# Advanced Reactors

The American Nuclear Society promotes the development and deployment of advanced reactors because of their importance to the decarbonization, affordability, reliability, and security of the world's long-term energy supply. Governments, environmental groups, and major energy producers and consumers all increasingly recognize that nuclear energy has an essential role in providing clean, reliable electricity. Advanced reactor designs offer the benefits of current reactors as well as the potential to deploy in high-temperature industrial applications beyond electricity generation,[1] inherent features that reduce complexity and enhance safety, and more efficient fuel use for long-term fuel supply sustainability.

The American Nuclear Society recommends the following policy actions to foster the development of advanced reactors:

1. Use the capabilities of the U.S. Department of Energy infrastructure, U.S. universities, and international partners to perform vital fundamental research related to advanced reactors. While some designs are ready for deployment based on current technology, long-term advancements in applied science and engineering will enable advanced reactors to fully realize their potential. In particular, fast reactor designs would benefit significantly from a fast neutron source for materials and fuels testing.
2. Continue and expand private-public partnerships to build demonstration units for multiple advanced reactor designs. Demonstration reactors and other first-of-a-kind nuclear reactor deployment projects will provide operational experience and focus research and development on advancements needed to optimize designs for commercial deployment. Nuclear energy systems have high development costs and longer time frames than other energy sources, but their attributes justify the public funding needed to bring promising designs to fruition.
3. Support the prompt development of a technology-neutral, risk-informed, and performance-based licensing framework that will provide effective and efficient regulation of advanced reactor designs.

## Background

Advanced reactor development has accelerated in the U.S. over the past decade due to increased private sector investment spurred by strong government backing through impactful programs such as the Advanced Reactor Demonstration Program,[2] the Advanced Reactor Concepts program,[3] and programs focused on the development of small modular reactors.[4] Interest in deploying new nuclear energy systems is growing rapidly as national and global concerns rise over carbon emissions, energy security and resiliency, and system costs. Sustained government support will enable the United States to lead the next wave of nuclear plant construction, reestablish itself as the global leader in the development of advanced reactors, and achieve national objectives in nuclear safety, security, and nonproliferation. Additional public policy actions are needed to ensure continued U.S. leadership in this vital sector.

Advanced reactors often use fuel types different from conventional low-enriched uranium oxide—such as high-assay low-enriched uranium,[5] mixed uranium-plutonium, or thorium-based fuels—and generally incorporate coolants such as liquid metal, gas, or molten salt. Attributes of advanced reactor designs will enable fission technology to extend beyond clean electricity production. The higher operating temperatures of many advanced non–light water reactor designs enable clean, carbon-free, and economical process heat applications, providing an alternative to the fossil fuels that are currently used for these applications.

Many proposed advanced reactor designs produce a lower volume of high-level nuclear waste per unit energy generated than current reactors and/or plan to utilize existing high-level waste or depleted uranium as a source of fuel. Advanced reactors often combine existing features of conventional nuclear power, such as resilience, reliability, and high capacity factors with other features, such as thermal storage, enhanced load following, microgrid generation, on line refueling, alternative (nonelectricity) revenues, and extended

periods of uninterrupted operation. These features will enable advanced reactors to play a central role in providing low-emission energy generation, improving the economic performance of nuclear energy, and increasing nuclear energy's market attractiveness.

Advanced reactors offer the promise of improved safety and economics as well as more flexible operations, maintenance, and surveillance through inherent system characteristics. A risk-informed and performance-based framework for design and regulation[6] will enable advanced reactors to realize reduced capital and operating costs through simpler designs that have fewer unnecessary requirements associated with fabrication, installation, maintenance, and testing of safety-related systems and components.

**References**


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4. American Nuclear Society. Position Statement #25: "Small Modular Reactors." October 2020. https://cdn.ans.org/policy/statements/docs/ps25.pdf (current as of Jun. 20, 2022).

5. American Nuclear Society. Position Statement #84: "Safeguards and Security for Advanced Reactors Using HALEU." June 2022. https://cdn.ans.org/policy/statements/docs/ps84.pdf (current as of Jun. 20, 2022).

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