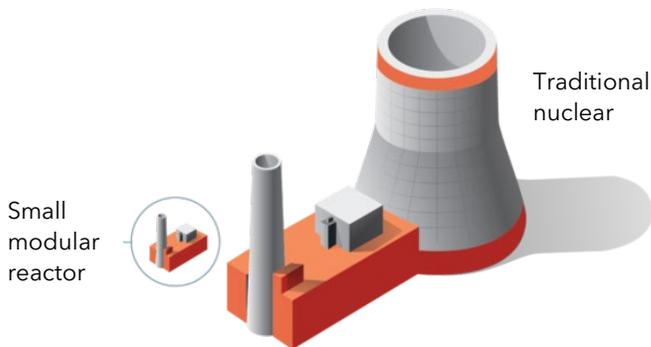


The Case for Advanced Nuclear Energy

Nuclear energy is a clean energy solution for meeting energy security and net-zero emissions goals, and it is saving lives by reducing air pollution. Existing nuclear energy supplies roughly 10% of global electricity and 20% of U.S. electricity. In the United States, the existing nuclear fleet provides roughly the same amount of carbon-free electricity as wind, solar, and hydro power combined. One [2021 study](#) has shown that the reduction of air pollution from generating clean nuclear energy has prevented almost 42 million deaths globally between 2000 and 2020, and projected an additional 46 million lives saved by 2040.

The next generation of nuclear reactors are being built now and will begin to be deployed [by the end of the decade](#). Recent government and industry activities are encouraging the development of advanced nuclear reactors. Bipartisan legislation has [provided a foundation](#) for federal research, development and demonstration, and has provided [funding](#) to ensure many advanced reactors have the fuel they will need. The U.S. Department of Energy's Advanced Reactor Demonstration Program, led by the Office of Clean Energy Demonstrations, will fund public-private partnerships for first-of-a-kind demonstrations of advanced nuclear reactors. These advanced nuclear reactors provide several benefits over traditional reactors, and together with renewable energy and other carbon-free energy sources, will allow the United States to reach its energy security and clean energy goals by 2050.



Source: [Idaho National Lab](#)

In addition to the benefits traditional nuclear reactors provide, advanced nuclear reactors:

1. Include innovations that can reduce costs, increase fuel efficiency, and improve safety
2. Create substantial economic benefits, including improved international competitiveness
3. Help make reaching net-zero emissions a reality by providing firm clean electricity and decarbonizing non-electric sectors
4. Mitigate spent fuel concerns

1. Reduced Costs, Increased Fuel Efficiency, and Improved Safety:

Nuclear innovators are pursuing multiple strategies to create new designs that make the next generation of reactors even better. Many advanced nuclear reactor designs, including small modular reactors and micro reactors, reduce the size of the reactor, which can lower upfront capital costs, shorten construction timelines, and decrease financing uncertainty. By building plants more quickly, developers can achieve rapid innovation cycles and continuous [technological learning](#) to reduce costs. Compared to traditional reactors, advanced nuclear reactors burn more of their fuel, increasing fuel efficiency, decreasing the amount of fuel needed, and ultimately reducing the total cost of fuel needed. Additionally, advanced reactor designs include inherent safety features, making them safer than traditional reactors. Together, these innovations mean that advanced reactors promise to be more economically viable, efficient, and safe.

2. Economic Benefits and International Competitiveness:

Currently, the U.S. nuclear energy industry supports [half a million employees](#) with salaries that are 30% higher than local averages. In addition to higher salaries, nuclear employees have higher rates of unionization and provide substantial employment opportunities for veterans. Advanced nuclear projects can support regional and state economies through [innovation hubs](#) and by attracting human capital. Small microreactors promise to make nuclear energy a [distributed energy source for the first time](#), powering microgrids, and remote energy-poor communities that currently rely on diesel fuel for electricity. Advanced nuclear reactors can be located at [retiring coal plant sites](#), making use of transmission and other infrastructure while providing economic benefits to local communities. That is a significant advantage compared to other potential sources of zero-carbon generation, which typically require new sites that may be far from existing transmission, and which do not provide similar levels of economic opportunities. Additionally, U.S. advanced reactor designs can be competitive in global markets, growing U.S. exports while enabling both decarbonization and economic growth for emerging economies.

3. Reaching Net-Zero Emissions:

Most energy-system modeling shows that full decarbonization will require firm zero-carbon electricity generation and decarbonized non-electric energy sectors, in addition to variable renewables. Nuclear energy can do both. Nuclear energy's historical role in providing a firm carbon-free backbone for the electric grid is well understood. Advanced nuclear reactors can also contribute to the broader decarbonization of other sectors. For example, high-temperature and excess heat generated from advanced nuclear reactors have the potential to decarbonize industrial processes, provide district heating to residential and commercial buildings, generate clean hydrogen, and even provide the energy for desalinization plants. Advanced nuclear technology can also enhance electricity market competitiveness through load following and integration with renewables and can generate clean electricity for electric vehicles and heat pumps to decarbonize the transportation, residential, and commercial sectors.

4. Mitigating Spent Fuel Concerns:

Advanced nuclear reactors can reduce the amount of spent nuclear fuel generated, thereby reducing the amount that requires long-term geological storage. Some advanced reactor designs plan to run on fuel recycled from existing stockpiles. Greater fuel efficiency will reduce the amount of spent nuclear fuel created per unit of nuclear energy produced. Additionally, some advanced reactors may reduce the duration and amount of the radioactivity of spent fuel. For more information on spent nuclear fuel, see the Nuclear Innovation Alliance's [fact sheet](#) on this topic.

Conclusion:

Advanced nuclear reactors can help meet our energy security and clean energy goals. Many advanced reactor designs have been developed, and several companies are planning to build their design by the end of the decade. These innovative reactor designs include a wide array of benefits that improve upon existing light water reactor technologies. Over the next few decades, advanced nuclear energy can play a vital role in shaping our clean energy landscape, and ensuring we reach net-zero emissions by midcentury.

For more information on advanced nuclear energy, please visit <https://nuclearinnovationalliance.org/> or contact Erik Cothron, NIA Analyst, at: ecothon@nuclearinnovationalliance.org