4 Working group reports

Economic Modelling Working Group

The Economic Modelling Working Group (EMWG) was established in 2003 to provide a methodology for the assessment of Generation IV (Gen-IV) systems against two economic-related goals:

- to have a life-cycle cost advantage over other energy sources (i.e. to have a lower levelized unit cost of energy);
- to have a level of financial risk comparable to other energy projects (i.e. to have a similar total investment cost at the time of commercial operation).

The EMWG published *Cost Estimating Guidelines for Generation IV Nuclear Energy Systems* (GIF, 2007) and released the Excel-based software package, G4ECONS v2.0, providing the EMWG the means to calculate the levelized cost of energy and the total investment cost so as to evaluate Gen-IV systems against GIF economic goals. These resources were made available to the public through the GIF Technical Secretariat, resulting in subsequent publications[1] that demonstrate the EMWG methodology for the economic assessments of Gen-III and Gen-IV systems, as well for cogeneration applications, such as hydrogen production.

G4ECONS v2.0 was also benchmarked against economic models developed by the International Atomic Energy Agency (IAEA), including the Nuclear Economics Support Tool (NEST) and the Hydrogen Economic Evaluation Programme (HEEP), and the results were published in peer-reviewed publications. Lessons learned from the benchmarking exercise and from the feedback of users has informed the refinement of the G4ECONS tool. The EMWG released the latest version, G4ECONS v3.0, with an improved user interface, in October 2018. In 2022, the EMWG launched a survey to collect user feedback on G4ECONS v3.0 and identify potential model improvements.

In 2016, the EMWG started to investigate challenges and opportunities for the deployment of Gen-IV systems in emerging energy markets with an increasing share of renewable energy resources. The terms of reference for the EMWG were amended in 2018 to incorporate the expanded mandate so as to inform the GIF Policy Group and the Experts Group on the policies and R&D needs for the future deployment of Gen-IV systems.

Since October 2016, the EMWG has worked collaboratively with the GIF Senior Industry Advisory Panel (SIAP) to investigate challenges and opportunities for deployment of Gen-IV systems in electricity markets with a significant penetration of renewable energy resources and to produce a position paper for the Policy Group. An abridged version of the EMWG position paper on the impact of increasing shares of renewables on the deployment prospects of Gen IV systems was presented at the 4th GIF Symposium (2018) and an executive summary was posted on the GIF website.[2] The study found that Gen-IV systems need to be more flexible compared to current reactors for deployment in low-carbon energy systems, and such requirements are already being proposed by the utilities. Large-scale energy-storage and cogeneration applications, for example, would allow flexible dispatch while ensuring high-capacity utilization. Nuclear/renewable hybrid energy systems with adequate energy-storage and cogeneration applications could, in this way, meet flexible demands from the grid while operating power generators at full capacity to ensure overall economically viable operation. However, such flexibility considerations impose additional requirements on the R&D of Gen-IV systems.

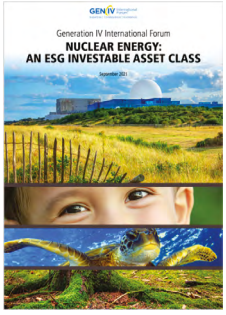
In 2022, the EMWG will survey modeling requirements for the G4ECONS software, develop new cost reduction strategies in accordance with the advanced nuclear technology cost reduction strategies and systematic economic review (ANTSER) framework and extend work on nuclear financing. The EMWG is engaging with the IAEA and the GIF Proliferation Resistance and Physical Protection Working Group (PRPPWG) on economic topics, including safeguards and security, cost modeling, and the economics of emerging and existing reactors.

1. All EMWG publications are available on the GIF website at www.gen-4.org/gif/jcms/c_9364/economics.
2. See: www.gen-4.org/gif/jcms/c_117864/2018-gif-symposium-proceedings.

EMWG activities in 2021

In 2021, the EMWG issued two major reports:

Nuclear Energy: An ESG investable Asset Class:

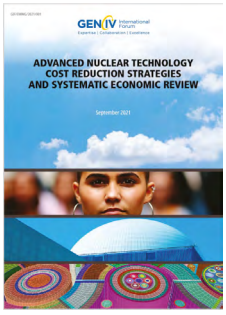


This report was produced by a finance industry taskforce set up by the EMWG in 2020 to consider the nuclear industry's ability to report against environmental, social and governance data collection and accounting metrics (ESG). Reporting well against ESG allows nuclear energy to be considered as an investable asset class, thereby enabling nuclear companies and projects to access climate finance.

The report has been produced by the finance community for the finance community. It establishes not only how nuclear energy, as an asset class, has the potential to report well against a wide range of ESG, but also highlights the importance of wide ranging, consistent and standardized ESG reporting to determine the credentials of all energy companies across their lifecycles and throughout their supply chains. The report discusses how ESG fit within international frameworks, including the UN Framework Convention on Climate Change (1992), the Kyoto Protocol (1997) and the Paris Agreement (2015), and how ESG are linked to the Green Bond Principles, while examining the relationship between ESGs and the various taxonomies and other policy documents being developed around the world.

The report can be viewed as a blueprint on how to set up a project and enable it to access financing. It received significant press coverage (e.g. from Standard & Poor's, Reuters, World Nuclear News) and was successfully presented in a dedicated workshop at the 2021 World Nuclear Exhibition.

Advanced Nuclear Technology Cost Reduction Strategies and Systematic Economic Review:



This report provides a process to produce a methodological framework for evaluating nuclear cost reduction strategies. Key areas for nuclear cost reduction strategies and technologies are categorized under design, construction/production and project management. Application of the framework is illustrated on reactor designs that are based on cost reduction through "functional confinement," followed by a presentation of a more rigorous application of the methodology.

The report has been written with three goals in mind: first, to create a methodology for creating impactful cost reduction strategies that cut across a broad set of advanced nuclear reactor technologies; second, to generate an example cost reduction strategy using the methodology; and third, to provide a path forward to improve the methodology and produce additional cost reduction strategies. The EMWG can lead future cost reduction strategy studies, but the range and impact of this body of work is greatly enhanced by direct contributions from the GIF methodology working groups, task forces and system steering committees for the six Gen-IV reactors, as well as SIAP. In 2022, the EMWG will investigate other cost reduction strategies, such as "modularity at scale".

References

GIF (2021), *Nuclear Energy: An ESG investable Asset Class*, GIF, Paris.

GIF (2021), *Advanced Nuclear Technology Cost Reduction Strategies and Systematic Economic Review*, GIF, Paris.

GIF (2007), *Cost Estimating Guidelines for Generation IV Nuclear Energy Systems*, GIF, Paris.

David Shropshire
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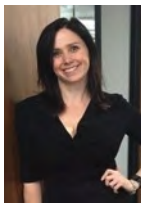


Fiona Reilly
Co-Chair of the EMWG

Education and Training Working Group

The Education and Training Working Group (ETWG) was launched in 2015 to enhance open education and training, as well as communication and networking among people and organizations supporting GIF. The ETWG has partnered with numerous university professors, scientists and engineers around the world to create and deliver 60 webinars from September 2016 to December 2021, all of which are archived on the GIF website.[1] The webinars have focused on advanced reactor systems, as well as on numerous other areas such as nuclear fuels, structural materials and the nuclear fuel cycle. The webinars presented in 2021 (highlighted in blue) are archived and retrievable in digital format (see Table ETWG-1).

Table ETWG-1: GIF webinar series from September 2016 to December 2021

	GIF webinars from September 2016 to December 2021 – Presented and archived
Introduction **3 webinars**	**Atoms for Peace** - John Kelly, United States (2016) **Introduction to Nuclear Reactor Design** - Claude Renault, France (2016) **European Sodium Fast Reactor: An Introduction** - Konstantin Mikityuk, Switzerland (2019)
Gen-IV systems **17 webinars**	**Sodium-cooled Fast Reactor** - Bob Hill, United States (2016) **Lead Fast Reactor** - Craig Smith, United States (2017) **Gas-cooled Fast Reactor** - Alfredo Vassile, France (2017) **Very-High-Temperature Reactors** - Carl Sink, United States (2017) **Supercritical Water Reactors (SCWRs)** - Laurence Leung, Canada (2017) **Fluoride-cooled High-Temperature Reactors** - Per Peterson, United States (2017) **Molten Salt Reactors** - Elsa Merle, France (2017) **MYRRHA: An Accelerator Driven System Based on LFR Technology** – H.A. Abderrahim, Belgium (2018) **Molten Salt Actinide Recycler & Transforming System with and without thorium-uraniumSupport: MOSART** - Victor Ignatiev, Russia (2018) **Lead containing mainly Isotope Pb-208: New Reflector for Improving Safety of Fast Neutron Reactors** - Evgeny Kulikov, Russia (2019) **Gen-IV Coolants Quality Control** - Christian Latge, France (2019) **Czech Experimental Program on MSR Technology Development** - Jan Uhlir, Czech Republic (2019) **GIF VHTR Hydrogen Production Project Management Board** - Sam Suppiah, Canada (2020) **Thermal Hydraulics in Liquid Metal Fast Reactor** - Antoine Gerschenfeld, CEA, France (2020) **Micro-reactors: A Technology Option for Accelerated Innovation** - D.V. Rao, United States (2020) **Overview of Small Modular Reactor Technology Development** - Frederik Reitsma, IAEA (2020) **Experimental R&D in Russia to Justify Sodium Fast Reactors** - Iuliia Kuzina, Russia (2021)
Operational experience **13 webinars**	**Feedback Phénix and Superphénix** - Joel Guidez, France (2017) **Design, Safety Features and Progress of HTR-PM** - Yujie Dong, China (2018) **ASTRID Lessons Learned** - Gilles Rodriguez, France (2018) **Advanced Lead Fast Reactor European Demonstrator, ALFRED Project** – A. Alemberti, EC (2018) **Russia BN 600 & BN 800** - Ilya Pakhomov, Russia (2018) **Safety of Gen-IV Reactors** - Luca Ammirabile, EC (2019) **The ALLEGRO Experimental Gas-Cooled Fast Reactor Project** - Ladislav Belovsky, Czech Republic, (2019) **Passive Decay Heat Removal** - Mitchell Farmer, ANL United States (2019) **Molten Salt SFR Safety Design Criteria (SDC) and Safety Design Guideline (SDG)** - S. Kubo, Japan 2020) **Reactor Safety Evaluation** - A U.S. Perspective - David Holcomb, United States (2020) **Introducing New Plant Systems Design Code** - Nawal Prinja, UK (2021) **Experience of HTTR Licensing for Japan's New Nuclear Regulation** - Etsuo Ishitsuka, Japan (2021) **In Service Inspection and Repair Developments for SFRs and Extension to Other Gen-IV Systems** - François Baqué, France (2021)
Gen-IV cross cutting topics **13 webinars**	**Energy Conversion** - Richard Stainsby, United Kingdom (2017) **Estimating Costs of Gen-IV Systems** - Geoffrey Rothwell, NEA/OECD (2017) **Materials Challenges for Gen-IV Reactors** - Stu Maloy, United States (2018) **Proliferation Resistance and Physical Protection of Gen-IV Reactor Systems** - Robert Bari, United States (2018) **Maximizing Clean Energy Integration: The Role of Nuclear and Renewable Technologies in Integrated Energy Systems** - Shannon Bragg-Sitton, United States (2020) **Global Potential for Small and Micro Reactor Systems to Provide Electricity Access** - Amy Schweikert, United States (2020) **Neutrino and Gen-IV Reactor Systems** - Jonathan Link, United States (2020) **Overview of Waste Treatment Plant**, Hanford Site - David Peeler, United States (2021) **Opportunities for Generation-IV Reactor Designers through Advanced Manufacturing Techniques** - Isabella Van Rooyen, United States (2021) **Graded Approach: Not just Why and When, but How** - Vince Chermak, United States (2021) **Geometry Design and Transient Simulation of a Heat Pipe Micro Reactor** - Jun Wang, United States (2021) **Metal Fuel for Prototype Generation-IV SFR: Design, Fabrication and Qualification** - Chan Bock Lee, Korea (2021) **Development of an austenitic/martensitic gradient steel connection by additive manufacturing** - Flore Villaret, France (2021)
Fuel types **5 webinars**	**General Consideration on Thorium as a Nuclear Fuel** - Franco Michel-Sendis, NEA/OECD (2017) **Metallic Fuels for SFRs** - Steven Hayes, United States (2017) **Advanced Gas Reactor TRISO Particle Fuel** - Madeline Feltus, United States (2019) **Performance Assessments for Fuels and Materials for Advanced Nuclear Reactors** - D. LaBrier, United States (2020) **MOX Fuel for Advanced Reactors** - Nathalie Chauvin, CEA France (2021)
Fuel cycle **4 webinars**	**Closing the Fuel Cycle** - Myeung Seung, Korea (2016) **Sustainability, A Relevant Approach for Defining Future Nuclear Fuel Cycles** - Christophe Poinssot, France (2017) **Scientific and Technical Problems of Closed Nuclear Fuel in Two-Component Nuclear Energetics** – Alexander Orlov, Russia (2019) **Comparison of 16 Reactors' Neutronic Performance in Closed Th-U and U-Pu Cycles** – Jerri Krepel, Switzerland, (2020)
Winners of Pitch Competition **5 webinars**	**Formulation of Alternative Cement Matrix For Solidification/Stabilization of Nuclear Waste** - Matthieu de Campos, France (2019) **Interactions between Sodium and Fission Products in case of a severe Accident in a Sodium-cooled Fast Reactor** - Guilhem Kauric, France (2019) **Security Study of Sodium Gas Heat Exchangers in Frame of Sodium-Cooled Fast Reactors** - Fang Chen, France (2019) **Development of Multiple Particle Positron Emission Tracking for Flow Measurement** - Cody Wiggins, United States (2020) **Evaluating Changing Paradigms Across the Nuclear Industry** - Jessica Lovering, United States (2021)

1. See: www.gen-4.org/jcms/c_84279/webinars

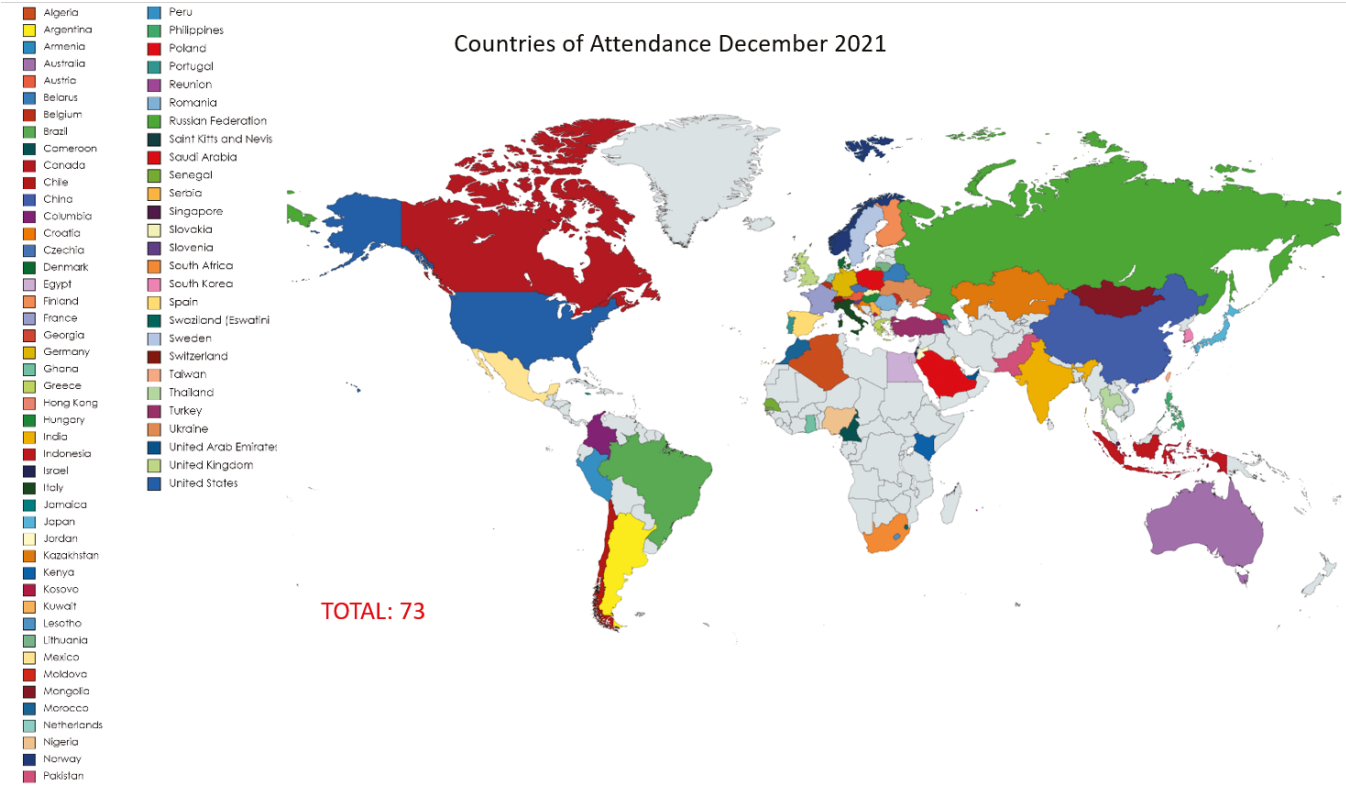


Figure ETWG-1. International participation in the GIF webinar series

As of December 2021, attendance during the live webcasts totaled 5 542. The number of viewings of recorded webinars in the online archive was 6 642. The total over a five-year period for webinar viewing is 12 084. These webinars have reached scientists and engineers across a total of 73 countries (Figure ETWG-1).

The GIF ETWG launched a virtual "Pitch your Gen-IV Research (PyGR)" competition in February 2021, for several reasons. The first reason was to involve junior researchers in the Gen-IV community by stimulating their interest. The second was to inform the public about advanced reactors and related topics, and at the same time, provide an opportunity to participate by voting for a preferred video/candidate/topic. Finally, the last reason was to have very short videos available on YouTube and Bilibili platforms that could be viewed any time to reach out to a large public and increase global awareness in the nuclear energy sector. The ETWG competition invited all junior researchers worldwide who were either PhD students or had completed their PhDs after 1 January 2019 to participate in the competition. Their research work needed to be related to Gen-IV advanced nuclear energy systems and could be either an independent research project or one working with a research mentor. Of the 51 submittals, the top 21 research projects were selected for the finals, in which proponents were invited to record a 3-minute video pitch. The six Gen-IV reactor systems (SFR, MSR, GFR, VHTR, SCWR, LFR) were represented with different topics. Three winners were selected for the 2021 PyGR competition, and each winner has been invited to present a webinar. In addition, the first prize winner will attend the next GIF Symposium planned in October 2022.

Also this year, an international panel discussion featuring the current and former GIF Chairs was organized and executed as a webinar in April 2021. The Chairs provided their perspectives on the progress of Gen-IV systems and prospects for the deployment of Gen-IV systems.

Patricia Paviet
Chair of the ETWG, with contributions from ETWG members

Proliferation Resistance and Physical Protection Working Group

The PRPPWG was established to develop, implement and foster the use of an evaluation methodology to assess Gen-IV nuclear energy systems with respect to the GIF PR&PP goal, whereby:

"*Generation IV nuclear energy systems will increase the assurance that they are a very unattractive and the least desirable route for diversion or theft of weapons-usable materials, and provide increased physical protection against acts of terrorism.*"

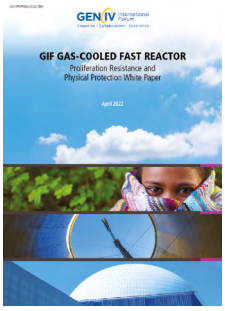
The methodology provides designers and policy-makers with a technology-neutral framework and a formal comprehensive approach to evaluate, through measures and metrics, the proliferation resistance (PR) and physical protection (PP) characteristics of advanced nuclear systems. As such, application of the evaluation methodology offers opportunities to improve the PR&PP robustness of system concepts throughout their development cycle. The working group released *Evaluation Methodology for Proliferation Resistance and Physical Protection of Generation IV Nuclear Energy Systems: Revision 6* (GIF, 2011) for general distribution,[1] and Japanese and Korean translations of the methodology report have been produced for national use.

Since 2018, the main focus of the PRPPWG has been on updating white papers on PRPP robustness of the six GIF design concepts. The past decade has seen several new advanced reactor vendors receiving funding from private and public investment, and these white papers provide recommendations to improve the safeguards and security of a variety of advanced reactor designs. This is a joint effort with System Steering Committees (SSCs) and the provisional System Steering Committees (pSSCs) of the six Gen-IV technologies. The first versions of these white papers were produced in the period from 2008 to 2011.[2] Currently, the papers are being updated according to a revised, common template. The current update reflects changes in the reactor designs with new tracks added and maturation of the designs of the six GIF systems, including through enhanced intrinsic PR&PP features.

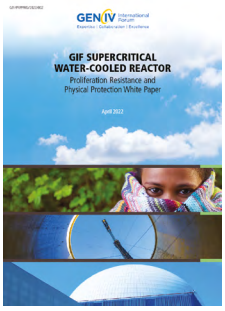
Individual white papers, after endorsement by both the PRPPWG and the responsible SSC/pSSC, will be transmitted to the Experts Group for approval and published as GIF reports. PR&PP aspects that transcend all six GIF systems are also being investigated. Cross-cutting topics include common themes, such as the fuel type, or topics not dealt with in the white papers, such as cybersecurity. The target is to complete and publish the reports on the GIF website during the course of 2022. Two white papers (i.e. on LFRs and SFRs) were finalized and made publicly available for download on the GIF website in October 2021 (GIF, 2021). Below is a summary status of the white papers still in the process of being updated as of the end of 2021.

- GFR – the draft has been updated, incorporating PRPPWG and GFR SSC recommendations. The PRPPWG is currently performing a final technical review and formatting prior to its release to the Experts Group.
- SCWR – the paper is in its final form, undergoing final review prior to its release to the Experts Group.
- MSR – the paper incorporated feedback from the pSSC and the PRPPWG in a new draft. The MSR pSSC is currently reviewing the latest draft.
- VHTR – the latest draft incorporated revisions by the VHTR SSC Chair after multiple exchanges. The PRPPWG will address additional SSC questions/comments in a modified draft of the white paper.

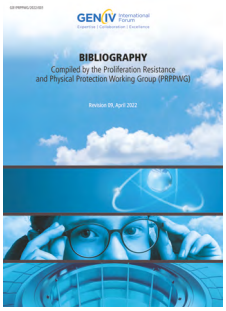
A paper outlining the status of updates to the six GIF reactor technology white papers was presented by the PRPPWG at the 2021 Institute of Nuclear Materials Management and European Safeguards Research and Development Association (INMM & ESARDA) Joint Virtual Annual Meeting, and is available in the meeting's online proceedings (Cheng, et al. 2021).



The PRPPWG maintains an annually updated bibliography of official publications, of publications referring to the PR&PP methodology and of relevant issues (GIF, 2021). The latest edition, revision 8, was published in April 2021. It is available on the GIF website.



The PRPPWG maintains regular exchanges with the IAEA International Project on Innovative Nuclear Reactors and Fuel Cycles (INPRO) and the agency's Department of Safeguards. An IAEA representative participates regularly in PRPPWG activities. The PRPPWG made a presentation at the 15th GIF-IAEA Interface meeting on 29-30 June 2021, highlighting collaboration on the INPRO PR methodology that the IAEA is updating, as well as on emerging safe-



1. See: www.gen-4.org/gif/jcms/c_40413/evaluation-methodology-for-proliferation-resistance-and-physical-protection-of-generation-iv-nuclear-energy-systems-rev-6.

2. See: www.gen-4.org/gif/jcms/c_40414/proliferation-resistance-and-physical-protection-of-the-six-generation-iv-nuclear-energy-system.

guards issues related to the deployment of small modular reactors (SMRs) and microreactors, and the interfaces between safety, security and safeguards.

Collaboration with the GIF Risk and Safety Working Group (RSWG) was strengthened through personal exchanges at each group's meetings. PRPPWG representatives attended the 32nd and 33rd meetings of the RSWG, and RSWG representatives attended the 32nd PRPPWG meeting. During the latter, it was agreed to expand collaboration on the investigation of interfaces between safety, security and safeguards, a topic that is also of interest to the IAEA. A dedicated meeting with participants from both working groups is foreseen in early 2022 to propose a path forward for this collaboration.

The PRPPWG is also engaged with the GIF Economic Modelling Working Group (EMWG) in exploring areas of potential collaboration. The EMWG co-chair joined one of the PRPPWG virtual meetings, and presented the advanced nuclear technology cost reduction strategies and systematic economic review (ANTSER) methodology. One area of mutual interest is the economic impact of safeguards by design.

The PRPPWG holds monthly teleconferences to report on the progress of group and member activities. The group held its 32nd annual meeting in virtual mode in three separate sessions (15 and 17 November, and on 6 December). Most member countries attended the meeting and delivered country reports. Representatives from the IAEA and the RSWG also participated. The meeting was dedicated to discussing the advancement of white papers, planning of new activities, such as the cross-cutting topics from the white papers, and developing the work plan for the period 2022-2023.

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Giacomo Cojazzi
Co-Chair of the PRPPWG

Lap-Yan Cheng
Co-Chair of the PRPPWG

Risk and Safety Working Group

The RSWG was formed in 2005 to promote a consistent approach to safety, risk and regulatory issues between the six Gen-IV systems, and to establish broad safety principles and attributes as input to R&D plans for specific design tracks based on high-level GIF safety and reliability goals. In 2021, RSWG membership included representatives from Canada, China, the European Union, France, Japan, Korea, South Africa, Russia, the United Kingdom and the United States. The IAEA Safety Department also participates as an observer.

The RSWG has developed the integrated safety assessment methodology (ISAM) as a technology-neutral toolkit to support design and evaluate risk and safety. After completion of the ISAM, the RSWG also supported its implementation by GIF System Steering Committees (SSCs) for specific Gen-IV design tracks as documented in a series of system-specific white papers. More recent emphasis has been placed on the preparation of system safety assessments as a summary of high-level safety design attributes and remaining R&D needs, also in close coordination with the respective GIF SSCs. Two ISAM documents, as well as the white papers and system safety assessment reports completed to date, are available on the GIF RSWG web page.[1]

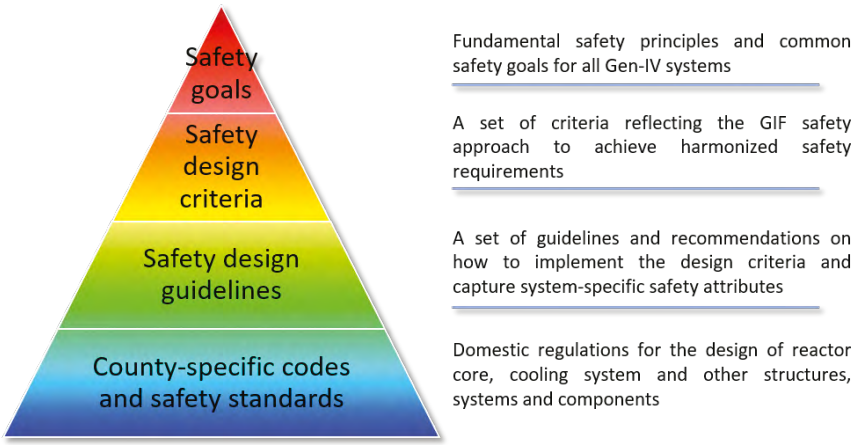
The first RSWG accomplishment in 2021 was the publication of the GIF report, *Basis for the Safety Approach for Design & Assessment of Generation IV Nuclear Systems* (GIF, 2021). As an update to the original 2008 version, the report aims to:

- capture the post-Fukushima recommendations and requirements to ensure a level of safety consistent with the regulatory expectations;
- provide common definitions for the plant states considered in a design and their alignment with the levels of defense in depth;
- clarify the concepts of design extension conditions and practically eliminated situations;
- achieve a balance between the prevention and mitigation of accidents, emphasizing the importance of reliance on inherent and passive safety;
- reinforce the independence of safety systems and features in different defense-in-depth levels.

The development of safety design criteria (SDC) and guidelines for specific systems is also an ongoing collaborative effort between the RSWG and SSCs to establish the basic requirements for design, fabrication, construction, inspection, testing and operation of Gen-IV prototypes. As shown in Figure RSWG-1, the SDC and guidelines are intended to fill the gap between the high-level GIF safety goals and country-specific codes and standards.

In 2021, the *Safety Design Criteria for Generation IV Lead-Cooled Fast Reactor System* report (GIF, 2021) was completed in collaboration with the LFR provisional SSC. Based on SFR SDC as the starting point, the LFR SDC introduces specific revisions that capture the impact of differences between sodium and lead as a very low Prandtl number liquid metal coolant with large thermal inertia and very high density, freezing and boiling points, induced coolant activity, and corrosion/erosion challenges posing elevated material compatibility concerns and requiring an elevated level of coolant purity control. Unique LFR thermo-fluid system designs with integrated primary coolant and power conversion systems (without an intermediate loop) are also addressed.

Figure RSWG-1: Hierarchy of safety standards



1. See: www.gen-4.org/gif/jcms/c_9366/risk-safety.

The LFR SDC mandates the robust assessment of accidents that may lead to core melt so as to demonstrate their practical elimination with a high degree of confidence.

The RSWG is currently collaborating with the VHTR SSC for SDC development. In 2021, an informal subgroup was created, gathering RSWG and VHTR SSC experts, who completed the first draft of SDC largely based on two previous IAEA efforts to revise the IAEA SSR 2/1 requirements for HTGRs. The draft VHTR SDC addresses consistency with the GIF basic safety approach and IAEA safety standards for design extension conditions, clarifies the requirements for confinement function versus the conventional containment structure, and introduces revisions and new requirements for the VHTR fuel forms based on coated fuel particles, as well as for unique coolant and decay heat removal system designs. The SDC development effort is expected to continue throughout 2022, before the report can be finalized.

The RSWG maintains technical interfaces with the OECD/NEA Working Group on the Safety of Advanced Reactors (WGSAR), which operates under the Committee on Nuclear Regulatory Activities (CNRA). In the past, the working group performed independent reviews of the SFR SDC and produced two SFR safety design guideline reports, providing extensive comments that led to significant revisions. Following its completion, the WGSAR is currently performing an independent review of the LFR SDC, and feedback is anticipated in 2022. In 2021, the RSWG also coordinated GIF contributions to the WGSAR report on "Fuel Qualification for Generation-IV Nuclear Energy Systems." GIF contributions provide high-level descriptions of SFR, VHTR, GFR, MSR, LFR and SCWR fuel types and forms, their role in the safety case and anticipated challenges for their qualifications.

Ongoing RSWG-WGSAR collaboration also includes the new joint initiative for the development of a risk-informed approach to the selection of licensing basis events and safety classification of systems, structures and components. In 2021, a position paper that introduces the foundational concepts and main elements of the approach was finalized by the RSWG and was distributed to WGSAR members. The paper establishes the event sequence categories considered in design to integrate the deterministic input and risk insights, defines a generic frequency-consequence target structure to categorize the event sequences against the regulatory requirements, outlines a process to classify the plant equipment based on their risk-significance and role in plant safety, and supports the selection of design-basis accidents and design extension conditions consistent with the safety classification of the responding plant equipment. Based on WGSAR comments and input, the position paper is expected to be finalized in 2023.

The RSWG also maintains technical interfaces with the IAEA and participates in the new IAEA initiative on the development of safety standards for SMRs and novel advanced reactors. Since these reactors have many technical similarities to GIF systems, selected RSWG experts have been sharing GIF experience while identifying system-specific safety features and supporting completion of the IAEA report on the applicability of IAEA safety standards to novel advanced reactors. The RSWG also contributes to the organization of joint IAEA-GIF technical meetings on the safety of liquid metal-cooled fast reactors that focus on the development of safety design guidelines (SDGs) for SFRs and SDC for LFRs.

Having completed most of its 2019 missions, the SFR Safety Design Criteria Task Force (SDC-TF) members have now joined the RSWG, and the remaining work on updating the SDGs for SFR systems, structures and components based on IAEA and WGSAR comments is being subsumed by the RSWG. IAEA and WGSAR comments are currently being addressed, and they are expected to be incorporated into the next version of the report in 2022. These new RSWG members (former SDC-TF members) will also support the pilot implementation of the proposed risk-informed approach for GIF SFR design tracks to demonstrate its applicability and ensure its consistency with the SFR SDC and SDG reports completed in earlier years.

References

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Chair of the RSWG, with contributions from RSWG members