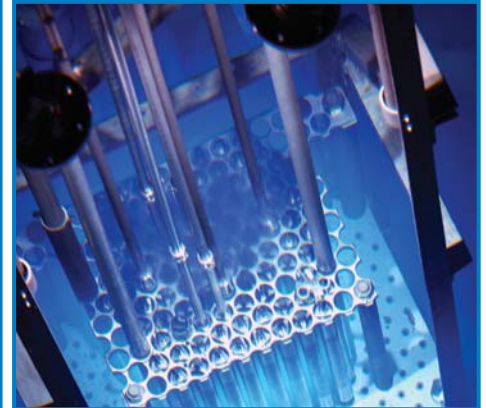


Next-Generation Nuclear Energy

The U.S. Department of Energy's Office of Nuclear Energy

Generation IV systems concepts excel in safety, sustainability, cost-effectiveness and proliferation resistance.



- The Department of Energy's (DOE) strategic plan lays the groundwork of the ambitious, long-term vision of a zero-emissions future, free of the reliance on imported energy. The Generation IV program is a vital part of this vision.

- Both the President's National Energy Policy of 2001 and the Energy Policy Act of 2005 (EPAAct 2005) acknowledge the potential for nuclear energy to help meet our Nation's growing need for safe, reliable, and environmentally responsible energy supply. The goal of the Generation IV Nuclear Energy Systems Initiative is to address the fundamental research and development (R&D) issues necessary to establish the viability of next-generation nuclear energy system concepts and investigate the application of the R&D results to extend the operating life of existing light water reactors (LWR). Successfully addressing the fundamental R&D issues of Gen IV concepts that excel in safety, sustainability, cost-effectiveness, and proliferation-resistance, will allow these advanced reactor concepts to be considered for future commercial development and deployment by the private sector.

- The Generation IV program is focused on very high temperature reactor technologies for use in a Next Generation Nuclear Plant (NGNP) to produce hydrogen and other energy products, and on readying technologies that will further improve the economic and safety performance of existing LWR and advanced Gen IV reactor concepts.

• Benefits of the Initiative

- The Generation IV program integrates into the Department's portfolio of nuclear initiatives to provide for near-term Nuclear Power 2010 (NP2010), medium-term Global Nuclear Energy Partnership (GNEP), and long-term (Generation

Bottom Right Photo Courtesy of Penn State Radiation Science and Engineering Center

IV) sustained advances in nuclear technology. R&D conducted under the Generation IV program has direct application and benefits for both the NP2010 and GNEP programs in the areas of:

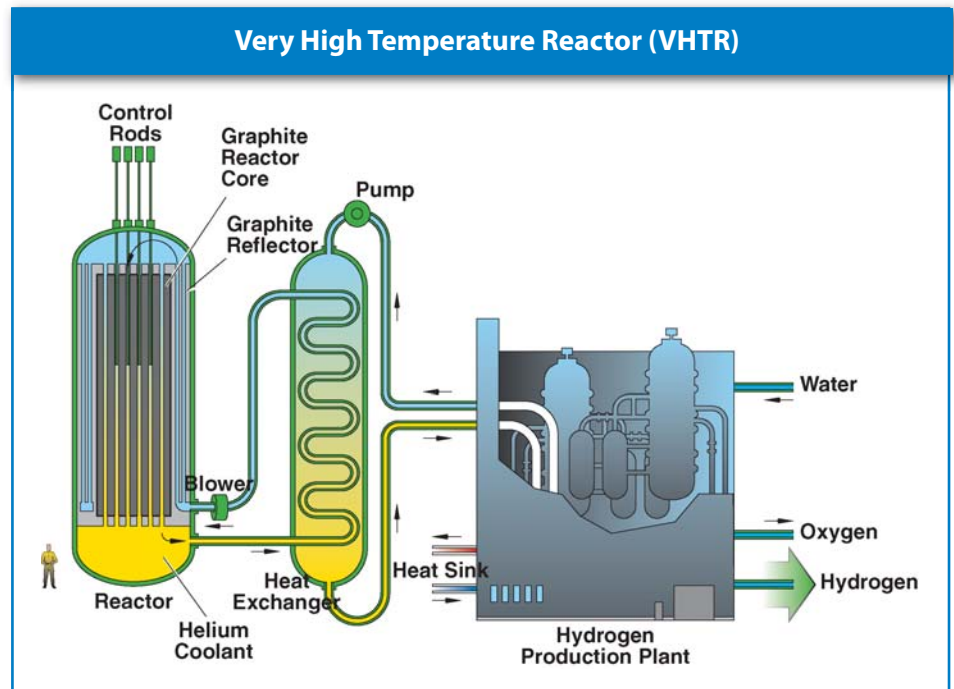
- Nuclear regulation and licensing, and
- Component and materials aging and degradation.

For the long term, the Generation IV program will develop new nuclear energy systems that are competitive with advanced fossil and renewable technologies, enabling power providers to select from a diverse group of options that are economical, reliable, safe, secure, and environmentally acceptable. In addition, the NGNP reactor concept will be capable of providing high-temperature process heat for various industrial applications, including the production of hydrogen in support of the President's Advanced Energy Initiative.

Generation IV nuclear energy systems are being developed to use high burn-up fuel, transmutation fuel, and recycled fuel. Such fuel cycle strategies allow for more efficient utilization of our domestic uranium resources and minimization of waste generation.

Proliferation resistance and physical protection improvements are being designed into Generation IV nuclear energy systems. Generation IV plants will also feature advances in safety with the goal of eliminating the need for offsite emergency response and to further improve public confidence in the safety of nuclear energy, while providing enhanced investment protection for plant owners.

Competitive life-cycle costs and acceptable financial risks are being factored into Generation IV designs with high-efficiency electricity generation systems, modular construction, and shortened development schedules before plant startup.

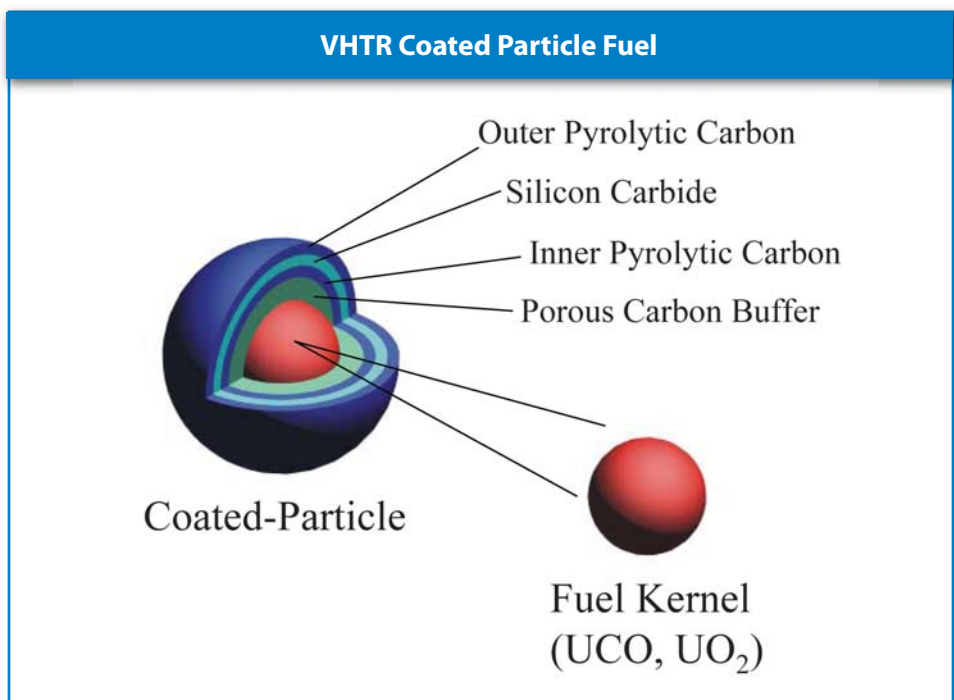


The Generation IV program also includes R&D focused on component and material aging and degradation resulting from long-term operation in the harsh nuclear environment (temperature, chemistry, and radiation). Results of this research will directly benefit existing nuclear plants by enabling the extension of their current operating licensing period. It will also enable the design of advanced reactor concept plants with a longer operating life.

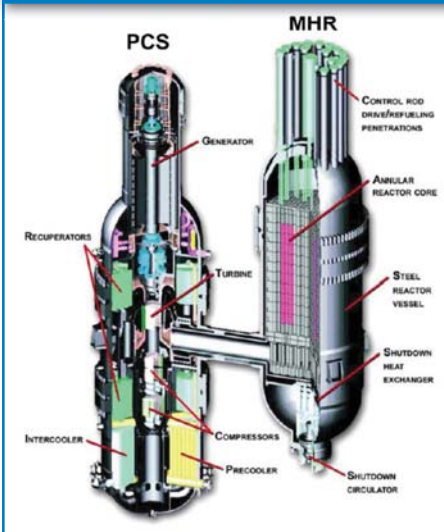
International Cooperation

Key to the strategy for conducting all Generation IV research and development is the multiplication effect on investment derived from international collaboration. By coordinating U.S. efforts with partner nations, our funding is leveraged by a factor of two to ten.

The United States collaborates with the international community via the



Pre-Conceptual General Atomics Modular Helium Reactor NGNP Design



Generation IV International Forum (GIF) and bilateral agreements pioneered under the International Nuclear Energy Research Initiative to support developments in the Very High Temperature Reactor (VHTR).

Next-Generation Nuclear Plant

An NGNP is configured for application to process heat production for the generation of hydrogen, electricity, and other industrial commodities. EAct 2005 authorized DOE to create a two-phased NGNP Project at

the Idaho National Laboratory. DOE is presently engaged in the Phase I scope of work; that is, it is developing a licensing strategy, selecting a hydrogen production technology, and conducting enabling R&D for the reactor system.

The ongoing R&D activities focus on such enabling technologies as high-temperature metal alloys, nuclear-grade graphites, and coated particle fuels. High-burnup fuel is being developed to withstand extreme conditions while maintaining the integrity of the fuel and retaining the fission products within the fuel particle coatings. Work progresses in developing design data needs for the reactor system, including such key components as the reactor vessel and intermediate heat exchanger.

In November 2006, DOE formally entered into the GIF System Arrangement for the VHTR with Canada, Euratom, France, Japan, the Republic of Korea, and Switzerland. Lower tier VHTR collaborations on Materials, Fuels and Hydrogen Production have been finalized and will be signed by the various international partners in 2008. Collaboration with private industry and potential end-users to

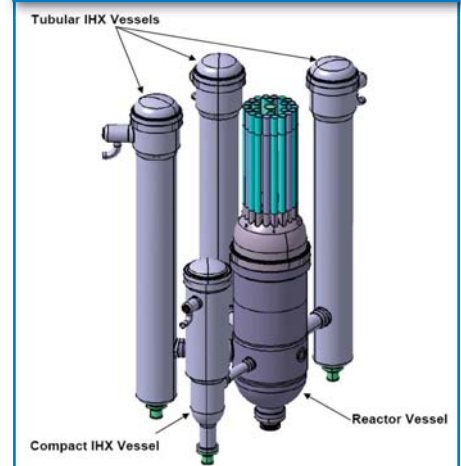
drive the development of the NGNP is underway.

Planned Program Accomplishments

FY 2008

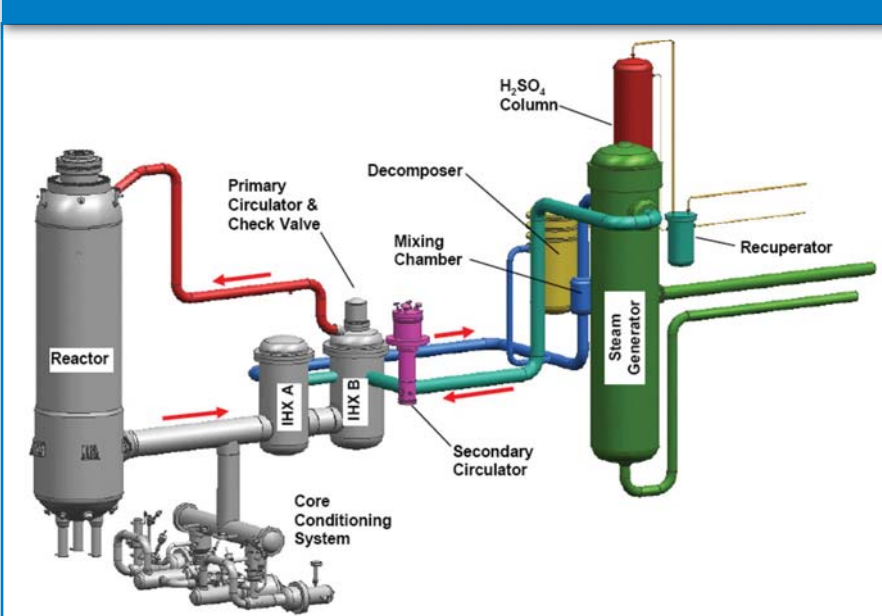
- Complete the joint development of the NGNP Licensing Strategy with the Nuclear Regulatory Commission and submit the strategy to Congress as required by EAct 2005.
- Continue the irradiation of the first NGNP fuel tests at the Advanced Test Reactor (ATR) at Idaho National Laboratory.

Pre-Conceptual Areva Prismatic Core NGNP Design

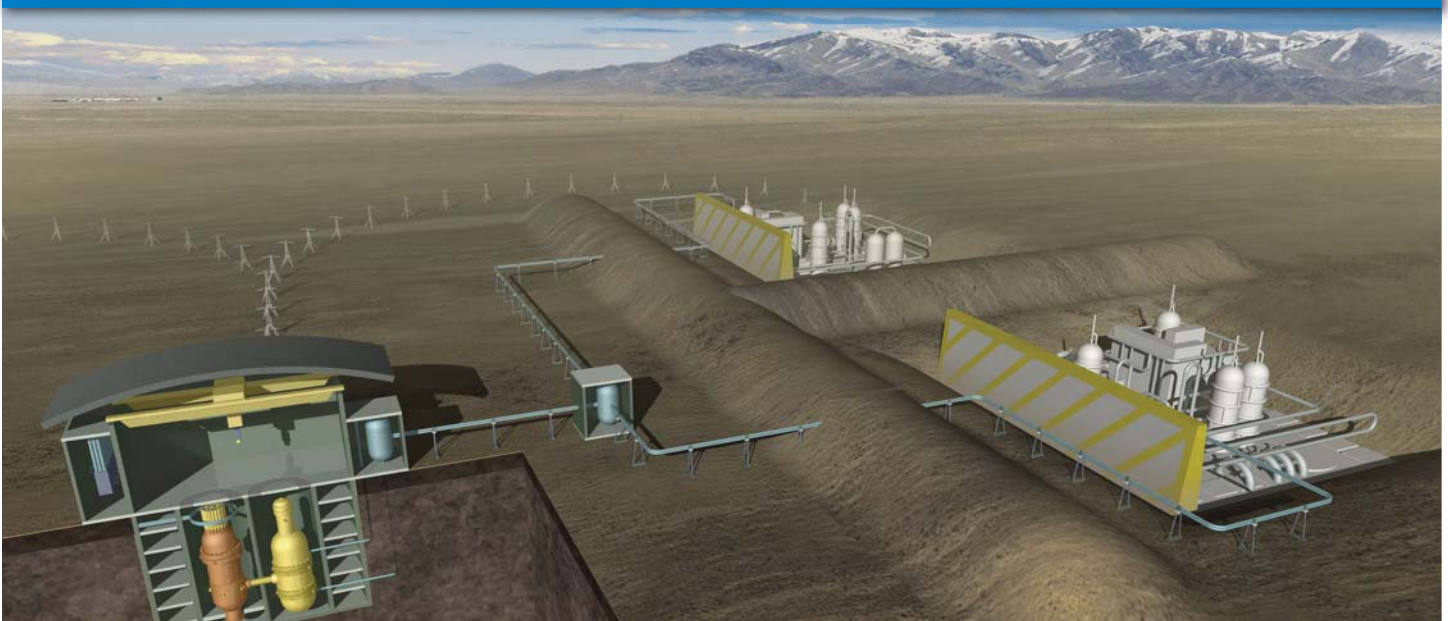


- Continue the support of industry code committees in qualifying high-temperature materials and analytical methods.
- Continue support to the American Nuclear Society (ANS) on developing regulatory gap analysis for LWR vs. High-Temperature Gas Reactor (HTGR) and ANS 28 HTGR Design Criteria Standard.
- Pursue benchmarked analyses of pebble-bed and prismatic cores for both physics and heat transport.
- Initiate conceptual design activities aimed at high project-risk systems and components.

Pre-Conceptual PBMR Pebble-Bed NGNP Design



Generation IV Artist's Rendition



- Conduct cost-shared research in GIF VHTR Projects for Design, Safety, and Integration; Computational Methods and Benchmarks; Materials; and Fuel and Fuel Cycle.
- Continue development of benchmarking methodologies (economics, proliferation resistance, physical protection, and reactor safety).
- Co-chair the GIF VHTR Steering Committee and provide critical GIF Secretariat and meeting facilitation support for GIF Policy Group and GIF Expert Group meetings.
- Continue the support of industry code committees in qualifying high-temperature materials and analytical methods.
- Work with the NRC to resolve regulatory uncertainties for gas reactors.
- Conduct cost-shared research in GIF VHTR Projects for Design, Safety, and Integration; Computational Methods and Benchmarks; Materials; and Fuel and Fuel Cycle.
- Continue development of benchmarking methodologies (economics, proliferation resistance, physical protection, and reactor safety).
- Co-chair the GIF VHTR Steering Committee and provide critical Secretariat and meeting facilitation support for GIF Policy Group and GIF Expert Group meetings.
- Maintain the *Generation IV Materials Handbook* and arrange for other GIF organizations to share existing data and new materials data developed in the Gen IV Program.
- Initiate laboratory and industry cost-shared research projects on material and component aging and degradation focused on fuel clad failures, and structural and reactor vessel materials that challenge nuclear plant operations beyond 60 years. These efforts would also re-establish a long-term, low-irradiation reactor vessel program.

FY 2009

- Complete the irradiation of the first NGNP fuel tests in the ATR.
- Negotiate an agreement with industry on cooperative development of NGNP.
- Continue analytical method and code development for benchmarking pebble-bed and prismatic cores in both physics and heat transport.

Program Budget

Generation IV Nuclear Energy Systems Initiative (\$ in Millions)

	FY 2008 Request	FY 2008 Actual	FY 2009 Request
Gen IV Nuclear Energy	\$36.1	\$114.9	\$70.0