

Non-Electric Applications of Nuclear Heat Task Force

In November 2020 and February 2021, GIF held two, open brainstorming meetings out to exchange expert views on the position of Gen-IV systems (and particularly advanced modular reactors) regarding non-electric applications of nuclear heat (NEaNH). The outcomes from the brainstorming sessions suggested a path forward for the development of a NEaNH-related activity, and the following key areas were identified:

- GIF can play an important role in identifying the specific benefits that Gen-IV reactor technologies could bring to the NEaNH sector in the context of future energy markets.
- The development of a NEaNH-related activity launched under the auspices of GIF should be based upon the considerations listed below.
 - Organizations and members express an interest in contributing to the proposed activity and are able to share foundational knowledge and input data on the subject, such that a limited but relevant amount of useful documentation can be identified and produced to support the NEaNH objectives.
 - Overlaps with similar efforts undertaken within other nuclear organizations (e.g. IAEA, IEA, NEA, WNA) are avoided and opportunities for collaboration pursued.
 - An optimal balance is sought between addressing potential NEaNH configurations that can be achieved with Gen-III technologies (mainly pressurized water reactors) and those addressing specific high-temperature NEaNH processes, requiring that Gen-IV technologies be deployed. The complexity and variety of boundary conditions (e.g. local/global economy, geopolitics, government strategies) must be taken into account to determine the optimal combination of reactor technology, power level and NEaNH

to fulfill specific requirements; this activity should aim at providing decision makers with the tools for pursuing optimal solutions which depend on their specific needs rather than suggesting a technology down-selection.

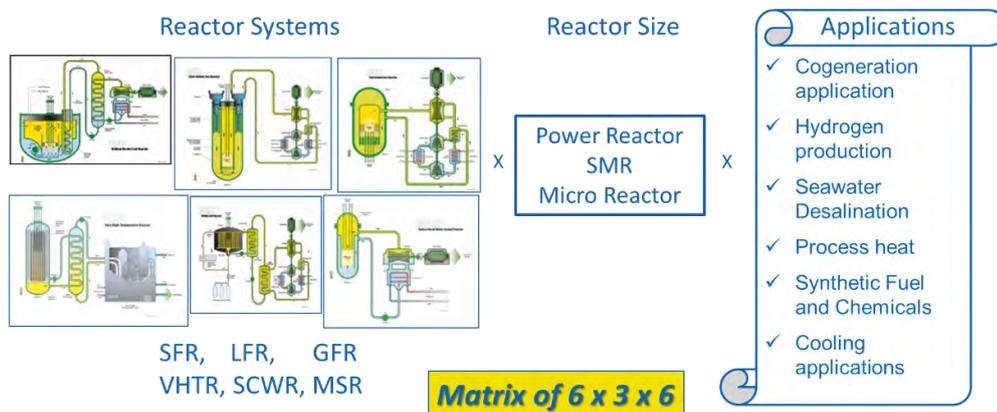
- In order to address the previous item, this activity should explore combinations arising from the “6 (NEaNH processes) x 3 (levels of power) x 6 (GIF reactor systems) matrix” (see Figure NEaNH-1) from different perspectives (geopolitical, economic, R&D, regulation). Use of such a matrix would enable the identification of potential technical and economic hurdles specific to the most promising combinations.
- Efforts are needed to reach out to technical-economic communities beyond the nuclear power sector. In particular, efforts should be made to engage stakeholders in the high-temperature community (e.g. concentrated solar power, industrial processes, thermal energy storage).

Objectives of the GIF NEaNH Task Force

In order to fulfill the requirements outlined above, a dedicated, new task force was created in October 2021, the Non-Electric Applications of Nuclear Heat Task Force, or NEaNH TF (pronounced “NENH”). This task force is initially defined for a duration of 24 months, with a predefinition of the following items:

- Item 1: provide to GIF a position paper on its vision for NEaNH coupled to GIF systems (near term and transition to future).
- Item 2: upgrade and share the general level of knowledge to all GIF members by organizing an open workshop and establishing a shared database, implemented on the GIF website and updated regularly.

Figure NEaNH-1: Definition of the 6x3x6 matrix: 6 Gen-IV systems over 3 power ranges to address 6 major non-electric applications



- Item 3: highlight relevant solutions of the 6x3x6 matrix; creating a dedicated mind map to fill in potentially viable configurations.
- Item 4: implement within GIF a network that extends beyond the nuclear field and connects with the high temperature community.
- Item 5: analyze these systems in view of:
 - technology readiness levels, timeliness/geographical suitability and footprint/CO₂ emission reduction potential;
 - cost evaluation (USD/t CO₂ saved), return on investment evaluation (annual emission reduction/required investment); several tools from the IAEA and OECD/NEA, as well as from participant organizations if available as open source tools, could be applied;
 - boundary conditions that are necessary to make such systems viable (e.g. cost of competing energy sources such as natural gas, levels of CO₂ tax, interest rates, discount rates).

With these results, GIF could deliver advice to policy-makers, industry, licensing authorities and investors in terms of which nuclear applications are likely to be

best suited (i.e. effective, timely) for meeting specific policy goals, how much these options may cost and how much economic benefit they could potentially offer. Participation in the GIF NEaNH TF has been confirmed by the following member countries: Australia, Canada, China, Euratom, France, Japan, Korea, Russia, the United Kingdom and the United States. GIF plans regarding the NEaNH TF were shared at the IAEA Technical Meeting on the Role of Nuclear Cogeneration Applications Towards Climate Change Mitigation, held on 11-13 October 2021.¹



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Chair of the NEaNH TF,
with contributions from NEaNH TF
members

1. See GIF presentation by G. RODRIGUEZ entitled “Non-Electric Applications of Nuclear-Heat: A new Generation IV International Forum initiative” IAEA Technical Meeting on the Role of Nuclear Cogeneration Towards Climate Change Mitigation, Virtual Meeting, Oct. 11-13, 2021 (Event code: EBT2003995).