

## RDTF: Research & Development Infrastructure Task Force

### R&D infrastructure

Today's research infrastructure needs, from R&D to demonstration and deployment, includes major scientific equipment, scientific collections, structured information and ICT-based infrastructure. They are single-sited or distributed throughout several countries. GIF member countries are faced with a wide spectrum of issues related to infrastructure, many of which are globally unique and regionally distributed. Many stakeholders are involved, from ministries to researchers and industry, with an underlying and growing use of e-infrastructure. They present opportunities for, and yet difficulties in, interactions between basic research and industry. Public and private funding appears always to be lacking, and single countries do not have the critical mass or the dimensions to implement large research infrastructure. There is a real need to co-operate on a broad international level. Substantial research, development and demonstration (RD&D) of systems' conceptual/detailed design and analysis are needed. Refurbishment and/or construction of research infrastructure and facilities are increasingly complex and costly. An opportunity exists, by identifying the latest R&D needs and the mapping of infrastructure, to plan for the shared use of existing facilities and to undertake the development of others. The most important priorities are in the areas of fuel cycle, fuel and material irradiation, reactor safety, dedicated loops, mock-ups and test facilities, advanced simulation and validation tools, transnational access to infrastructures, the E&T and Knowledge Management (KM) of scientists and engineers. GIF members strongly support a co-ordinated revitalization of nuclear RD&D infrastructure worldwide, to a level that would once again quickly move forward a new generation of reactors.

### Background/terms of reference

**Background:** At the 43<sup>rd</sup> GIF Policy Group (PG) meeting held on 13-14 April 2017 in Paris, France, it was decided to establish a new Task Force (TF) on R&D Infrastructure. The PG tasked the Technical Director (TD) to develop, in collaboration with the PG Vice Chair in charge of external collaboration and with the Technical Secretariat (TS), the Terms of Reference (ToR) for the GIF R&D Infrastructure Task Force (GIF RDTF). This Task Force is expected to accomplish its objectives over a short duration (less than two years) and make maximum benefit of the GIF Symposium held in October 2018.

**Objectives:** Identify essential R&D experimental facilities needed for development, demonstration and qualification of Gen-IV components and systems, including activities to meet safety and security objectives. To this end, the Task Force should prepare relevant presentations and papers for the October 2018 GIF Symposium.

Promote the utilization of the experimental facilities for collaborative R&D activities among the GIF partners. To this end, identify existing mechanisms and approaches, including organizational points of contact, for obtaining access to relevant R&D facilities in the GIF member countries. This information should be made accessible to GIF participants on the GIF website.

**Organization:** Each Gen-IV System Steering and provisional System Steering Committee (SSC and pSSC) designated one representative to the GIF RDTF. The task Force reports to the Technical Director (TD), the Expert Group (EG) for review, quality and completeness, and the Policy Group (PG). Members of the GIF RDTF meet as needed, taking advantage of teleconferences and GIF EG/PG venues. Chairpersons and a two-year work plan were agreed since their first meeting at OECD/NEA in Paris in February 2018. It included milestones and deliverables, with a recommendation to take full advantage of any relevant work from IAEA and NEA in the area of infrastructures. First objective was reached on time for presentation at the October 2018 GIF Symposium in Paris. The second objective, originally planned by spring 2019 was delayed, and upon completion of the two objectives of the GIF RDTF, SSCs and pSSCs will be expected to maintain cognizance of infrastructure needs and approaches for their access as work evolves from mid-2020 onwards.

### Main achievements in 2019

Identification of existing experimental facilities in response to the aforementioned needs highlighted some gaps. Planned experimental infrastructure constructions, availability of experimental infrastructures outside the GIF countries were discussed.

An opportunity was also taken to propose any update of existing IAEA and NEA databases (including any new infrastructures or facilities launched) with the close support of GIF SSC (or pSSC) and EG groups. The Task Force benefitted from GIF Member State's latest relevant updates and R&D needs outlooks together with: a) IAEA database of Facilities in Support of Liquid Metal-cooled Fast Neutron Systems Facilities and its latest compendium; b) The Advanced Reactor Information System (ARIS); c) The Research Reactor database (RRDB); d) OECD/NEA Research and test facilities database (RTFDB); e) OECD/NEA Task Group on Advanced Experimental Facilities (TAREF) on SFR and GFR but also the Support Facilities for Existing and Advanced Reactors (SFEAR); and f) International Co-operation initiatives and collaborative projects (e.g. IAEA CRPs, ICERR, NEA joint projects, NEST, NI2050, and EU/Euratom projects) for building knowledge and facilities needed for the development of nuclear energy systems e.g. ADRIANA (Advanced Reactor Initiative And Network Arrangement).

An opportunity to start interacting with NEA Working Group on Safety of Advanced Reactors WGSAR took place as from October 2018, to identify and address safety research needs, and to identify and resolve key regulatory issues.

IAEA Liquid Metal-cooled Fast Neutron Systems (LMFNS) database's update took place throughout the year 2019, by organizing a technical meeting in January, a joint workshop by the end of March, and updates on a case by case basis during the following months. To summarize, LMFNS has been updated as following: a) 43 facilities updated (22 LFR facilities and 21 SFR facilities); b) 34 new facilities added (16 SFR facilities and 18 LFR facilities); and c) now LMFNS Online Catalogue includes 180 facilities (86 SFRs, 80 LFRs, and 14 cross-cutting, for dual applications). IAEA LMFNS Online Catalogue is from now on publicly available at <https://nucleus.iaea.org/sites/lmfns> and it is online since August 2019. Any new update is welcome and dealt with on.

Similarly, IAEA Technical Meeting on Knowledge Preservation for Gas Cooled Reactor Technology and Experimental Facilities (GCR and HTR) database was launched in December 2018. IAEA and GIF RTDF members devoted efforts in compiling around 115 facilities identified. A database "GCR and HTR" has been produced in 2019, quality checks are taking place and a database could be available by mid-2020. As such, GIF RDTF participants welcome such existing databases' updates. IAEA should be able to update them on a two years' basis. GIF Policy Group should engage and give their full support.

A dedicated GIF RDTF report was drafted during 2019 and presented at the GIF EG/PG meeting in Weihai (CN). Three major sections still need to be completed namely: a) section IX – cross-cutting R&D infrastructures; b) section X – Mechanisms and approaches for collaborative R&D activities; and c) section XI – key recommendations. The objective will be to have a full draft report available for its review by the EG members, by May 2020, also integrating key recommendations of the following workshops.

GIF International Workshops with Nuclear Industry including SMR vendors and supply chain SMEs were organized successfully, with 60 high-level participants, on 18-20 February 2020, at OECD/NEA, in Boulogne-Billancourt, France. The first and half day, the Workshop was devoted on Advanced Manufacturing (see AMME report). The second half of the Workshop was on R&D Infrastructures needs and opportunities. It included roundtables: Engaging with the private sector, Identification of collaboration opportunities between private and public sectors for Gen-IV systems, a Networking Cocktail gathering both GIF representatives and Industry, Examples of collaboration between governmental organizations and industry, and views from the private sector, an Outlook for SMRs. GIF Policy Group Chair Hideki Kamide concluded the workshop together with representatives of industry, regulators, GIF Member States' and OECD/NEA representatives.

## Conclusions (and/or Next steps)

The results show that there is a very real interest in both research institutions and nuclear companies within GIF countries in active collaboration supporting GIF member's organizations at the workshops. The main objective for 2020 is to finalize GIF RDTF report and any related database update. Way forward will also be discussed at the EG/PG meeting in May 2020, in Sydney, Australia.

**GEN IV International Forum™**

**GIF International Workshops with Nuclear Industry including SMR vendors and supply chain SMEs:**

**GIF workshop on R&D Infrastructures needs and opportunities**

**Wednesday 19 February 2020**

- 11h00 - 11h15 Welcome
  - Welcome by *Roger Garbil*, Euratom, DG RTD, Chair of the GIF R&D Task Force and *Sama Bilbao y Leon*, NEA
- 11h15 - 12h30 Engaging with the private sector – Round Table
 

Moderator: *Sama Bilbao y Leon*

  - R&D challenges for Gen IV systems, *Gilles Rodriguez*, CEA (GIF Technical Director)
  - GIF R&D infrastructures and large scale experimental programmes, *Roger Garbil*
  - GIF Advanced Manufacturing initiative, *Lyndon Edwards*
  - Regulatory challenges to license Gen IV systems, *Raj Iyengar*, Chief of the Component Integrity Branch, NRC's Office of Research
- 14h00 – 16h00 Identification of collaboration opportunities between private and public sectors for Gen IV systems
  - 14h00 - 14h10 Introduction - *Roger Garbil*, Euratom, DG RTD, Chair of GIF R&D TF
  - 14h10 – 14h30 Example of a LWR-based Advanced Reactor development programme
 

Moderator: *Sang Ji Kim*

    - *Fredrik Vitabäck*, GE-Hitachi, BWRX300
    - *Richard Wain*, UK SMR, Rolls Royce
    - *Jean-Michel Ruggieri*, Program Manager, SMRs, CEA, NUWARD Project
    - *Sang Ji Kim*, SMART Technology Development Division, KAERI, GIF EG member
    - *Marketa Krykova*, Project Manager, CVR, SSC SCWR co-Chair
  - 14h30 – 15h00 Molten Salt Reactors (MSR)
 

Moderator: *Stephane Bourg*

    - *David Leblanc*, President and CTO, Terrestrial Energy
    - *Stephane Bourg*, CEA, GIF SSC Chair
    - *Lou Martinez Sancho*, CIO Kairos Power FHR (KP-FHR)
    - *Victor Ignatiev*, IPPE, MOSART project and related infrastructures
    - *Jan Uhlir*, Update on PuPr cooperation in CZ
  - 15h15 - 15h45 Liquid Metal Reactors (LMR and LFR)
 

Moderator: *Alessandro Alamberti*

    - *Fausto Franceschini*, Westinghouse LFR,
    - *Alessandro Alamberti*, ANSALDO Nucleare, LFR SSC Chair,
    - *Jean-Marie Hamy*, Framatome, SFR,
    - *Ilya Pakhomov*, Head of Laboratory, Russian Federation, Institute for Physics and Power Engineering (IPPE)

GIF International Workshops with Nuclear Industry including SMR vendors and supply chain SMEs:  
Workshop on Advanced Manufacturing / Workshop on R&D Infrastructures needs and opportunities  
18-19-20 February 2020, OECD/NEA – Boulogne-Billancourt, France

- 15h45 – 16h15 Gas-cooled High Temperature Reactors (HTR)
 

Moderator: *Lyndon Edwards*

  - *Jean-Marie Hamy*, Framatome, US SC-HTGR program
  - *Dominique Hittner*, UNSC
  - *Karl-Fredrik Nilsson*, EU/Euratom JRC, Chair HTR SSC
- 16h15 – 16h45 Cross-cutting topics, non-electric applications
 

Moderator: *Tajji SHIBATA*

  - *John Jackson*, INL, National Reactor Innovation Center,
  - *François LE Nour*, CEA
  - *Tajji Shibata*, IAEA
  - *Abderrahim Al Mazouti*, EDF
- 16h45 – 17h30 Wrap-up and lessons learnt (Tech Director + Moderators)
  - All the moderators – Need to 2 bullet points + ½ page reporting
- 17h30 Networking Cocktail – GIF and Industry
  - Making connections and fostering exchanges among GEN-IV systems and cross-cutting topics between: Public / Private sectors, R&D Organisms / Industry, R&D platforms.

**Thursday 20 February:**

- 9h00 – 11h00 Examples of collaboration between Governmental organisations and industry
  - Welcome by GIF Vice Chair on R&D Collaboration, *Jong-Hyuk Baek*, KAERI
  - Panel discussion - Moderator: *Gilles Rodriguez*
    - *Gilles Rodriguez*, (on behalf of the CEA's Sodium School Director)
    - *John H. Jackson*, Acting Director, Gateway for Accelerated Innovation in Nuclear (GAIN)
    - *Tatiana Ivanova*, FIDES projects to address post-Halden situation / OECD
    - *Stefano Monti*, IAEA
    - *Raj Iyengar*, Chief of the Component Integrity Branch, NRC's Office of Research
    - *Stephen Bushby*, Atomic Energy of Canada Limited
    - *Iuliu Kusina*, Director, Institute for Physics and Power Engineering (IPPE)
- 11h30 – 12h30 Views from the Private Sector, an Outlook for SMRs
 

Moderator: *Stefano Monti*

  - *Fausto Franceschini*, Westinghouse LFR,
  - *Lou Martinez Sancho*, CIO Kairos Power FHR (KP-FHR),
  - *David Leblanc*, President and CTO, Terrestrial Energy,
  - *Robin Manley*, VP SMR Technology, Ontario Power Generation,
  - *Raj Iyengar*, Chief Component Integrity Branch, NRC's Office of Research,
  - *Dominique Hittner*, UNSC,
  - *Richard Wain*, UK SMR, Rolls Royce
  - *Fredrik Vitabäck*, GE-Hitachi, BWRX300,
  - *Arkady Karneev*, Rosatom Western Europe
- 12h30 – 13h00 Workshop conclusions
 

GIF Policy Group Chair *Hideki Kamide*, representative of industry, representative of regulator, representative of OECD/NEA
- 13h00 Closing of the Workshop

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**Roger Garbil**

Chair of the RDTF TF  
and all Contributors