



Clean. Reliable. Nuclear.

Nuclear Energy Sustainability

The mission of the U.S. Department of Energy's Office of Nuclear Energy (DOE-NE) is to advance nuclear power as a resource capable of making major contributions in meeting the energy supply, environmental, and energy security needs of the United States. These efforts support the U.S. government's goals of providing domestic sources of secure and clean energy, and enhancing national security.

NE's programs are focused on both maintaining and enhancing the existing fleet, developing the pipeline of advanced reactors, and re-establishing the national fuel cycle infrastructure:

- Existing Fleet – through cost-shared awards, we are working with U.S. Industry to address priority cost and technical problems.
- Advanced Reactor Pipeline for the 2020s – through competitive private-public partnerships, providing state-of-the-art infrastructure and supporting critical research and development.
- Fuel Cycle – Will focus on those steps necessary to establish capabilities to produce high assay low enriched uranium, outline reprocessing infrastructure needs and options and address used fuel.

Some of the key programs working to achieve these objectives include:

Light Water Reactor Sustainability (LWRS) Program

The LWRS Program is developing the scientific basis to ensure long-term plant economic viability, safety and security. The program is conducted jointly with U.S. industry, and in collaboration with national laboratories, universities, and international partners.

These public/private research and development projects are organized into the following topics:

- Materials Aging and Degradation Assessment, to understand and predict long-term environmental degradation behavior of materials in nuclear power plants.
- Advanced Instrumentation, Information, and Control Systems Technologies, to address long-term aging and modernization of current instrumentation and control technologies through development, demonstration, and testing of new digital

instrumentation and control technologies and advanced condition monitoring technologies.

- Risk-Informed Safety Margin Characterization, to develop and deploy approaches to support the management of uncertainty in safety margins quantification to improve decision making for nuclear power plants.
- Reactor Safety Technologies to improve the understanding of "beyond design basis" events and reduce uncertainty in severe accident progression, phenomenology, and outcomes using existing analytical codes and information gleaned from severe accidents, in particular the Fukushima Daiichi events.

Fuel Cycle Technologies (FCT) Program

Fuel Cycle Technologies (FCT) Program encompasses both the front end and the back end of the nuclear fuel cycle. The program seeks to optimize each step of the fuel cycle through systems analysis, engineering and integration. The mission of the program is twofold:



- 1) Continue to conduct generic research and development to develop used nuclear fuel (UNF) management strategies and technologies to support meeting federal government responsibility to manage and dispose of the US commercial used nuclear fuel and high-level waste.
- 2) Develop sustainable fuel cycle technologies and options that improve resource utilization and energy generation, reduce waste generation, enhance safety, and limit proliferation risk.

Fuel Cycle R&D - Accident Tolerant Fuel

The ATF Program demonstrates NE's commitment to safe, reliable, and economic energy for the future. This program is developing light water reactor (LWR) fuels with enhanced accident tolerant characteristics. Overall program objectives are:

- Identify and select advanced LWR fuel concepts for development leading to insertion in a commercial U.S. reactor in the 2022 timeframe.

- Support the development of state-of-the-art R&D infrastructure that can be used to accelerate further development of nuclear fuels and materials.
- Support the development of the predictive, multi-scale, multi-physics fuel performance computer models and the associated benchmark evaluation.

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