

Roll Up of Metrics, Criteria, Goals and Goal Areas

4 Goal Areas	8 Goals	15 Criteria	24 Metrics
Sustainability	SU1 Resource Utilization SU2 Waste Minimization and Management	SU1-1 Fuel Utilization	<ul style="list-style-type: none"> • Use of fuel resources
		SU2-1 Waste minimization SU2-2 Environmental impact of waste management and disposal	<ul style="list-style-type: none"> • Waste mass • Volume • Heat load • Radiotoxicity • Environmental impact
Economics	EC1 Life Cycle Cost EC2 Risk to Capital	EC1-1 Overnight construction costs EC1-2 Production costs EC2-1 Construction duration	<ul style="list-style-type: none"> • Overnight construction costs • Production costs • Construction duration
		EC1-1 Overnight construction costs EC2-1 Construction duration	<ul style="list-style-type: none"> • Overnight construction costs • Construction duration
Safety and Reliability	SR1 Operational Safety and Reliability SR2 Core Damage SR3 Offsite Emergency Response	SR1-1 Reliability SR1-2 Worker/public - routine exposure SR1-3 Worker/public - accident exposure SR2-1 Robust safety features SR2-2 Well-characterized models SR3-1 Well-characterized source term energy SR3-2 Robust mitigation features	<ul style="list-style-type: none"> • Forced outage rate • Routine exposures • Accident exposures • Reliable reactivity control • Reliable decay heat removal • Dominant phenomena - uncertainty • Long fuel thermal response time • Integral experiments scalability • Source term mechanisms for energy release • Long system time constants • Long and effective holdup
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Proliferation Resistance and Physical Protection	PR1 Proliferation Resistance and Physical Protection	PR1-1 Susceptibility to diversion or undeclared production PR1-2 Vulnerability of installations	<ul style="list-style-type: none"> • Separated materials • Spent fuel characteristics • Passive safety features

Near the end of the first step, the GIF met to conduct the second step of the selection process in February 2002. Leaders from the NERAC Subcommittee participated in the meeting. The GIF reviewed the preliminary evaluation results and discussed additional considerations that would be important to their final decision. These

included a review of the important conclusions of the fuel cycle studies, which helped to suggest the various missions for Generation IV systems that were of interest: electricity and hydrogen production and actinide management. These missions are outlined in a section below.

[†]The term *actinide* refers to the heaviest elements found in used reactor fuel, many of which have long half-lives, including isotopes of uranium, plutonium, neptunium, americium and curium.

A final review of evaluations and performance to missions by the GIF Experts Group completed the third step in April 2002. The GIF met in May and July 2002 to conduct the fourth step. In brief, the candidate concepts that emerged from the final screening were discussed. Each was introduced with a presentation of the concept in terms of final evaluations, performance of missions, and estimated deployment dates and R&D costs. The Policy members discussed the concepts until a consensus was reached on six systems found to be the most promising and worthy of collaborative development.

Generation IV Nuclear Energy Systems

The Generation IV roadmap process described in the previous section culminated in the selection of six Generation IV systems. The motivation for the selection of six systems is to

- Identify systems that make significant advances toward the technology goals
- Ensure that the important missions of electricity generation, hydrogen and process heat production, and actinide management may be adequately addressed by Generation IV systems
- Provide some overlapping coverage of capabilities, because not all of the systems may ultimately be viable or attain their performance objectives and attract commercial deployment
- Accommodate the range of national priorities and interests of the GIF countries.

The following six systems, listed alphabetically, were selected to Generation IV by the GIF:

Generation IV System	Acronym
Gas-Cooled Fast Reactor System	GFR
Lead-Cooled Fast Reactor System	LFR
Molten Salt Reactor System	MSR
Sodium-Cooled Fast Reactor System	SFR
Supercritical-Water-Cooled Reactor System	SCWR
Very-High-Temperature Reactor System	VHTR

The six Generation IV systems are summarized in the next section after a short introduction of the FCCG findings. The INTD systems are described later in the report. In addition to overall summaries regarding fuel cycles and overall sustainability, the section describes missions and economic outlook, approach to safety and reliability, and path forward on proliferation resistance and physical protection.