

Generation IV International Forum (GIF)



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VP Science and Technology, UKNNL

Introduction to GIF: its members

Created in 2001, GIF is a framework for international co-operation in research and development for the next generation of nuclear energy systems.



On 1st March 2025, the new Framework Agreement entered into force and ten Member Countries plus the EU are expected to join within the next 3 years



Australia



Canada



China (People's Republic of)



Euratom



France



Japan



Korea



South Africa



Switzerland



United Kingdom



United States

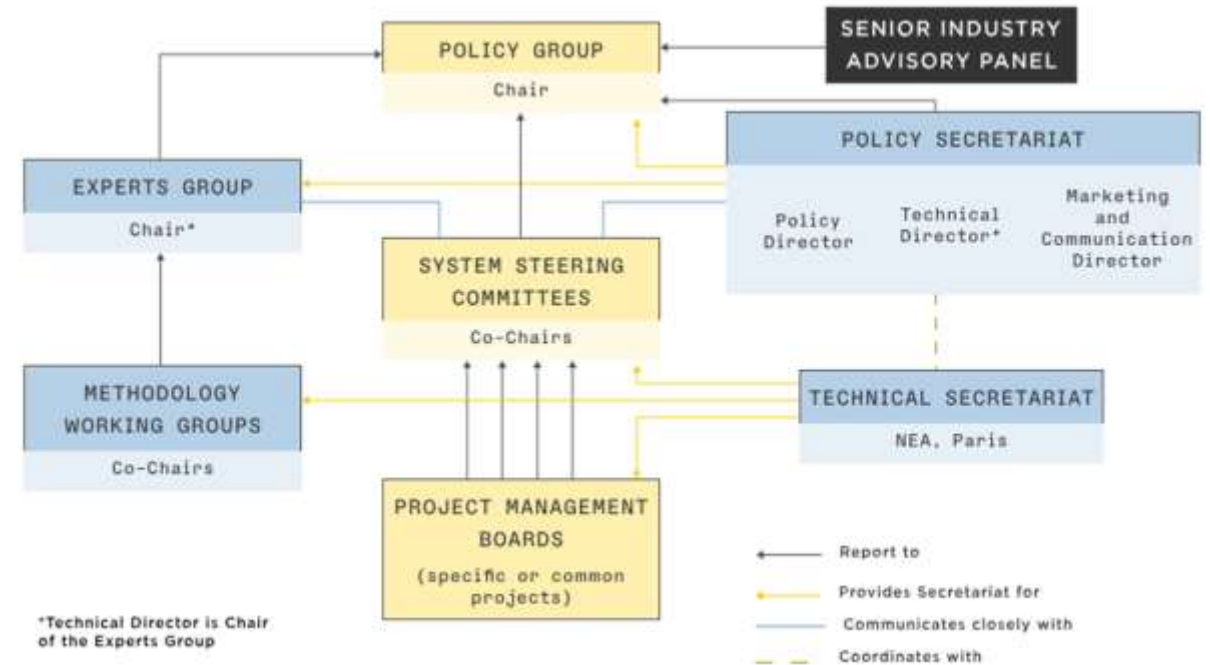
GIF's History – 25 years of international cooperation on Generation IV Nuclear Energy Systems

- GIF originated from **an international experts meeting in January 2000**
- In 2005 the **GIF Framework Agreement (FA)** was signed for 10 years and extended for an additional 10 years in 2015.
 - First International Treaty aimed at the international development of Advanced Nuclear Energy Systems.
- In 2025 a **New GIF Framework Agreement** was established.
 - The New GIF FA **entered into force on the 1st of March 2025** for a period of 10 years.
 - The **focus of the New GIF FA (2025)** is to:
 - Ensure **continuity** of GIF work
 - Build on **lessons learned** in the first 25 years of GIF existence to improve its governance and enable strengthened cooperation among its members
 - Facilitate **involvement** at the project level of **a broad scope of relevant stakeholders currently working on specific generation IV technologies and advancing their commercial deployment**

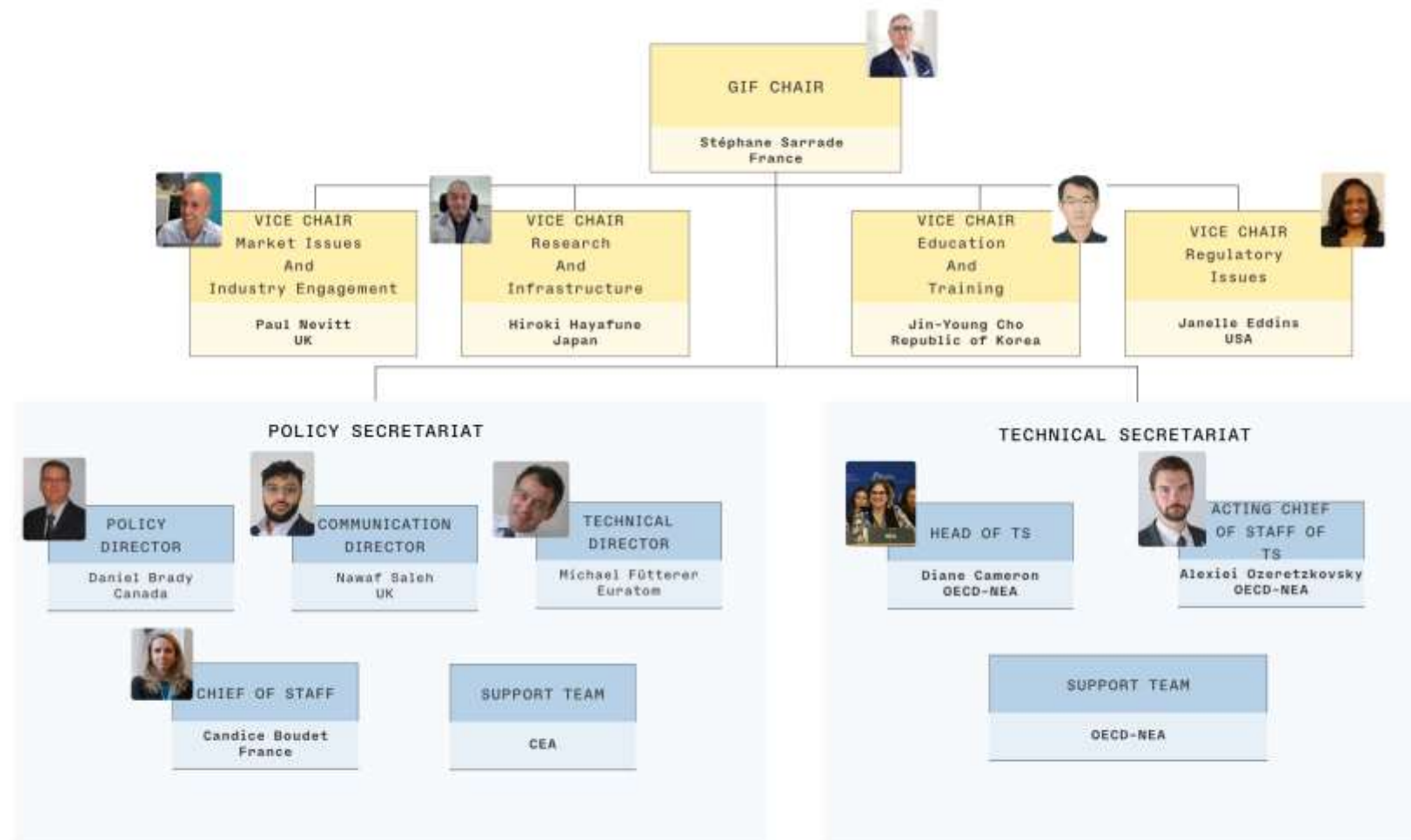
Introduction to GIF: Key theme

Accelerating the Readiness of Gen IV Systems to Meet Net Zero Goals

- **Strengthening Gen IV system features to address climate change**
 - Enabling Flexible operations applications beyond electricity generation
- **Supporting transition from R&D to demonstration and deployment**
 - Technical readiness,
 - Regulatory readiness
 - Optimising performance
- **Strengthening the relevance of GIF to the industry**
 - Promoting Industry engagement
 - Senior Industry Advisory Panel (SIAP)
- **Supporting the development of the Gen IV talent pipeline**



GIF Leadership Team (2025-2027)



Generation IV Goals and Gen. IV Nuclear Energy Systems

Generation IV Systems

Technologies identified as promising to meet Gen. IV Goals and deployable starting from 2030

GIF started its work by gathering more than **100 experts to review more than 130 reactor concepts.**

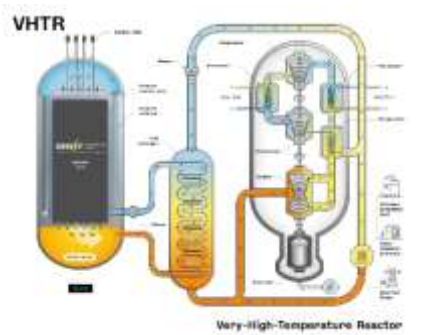
The result of this work was the **identification of the six nuclear energy systems concepts seen as the most promising to meet Gen IV goals** and be deployable starting from the 2030s: LFR, MSR, SFR, SCWR, VHTR, GFR nuclear energy systems.

Two **main GIF publications** resulting from these technology review and analysis efforts that **define strategic focus of GIF and a joint R&D roadmap**:

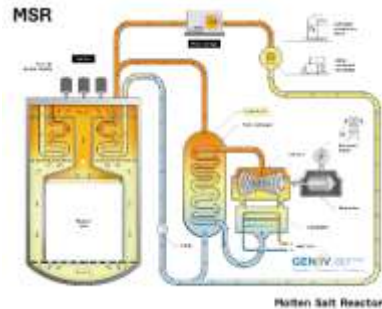
- Generation IV **Technology Roadmap** (2002, updated in 2014)
- GIF **Research and Development Outlook** for Gen. IV Nuclear Energy Systems (2018)

Six Generation IV Reactor Technologies

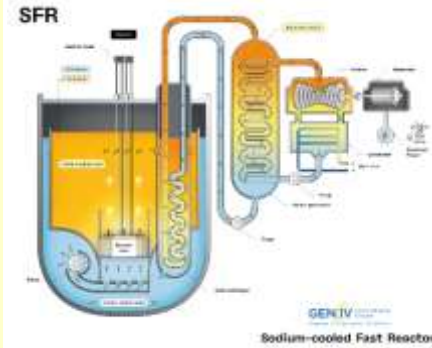
Very High Temperature Reactor (VHTR)



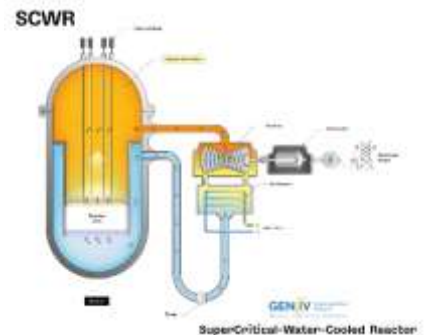
Molten Salt Reactor (MSR)



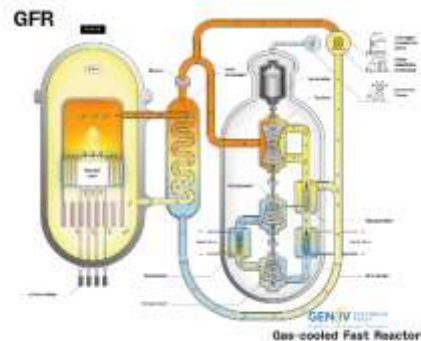
Sodium-cooled Fast Reactor (SFR)



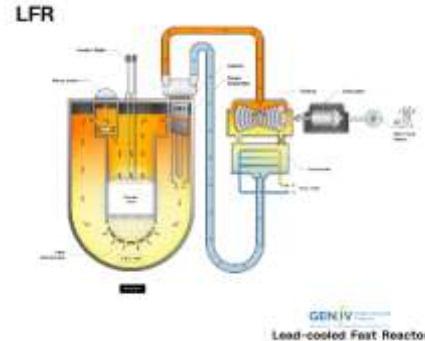
Supercritical Water-cooled Reactor (SCWR)



Gas-cooled Fast Reactor (GFR)



Lead-cooled Fast Reactor (LFR)



Cross-cutting Collaborations

- ❖ Economics & Modelling
- ❖ Education & Training
- ❖ Proliferation Resistance & Physical Protection
- ❖ Risk & Safety
- ❖ Safety Design Criteria
- ❖ Non-Electric Applications of Nuclear Heat
- ❖ Advanced Manufacturing & Materials Engineering

To achieve goals in four areas:

1. Sustainable energy with minimum waste
2. Life cycle cost advantages
3. Safety and reliability
4. Proliferation resistance & physical protection

Generation IV Goals

GIF has identified 8 technology goals in 4 broad areas that define the next generation of nuclear energy systems



SUSTAINABILITY

- Non-polluting, sustainable, long-term availability and **efficient fuel utilisation**
- **Minimise** the amount of **waste** produced and optimise their management



ECONOMICS

- Clear **lifecycle advantage** over other energy sources
- Level of financial risk comparable to other clean energy sources



SAFETY & RELIABILITY

- Excellence in **safety** and **reliability**
- Very **low likelihood** and degree of reactor core damage
- Elimination of the need for offsite emergency response

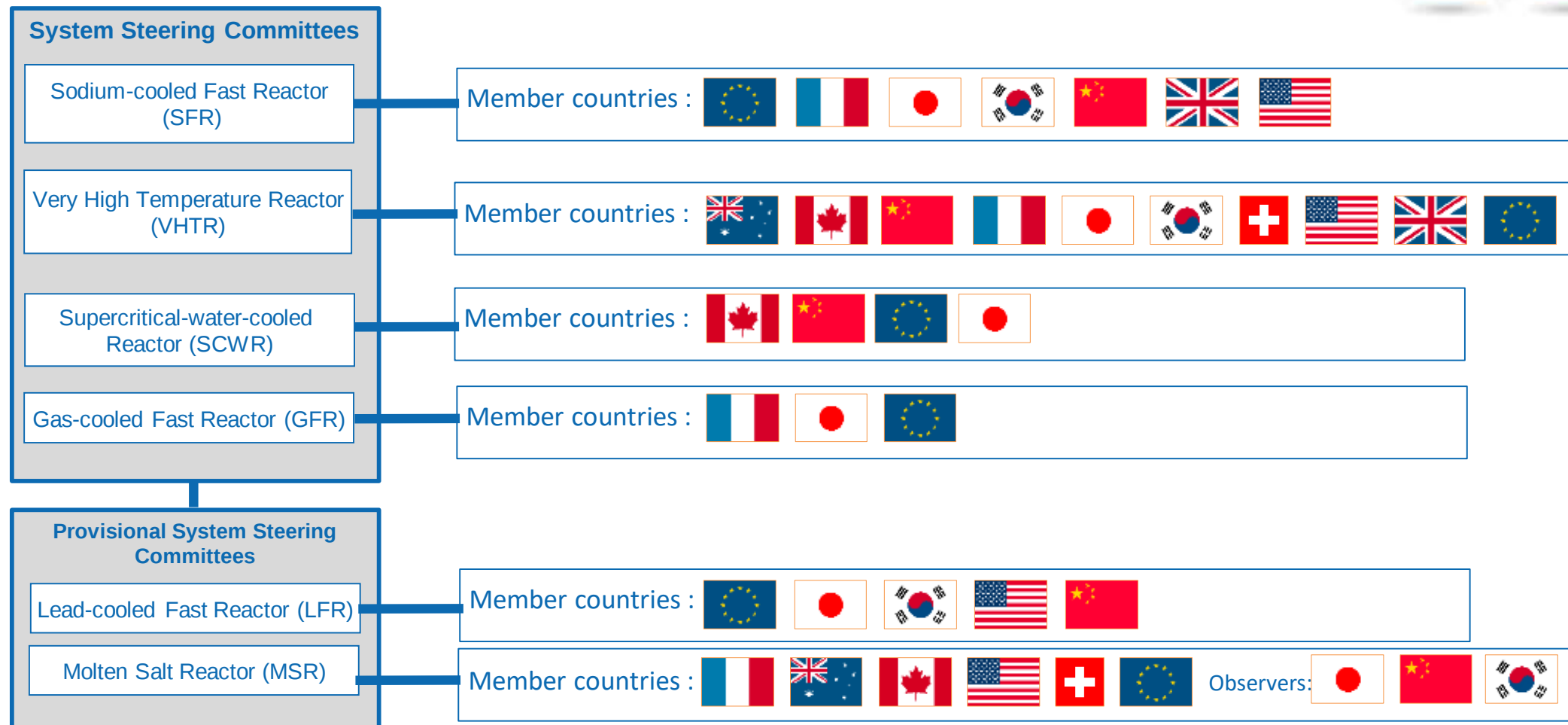


PROLIFERATION RESISTANCE & PHYSICAL PROTECTION

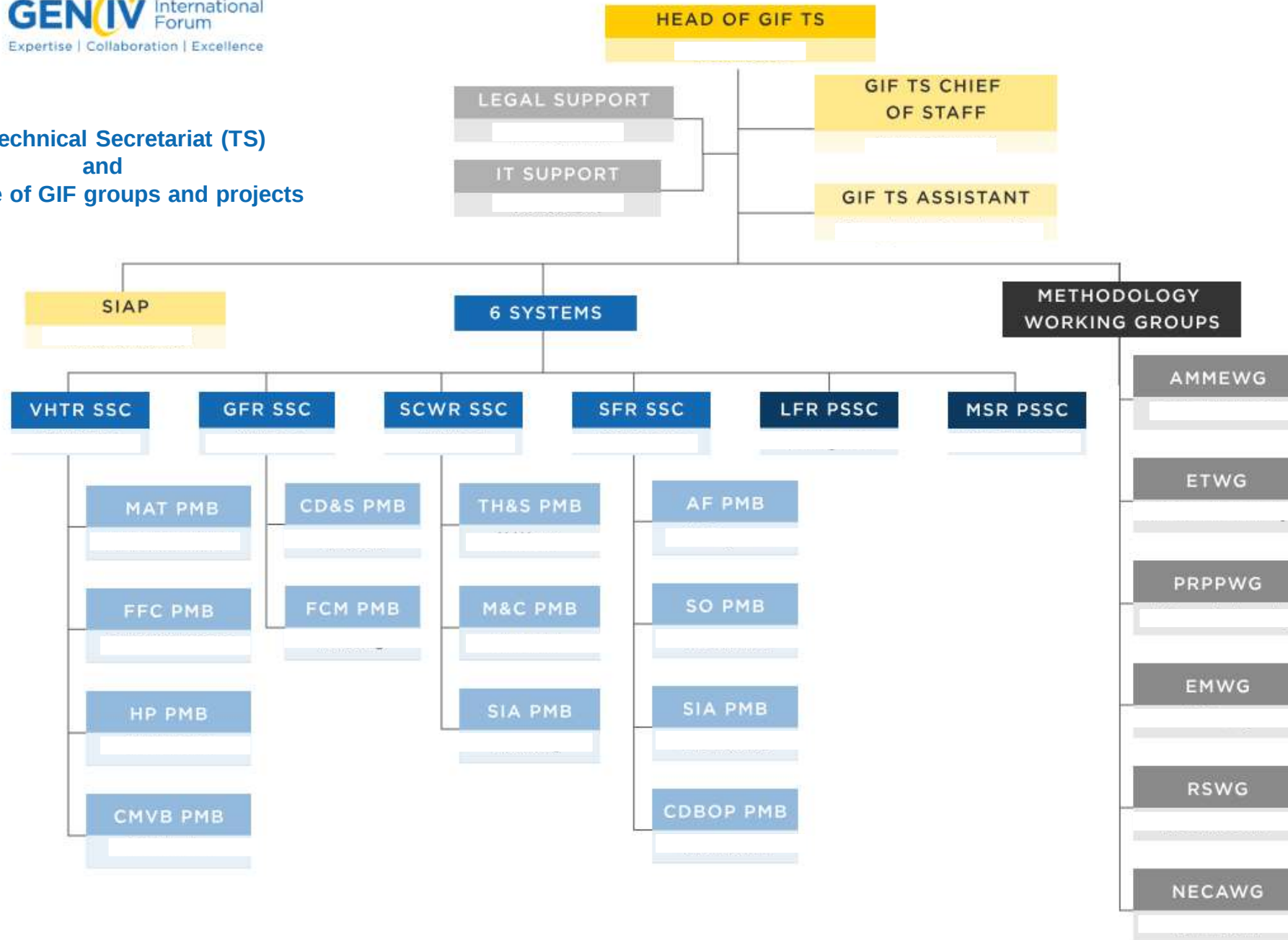
- **Unattractive and least desirable** route for diversion or theft of weapons-usable materials and increased physical protection against acts of terrorism



Countries Involvement in GIF's Systems



**GIF Technical Secretariat (TS)
and
Structure of GIF groups and projects**



Sodium-cooled Fast Reactor - SFR

GIF Project Arrangements under SFR System Steering Committee

ADVANCED FUELS (AF)

- **Investigating various SFR fuels** irradiation behavior, studying core materials withstanding high neutron doses and temperatures and novel fuel fabrication techniques
- Support the **development of high burnup minor-actinide bearing fuels**

COMPONENT DESIGN AND BALANCE-OF-PLANT (CD&BOP)

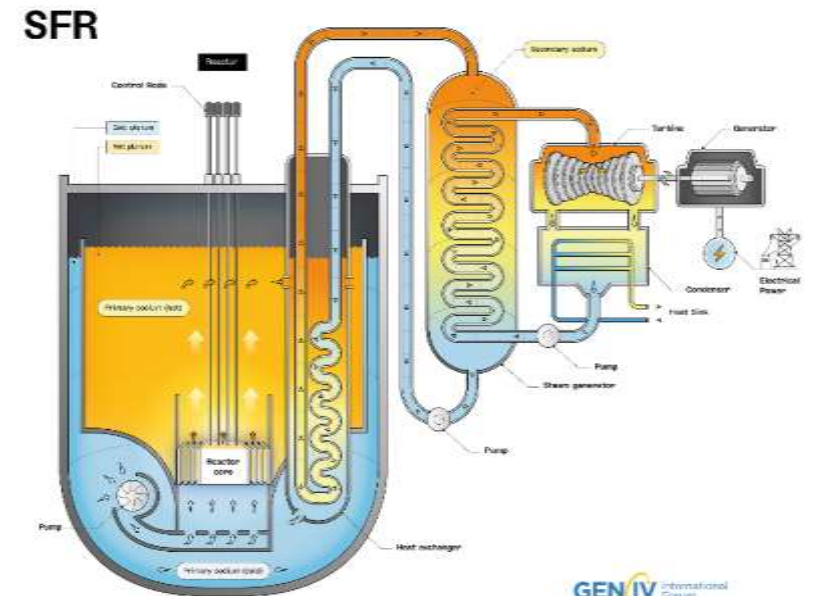
- Research and develop **innovative approaches** for designing advanced **components**, in-service **inspection tools**, and **maintenance strategies** to **improve economic performance** of SFRs.

SAFETY & OPERATION (SO)

- Conduct **analyses and experiments to: support safety** approaches; validate specific safety features; develop and validate modelling tools for safety analysis
- Cooperate and **share operating experience** from existing SFRs

SYSTEM INTEGRATION AND ASSESSMENT (SIA)

- **Review and integrate GIF R&D results** from a system design perspective to **refine requirements** and directions for the SFR R&D
- Periodically **assess the system options and design tracks** against the **GIF technology goals** and SFR-specific requirements



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Sodium-cooled Fast Reactor

Very High Temperature Reactor - VHTR

GIF Project Arrangements under VHTR System Steering Committee

FUEL AND FUEL CYCLE (FFC)

- Explore potential for further **TRISO fuel development** to improve burnup, fission product retention, and accidents tolerance
- Explore novel **fuel-cycle options** for VHTR fuel and **back-end management** solutions

COMPUTATIONAL METHODS, VALIDATION & BENCHMARKS (CMVB)

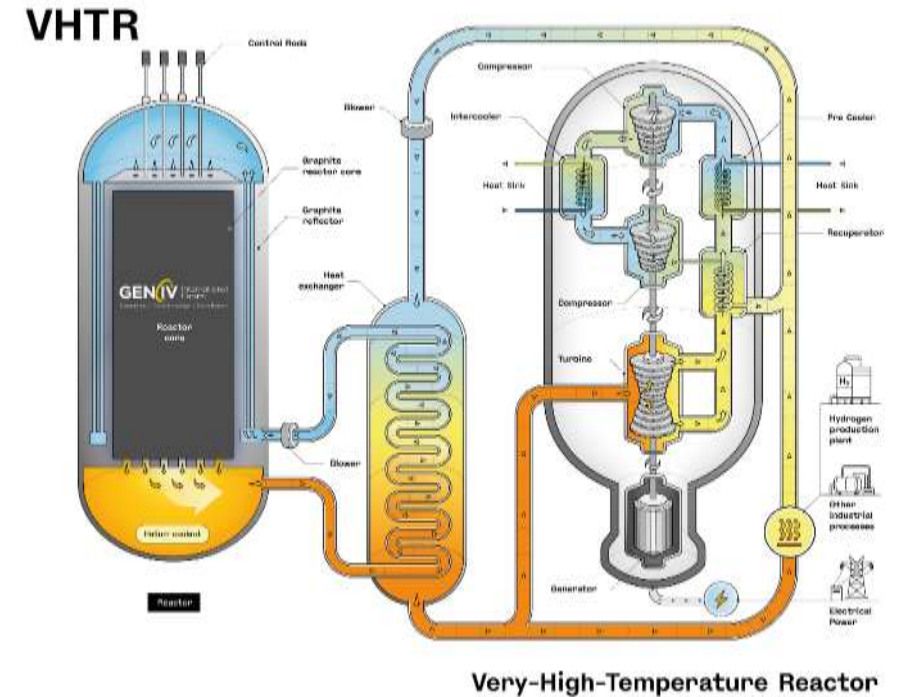
- **Validate and compare simulation tools** for thermal-hydraulics, core physics, and accident scenarios needed for the design and licensing of VHTRs

HYDROGEN PRODUCTION (HP)

- Joint R&D efforts to address material development, feasibility, optimization, efficiency and economic evaluation for **industrial-scale hydrogen production with VHTRs**

MATERIALS (MAT)

- Support the **development and qualification of advanced materials**
- Enrich and maintain the **Gen. IV Materials Handbook**
 - An international comprehensive database of reactor materials' properties
 - Supports materials selection, component design, stress analysis, and code development
 - Includes more than 550 materials related R&D reports



Gas Cooled Fast Reactor - GFR

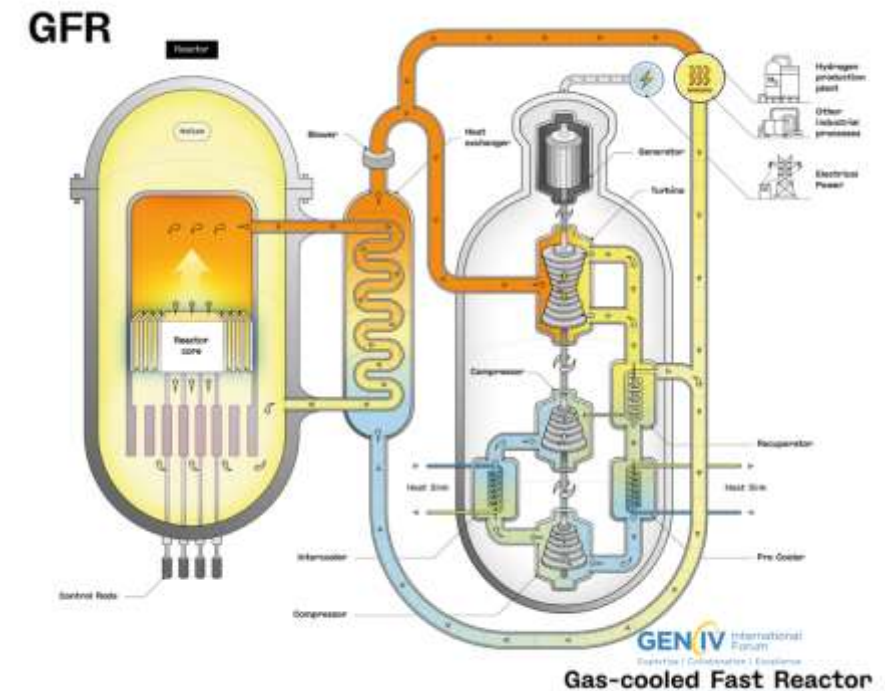
GIF Project Arrangements under GFR System Steering Committee

CONCEPTUAL DESIGN AND SAFETY (CD&S)

- Conceptual studies of a reference GFR system
- Analysis of specific **GFR safety features**
- Development of **dedicated computational tools**

FUEL AND CORE MATERIALS (FCM)

- **Test of fuel and core materials** for GFRs
- Develop qualification procedure for start-up core and numerical models for ALLEGRO start-up core fuel simulation



Super Critical Water Reactor - SCWR

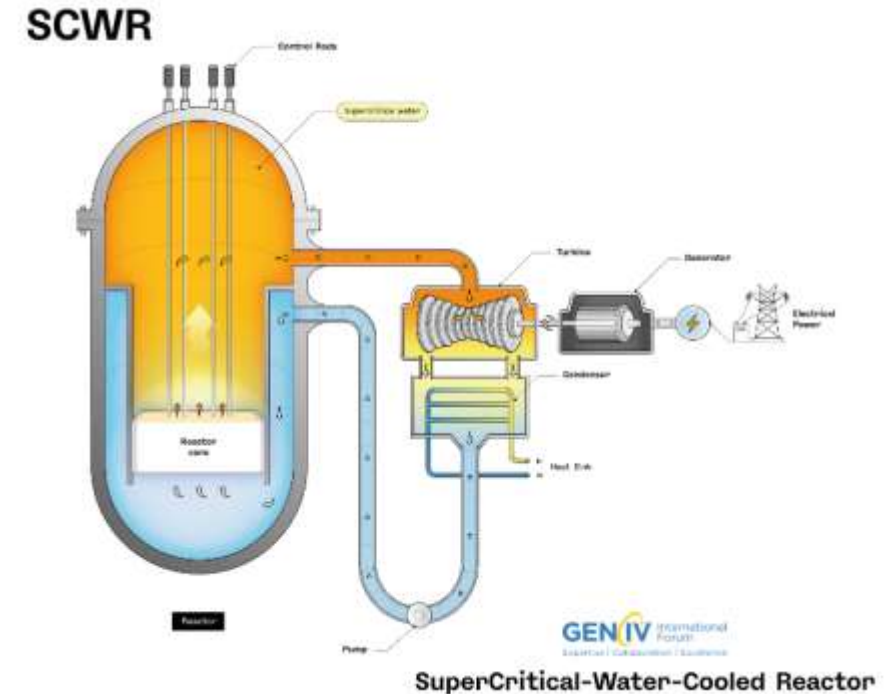
GIF Project Arrangements under SCWR System Steering Committee

MATERIALS AND CHEMISTRY (M&C)

- Collaborative research on basic **materials and chemistry development for SCWRs**
- Study **long-term behaviour of candidate materials** for in-core and out-of-core components, including the fuel cladding
- **Specify a water chemistry regime** for the testing of materials and for the future operation of a prototype SCWR

THERMAL-HYDRAULICS AND SAFETY (TH&S)

- Conduct collaborative research on basic **thermal-hydraulic phenomena, safety, stability and methods development** for the SCWR System
- Develop **reliable and robust codes** for the analysis of core subchannel and SCWR system and **provide accurate thermo-hydraulic data** to those analysis codes
- Perform **experiments on thermo-hydraulic phenomena** in laboratories and integral test loop
- **Establish a database** and work on modification, improvement, and benchmarking of **analysis codes**

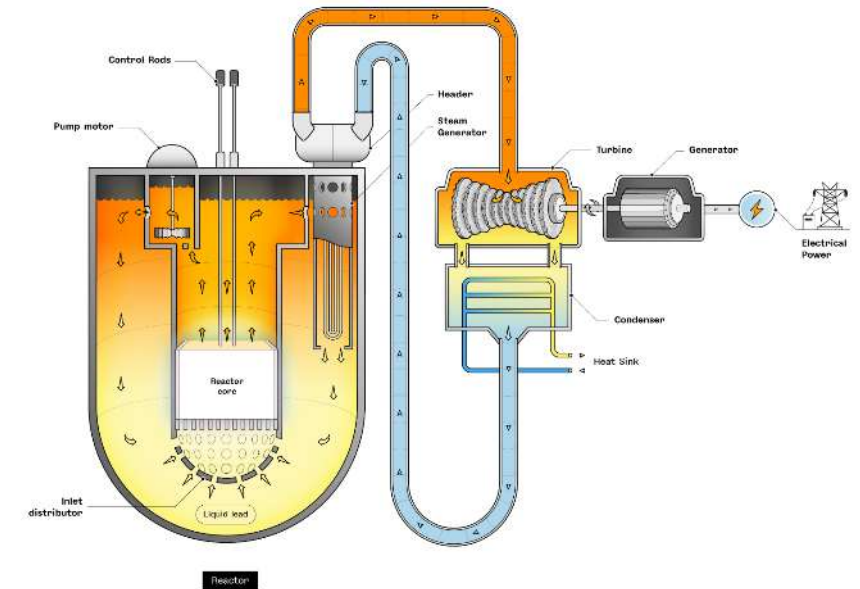


Lead-cooled Fast Reactor - LFR

GIF efforts under LFR Memorandum of Understanding (MoU)

- The GIF MoU on LFRs established a provisional System Steering Committee (pSSC) to facilitate information exchange among signatories on the progress of LFR-related research and development within their organisations and countries. While no formal GIF projects are conducted under this pSSC, the structure supports expert discussions based on shared knowledge and ongoing national programmes.
- The LFR pSSC hosted the 2024 Global Symposium on Lead and Lead Alloy Cooled Nuclear Energy Science and Technology
- The LFR pSSC was the first of GIF groups to participate to the “**GIF Talks With Industry**” Webinar Series.

LFR

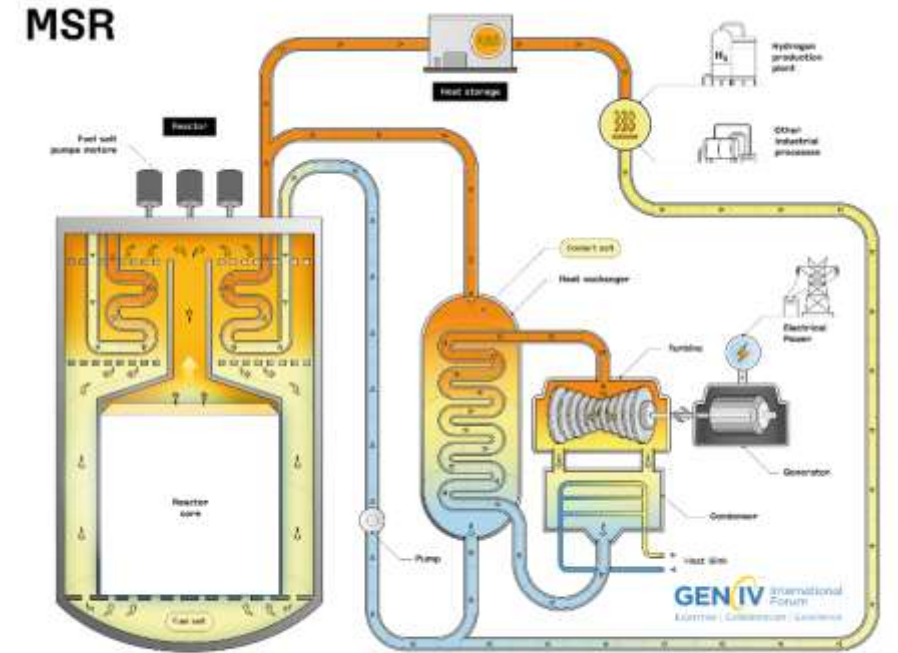


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Expertise | Collaboration | Excellence
Lead-cooled Fast Reactor

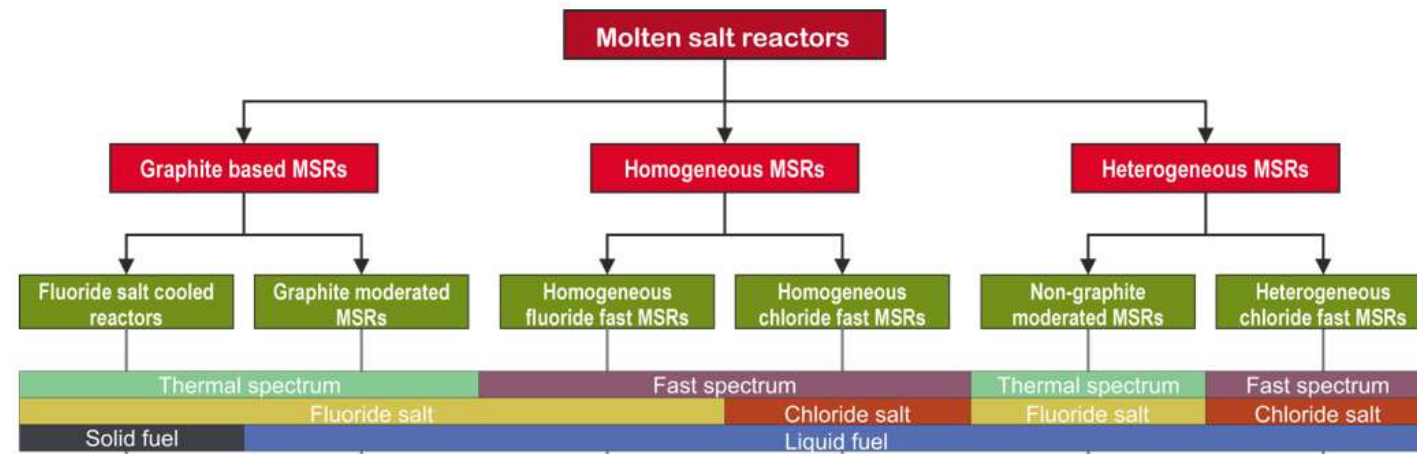
Molten Salt Reactor - MSR

GIF efforts under MSR Memorandum of Understanding

- The GIF Memorandum of Understanding (MoU) on Molten Salt Reactors (MSRs) established a provisional System Steering Committee (pSSC) to facilitate information exchange among signatories on developments in MSR research and programmes within their respective organisations and countries. While no formal GIF projects are conducted under pSSCs, this structure provides a platform for expert discussions based on shared knowledge. Should member countries decide to initiate specific joint projects, a System Arrangement may be established accordingly.



Molten Salt Reactor



Objectives and strategic orientation for the 3 years to come

The aim is to remain at the forefront of technological innovation and to pursue international collaborations in order to stimulate and accelerate the deployment of Generation IV systems.

➤ Capitalising on and improving the expertise acquired

- Entry into force of the **2025 GIF FA** on March 1, 2025, ensuring continuity of project
- Organisation of the **GIF Industry Forum** during the French presidency, building on the successful 2022 event.

➤ Expanding to new players, new applications and new markets beyond power generation.

- **Strengthening collaboration**
 - With start-ups
 - With European partners such as the European Alliance for SMRs, SNETP, and International organisations IAEA, OECD/NEA, IEA
- Take better account of the **fuel cycle parameters** in the various systems
- Establish a comprehensive **communication strategy** to raise GIF profile and attract new talent



Global Status Of Gen IV



[Nuclear Energy Agency \(NEA\) - The NEA Small Modular Reactor Dashboard: Third Edition](#)

Figure 11. SMR concepts

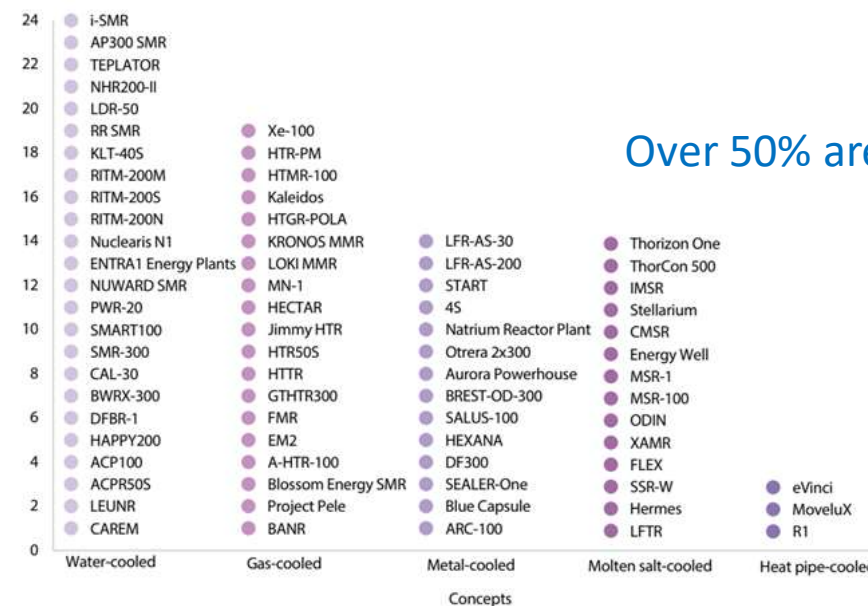
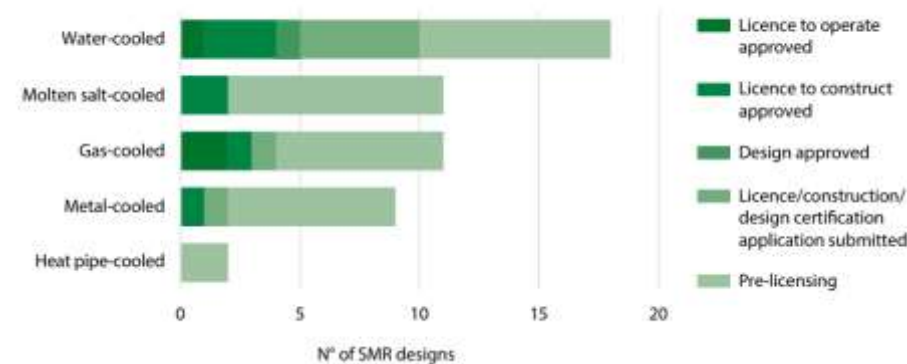


Figure 28. Licensing progress, by SMR concept



GIF Engaging with Industry

**GIF Policy Statement
2022: GIF Engagement
with the Nuclear Industry**

GIF Industry Forum

GIF talks with Industry

Senior Industry Advisory Panel (SIAP)

GIF Industry Engagement



[Industry Engagement | GIF Portal](#)

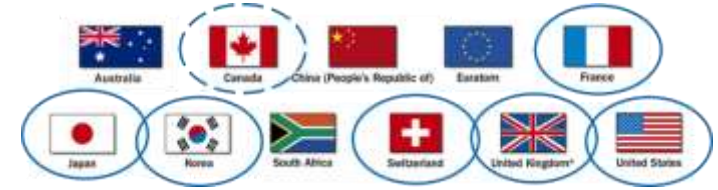
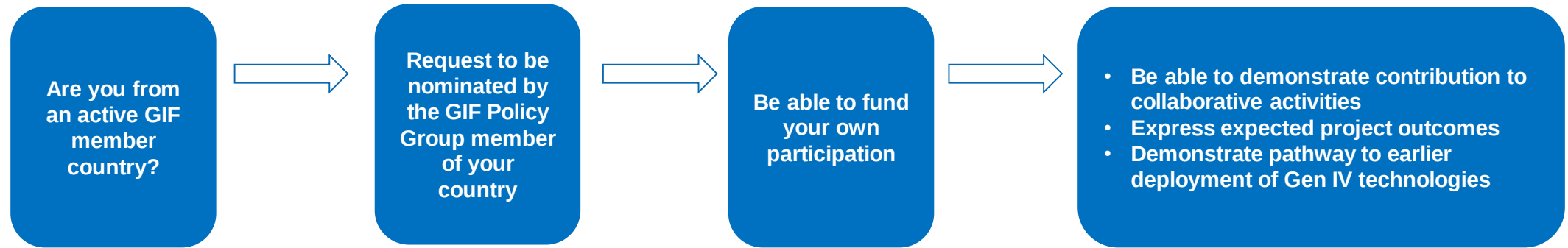
“The Nuclear Industry will ultimately be the conduit through which Generation IV reactors will become a reality, and it is through the Nuclear Industry that GIF can achieve its aim of contributing to the development of new nuclear energy systems.

The new policy statement details the agreed mechanisms and processes to interact with industry and provides the confidence to GIF members that they can and should engage with industry.

As an organisation created through an international treaty, it is important to have rules of engagement so that interactions with industry abide by the treaty, and the policy statement provides these, bringing together in one place the different procedures and processes by which industry can engage with, and benefit from the work of GIF.”

How industry can engage with GIF

Direct participation



Engage with GIF



Increasing GIF's Engagement with Industry: GIF regional Industry Round table

Objectives of the GIF Industry Round Table:

- Understand Chinese **industry perspectives on the opportunities and challenges** of participating in Generation IV system development.
- Explore mechanisms to **de-risk investment and strengthen collaboration** between government, laboratories, industry, and finance.
- Identify practical steps the GIF Policy Group can take to **enable stronger industry engagement globally**.

Expected outcomes of the GIF Industry Round Table :

- Clear articulation of **industry needs and expectations** from GIF.
- Identification of **enablers for finance and industry participation** in Generation IV development.
- Agreement on **2–3 concrete actions** for the Policy Group to progress.

Increasing GIF's Engagement with Industry: GIF regional Industry Round table

Main outcomes from the IRT in Korea:

- Financing and investment **de-risking mechanisms** are needed to accelerate deployment.
- **Government–industry–research collaboration** is essential for commercialization.
- **Demonstration projects** are required to prove technical and commercial viability.
- Standards, regulation, workforce development, and public acceptance remain critical enablers for Gen IV success.

Main outcomes from the IRT in China:

- **Industrial applications** are becoming the **primary market driver** for Generation IV reactors.
- Commercialization requires **coordinated regulatory, policy and financial support**.
- International harmonization of **standards and licensing** approaches is a top industry priority.
- **GIF** has a critical role to play in **enabling collaboration, knowledge sharing and deployment readiness**.

GIF IRT 2025, Republic of Korea, October 2025



GIF IRT 2026, China, April 2026



Increasing GIF's Engagement with Industry: GIF at the World Nuclear Exhibition

Successful session held at WNE 2025, with significant engagement from industry. Increasing awareness of GIF and what it can offer.



How GIF's members contribute

With concrete projects: contribution to a Project Plan

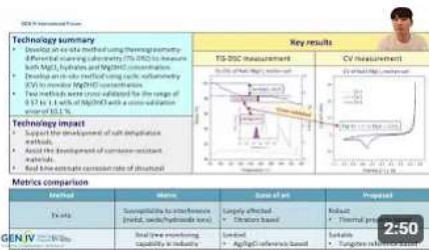
- 11 projects are running,
- 1 new will start with Industry

With in-kind contributions:

- Contribution to GIF's report and White Papers
- Active participation to webinars:
 - On cross-cutting collaborations,
 - On Education and training session,
 - With potential GIF's partners: GIF talks with industry
 - On dedicated technology

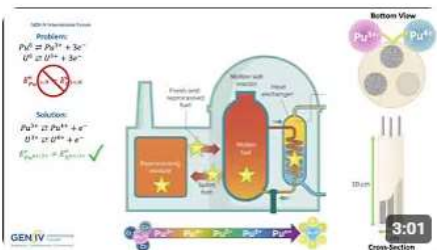
With a Voluntary Contribution to GIF's budget:

A dedicated budget has been strategically allocated to ensure the successful support of the GIF initiative.



PYG4R-2025: Method to Measuring Moisture Concentration in MgCl₂ Containing Molten...

518 vues • il y a 4 mois



PYG4R-2025: Novel Diamond Sensor to Investigate High-Valence Actinides in Molt...

311 vues • il y a 4 mois

WEBINARS

GIF talks with industry series #3 - LFR Developers: Ansaldo Nucleare

WEBINARS

GIF talks with industry series #2 - LFR Developers: Blykalla

WEBINARS

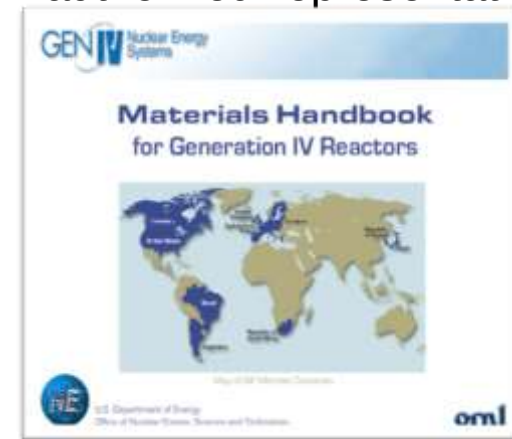
GIF talks with industry series #1 - LFR Developers: newcleo

Example of GIF R&D products – Gen IV Materials Handbook

R&D Results from the VHTR Materials Project are used to Qualify High Temperature Advanced Reactor Materials

The Gen IV Materials Handbook is a digital database system used to collect and manage well over \$250M GIF VHTR materials data:

- Includes graphite, metals, ceramics & composites data.
- Includes technical reports, test data, materials pedigrees, microstructures, data analysis & comparison tools, etc.
- Constitutes an authoritative single source of Gen IV VHTR materials data with controlled accesses: information is available to Project Arrangement Signatories and their authorized representatives.
- Provides technical basis for improved codes & standards.



Example of GIF R&D products: GIF reports and White papers

- Proliferation Resistance and Physical Protection White Paper
 - Molten Salt Reactors – 2023
 - Very High Temperature Reactors – 2022
 - Gas Fast Reactors – 2022
 - Super Critical Water Reactors – 2022
 - Lead Fast Reactors - 2021
 - Sodium Fast Reactors - 2021
- Safety Design Guidelines on Structures, Systems and Components for Generation IV **Sodium-cooled Fast Reactor systems** – 2024
- Safety Design Criteria for Generation IV **Very High Temperature Reactor System** – 2023
- **System Analysis: Hydrogen Production from Nuclear Energy**, led by NECA NEA with input from NEA Working Group on Hydrogen Value Chains – to be published 2025



Example of GIF R&D products: GIF Tools and Databases

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Search

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GIF ACTIVITIES INDUSTRY ENGAGEMENT EVENTS AND RESOURCES GENERATION IV CRITERIA AND TECHNOLOGIES ABOUT GIF

Home > Resources > GIF Tools and Databases

GIF Tools and Databases

Over the years GIF has developed several modeling tools and databases. Some are accessible by the public, others limited to GIF members. Resources in this section will let you learn more about these tools and databases.

← BACK TO RESOURCES

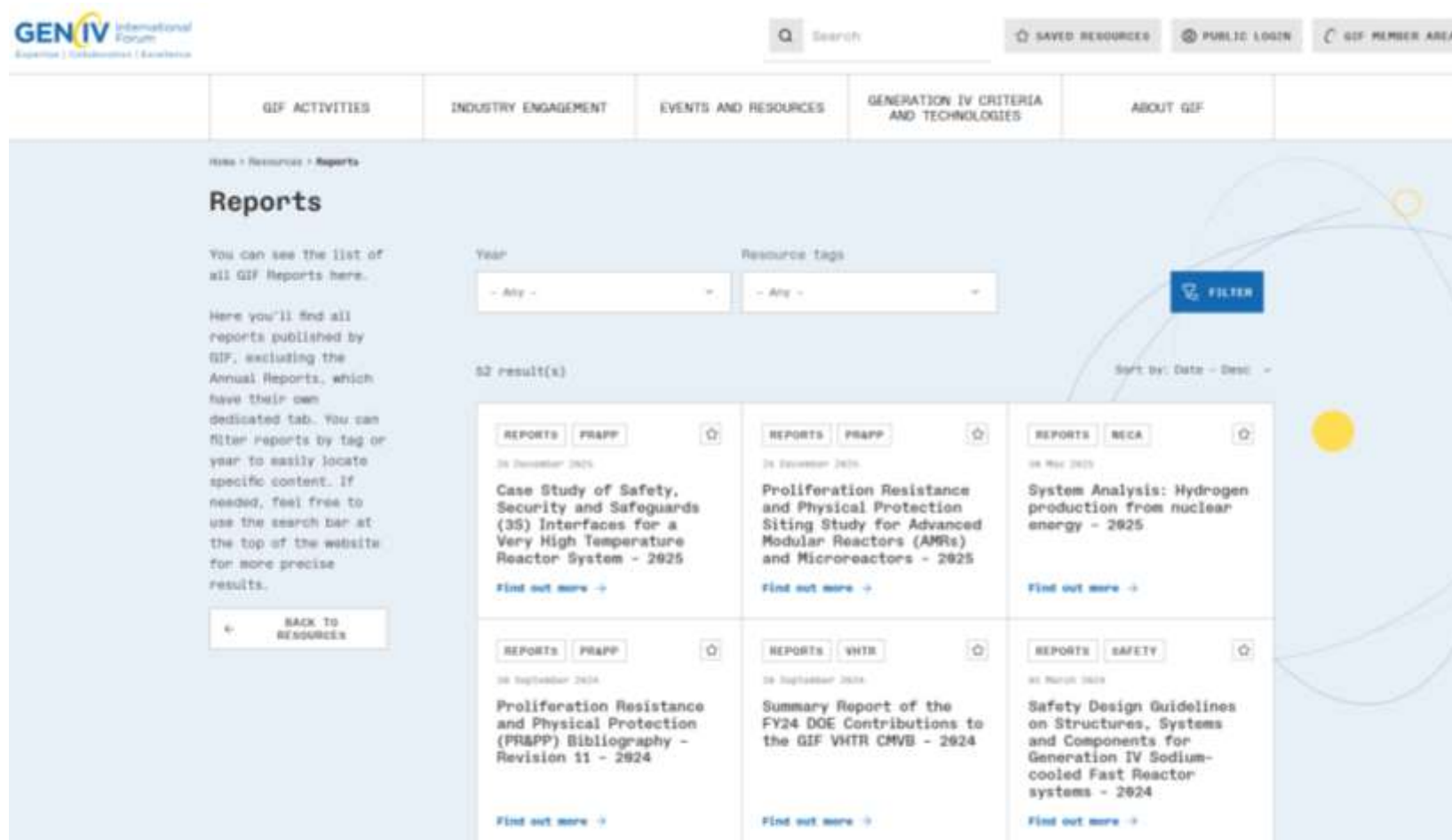
Year: - Any - Resource tags: - Any - FILTER

Sort by: Date - Desc

3 result(s)

GIF TOOLS AND DATABASES	GIF TOOLS AND DATABASES	GIF TOOLS AND DATABASES
NECA	VHTR	ECONOMICS
12 September 2024	12 September 2024	12 September 2024
GIF Non-Electric Application of Nuclear Heat (NEANH) Database	Generation IV Materials Handbook	G4ECONS Model
Find out more →	Find out more →	Find out more →

Example of GIF R&D products: Reports



GIF's main challenges

Knowledge Management

- That's the bottom line: **turning knowledge into strategic value**

Over the past 25 years, the organisation has built a strong knowledge that must now be capitalised and transformed into lasting value.

Appeal to Industry

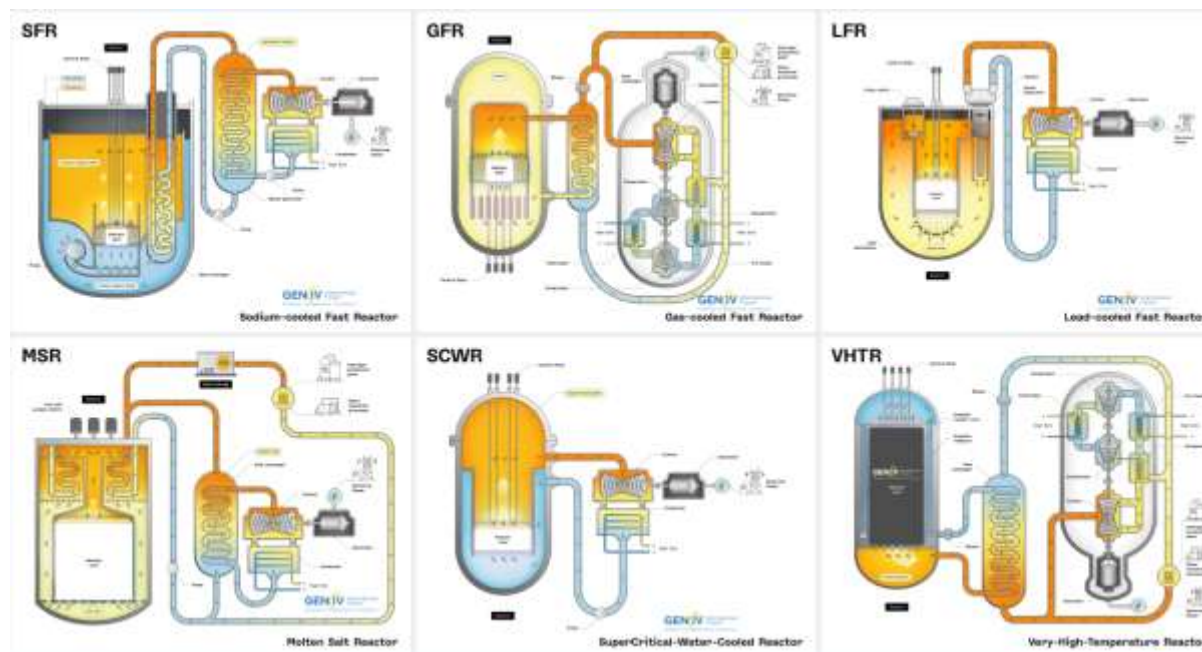
- To ensure lasting relevance, **GIF must connect with industry needs**, and industry must in turn acknowledge and leverage what GIF can bring to the table.

Diplomatic considerations

- GIF is based on a **Framework Agreement** for international collaboration, signed by Governments
- GIF's work from the governance level to the project level is subject to diplomatic dynamics

Generation IV International Forum

From R&D to industrial deployment



Thank you

Thank you for your attention

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www.gen-4.org



gif.secretariat@oecd-nea.org