

Market and industry perspectives and the GIF Senior Industry Advisory Panel (SIAP) report

Nuclear energy is expected to play an important and growing role in a worldwide net-zero CO₂ emissions scenario and in achieving the decarbonization objectives set by the Paris Agreement. Continued operation of the existing fleet of nuclear reactors, as well as the new build of large-scale and small modular reactors (SMRs) could avoid 87 gigatonnes of cumulative emissions between 2020 and 2050 (NEA, 2021). By 2050, nuclear energy could displace 5 gigatonnes of emissions per year, which is more than what the entire US economy emits annually today. Pathways to net zero will further benefit from the development and deployment of near-term innovative nuclear technologies.

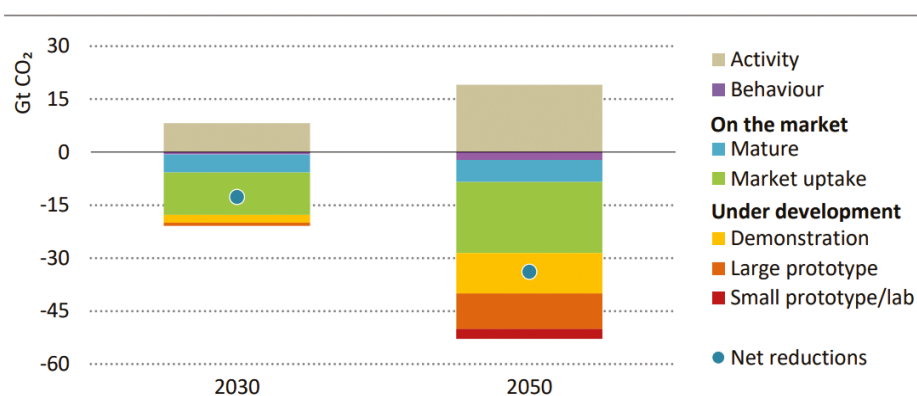
In line with the increasing number of country pledges to achieve carbon neutrality by 2050, the International Energy Agency (IEA) published its *Net Zero by 2050: A Roadmap for the Global Energy Sector* (IEA, 2021). More than 400 milestones across sectors and technologies have been identified to guide the global economy in its journey towards carbon neutrality by 2050. The “net-zero roadmap” also sees nuclear power playing an increasing role. Its global output should double by 2050, although its overall share

in the global electricity generation falls below the current 10% with variable renewables covering most of the electricity needs.

While the emissions reductions in 2030 rely primarily on technologies currently on the market, those under development today account for almost half of the emissions reductions in 2050 (see Figure 6.1). The report calls for important decisions to be made concerning nuclear power in different areas, including the extent of government support for advanced modular reactors. Technologies still under development hold the potential to expand markets for nuclear power beyond electricity and to foster decarbonization in hard-to-abate sectors. The current and next decade will be critical to demonstrate the commercial viability of Generation-IV (Gen-IV) systems in order to achieve sufficient market uptake to remain relevant and aligned with net-zero targets.

Since its inception, the Generation IV International Forum (GIF) has been at the forefront of international cooperation in the research and development of Gen IV systems. After more than 15 years of research, GIF has accumulated a vast amount of know-how and research data.

Figure 6.1: Global CO₂ emissions changes by technology maturity in the IEA “net-zero roadmap”



Source: IEA (2021)

In parallel, private sector interest in advanced nuclear technology has been increasing over the last years, with a multiplicity of designs being proposed. Some of these advanced nuclear technologies aim to build first demonstration units before 2030.¹ While GIF activities concentrate on technical viability, private vendors are driven by commercial deployment. Therefore, there is a role for GIF to play in advancing Gen-IV concepts towards the construction of demonstration and/or first-of-a-kind (FOAK) units through well-designed collaboration with private actors. Collaboration can be mutually beneficial and can take place under the existing GIF governing framework, while respecting member countries' interests and intellectual property rights. Potential areas of collaboration, as well as specific actions and pilot projects, were already identified in the 2019 and 2020 SIAP "charges"² and recommendations. In 2020 in particular, it was underlined that "*the SIAP recommendations explore ways to create a perennial collaborative framework with industry with specific initiatives while respecting existing governing frameworks, member countries' interests and intellectual property rights. Complementarities and synergies with ongoing activities should be explored*", with recommendation #9 more specifically highlighting that GIF should: "*Continue to interact periodically with the private sector with dedicated meeting/workshops in order to identify critical research areas and priorities and match emerging experimental and qualification needs with existing or future R&D infrastructure capabilities.*"

Activities to accelerate deployment of Gen-IV systems and enhance collaboration with the private sector

The GIF Experts Group and Policy Group have well recognized the critical importance of building a smart connection with the private sector and increasing involvement of industrial partners in GIF activities. In February 2020, a GIF workshop was organized, with the participation of the private sector and involving two GIF task forces - the Advanced Manufacturing and Materials Engineering Task Force (AMME-TF) and the Research and Development Infrastructures Task Force (RDTF) - in order to assess the maturity and readiness of the existing research and manufacturing infrastructure to support the deployment of first demonstration and/or FOAK units. Participants in the workshop acknowledged the success of this workshop and the necessity to leverage on these preliminary interactions to build a perennial collaborative framework with the private sector. New activities recently engaged within GIF to achieve this goal include:

- **GIF Forum with Industry 2022:** organization of a new event, approved by the Policy Group in May 2021, to replace the traditional GIF Symposium

(held every three years between 2009 and 2018), and merging with the AMME/RDTF Workshop, will adopt a more industry-oriented approach in order to foster collaboration on Gen-IV systems between the private and public sector.

- **GIF paper on "Considerations Towards Establishing a Framework for Collaboration with Industry":** drafting of a GIF report to explore options towards establishing a framework for collaboration between GIF members and private vendors. The objective of this framework would be to further the basic understanding of, and find solutions to, the common challenges associated with advancing Gen-IV and small modular technologies towards demonstration and deployment.
- **Non-Electric Applications of Nuclear Heat (NEaNH) Task Force:** creation of a new GIF task force, after three brainstorming sessions and official approval of the Policy Group in May 2021. Forum members agreed to create a cross-cutting task force dedicated to the non-electric applications of nuclear heat, including district and industrial heat applications, desalination and large-scale hydrogen production. The task force is already operating as an interim task force. Ideally, this task force will have a strong connection with industry and the potential end users of nuclear heat.

Senior Industry Advisory Panel report

Since the creation of the Generation IV International Forum in 2000, market conditions have continued to evolve, and they continue to be a common concern among users and developers of Gen-IV concepts. The role of the GIF Senior Industry Advisory Panel (SIAP) is to understand core drivers, opportunities and constraints related to the market environment with the objective of identifying the most appropriate advice in terms of GIF activities, in collaboration with the System Steering Committee (SSC) chairs, task forces and working groups, and with the guidance of the members of GIF Policy Group.

The Policy Group supported the work initiated in 2019 to build a smarter connection with the private sector and recommended the pursuit of these activities. SIAP continues to provide practical advice on strategic issues and specific activities already taking place within GIF to enhance collaboration with the private sector. SIAP recommendations suggest pathways to create a perennial collaborative framework with industry. Complementarities and synergies with ongoing GIF activities should be explored.

SIAP guidance and feedback is vital to support GIF initiatives aimed at enhancing the collaboration with the private sector. In terms of the specific requests for the three new activities noted above, this guidance and feedback is outlined below.

1. Some of these reactors have already made considerable progress, for example the HTR-PM helium-cooled gas reactor, the BREST-OD 300 LFR and the thorium molten salt reactor (TMSR-LF1).

2. A "charge" addressed to SIAP is a technical question or a problem emanating from the Policy Group and the Experts Group with the objective of obtaining SIAP feedback, and its vision and recommendations from an industrial point of view. Generally, a maximum of one charge per year is addressed to SIAP.

- For the GIF Forum with Industry 2022: SIAP is providing feedback and advice on the Forum's program, ideas for workshops (e.g. sessions involving the private sector) and relevant contacts from the industry, as well as for the potential end users of nuclear services (electricity/hydrogen/heat). The participation of interested SIAP members in the Organizational Committee of the Forum could be justified.
- For the GIF paper on "Considerations towards Establishing a Framework for Collaboration with Industry": SIAP is providing feedback on the first draft of the paper and advice on the associated action plan.
- For the Non-Electric Applications of Nuclear Heat (NEaNH) Task Force: SIAP is advising on the potential research program of the task force (e.g. integration of end-user requirements) and providing relevant industry contacts, in particular the end users of nuclear heat. It is putting a special focus on hydrogen production as one of the potential research topics for this cross-cutting task force. If possible, it will serve as a relay between GIF experts and end users, to better understand their principal features.

SIAP intentions for 2022

The Senior Industry Advisory Panel will continue to advise and support GIF in building better connections with the private sector and increasing involvement of industrial partners. It will stand ready to offer advice on how to interact with the private sector and implement recommendations in relation to previous SIAP charges. SIAP will also continue to provide industrial insight for GIF activities, create opportunities for the industry to bring together different viewpoints and to share experience in terms of the development and application of new technologies for Gen-IV concepts.

References

NEA (2021), *Mobilising climate and Development Finance to Meet the Paris Agreement: Perspectives on Nuclear Energy*, OECD Publishing, Paris, available at: <https://oecd-events.org/cop26>.

IEA (2021), *Net Zero by 2050: A Roadmap for the Global Energy Sector*, IEA, Paris, available at: www.iea.org/reports/net-zero-by-2050.