



Generation IV Nuclear Energy Systems Initiative

Office of Nuclear Energy, Science and Technology
U. S. Department of Energy

January 2003

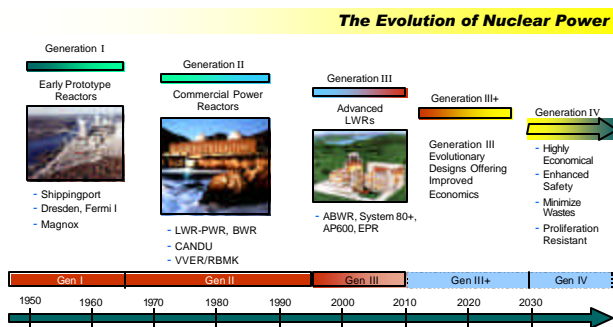
What is Generation IV?

At the end of 2001, 438 nuclear power reactors were in operation in 31 countries around the world, generating electricity for nearly 1 billion people. They account for approximately 17 percent of worldwide installed base capacity for electricity generation and provide half or more of the electricity in a number of countries. As a whole, these reactors have an excellent operating record and are generating electricity in a reliable, environmentally safe, and affordable manner without emitting noxious gases into the atmosphere.

Concerns over energy resource availability, climate change, air quality, and energy security suggest an important role for nuclear power in future energy supplies. While the current Generation II and III nuclear power plant designs provide an economically, technically, and publicly acceptable electricity supply in many markets, further advances in nuclear energy system design can broaden the opportunities for the use of nuclear energy. To explore these opportunities, the U.S. Department of Energy's Office of Nuclear Energy, Science and Technology has engaged governments, industry, and the research community worldwide in a wide-ranging discussion on the development of next-generation nuclear energy systems known as "Generation IV".

Generation IV Technology Roadmap

The Generation IV Technology Roadmap evaluates nuclear energy concepts, selects the most promising concepts for further development, and defines the research and development (R&D) needed to bring these concepts to maturity for potential commercialization. U.S. and international experts developed the Roadmap over a period of two years.



A first step in the Roadmap was defining technology goals that capture sustainability, safety and reliability, and economic goals for energy production.

The technology goals for Generation IV nuclear energy systems were developed by the Subcommittee on Generation IV Technology Planning, a subcommittee of the

Gen IV Technology Goals

Generation IV nuclear energy systems will:

- Provide sustainable energy generation that meets clean air objectives and promotes long-term availability of systems and effective fuel utilization for worldwide energy production.
- Minimize and manage their nuclear waste and notably reduce the long term stewardship burden in the future, thereby improving protection for the public health and the environment.
- Increase the assurance that they are a very unattractive and least desirable route for diversion or theft of weapons-usable materials.
- Excel in safety and reliability.
- Have a very low likelihood and degree of reactor core damage.
- Eliminate the need for offsite emergency response.
- Have a clear life-cycle cost advantage over other energy sources.
- Have a level of financial risk comparable to other energy projects.

Department's independent Nuclear Energy Research Advisory Committee (NERAC) in cooperation with the international research community. The goals are now widely endorsed as an appropriate basis for deciding on a future, multinational R&D plan for developing advanced nuclear energy technologies.

The selection of the most promising concepts was performed on the basis of thorough evaluations and anticipated future Generation IV energy missions. Technical Working Groups collected information on and evaluated four broad classes of nuclear energy system concepts by reactor coolant type: water, gas, liquid metal, and nonclassical. The Technical Working Groups were assisted by the Evaluation Methods Group and other crosscutting groups who conducted comparative assessments of alternative fuel cycles and specific technology areas.

Generation IV International Forum (GIF)

GIF is a group of ten countries -- Argentina, Brazil, Canada, France, Japan, Republic of Korea, Republic of South Africa, Switzerland, United Kingdom, and the United States -- that are interested in jointly planning the future of nuclear energy and together developed the Roadmap. GIF is a formal, government-sanctioned organization committed to collaboratively pursue R&D on Generation IV systems.

FY 2002 Accomplishments:

- Six candidate Generation IV reactor concepts were selected by GIF for development. These concepts are the gas-cooled fast reactor (GFR), the lead-cooled fast reactor (LFR), the sodium-cooled fast reactor (SFR), the supercritical-water-cooled reactor (SCWR), the very high temperature reactor (VHTR), and the molten salt reactor (MSR).
- More than 100 technical experts from 10 countries and OECD/NEA, IAEA, and EC worked together to develop the Roadmap. The Roadmap was prepared in close cooperation with NERAC and GIF.
- Completed the draft Generation IV Technology Roadmap.

FY 2003 Planned Accomplishments:

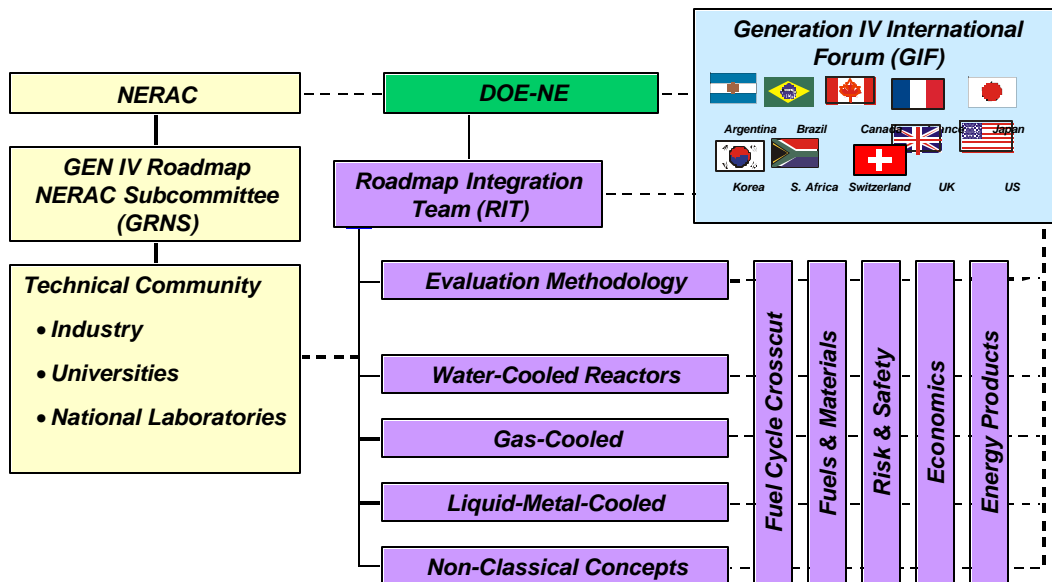
- Submit Roadmap to Congress by March 1, 2003.
- Develop U.S.-specific program plan for Generation IV and submit the Generation IV Implementation Plan to Congress by March 31, 2003.
- Establish research agreements with GIF countries on the division of responsibilities.
- Initiate R&D in accordance with the Generation IV Technology Roadmap and Gen IV Implementation Plan.

FY 2004 Planned Accomplishments:

- Complete reference point design for VHTR.
- Complete assessment of R&D priorities for thermochemical cycles, thermally-assisted electrolysis and steam reforming for nuclear-assisted hydrogen production.
- Complete initial materials screening studies for advanced materials for high-temperature service.
- Define nuclear data measurement, evaluation, and validation needs based on data sensitivity evaluations of Gen IV systems.
- Develop specifications for an integrated nuclear economics model.

Program Budget Generation IV (\$ in Millions)		
<u>FY 2002 Appropriation</u>	<u>FY 2003 Request</u>	<u>FY 2004 Request</u>
\$4.0	\$7.8	\$9.7

Overall Roadmap Organization



Visit our web site: nuclear.gov