NUCLEAR INNOVATION ALLIANCE

Recent Advanced Nuclear Energy Activity & Deployment Needs

June 2024

Overview

While advanced nuclear energy holds great potential to help reach mid-century climate goals and secure energy independence,[1] several obstacles stand in its way. This brief provides an overview of recent activities intended to overcome barriers to advanced nuclear energy deployment, and discusses additional actions needed to ensure advanced nuclear energy can be a key part of the climate and energy solution.

For more information on specific barriers to advanced reactor deployment, and what is needed to overcome them, see NIA's "Fission Vision" report: https://nuclearinnovationalliance.org/fission-vision-doubling-nuclear-energy-production-meet-clean-energy-needs

For more information regarding the specific advanced reactor technologies that exist, and the companies that are working on projects to deploy those technologies, see NIA's "Advanced Nuclear Reactor Technology Primer": https://nuclearinnovationalliance.org/advanced-nuclear-reactor-technology-primer

Improving Nuclear Energy Licensing and Regulation

NRC Modernization: Nuclear Regulatory Commission (NRC) modernization is critical to enabling deployment of advanced nuclear energy. The NRC's current regulatory framework has been optimized for the regulation of existing nuclear reactors and presents obstacles to the timely licensing and deployment of advanced nuclear reactors. The NRC must modernize its regulatory approach to ensure effective, efficient, and predictable licensing. More specifically, the NRC should prioritize short-term process improvements to increase licensing efficiency under existing regulatory frameworks for near-term deployment, support medium-term development of new modern regulation for advanced reactors, and explore long-term strategies for successfully licensing large numbers of advanced reactors needed to meet climate and energy security goals.

Update on 10 CFR Part 53: In March of 2024, the Commission voted on the draft proposed rule for 10 CFR Part 53 - a new risk-informed, performance-based, and technology-inclusive regulatory framework to enable more effective and efficient licensing of advanced reactors. The Commission directed the NRC staff to make major changes to the staff's 2023 draft proposed rule that reflect congressional and stakeholder feedback and comments. NIA believes this clear direction from the Commission will clarify the intent of the draft proposed rule for 10 CFR Part 53 and better align NRC staff with Congress and external stakeholders as the NRC works to complete the rule before 2027.

Update on Chair Hanson Nomination: In June of 2024, NRC Chair Christopher T. Hanson was confirmed by the U.S. senate to serve an additional five-year term on the Commission. Chair Hanson's leadership and commitment to transforming the NRC into a modern, risk-informed

[1] https://nuclearinnovationalliance.org/the-case-advanced-nuclear-energy

regulator has contributed to many of the NRC's recent successes and resulted in a vast majority of Senate votes in favor of his confirmation.

For more information on what is needed for NRC modernization, see NIA's two-pager "The Urgency of NRC Reform": https://nuclearinnovationalliance.org/urgency-nrc-reform

For more information on the 10 CFR Part 53 rulemaking process and next steps on advanced reactor regulation, see NIA's webinar on 10 CFR Part 53: https://www.nuclearinovationalliance.org/next-steps-10cfr53-updates-developing-new-regulatory-framework-advanced-reactors

Federal Legislation and Nuclear Fuel Availability

HALEU: The Consolidated Appropriations Act of 2024, which was signed into law in March of 2024, appropriated $2.72 billion to increase U.S. domestic enrichment capacity to meet the needs of U.S. operating nuclear reactors, that of our allies, and future reactor designs. This funding, which was contingent on a ban of Russian uranium imports, was unlocked by the passage of the Prohibiting Russian Uranium Imports Act in May of 2024. Now, the Department of Energy's (DOE) has the funding it needs to develop public-private partnerships that will catalyze private investment in domestic HALEU fuel production capacity and reduce U.S. dependency on Russia for HALEU fuels. DOE must now work effectively and efficiently with industry, without delay, to accomplish these goals.

For more information about U.S. efforts to catalyze a domestic uranium supply chain, High-Assay Low-Enriched Uranium (HALEU), and why DOE must move swiftly to partner with industry, see NIA's op-ed in the National Interest: https://nationalinterest.org/feature/domestic-uranium-enrichment-will-secure-americas-energy-future-210905

For more information about HALEU costs and HALEU program implementation options, see NIA's report on HALEU production: https://nuclearinnovationalliance.org/characterizing-emerging-market-high-assay-low-enriched-uranium-production.

Tax Credits: The Inflation Reduction Act (IRA) of 2022 created two new technology-neutral tax credits for zero-emitting energy projects: a Clean Electricity Production Tax Credit (PTC) and a Clean Electricity Investment Tax Credit (ITC). These tax credits are intended to accelerate deployment of clean energy technologies, including advanced nuclear reactors. A project developer could elect either tax credit, but not both.

For more information about IRA tax credits available to advanced nuclear energy, see: https://nuclearinnovationalliance.org/advanced-nuclear-energy-tax-provisions-inflation-reduction-act-2022 and https://nuclearinnovationalliance.org/implications-inflation-reduction-act-tax-credits-advanced-nuclear-energy

Price-Anderson Act: The Price-Anderson Act, which provides the insurance liability framework for civil nuclear activities in the United States, was set to expire on December 31st, 2025. The Further Consolidated Appropriations Act, 2024 signed into law on March 23rd, formally extended the Price-Anderson Act by 40 years to 2065 and included important updates on international nuclear liability.

AEAA/ADVANCE: The Senate and the House have both recently taken steps to pass bipartisan legislation to help accelerate the deployment of new nuclear energy technologies. The Senate passed bill S.1111, the Accelerating Deployment of Versatile Advanced Nuclear Energy for

Clean Energy Act (ADVANCE Act), on July 27th 2023.[2] The House passed similar legislation, H.R. 6544, the Atomic Energy Advancement Act (AEAA), on February 28th, 2024.[3] These bills would help ensure more effective and efficient regulation of new nuclear technologies, reduce certain licensing fees charged to advanced reactor applicants, and kick-start U.S. advanced nuclear international engagement and coordination efforts,[4] among other things. The House and Senate bills include many of the same provisions needed to achieve these goals; however, differences exist between the two versions including different additional provisions. The House and Senate are working toward agreement regarding what provisions should be included in a final bill.

Industrial decarbonization

Background: Advanced nuclear reactors can produce dispatchable high-temperature heat, high-temperature and high-pressure steam, and electricity that enable the decarbonization of many energy-intensive industrial processes such as district heating, seawater desalination, methanol production, steam methane reforming, and more. Industrial energy consumption accounts for roughly one third of U.S. emissions, so advanced nuclear energy can play an important role in decarbonizing this traditionally "hard-to-decarbonize" economic sector.

X-energy and Dow Chemical: X-energy, an advanced reactor developer, is partnering with Dow Chemical to demonstrate the first ever integration of an advanced nuclear reactor with a commercial industrial production facility. X-energy's "*Xe-100*" reactor, will be deployed at Dow's facility in Seadrift, Texas by the end of the decade. This project is co-funded by DOE through their Advanced Reactor Demonstration Program (ARDP).

Industrial Demonstration Program: In March 2024, DOE announced up to $6 billion for 33 projects across more than 20 states to decarbonize energy-intensive industries, including chemicals and refining, process heat, iron and steel making, and more. Before final funding decisions are made, DOE and the selected applicants will undergo a negotiation process. DOE's Office of Clean Energy Demonstrations will oversee any funded projects through a phased approach to project management that includes "go/no-go" decision points. While none of these near-term projects will use nuclear energy, DOE can do more to identify and incentivize use of nuclear energy for industrial decarbonization through future funding opportunities.

Industrial Decarbonization Blueprint: A coalition of stakeholders, including NIA, are identifying what steps must be taken to realize the full benefits of industrial decarbonization in the United States, and identifying how nuclear energy can best contribute to these efforts. This is outlined in the Industrial Innovative Initiative's 2024 Industrial Decarbonization Federal Policy Blueprint.

---

[2] https://www.congress.gov/bill/118th-congress/senate-bill/1111

[3] https://www.congress.gov/bill/118th-congress/house-bill/6544

[4] For example, by ensuring advanced nuclear technologies approved for export are in compliance with nonproliferation standards, and by requiring the Secretary of Energy to establish an initiative to modernize civil nuclear outreach to embarking civil nuclear nations.

For more information on industrial decarbonization and advanced reactor deployment, see page 10 of NIA's "Fission Vision" report: https://nuclearinnovationalliance.org/fission-vision-doubling-nuclear-energy-production-meet-clean-energy-needs

For more information on industrial decarbonization strategy, see the 2024 Industrial Decarbonization Federal Policy Blueprint: https://industrialinnovation.org//2024-blueprint-factsheet

Advanced Nuclear Energy Exports

Background: The United States is seeking to deploy advanced reactors both domestically and internationally. There is growing interest around the world in new nuclear energy,[5] and countries including China and Russia are competing with the United States to supply it.[6] Advanced nuclear energy is in a unique position due to an ever-evolving geopolitical landscape, complex market conditions, and a wide range of international policies associated with nuclear technologies. These conditions present significant opportunities for U.S. companies, but also present new challenges. Establishing U.S. advanced nuclear international leadership requires broad bipartisan support, effective federal policies, and cooperation between the United States and allied countries.

Provisions in AEAA/ADVANCE: The ADVANCE Act and AEAA currently under consideration by the Senate and the House include important provisions related to international nuclear exports, export license requirements, coordinated international engagement, and transfer of unclassified nuclear technology. These provisions are an important first step in reducing barriers to the export of commercial advanced nuclear reactors to U.S. allies and partners.

For more information and recommendations on how to establish the United States as an international advanced nuclear leader, see expert Paul Saunders' recent report on nuclear exports: https://innovationreform.org/restoring-americas-nuclear-energy-leadership-and-exports/

Early Mover Project Risk Sharing

Background: Advanced reactor developers are increasingly attracting private investment for technology development, but much more investment will be needed to deploy new advanced nuclear reactors at scale. A key factor inhibiting potential investment in advanced nuclear energy projects is concern about the ability to license and build new reactors on-time and on-budget. Strategies and policies to mitigate risk for project developers and off-takers are needed.

Early Mover Project Completion: One strategy to spur private investment into advanced nuclear energy deployment is to share the risk of increased project completion cost among multiple commercial partners. The U.S. Government could help catalyze private investment in first-mover projects by participating in risk sharing programs, including through the DOE's Loan Program Office (LPO) or other DOE programs. Federal programs that address project cost and completion risks would require significant private-sector contributions, limit the government's exposure to cost increases, and require the implementation of best management practices to

[5] In December 2023, the USA, France, UK and 17 other nations announced their intention to help triple global nuclear energy capacity by 2050 at COP28.

[6] https://www.thirdway.org/memo/2023-map-the-world-wants-nuclear-energy-china-and-russia-are-racing-ahead

maximize the likelihood of project completion on-time and on-budget. Stakeholders including advanced reactor project developers and potential customers are currently exploring options. The availability of private and public cost-sharing mechanisms would address a key area of uncertainty for private investors, and potentially accelerate investment in new advanced nuclear energy projects.

For more information on early mover project risk sharing, see NIA's new report: https://nuclearinnovationalliance.org/catalyzing-commitments-advanced-nuclear-energy-projects

Hydrogen Production

Background: Hydrogen is a versatile tool that can help achieve a zero-carbon future, but over 95% of hydrogen is currently produced by steam-methane reforming, which emits greenhouse gases (GHG). Hydrogen consumption is expected to grow from 90 Mt in 2020 to over 500 Mt by 2050 worldwide, so ensuring that hydrogen production does not contribute to GHG production is critical. Several non-carbon-emitting sources can produce hydrogen, including conventional and advanced nuclear reactors using low and high-temperature electrolysis methods. Nuclear energy's unique operational characteristics, including high operating capacity factors and high operating temperatures, can enable nuclear energy to produce hydrogen more efficiently and at the scale needed to help meet future global hydrogen demand.

Hydrogen Hubs: The 2023 Infrastructure Investment and Jobs Act (IIJA) included $7 billion for DOE to establish "hydrogen hubs" to support clean hydrogen production in the United States. In October 2023, seven applicants were selected to receive this funding, several of which plan to use nuclear energy to produce clean hydrogen.[7]

Tax Credits: The 2023 Inflation Reduction Act included a 10-year hydrogen production tax credit ("PTC" or "45v" tax credit) that ranged in value from $0.60/kg to $3/Kg of hydrogen produced, depending on the lifecycle emissions of the hydrogen production. The Internal Revenue Service (IRS) has initiated a rulemaking to issue guidance on the implementation of these tax credits. However, the proposed guidance outlined in the recent IRS Notice of Proposed Rulemaking risks limiting nuclear energy's contribution to the clean hydrogen market, contrary to the objectives of the IRA and IIJA clean hydrogen programs, because it prevents existing nuclear reactors from being eligible to receive these tax credits. It is important that IRS guidance recognize the role of nuclear energy in clean hydrogen production and helps catalyze investment in nuclear energy for clean hydrogen production.

For more information on what NIA and other stakeholders recommend IRS guidance, see NIA's joint public comments to the IRS on the hydrogen production tax credits: https://downloads.regulations.gov/IRS-2023-0066-29561/attachment_1.pdf

[7] https://www.whitehouse.gov/briefing-room/statements-releases/2023/10/13/biden-harris-administration-announces-regional-clean-hydrogen-hubs-to-drive-clean-manufacturing-and-jobs/