■ Industrial Power

Advancing Nuclear Energy with the Loan Programs Office

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SUMMARY

To unleash a nuclear renaissance, the US needs to leverage the Department of Energy's Loan Programs Office (LPO)'s ability to de-risk and finance nuclear investments.

PROBLEM

Headlines claim that America and China are in a race for computational dominance, but this can obscure the hard reality of the industrial challenge datacenter energy demand poses for America. The real race is for thermodynamic supremacy. If America wants to win, it needs to invest in radically expanding its nuclear fleet.

However, the nuclear industry has been trapped in a vicious cycle. Anemic supply chains have increased financing costs, since new builds must establish said supply chains from scratch. As a consequence, supply chain development has been stultified, which has led to delayed deployment and cost overruns, which then discouraged further investment in nuclear, thus perpetuating the brittleness of its supply chains. As a result, private capital looks askance at nuclear financing.

To break out of this cycle, the Department of Energy's Loans Program Office, an office dedicated to providing vital energy projects with financial assistance, has a unique opportunity to offer robust, long-term financing for traditional and advanced reactors that can de-risk nuclear development and fortify its supply chains. This will enable the economy of repetition needed to drive down reactor costs and open up new avenues for innovation.

SOLUTION

Through the Loans Program Office, the Department of Energy can ignite a nuclear renaissance in America through three programs aimed at the near, medium, and long term.

Operation Full Tank (Near Term)

PREMISE: Deploying already proven nuclear technology at power plants with open reactor spots is the lowest-hanging fruit for a fleet-scale nuclear build.

OPPORTUNITY: America has 18 empty reactor spots large enough for gigawatt-scale nuclear reactor slots in various nuclear power plants across the country. This represents around 20,000 megawatts of power capacity, enough to serve 22 million people.

PROGRAM: The LPO can coordinate with hyperscalers (i.e., datacenters hungry for electricity), utilities, independent power producers, or a consortium thereof, to provide project financing a fleet-scale build of proven nuclear technology at sites that possess: a) an owner with a nuclear operating license; b) a grid connection; and c) space for at least one additional reactor unit. The LPO should direct $10 billion in low, fixed-interest construction loans through credit subsidies for such projects. This will allow the LPO to unlock more funding for these projects by an order of magnitude. Additionally, it should offer $10 billion in long-term, fixed-rate loans post-completion to protect these projects from refinancing risk when construction loans come due. Additionally, the LPO should establish an Offtake Contract Authority similar to the Department of Energy's Transmission Facilitation Program. In the way that the TFP provides financing tools that help shovel-ready transmission line projects establish a customer base, the OCA would help these nuclear projects secure long-term Power Purchase Agreements.

Operation Atomic Heartland (Medium Term)

PREMISE: America's coal fleet teeters on the brink of extinction. A bleak future awaits the communities that host these plants. Rarely, if ever, does a community economically recover from a plant closure. Losing these plants is a tragedy not just for these communities, but for the industrial commons of our power grid, which is starved of firm capacity. Providing these coal plant owners and their communities with the chance to flourish in perpetuity while stabilizing our most essential piece of infrastructure needs to be a national priority.

OPPORTUNITY: Given that the bevy of coal plants set to retire in the 2030s are of varying sizes, both small modular reactors and traditional gigawatt-scale reactors are eligible to replace their spot in the grid. There are 85 coal plant sites slated to retire in 28 states that could serve as sites for new nuclear reactors.

PROGRAM: The LPO should establish a program whereby host communities for coal plants, their respective utilities, and their respective workforces apply to host a nuclear reactor of appropriate size for their site. The LPO will provide $15 billion in financial assistance for site cleanup and conversion, $5 billion for workforce retraining, and $20 billion in low, fixed-interest construction loans for reactor construction via credit subsidies. Lastly, these projects should be eligible for the long-term PPA procurement through an Offtake Contract Authority as stated above.

Operation Eternal Dominance (Long Term)

PREMISE: America not only wants to master traditional nuclear, but to become a prime mover in nuclear innovation.

OPPORTUNITY: Our national lab system is already robust and ready to help advanced nuclear companies prototype their designs so that they can troubleshoot technical challenges before dealing with the added pressure of commercialization.

PROGRAM: The Department of Energy needs to use its network of national labs to create a commercialization pipeline. Advanced nuclear companies could apply to build a commercial reactor prototype at a national lab site with a reduced regulatory burden. For the companies that successfully debut a reactor for commercial power production at a lab, the LPO can offer a total of $10 billion in cost insurance to ease their deployment in a commercial setting by covering budgetary outlays for regulatory expenses (e.g., Nuclear Regulatory Commission safety compliance), environmental compliance, interconnection fees, etc. It should also offer $10 billion in offtake loans post completion for the reasons stated above.

To fund these missions, Congress will need to appropriate the requisite $80 billion. To put this amount in broader context, China has committed nearly half a trillion dollars to building 100 new reactors premised on Westinghouse's AP-1000 design. They plan to switch one on every five years. The race is on.

JUSTIFICATION

Fleet-scale builds in practice and theory

The most famous nuclear build in history took place in France during the 1970s, when Marcel Boiteux, then head of the national utility, Électricité de France, brute-forced a fleet-scale nuclear deployment of 56 reactors over 15 years. By committing to the same reactor design, France sped up deployment times as their experience with the technology increased. Standardization was the lynchpin of France's successful nuclear deployment.

America pursued a variety of reactor designs following the dawn of nuclear power in the late 1950s. A fateful combination of regulatory shifts, a flatlining of load growth, and a lack of standardization stymied the industry by the 1980s. To avoid this pitfall, the US needs to incentivize the deployment of already proven technology.

Moreover, reports from both the Massachusetts Institute of Technology and the Department of Energy reveal that -nth-of-a-kind plants (i.e., successive plants of the same type) can deliver cost reductions more assuredly than first-of-a-kind plants. Both Russia and China have pursued this strategy, which has allowed them to reduce costs and deployment time, while providing them with the expertise to experiment with advanced reactor types.

Learning from our northern neighbors

Ontario achieved one of the most seamless and robust energy scale-ups in human history by phasing out its coal fleet and replacing it with nuclear reactors. Even more impressive, the province retained its coal workforce by retraining them to operate nuclear reactors. While the American experience will involve less central planning (Ontario's power system is a publicly owned utility), Canada's achievements in this regard serve as a general proof of concept for a transition from coal to nuclear power.

Reactor Park: an old debate made new

In the early years of nuclear development, the Atomic Energy Commission and America's utilities debated how best to proceed when it came to developing nuclear power. Utilities wanted the national labs to experiment with several different reactor types to see which held the most promise, a desire the power industry held onto even after Admiral Hyman Rickover debuted the first civilian power reactor in 1957. However, the national labs were more interested in scientific experimentation than practical commercialization. The idea of leveraging the national labs to prototype commercial reactors therefore never took off.

Today, with an already established fleet and a burgeoning advanced reactor sector, the picture looks much different. Now, the national labs can play a unique role in helping the private sector cultivate deeper technical proficiency in producing cutting-edge nuclear technology for commercial purposes. By demonstrating prototypes at the various labs, small modular reactor companies trying to build innovative designs that can be "snapped together" like LEGOs on site will be able to work the kinks out in their designs before they take on the risk of debuting commercial reactors. As a result, their deployments will go more smoothly while American nuclear engineering discipline simultaneously accrues, which will allow the US to pull ahead of the current industry leaders, China and Russia. ■

FURTHER RESOURCES

- Department of Energy, "Pathways to Commercial Liftoff: Advanced Nuclear," 2024
- Idaho National Lab, "Investigating Benefits and Challenges of Converting Retiring Coal Plants into Nuclear Plants," 2022
- Idaho National Lab, "Evaluation of Nuclear Power Plant and Coal Power Plant Sites for New Nuclear Capacity," 2024
- Idaho National Lab, "Opportunities for AP1000 Deployment at Existing and Planned Nuclear Sites," 2024

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