5.

Nuclear

ACCELERATING NUCLEAR ENERGY DEPLOYMENT

Key Takeaways:

- Nuclear power is safe, reliable, and the world's second-largest source of carbon-free electricity.
- Innovative companies are paving the way for the next generation of nuclear power plants.
- Modernizing regulations will accelerate the deployment of nuclear energy in the United States, and opening markets will encourage the safe deployment of emissions-free nuclear power around the world.

THE POTENTIAL FOR NUCLEAR TO SUPPLY CLEAN, AFFORDABLE POWER

Nuclear power is the second largest emissions-free source of electricity in the world. With 440 reactors (and 50 reactors in construction across 50 countries), nuclear provides about 10 percent of the world's power.[1] In the United States, 93 reactors in 28 states generate approximately 20 percent of the country's electricity and about half of the country's emissions-free electricity.[2] In addition to commercial nuclear plants that provide electricity, "there are about 220 research reactors operating in over 50 countries, with more under construction. As well as being used for research and training, many of these reactors produce medical and industrial isotopes."[3]

Nuclear power has significant potential to meet the world's energy needs and climate goals. Innovative companies are paving the way for the next generation of nuclear power plants that may pose even fewer public safety or proliferation risks than the ones that are currently on the market. In fact, nuclear is already among the safest forms of energy, if not the safest form of energy, that exists today.[4]

Different technologies such as advanced water-cooled reactors, sodium-cooled, molten-salt reactors, and fusion reactors could improve upon an already-safe nuclear industry. Advanced nuclear reactors, whether they are small modular reactors (SMRs) or microreactors, offer several potential advantages to complement the large (1,000 megawatt) light-water fleet of reactors that exist in the United States today. Smaller reactors have lower upfront capital costs, can be built in remote areas or underground, and have smaller (and in some cases nonexistent) waste streams.[5]

> ***"Nuclear power has significant potential to meet the world's energy needs and climate goals."***

Some small reactor designs, such as Oklo's 1.5-megawatt reactor, are micro-reactors.[6] Oklo's advanced design would use spent nuclear fuel as an energy source.[7] Oklo is partnering with two Department of Energy national laboratories (Argonne and Idaho) and Deep Isolation for an advanced fuel recycling demonstration project. The facility "will enable Oklo to convert nuclear waste from existing used nuclear fuel into clean energy, as well as to recycle fuel from Oklo's plants, allowing for a dramatic cost reduction and solving for a key supply chain need."[8]

In August 2020, the Nuclear Regulatory Commission approved a design certification for NuScale's small modular reactor.[9] A few months later, the U.S. and Romania announced a partnership for Romania to build six small reactor modules designed by American SMR company NuScale.[10] NuScale has similar commitments with several other European countries. Expanded SMR technology throughout Europe using American technologies can help Europe achieve its energy security and climate objectives. While domestic certification approvals and DOE partnerships represent a significant milestone, they also represent an opportunity to learn and improve the process.

Another advanced nuclear reactor startup, TerraPower, announced that Kemmerer, Wyoming would be the location for the company's first demonstration reactor.[11] The power plant is a sodium-cooled reactor that could safely power up to 400,000 homes.

The aforementioned developments are a mere snippet of the innovation, investment, and deployment of nuclear power in the U.S. and around the world (For a more detailed picture, please see Third Way's advanced nuclear map).[12] With

promising technologies and a global desire for emissions-free power sources, the future of nuclear energy is bright.

POLICY RECOMMENDATIONS

Nuclear power will be critical to meeting domestic and international climate targets, but antiquated policies and regulations inhibit its progress. Congress and the administration should establish a flexible, technology-neutral framework to enable different nuclear energy technologies to compete in the marketplace. Whether it is research and development, licensing and permitting, or spent fuel management, policymakers should remove impediments to nuclear energy innovation, investment, and spent fuel management.

This chapter draws on the many helpful recommendations for regulatory modernization that are found in nuclear energy expert Katie Tubb's white paper: Needed: An Effective Nuclear Energy Policy.[13] It also draws heavily on the insightful analysis and recommendations that Adam Stein (Breakthrough Institute) and Nicholas McMurray (ClearPath) made in papers, observations, and comments to the Nuclear Regulatory Commission.

"Nuclear power will be critical to meeting domestic and international climate targets, but antiquated policies and regulations inhibit its progress."

To promote nuclear innovation, cost reduction and deployment, policymakers should:

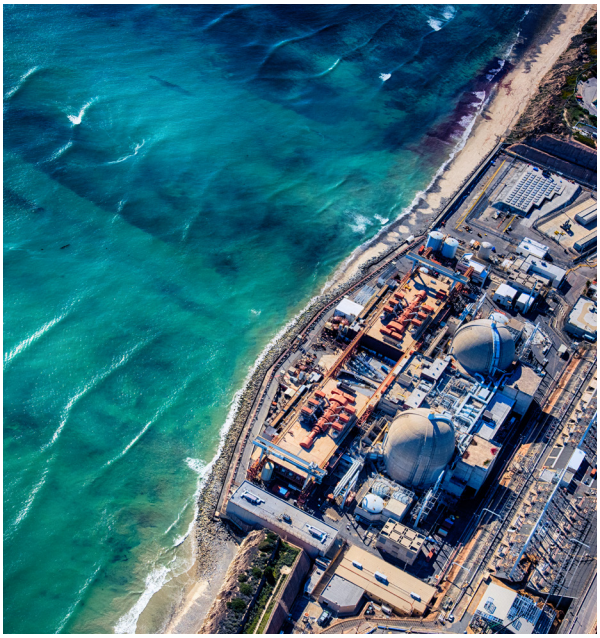
- **Streamline permitting for new reactor construction, whether for large light-water reactors, small modular reactors, or microreactors. Specifically, Congress and the administration should:**
    - Require the NRC to use prior environmental impact assessment and information "to the maximum extent possible" for permitting new plants at existing locations.
    - Use Environmental Assessments and Finding of No Significant Impact before conducting an EIS when applicable (more efficient designs and/or sited at brownfield locations).[14]
    - Adopt the process of allowing applicants to draft Environmental Impact Statements and Environmental Assessments (a process that is already accepted at the Federal Energy Regulatory Commission and Bureau of Land Management).[15]
    - Include nuclear power generation in categorical exclusions as part of Section 390 of the Energy Policy Act of 2005 for activities that are part of prior NEPA reviews or other regulatory actions that would qualify.
    - Narrowly tailor design and site alternatives under NEPA for demonstration projects connected to DOD facilities or national laboratories.
    - Authorize the DOE to provide technical assistance to states, local governments, Tribes, and private entities for commercial planning, licensing, development, and construction of new plants.

- **Keep Part 53 Regulatory Framework for Advanced Reactors on Track.** The Nuclear Energy Innovation and Modernization Act (NEIMA) of 2019 charged the NRC to develop a new licensing framework for next generation nuclear technologies. A new regulatory framework, known as Part 53, is much-needed, and its principles of being technology-neutral, risk-informed, and performance-based would be preferable compared to an overly prescriptive licensing process.[16] NRC aims to finalize the rulemaking by October 2024 (ahead of the 2027 deadline required by NEIMA).[17] The NRC has the challenging task of creating a framework that is both predictable and flexible. The NRC should adopt the recommendations of public comments[18] that will ultimately improve the final licensing process. Notable recommendations from Stein and McMurray include:
    - Prioritize a performance-based review, which will help maintain technology neutrality, and focus on adequate protection over frameworks like ALARA or linear no-dose thresholds.
    - Prioritize flexibility to be inclusive of a variety of applications. A more predictable process will develop from learn-by-doing and reviewing applications and the process of licensing.
    - Ensure a risk-informed process that includes a variety of analyses rather than explicit ones (ie., probabilistic risk assessments).

- Accommodate, but do not require, the use of the Licensing Modernization Process.[19]
- Remove Quantitative Health Objective requirements as these were tried and deemed impractical.[20]
- Provide justification for how Part 53 requirements would reduce time and cost burdens for applicants.
- Consider and, when acceptable, adopt international standards and recommendations as other countries have already licensed advanced reactors (including but not limited to quality assurance standards).
- Ensure transparency throughout the process to understand stakeholders' comments.[21]

- **Modernize radiation standards.** Radiation standards vary across federal agencies and vary from international standards. The NRC requires that nuclear companies reduce radiation "as low as is reasonably achievable."[22] The result is higher costs for no meaningful benefit and can disincentivize the development of innovative nuclear technologies. Transitioning to evidence-based regulations that comport with international standards would protect public health and safety while creating a more competitive environment for reactor technologies.
- **Appropriate funds for Low Dose Radiation Research Program.** Continued support for the Department of Energy's research on low dose radiation will support our understanding of radiation risk and should better inform evidence-based regulations surrounding radiation.[23]
- **Appropriate funds to complete the NRC review of Yucca Mountain in Nevada.** Long-term spent fuel management will almost certainly require a geologic repository. Completing the NRC review of Yucca will not force the repository on Nevadans but would keep the option available.
- **Continue to support and appropriate funds for the Pele Program.** The Pele Program, housed in the Department of Defense's Strategic Capabilities Office, funds the development of transportable microreactors. The competitive program can enhance the military's capabilities while ushering in a new generation of commercial reactors. In September 2021, DOD released its draft Environmental Impact Statement for the selected design reactor.[24] Congress and the administration should continue to support this program so long as DOD finds the project worthwhile and believes the potential benefits outweigh the costs.
- **Produce an annual report on spent nuclear fuel and high-level radioactive waste in the U.S. including updating the amount of waste generated, the potential lifecycle costs of various spent fuel management options, and options for cost-effective solutions.** The study should also examine successful international models of spent fuel management and what it would take to implement a similar program in the U.S.[25]
- **Amend the Nuclear Waste Policy Act to state that new reactors do not need to contract with the Department of Energy for waste management for an NRC license.** Tubb writes, "Even as Congress deliberates broader waste management policy, it should modify and implement a recommendation by the Obama Administration's 2012 Blue Ribbon Commission on Nuclear Waste directing nuclear operators to set aside funds for waste disposal in private escrow accounts. New nuclear power plants should use these accounts to finance their waste management and disposal."[26]

- **Shift application and safety costs to the federal government.** The provisions of nuclear safety are a public good and thus the costs should be borne by the taxpayer. Congress should appropriate money to extend cost-sharing on license applications or eliminate NRC licensing fees (which the NRC charged at $288 per hour per person in FY 2021) for all nuclear applicants.[27] Further, Congress should appropriate money to the extent necessary to NRC for nuclear security and environmental safeguards at power plants.
- **Expand international cooperation on commercial nuclear power.** U.S. cooperation on commercial nuclear power will help expand the deployment of nuclear, which will be critical in meeting future global energy demand and reducing global greenhouse gas emissions. Specifically, Congress should:



    - Require the NRC to coordinate and engage in nuclear import and export licensing, international cooperation, exchange programs and training with other countries, technical assistance, and other nuclear regulatory and legal frameworks (as stipulated by Section 101 of the American Nuclear Infrastructure Act).
    - Allow foreign ownership and investment by amending the Atomic Energy Act to allow the NRC to grant a license to companies under the jurisdiction of an allied government, such as a NATO member, Australia, Japan, or South Korea, as well as other countries in which the NRC determines there is no national security threat. As Tubb points out, "Foreign-ownership restrictions have halted investment in civilian nuclear energy projects in Texas (by Japanese company, Toshiba) and Maryland (by French company, Électricité de France), among others in recent decades."[28]
    - Ensure nuclear exports meet nonproliferation standards.

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