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GIF outlook and current initiatives

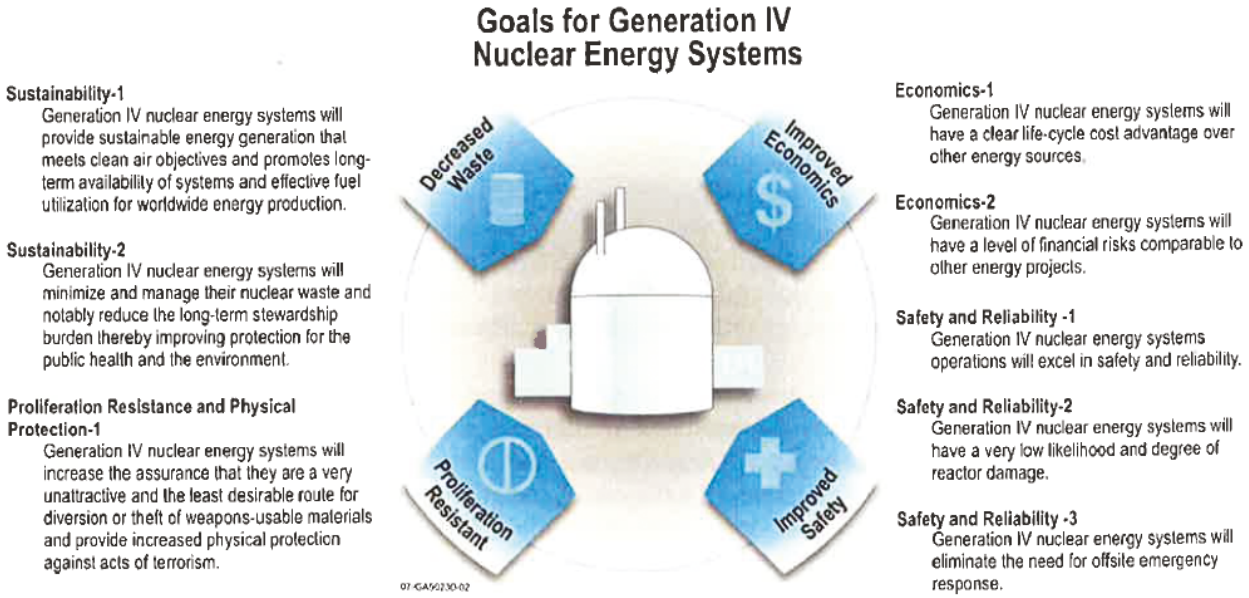
The Generation-IV (Gen-IV) goals originally defined in the Generation IV International Forum (GIF) Charter[1] have continued to motivate research and development (R&D) on advanced reactor technology options and guide GIF collaboration activities. Gen-IV goals are defined in four broad areas:

- Sustainability is the ability to meet present needs without compromising the ability of future generations to meet their own needs. Sustainability requires conserving resources, protecting the environment and preserving capabilities. In the GIF Technology Roadmap (GIF, 2002), sustainability goals are defined with a focus on waste management and resource utilization.
- Economic competitiveness is a requirement of the marketplace and is essential for Generation-IV nuclear energy systems. Future nuclear energy systems should accommodate a range of plant ownership options and anticipate a wider array of potential energy supply roles. Generation-IV nuclear energy systems may be utilized for a broader range of energy products beyond electricity.
- Safety and reliability are essential priorities in the deployment and sustained operation of nuclear energy systems, while competitiveness requires a very high level of reliability and performance. Generation-IV nuclear energy systems reinforce the defense-in-depth approach and utilize innovative features to provide inherent safety (i.e. passive decay heat removal pathways).
- Proliferation resistance and physical protection are also essential priorities for the expanded deployment of nuclear energy systems. In addition to the ready application of international safeguards, Generation-IV advanced reactor technologies promote the integration of safety, security and safeguard requirements into the design of new fuel cycles and reactors.

For these four areas, the eight specific goals utilized in the GIF Roadmap (GIF, 2002) are shown below:

The GIF Roadmap also identified three successive phases for advanced reactor development:

- the viability phase, when basic concepts are tested under relevant conditions and all potential technical showstoppers are identified and resolved;
- the performance phase, when engineering-scale processes, phenomena and materials capabilities are verified and refined under prototypical conditions;



1. For more information on the GIF Charter, please visit www.gen-4.org/gif/jcms/c_40243/gif-charter.

- the demonstration phase, when the detailed design is finalized, and licensing, construction and operation of the system is carried out, with the aim of bringing Gen-IV reactors to commercial deployment.

The current technology status and timeline for the phases were evaluated in 2014, in the GIF Technology Roadmap update (GIF, 2013). Today, several of the six Gen-IV systems are entering the demonstration phase, which presents several challenges and opportunities for the GIF community.

In general, the same infrastructure (both in terms of expertise and facilities) that is needed for R&D on viability and performance remains useful in the demonstration and deployment phases. However, the topics that need to be addressed are identified and prioritized by operational and construction experience. An intimate working relationship with the advanced reactor industry working to license, construct and operate advanced reactors is thus needed to ensure the continued relevance of Gen-IV contributions.

Another challenge relates to systems that are being demonstrated in the near term and utilize low-risk (high technical maturity) design choices. However, developers are often aware beforehand of favorable features that are not yet technically mature, and operational experience will identify specific technology challenges for optimal performance. Therefore, to support future innovation, a robust R&D infrastructure is needed to support technology development, where particular design features or subsystems can be quickly matured through the viability and performance phases (even while first-of-a-kind Gen-IV technology advanced reactors are operating in the demonstration phase). This provision for future refinement may prove to be critical for the widespread deployment of Gen-IV technology that will depend on the reliable, robust and high-performance operations of these advanced reactors.

Reference

GIF (2002), *A Technology Roadmap for Generation IV Nuclear Energy Systems*, Generation IV International Forum, Paris, GIF-002-00.

GIF (2013), *Technology Roadmap Update for Generation IV Nuclear Energy Systems*, Generation IV International Forum, Paris.

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