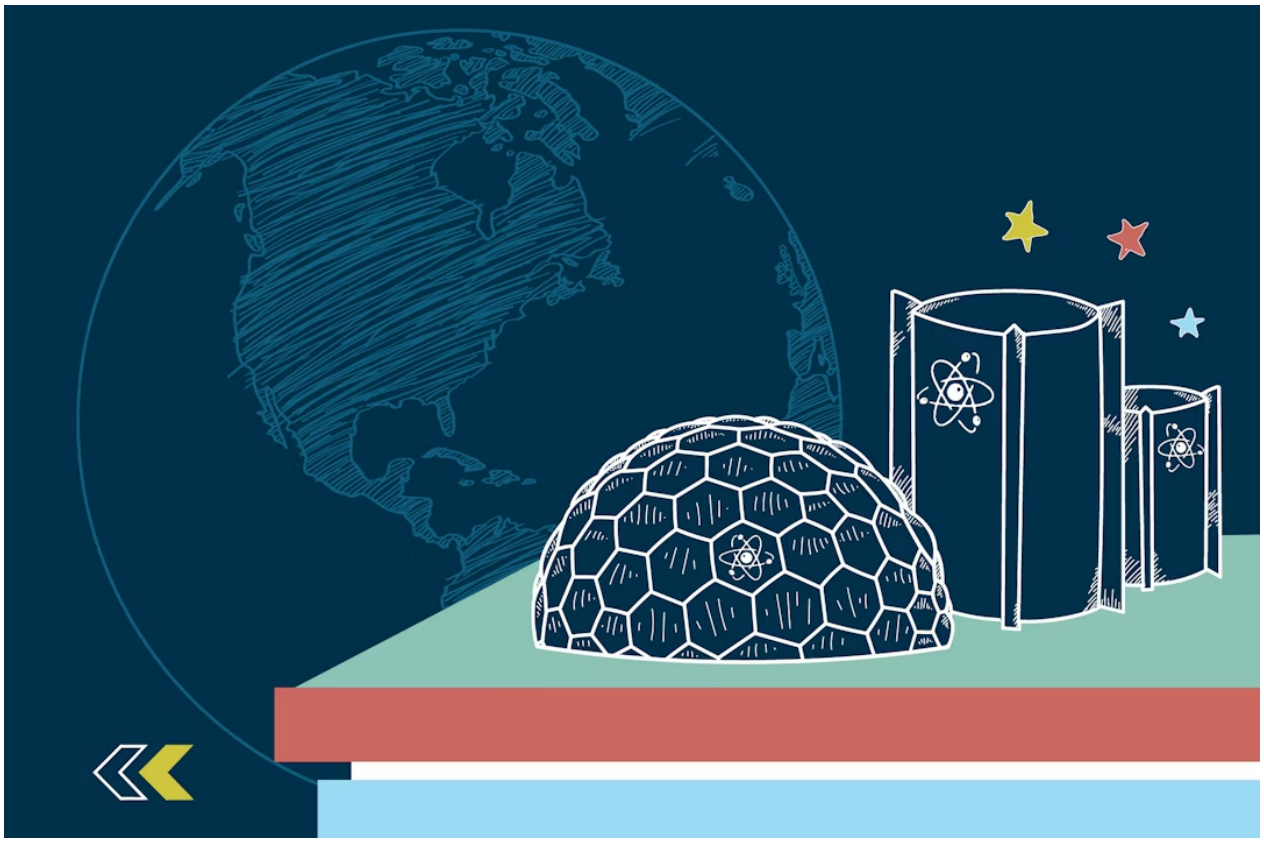
THIRD WAY

MEMO *Published July 19, 2024 • 10 minute read*

Status Report: America's Competitive Advantage in Advanced Nuclear



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As countries race to meet decarbonization targets while still ensuring reliable power for growing energy demands, nuclear energy is emerging as a key solution. Over 20 countries have pledged to triple nuclear power by 2050, increasingly turning to nuclear for energy security amid global instability. The US, a pioneer in the nuclear industry with numerous advanced nuclear projects currently in works, is poised to meet this commercial demand.

However, countries like Russia and China are encroaching on the global nuclear marketplace. Leveraging state-backed financing and government influence to secure nuclear partnerships, Russia and China are using nuclear exports for long-term economic and diplomatic gains, leaving the US behind. Currently, China has 26 reactors under construction domestically, far outpacing other countries. Russia is building 23 reactors across seven nations, including China, India, Turkey,

and Iran. [1] In contrast, the US has only constructed two reactors, Vogtle Units 3 and 4, in the past several decades, and has just broken ground on one new reactor construction. Despite pioneering the nuclear industry, America is now trailing these authoritarian regimes that use nuclear exports for geopolitical leverage.

But the US is not down for the count. Over the past several years, the United States has elevated nuclear as a critical clean energy solution and invested billions in America's advanced nuclear supply chain. This memo spotlights key federal policies that are helping the US rebuild its edge in the nuclear industry and showcases milestones of how America is solidifying its' position as a leader in global nuclear markets.

How Federal Investments are Boosting America's Advanced Nuclear Industry

Landmark provisions across the Bipartisan Infrastructure Law (BIL) and the Inflation Reduction Act (IRA) are playing a pivotal role in establishing a resilient and robust American nuclear supply chain. These measures are not only reigniting American nuclear leadership but also reducing our dependence—and that of our allies—on unpredictable authoritarian regimes for nuclear supply.

These incentives and programs are designed to be distributed over several years, providing the long-term stability and support that gives manufacturers and industries the confidence they need to make bold investments in innovative American nuclear technologies. Some of the most impactful federal incentives include:

- $9 billion in grant funding to support research, demonstration, development, and deployment for advanced reactors, expand availability of High-Assay Low-Enriched Uranium (HALEU) fuel for both research and commercial use, and ensure effective management and oversight; [2]

- Production and investment tax credits to prevent decommissioning existing nuclear plants and maintaining the infrastructure, expertise, and momentum needed for next-generation nuclear energy; [3]

- $10 billion in tax credits to support manufacturing specialized components and equipment for nuclear reactors; [4] and

- And, $2.72 billion in funding, amongst other programs, to support domestic enrichment of nuclear fuel. [5]

These federal investments will be distributed over the next decade and will continue to pay dividends long after. And based on our analysis of Rhodium Group and MIT CEEPR's Clean

Investment Monitor, it's clear that these policies are already working. Public and private investment in nuclear technologies in just the past three years has reached nearly $7 billion. [6]

Road to Victory: Building on US Leadership in Nuclear Technologies

Competition in clean energy markets—especially for nuclear technologies—is intense. For nuclear leaders like Russia and China, dominating the nuclear market is about more than economic gains; it is about redefining global power structures. Their aggressive market penetration underscores an ambition to dictate global standards and extend political influence for decades.

Russia and China see nuclear energy as a strategic opportunity for geopolitical leverage and are aggressively expanding their market presence. Using state-backed financing and government influence, Russia and China are securing nuclear projects worldwide, forging long-term economic and diplomatic ties. This strategy not only puts them ahead of the American nuclear industry but also extends their geopolitical reach. This poses a serious risk to American interests and values.

While the US is currently behind, we're far from out of the race. Nuclear energy currently represents the largest source of carbon-free electricity in the US. We have substantial wins to build upon and an innovative ecosystem that rivals our competitors. By leveraging our advantages, the US can build on its nuclear legacy and secure leadership in the global advanced nuclear industry. Third Way's landmark analysis, in partnership with Breakthrough Energy and Boston Consulting Group, found that there are 2 segments of the advanced nuclear supply chain where the US should make the most effort to build or maintain its advantage. These segments were identified based on their market size and the potential for American leadership—and we're already seeing significant progress in these key areas. Let's break this down:

Raw Materials

Uranium supplies are the backbone of the advanced nuclear value chain. Right now, the US is lagging, handling less than 10% of global nuclear fuel enrichment. Meanwhile, Russia leads the

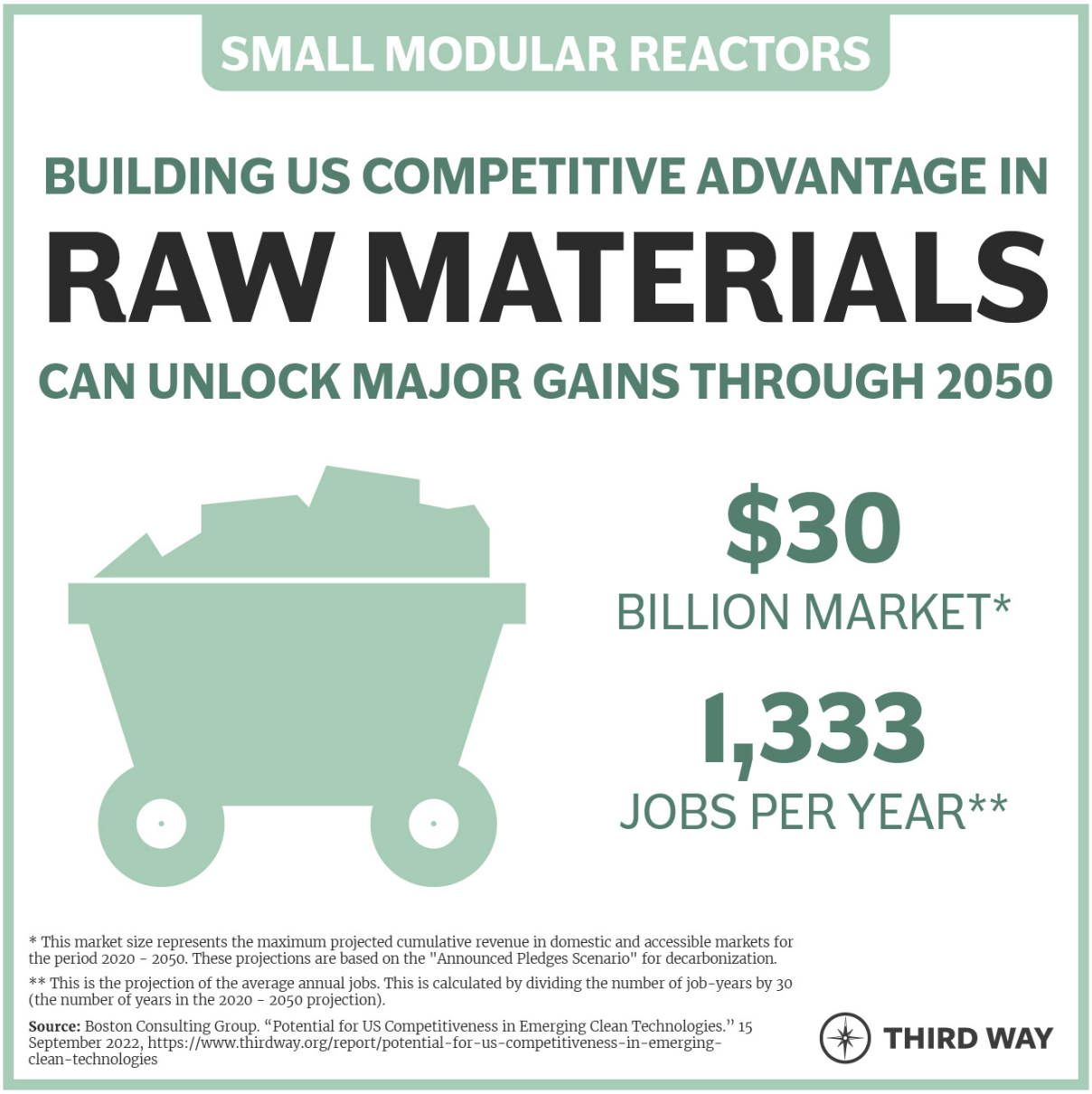
world in enrichment and holds a monopoly on commercial supply of high-assay low-enriched uranium (HALEU) fuel, essential for next-generation advanced reactors. But don't count us out. The US excels in research and technical expertise, leading the world in quality and innovation. Our researchers are top-notch, with higher citation rates than Chinese counterparts. While we need to boost our domestic enrichment capacity, we have the talent, know-how, and experience to compete in the $30 billion global market and create over 1,300 jobs annually through 2050. Here's how we're already accumulating wins:

- **Sending Strong Market Signals:** Through FY24 federal appropriations, Congress has provided $2.72 billion to help the US expand its nuclear fuel enrichment capacity and reduce reliance on unreliable partners for fuel. This funding will not only create new American jobs in communities across the country but will build out a domestic supply chain for HALEU fuel. This move is sending a strong signal—both to the market and to global partners—that the US is committed to becoming a reliable player in the nuclear fuel supply chain.

- **Demonstrating Domestic Fuel Production:** With support from the Department of Energy's HALEU Demonstration Project, Centrus Energy Corp produced the first 20kg of HALEU fuel at its enrichment facility in Piketon, Ohio, almost two months ahead of schedule. This milestone demonstrates US capability to produce essential fuel domestically and reduce dependence on Russian suppliers—showcasing America's potential as a key player in the global HALEU market.

- **Advanced American Fuel Fabrication:** Leveraging Inflation Reduction Act tax credits and funding through the Department of Energy's Advanced Reactor Demonstration Program, X-energy began construction of a first-of-a-kind fuel fabrication facility in Oak Ridge, Tennessee. This facility will manufacture X-energy's proprietary tri-structural isotropic (TRISO) fuel pebbles, which are essential for the Xe-100 reactor design. Not only does this enhance America's capability to produce advanced nuclear fuels domestically but demonstrates American competitive edge in advanced fuel fabrication technology.

- **Accelerating American Nuclear Fuel Procurement:** Enabled by funding from the Bipartisan Infrastructure Law, the Department of Energy released a request for proposals (RFP) for uranium enrichers to produce the HALEU necessary for advanced reactors. Stable fuel procurement underpins the competitiveness of the entire nuclear value chain, from raw materials to reactor operation. By securing domestic production and supply of HALEU, the US can mitigate supply chain risks, making its advanced nuclear sector more resilient and attractive to global markets.



Original Equipment Manufacturing

When it comes to manufacturing components and power generation equipment for nuclear power plants, the US holds a distinct advantage. As a leader in intellectual property and research, and with robust financing support through programs like the Department of Energy's ARDP, we have the edge to overcome barriers and drive innovation. The US is primed to capitalize on these strengths, securing a substantial portion of the $165 billion global OEM market and creating over 2,100 jobs annually through 2050. Here are some wins we're ready to build on:

- **Kickstarting American Nuclear Innovation:** The US Department of Defense (DoD) Strategic Capabilities Office (SCO) is formally moving forward with Project Pele, a program aimed at developing a microreactor with long refueling periods for deployment in forward areas. Granting awards to X-energy and BWXT to develop microreactor prototypes, DoD is showcasing the US's commitment to demonstrating advanced reactor technology and for reducing reliance on foreign technologies and components.

- **Boosting Economic Competitiveness:** Leveraging federal funding, MillenniTEK is set to demonstrate a unique fabrication technology to produce neutron absorbing and shielding components—crucial for advanced microreactors—in a fraction of the time required by traditional methods, without adding impurities, and at a lower capital and operating cost. By pioneering cost-effective and advanced manufacturing technologies, the US is leading the way in making American microreactors more economically competitive in global markets and is reinforcing its position as a leader in the global nuclear industry.

Other Value Chain Segments

Broadly, the US has achieved significant progress in the advanced nuclear industry. Here are several overarching wins worth noting:

- **Entering a New Era of American Innovation:** TerraPower submitted its construction permit application to the Nuclear Regulatory Commission (NRC) for its Natrium demonstration project in Kemmerer, Wyoming and broke ground for construction in June 2024. Backed by the DOE's Advanced Reactor Demonstration Program and forward-funding from the Bipartisan Infrastructure Law, TerraPower's project represents the first wave of commercial advanced reactor new builds in the US, showcasing American innovation and leadership in nuclear technology.

- **Advancing Nuclear for Industrial Use:** Supported by the Department of Energy's ARDP and forward-funds from BIL, X-energy and Dow are partnering to deploy a 4-unit Xe-100 plant for use in chemicals production at Dow's UCC Seadrift Operations. With plans to submit an NRC application in 2024 and begin construction in 2026, this partnership highlights the application of advanced nuclear technology for industrial use, demonstrating the versatility and economic potential of nuclear energy.

- **Preserving Capacity and Strengthening the Supply Chain:** The Department of Energy's Loan Programs Office announced a $1.5 billion loan guarantee to restart the Palisades nuclear facility. The plant will now remain operational until 2051, supporting up to 600 jobs in Michigan and 400 additional jobs during refueling and maintenance. By reopening the plant, the US is promoting American jobs, keeping nuclear supply chains active, and underscoring our commitment to nuclear leadership.

- **Accelerating Broad Deployment:** Supported by DOE's ARDP Risk Reduction Award, Kairos Power secured a construction permit from the NRC in December 2023 and is moving forward with construction for its Hermes non-power test reactor. Though the Hermes reactor will not produce power for our electrical grid, it will provide critical data for licensing, cost reduction, and commercialization efforts, accelerating the broader deployment of advanced reactors in the US.

- **Supporting US Competitiveness Overseas:** Working with the State Department, the Export-Import Bank (EXIM) unveiled a new toolkit for small modular reactor financing. This includes pre-export payments, co-financing with other export credit agencies, expanded repayment terms, and interest payment deferments—all of which will support overseas competitiveness for US advanced nuclear developers, help facilitate global market entry, and reinforce US leadership in nuclear technology.

So, What's Next?

The US is up against fierce competition in the global nuclear marketplace, especially from adversarial countries like Russia and China that don't share our values. But through targeted investments, innovative policies, and strategic partnerships, we're not just sharpening our competitive edge—we're set to lead. We've already achieved major milestones and proven that we have what it takes to stay in this race. By doubling down on our efforts, embracing cutting-edge technologies, and leveraging our expertise, America can cement its position as the global leader in the emerging nuclear industry.

TOPICS

ENDNOTES

1. The World Nuclear Association tracks worldwide plans for new reactors. WNA's tracker lists 26 projects under construction in China by various entities. Russia's 23 reactors under construction include both domestic reactors and deployments of the Russian-made VVER reactor technology in countries like Turkey and Slovakia. Four of China's 26 construction projects are Russian VVERs, demonstrating the competitive but cooperative approach Russia and China take to nuclear construction. "Plans for New Reactors Worldwide," World Nuclear Association. Updated 27 June 2024. https://world-nuclear.org/information-library/current-and-future-generation/plans-for-new-reactors-worldwide

2. This includes $2.5 billion designated for advanced nuclear demonstration through Section 41201 of the Infrastructure, Investment, and Jobs Act, $3.211 billion for the Department of Energy's Advanced Reactor Demonstration Program as well as $2.4 billion for specifically for risk reduction and advanced reactor concept projects as authorized by Section 41002 of the Infrastructure, Investment, and Jobs Act, $150 million authorized through the Inflation Reduction Act for infrastructure improvements at the Idaho National Laboratory (INL) to enhance nuclear energy research and development, and $700 million to support the HALEU Availability Program authorized through the Inflation Reduction Act.

3. This includes a Clean Electricity Production Tax Credit and Clean Electricity Investment Production Tax Credit created by Sections 13701 and 13702 of the Inflation Reduction Act, respectively.

4. This includes $10 billion for the Advanced Energy Manufacturing Project Tax Credit as established by the American Recovery and Reinvestment Act and extended by Section 13501 of the Inflation Reduction Act.

5. This includes funding made available through H.R.4394—the 2024 Energy and Water Development and Related Agencies Appropriations Act—up to $900 million of which can be leveraged for small modular reactors and up to $100 million for university-based nuclear reactor safety training, as well as authorizations under the National Fuel Security Act to support Department of Energy activities to secure HALEU fuel supply and increase domestic low-enriched uranium production.

6. Sourced from Rhodium Group/MIT-CEEPR Clean Investment Monitor data spanning from Q1 2021 to Q1 2024