THIRD WAY

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Revitalizing America's Nuclear Energy Supply Chain

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After years of investing in innovative advanced reactor designs, the United States now has a unique opportunity to deploy nuclear energy to reduce emissions, bolster American industry and manufacturing, and create thousands of good, well-paying jobs. A robust US advanced nuclear industry would also be well-positioned to lead the world in nuclear energy exports—there is a potentially massive global market for these technologies in the next few decades, including a projected demand of 200-300 GW of new nuclear by 2050 in just the EU and UK. This growing international demand for new nuclear builds is driven not only by the need to reduce emissions, but also to strengthen energy security and cut reliance on fossil fuel imports from hostile regimes. Recapturing this international market requires revitalizing our domestic nuclear supply chains, both for reactor components and fuel.

The Biden Administration has already elevated nuclear power as a critical climate solution and invested billions of dollars in the demonstration of new designs through the US Department of Energy's (DOE) Advanced Reactor Demonstration Program (ARDP). In this blog, we explain why these advanced reactor designs present new opportunities to recapture nuclear supply chains; and how revitalizing America's nuclear industry requires developing the workforce ready to manufacture and operate new reactors and establishing reliable domestic production of advanced reactor fuel (high-assay low-enriched uranium, or HALEU).

Brief History of Nuclear Supply Chains

The US pioneered nuclear power generation—Westinghouse designed the first fully commercial pressurized water reactor (PWR) in 1957. In the ensuing decades, the United States was the world's undisputed leader in civil nuclear technologies as the predominant global producer and supplier of light-water reactors and uranium fuel. Through the Atoms for Peace program, the US shared nuclear technology and materials with allies and international partners. By providing loans and grants for new nuclear projects, the US became a key partner in nuclear financing and helped kickstart civil nuclear energy programs around the world.

Despite this legacy, US global dominance in conventional light-water technology and its associated supply chain has since languished—largely to the benefit of Russia and China. The Russians have become the premier exporters of nuclear technology, and China now has the fastest growing nuclear power fleet in the world and is poised to become a major supplier to the global market.

Renewed Opportunities with Advanced Reactors

American innovation has renewed opportunities in the nuclear energy sector. The US nuclear industry currently stands poised as a world leader in advanced nuclear reactor technology, thanks largely to decades-long R&D programs conducted in US national laboratories. Through consistent bipartisan support across multiple administrations, advanced reactor projects are now closer to deployment and commercialization than ever before. Through the DOE Advanced Reactor Demonstration Program, we are set to have multiple commercial advanced reactor demonstrations online before the end of the decade, with the completion of these ARDP projects representing the first major step towards revitalizing our domestic nuclear supply chain.

Advanced reactor designs present new opportunities to recapture nuclear supply chains for four reasons:

- **US advanced nuclear developers are intelligently designing reactors that can easily be replicated and mass manufactured.** These smaller, modular designs limit reliance on overseas suppliers for heavy equipment and components. US small modular reactor (SMR) technology is already experiencing demand from international markets for its scalable, dispatchable design and widespread applications. For example, NuScale Power, based in Portland, Oregon, has secured a teaming agreement to explore the deployment of its SMR technology overseas to Romania and is in the process of expanding this technology to other European states.

- **The enhanced safety features of advanced reactors allow companies to use off-the-shelf components more readily sourced from domestic suppliers.** These enhanced safety features minimize requirements for redundant safety systems (such as large containment domes) and nuclear-grade materials, which are typically sourced overseas.

- **American workers can, in some cases, manufacture entire reactors in a factory setting, together with any necessary components to be shipped to domestic and international markets.** This approach reduces the need for on-site labor typically required for long, often delayed, construction projects. This reduces construction risk, accelerates the development of economies of scale, and enables next-of-a-kind (NOAK) cost reductions, thereby facilitating mass manufacture of these technologies powered by American workers.

- **Advanced reactor designs can be used for niche applications beyond electricity generation, better serving and capturing markets than large light water reactors from Russia and China.** Emerging US advanced reactors offer the flexibility to address non-power applications—district and industrial heat, hydrogen production, and desalination—further greening processes which are largely served by natural gas and fossil fuels.

Growing the Nuclear Workforce

Establishing robust domestic advanced nuclear supply chains will require new knowledge, skills, and capacities throughout the nuclear workforce, from a wide range of fields and educational backgrounds beyond the engineering and skilled trades. Fortunately, the evolving energy sector is ripe with the workers needed to meet this demand. American labor unions develop and offer training programs and make significant investments in education, and professional development for members. Additionally, unions serve as communities of knowledge and facilitate environments of learning in advanced reactor construction, manufacturing, maintenance, and operations.

Nuclear energy provides more local permanent jobs, and higher wages, than any other energy source. This makes working in nuclear energy an attractive alternative for fossil fuel workers. Nuclear reactors could be installed at retired or soon-to-retire unabated coal or fossil fuel plants not only to provide new jobs for the local trained/skilled workforce, but also to facilitate siting, utilize grid connection infrastructure, and reuse the cooling water intake systems. For example, TerraPower's 345 MWe Natrium Reactor will be constructed near the site of a retiring coal-fired

power plant in Kemmerer, Wyoming. The project is estimated to generate approximately 2,000 construction jobs and roughly 250 jobs in plant operations.

Preserving our existing large light-water reactor fleet, currently America's largest source of carbon-free electricity, will also be crucial to ensure that we have a foundation upon which we can build out our nuclear workforce and supply chains for advanced reactors in the future.

Developing Domestic Nuclear Fuel Infrastructure

Ultimately, for advanced reactor technology to strengthen the economy and ensure energy independence for ourselves and our allies, we must have a stable and secure source of nuclear fuel. Developing a reliable market supply of high-assay low-enriched uranium (HALEU), which many advanced reactor designs will require as fuel, is arguably the highest supply chain priority for US advanced nuclear—especially as Russia is now the only viable commercial HALEU supplier in the world.

Strong government support and leadership are needed to ensure that federal efforts to build out a domestic HALEU supply chain have the necessary resources and momentum. The US must exercise a whole-of-government approach to consolidate supply pathways for critical advanced reactor inputs, not only for HALEU but also key materials such as sodium and graphite. Such initiatives would not only be important for US advanced reactor deployment, but also create additional opportunities to build the economy and jobs at home.

Conclusion

We have the technology, expertise, and workforce to become the world's preeminent hub for advanced reactors and fuels. However, realizing the full benefits of US investments in advanced nuclear power will require redoubling policies that support the deployment of US nuclear technologies and supply chains. This includes expediting the demonstration of advanced reactors, ensuring a robust supply of HALEU fuel, and retaining a skilled unionized workforce to promote technical leadership in the manufacturing of nuclear components, management, and operation of nuclear power facilities. We have made the investments to position ourselves to become global leaders in advanced nuclear technology, now is the time to follow through on these efforts and realize the benefits.

TOPICS

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