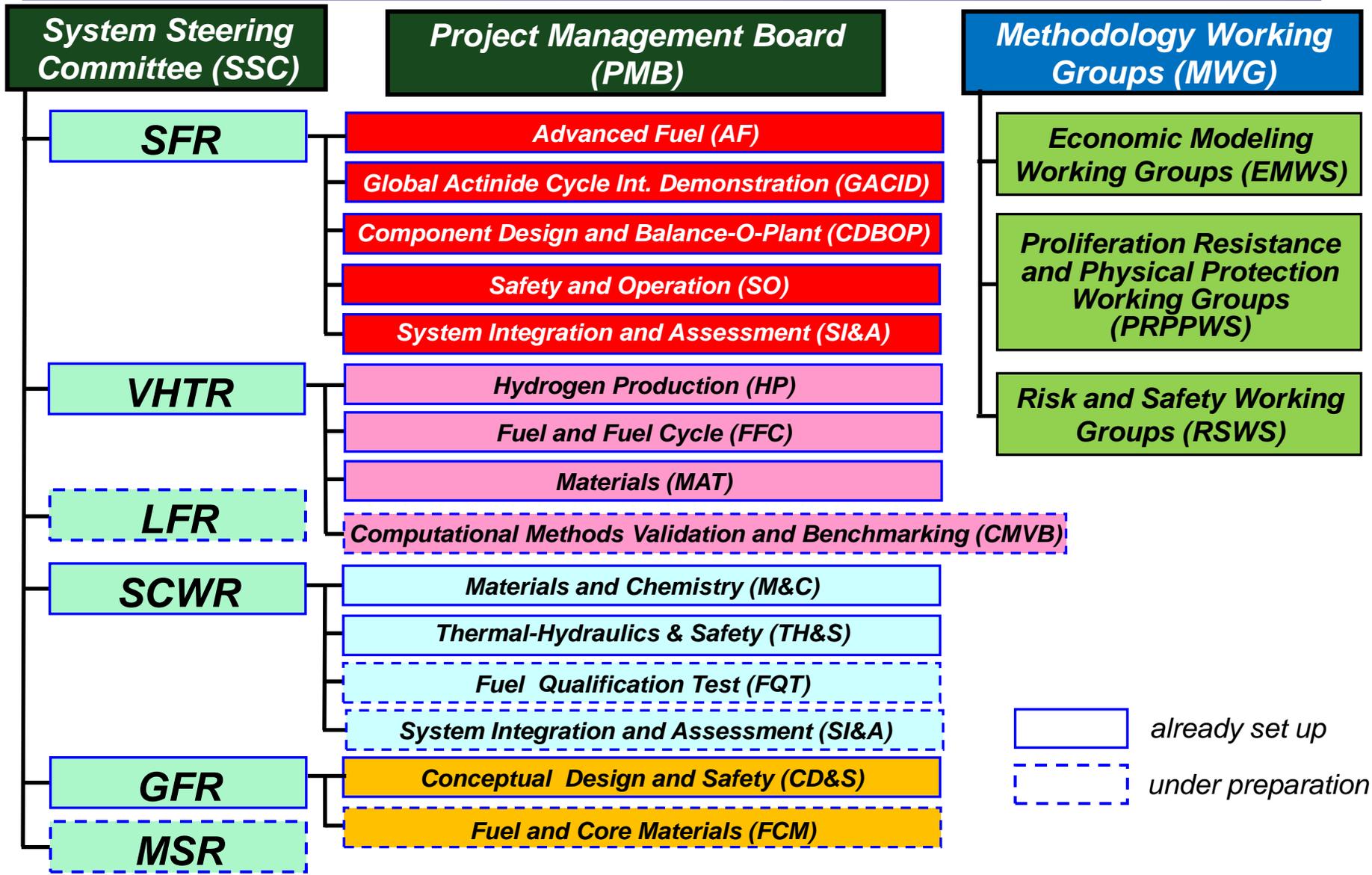
Generation IV System Development

	 Canada	 China	 France	 Japan	 Korea	 Russia	 South Africa	 Swiss	 USA	 EU
SFR		●	●	●	●	●			●	●
VHTR		●	●	●	●			●	●	●
LFR				○		○				○
SCWR	●	●		●		●				●
GFR			●	●				●		●
MSR			○			○				○

● *Participating member, a signatory of System Arrangements (SA)*

○ *Participating member, a signatory of Memoranda of Understanding (MOU)*

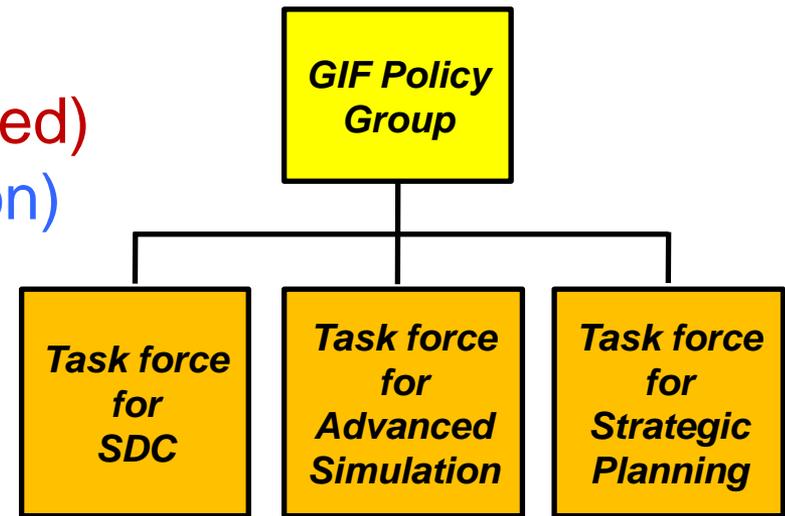
R&D Projects and Methodology WGs in GIF



Recent GIF's Activities

■ Task Forces

- Safety design criteria (SDC)
- **Advanced simulation (completed)**
- **Sustainability (under discussion)**



❖ Strategic planning is underway for further progress of GIF

- Ten years have passed from the establishment of GIF.
- Development of Gen-IV systems is progressing to the next phase.
- Technology has advanced.

■ Strategic planning activities (Task Forces)

Safety Design Criteria (SDC) Task Force

- In order to commercialize the SFR systems by the middle of this century, building of **international common criteria on safety design**, flexible within an acceptable range, has become more important.
- SFR “**Safety Design Criteria (SDC)**” to achieve safety goals of Gen-IV systems have been developed by the **SDC Task force**, which was established in May 2011, under the auspices of the GIF Policy Group.
- **The SDC Phase-1 report** was approved by the PG in May 2013 and is being **reviewed by national regulators** and **international organizations** (IAEA, MDEP, OECD/NEA/CNRA).
- “**Safety Design Guidelines (SDGs)**” development for application of the SFR SDC started in 2013.
 - Two SDGs are prepared: the first one of **safety approach and design conditions SDG** is in final drafting stage.

Hierarchy of Safety Standards (including GIF SDC and SDG)

Safety Fundamentals

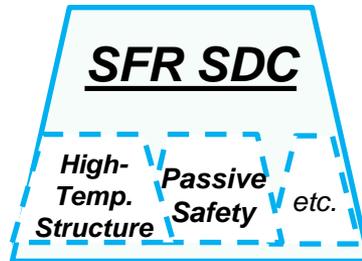
← Fundamental Safety Principles



Common Safety Goals and Safety Approach for Gen-IV Reactor

Safety Design Criteria [GIF-SDC]

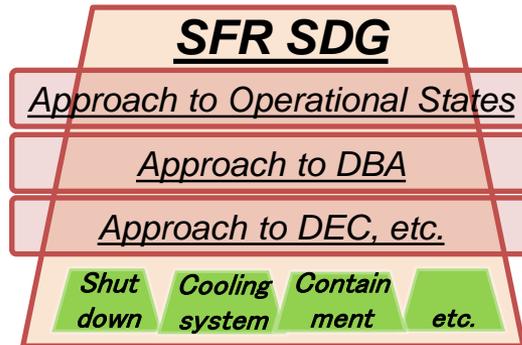
← Harmonized Safety Requirements for SFR



A set of Criteria based on GIF Basis for Safety Approach, with accounting SFR Specific Characteristics

Safety Design Guideline [GIF-SDG]

← Guides of Safety Design & Assessments

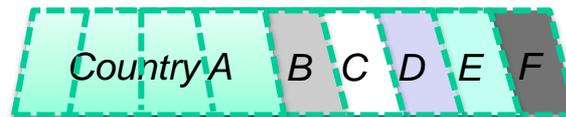


A set of Guides

- Guide to Approaches on specific safety concerns (e.g. Reactivity, Loss of heat removal...)
- Technical Guides of Safety Design & Assessments (e.g. Design Basis, Condition...)

Technical Codes & Standards

[Domestic Code & Standards]



Advanced Simulation Task Force

- ***A special GIF workshop on “Advanced simulation in support to GIF reactor design studies –Contribution of High Performance Computing (HPC) and Uncertainties Quantification” was held on 27 October 2013 in Paris***

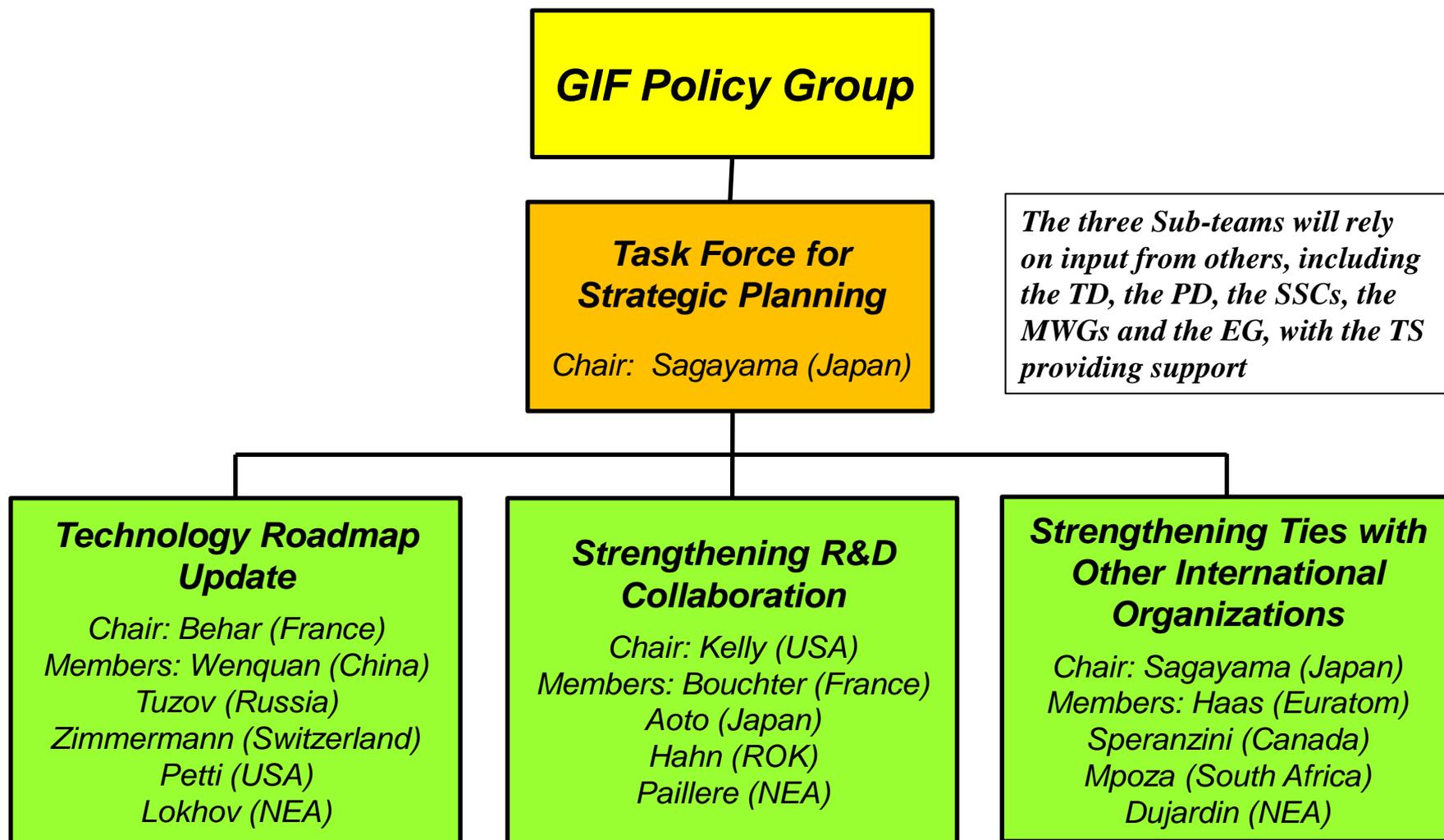
Objectives:

- **to exchange information between GIF systems and components designers and experts in advanced techniques for numerical simulation.**
- **to evaluate the interest of introducing these techniques in the GIF’s projects.**

Main Conclusions:

- **These advanced techniques are more often used for performance evaluation of component or equipment than for drawing a conceptual design.**
- **The importance of Computational Fluid Dynamic (CFD) is raising to help optimizing a design and CFD is the only advanced discipline that is used as a routine to optimize a component.**

GIF Strategic Planning Task Force



ST-1: Updating Technology Roadmap (1/2)

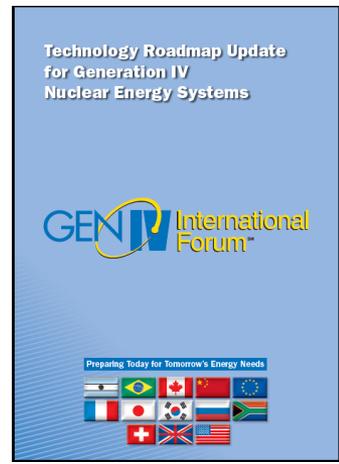
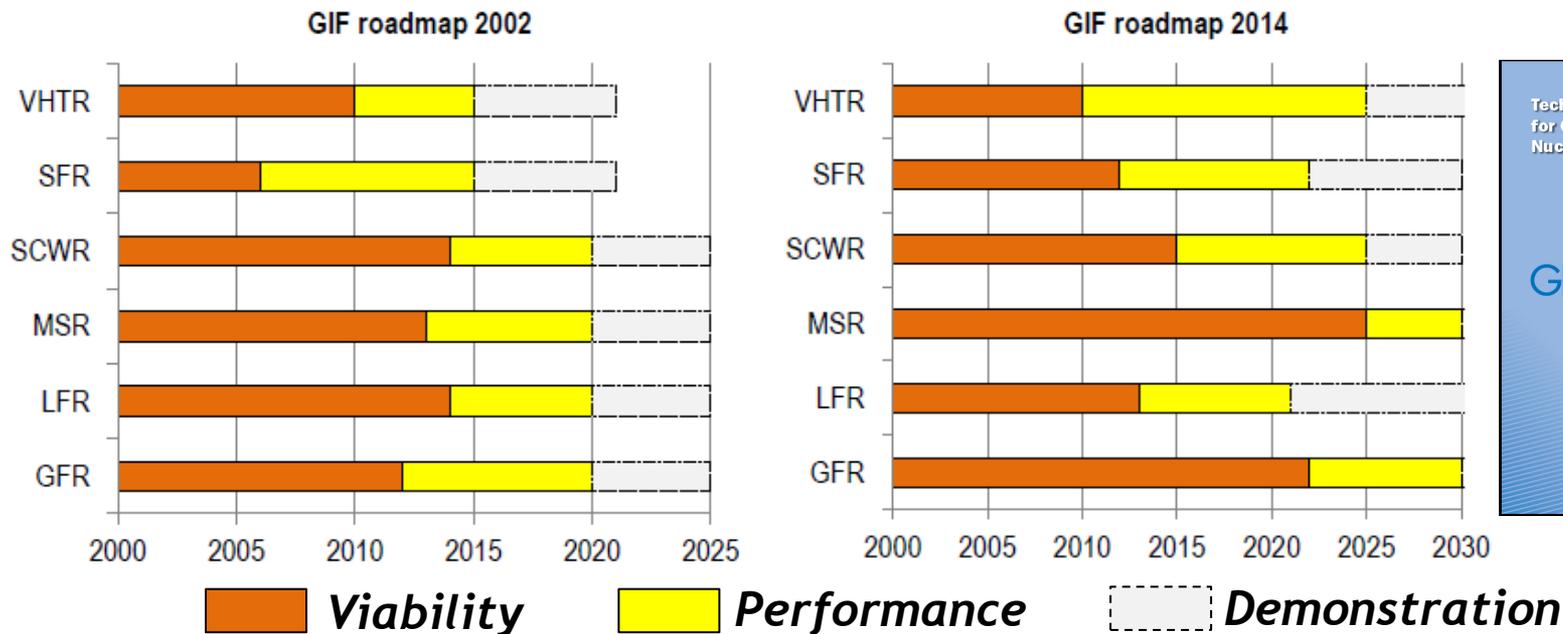
Objectives:

- *to formulate a high-level report summarizing the achievement of the past ten years and defining the R&D steps for the next decade, with more details for the coming three to five years.*
- *Worthwhile and challenging goals, as well as activities and projects to be accomplished in next decade through GIF, are explored considering the following items:*
 - *new/modified technical issues,*
 - *any new concepts to be considered for R&D collaboration within GIF,*
 - *impact of the Fukushima Daiichi accident on Gen IV goals and safety targets,*
 - *requirements for future R&D and prototype/technology demonstration.*

ST-1: Updating Technology Roadmap (2/2)

- Depending on their respective degrees of technical maturity, the Generation IV systems are expected to become available for commercial introduction in the period around 2030 or beyond.
- The path from current nuclear systems to Generation IV systems is described in the technology roadmap update:

www.gen-4.org/gif/upload/docs/application/pdf/2014-03/gif-tru2014.pdf



ST-2: Strengthening R&D collaboration

Objectives:

- ***to make its approach clear in developing recommendations for improving R&D collaboration***
- ***to identify internal issues with R&D collaborations within GIF and developing promising means of building stronger and broader collaboration.***

Identified issues:

- ***Project Management***
- ***Sharing Capabilities and Resources***
- ***Communication***
- ***Senior Industry Advisory Panel (SIAP) Engagement***
- ***implementation of identified recommendations will improve GIF collaborations for the coming decade and beyond.***

ST-3: Strengthening ties with other international organizations

Objectives:

- ***Collaboration with other organizations is useful to achieve GIF's objectives to promote R&D on Gen-IV systems efficiently and effectively, and also helpful to achieve the GIF's Technology Goals.***
- ***Appropriate co-operative activities with other organizations that have different characteristics will create synergy and provide strong support to achieve or goals.***
- ***Reviewed organizations:***
 - ***International Atomic Energy Agency (IAEA)***
 - ***OECD Nuclear Energy Agency (OECD/NEA)***
 - ***Multinational Design Evaluation Programme (MDEP)***
 - ***International Framework for Nuclear Energy Cooperation (IFNEC)***
 - ***Academic Societies, Universities and Industries***

Strengthening ties with IAEA

- ***Good collaboration between GIF and IAEA/INPRO***
 - ***Annual interface meeting,***
 - ***Modeling and Simulation in the areas of PRPP & Economics***
 - ***SFR Safety Workshops***
 - ***General and technically specific reviews on GIF SDC Phase-1 report (2014)***
 - ***Int. Conf. on Fast Reactors and Related Fuel Cycles 2013 (FR13) (2013).***
- ***Interactions with Departments of Nuclear Energy, Nuclear Safety and Security, and Safeguards.***
- ***Establishing guidelines or guidance for PRPP and In-Service Inspection (ISI) will be in the scope of new GIF collaborative activities.***

Strengthening ties with OECD/NEA

- ***The technical Secretariat, provided by the NEA, supports the System Steering Committees (SSCs), Project Management Boards (PMBs), Modeling Working Groups (MWGs) and Task Forces (TFs).***
- ***The NEA addresses scientific and safety issues for both current and advanced concepts of nuclear energy systems and helps to maintain the necessary R&D infrastructure through international co-operation.***
- ***Start interaction with the NEA Committee on Nuclear Regulatory Activities (CNRA) to obtain comments on SFR SDC.***

OECD Nuclear Energy Agency: OECD/NEA

Strengthening ties with MDEP

- ***MDEP is an important forum for discussing new reactor safety issues and exploring harmonization and convergence opportunities for new reactor regulatory practices.***
- ***GIF SFR “SDC Phase 1 Report” was sent to MDEP for review in July 2013.***
- ***GIF Projects will be able to take benefit from the MDEP experience in making comparisons of the regulatory practices in the member countries, identifying differences, and developing common positions and methodologies.***

Multinational Design Evaluation Programme : MDEP

Strengthening ties with IFNEC

- ***Introduction of the GIF activity and outline of Gen-IV systems gives a better understanding of IFNEC participants on the target and outline of Gen-IV system from its development stage.***
- ***It may be a strategic arrangement for their future introduction of Gen-IV system and lead its global expansion.***
- ***Invitation of IFNEC participants to GIF symposiums, and distribution of GIF annual reports and education material of Gen IV systems.***
- ***Active involvement by GIF representatives in IFNEC WGs***

International Framework for Nuclear Energy Cooperation: IFNEC

GIF website

https://www.gen-4.org/gif/jcms/c_9260/public

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The Generation IV International Forum (GIF) is a co-operative international endeavour organised to carry out the research and development (R&D) needed to establish the feasibility and performance capabilities of the next generation nuclear energy systems.

The Generation IV International Forum has [thirteen Members](#) which are signatories of its founding document, the [GIF Charter](#).

The goals adopted by GIF provided the basis for identifying and selecting [six nuclear energy systems](#) for further development. The six selected systems employ a variety of reactors, energy conversion and fuel cycle technologies. Their designs feature thermal and fast neutron spectra, closed and open fuel cycles and a wide range of reactor sizes from very small to very large. Depending on their respective degrees of technical maturity, the Generation IV systems are expected to become available for commercial introduction around 2030-2040.

GIF PRESENTATIONS »

Generation IV International Forum

John S. Kelly
Special Assistant Secretary for Nuclear Reaction Technologies
Office of Nuclear Energy
US Department of Energy
January 2016

GIF FACTS AND GRAPHS »

What's New

Just Published: GIF Technology Roadmap Update

Upcoming Events

News & Events

Latest progress in the development of VHTR TRISO fuel

Gen IV News Article

SCWR System Steering Committee Meeting

1950 1970 1990 2010 2030 2050 2070 2090

Thank you for your attention !
