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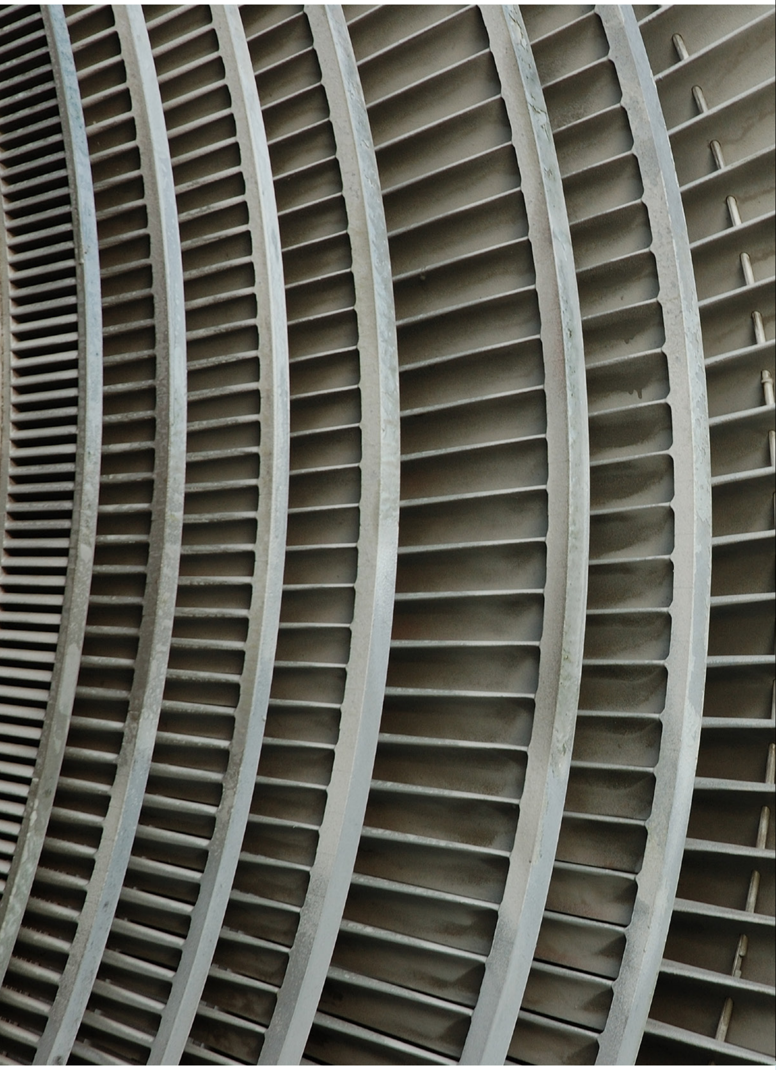

CI Consulting

Critical Mass

Business Models for Turning the Promise of Small Modular Reactors into Scalable Reality

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Electricity demand in the United States (US) is expected to rise 35-50% by 2040, according to a recent S&P Global Commodity Insights study for the American Clean Power Association. This growth is driven by the rapid expansion of datacenters, a resurgence in domestic manufacturing, and the widespread electrification of transportation and heating systems. Amid rising energy demand, small modular reactors (SMRs) are uniquely positioned to deliver reliable, clean power.

Today, SMRs are at a particularly promising inflection point. Financing parties are emerging, demand for carbon-free power is rising with willing offtakers in place, and reactor designs are advancing rapidly. Backed by not only by government incentives in the US Inflation Reduction Act, Department of Energy (DOE) funding programs, and strong bipartisan support, but also by recent Executive Orders under the Trump administration aimed at reigniting a nuclear renaissance in the US, SMRs are rapidly building momentum.

Yet, this is not the first time SMRs have appeared on the cusp of a commercial breakthrough. Past forecasts anticipated substantial SMR capacity would be online by now, but those expectations have not materialized due to regulatory, financing and technical hurdles. Understanding what needs to be done differently in today's environment will be the key to achieving successful SMR commercialization.

The US has the largest SMR development pipeline in the world, totaling 5 gigawatt electrical (GWe) (Figure 1). Of the 31 projects currently underway, the majority remain in early planning stages. To date, only three projects, representing a combined 95 megawatt electrical (MWe), have entered the construction phase.

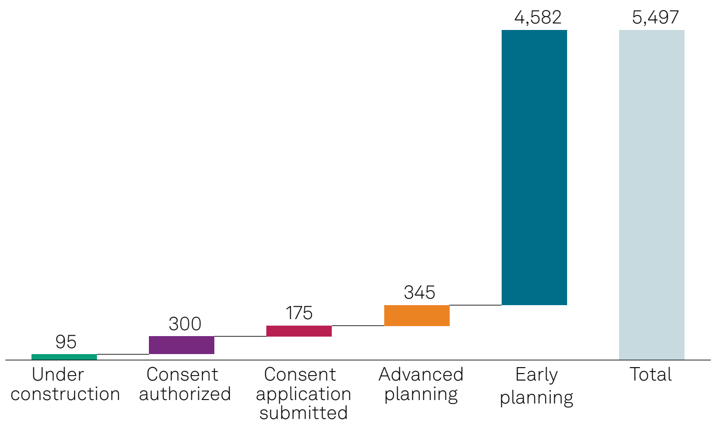
The Western US, Midwest, and Southeast are emerging as key hubs for SMR deployment (Figure 3). In Idaho, projects led by BWX Technologies, Oklo, TerraPower, and GE Hitachi are advancing with the support of federal funding and technical expertise from Idaho National Laboratory (INL). Interest is also growing in repurposing retiring coal plant sites for SMRs—most notably, TerraPower's Kemmerer Power Station Unit 1, a 345 MWe sodium-cooled fast reactor under development near the site of a retiring coal facility in Wyoming.

In the Southeast, Tennessee is positioning itself as a center for advanced nuclear research and development. For example, the Tennessee Valley Authority (TVA) and GE Hitachi are developing the BWRX-300 project at the Clinch River site. The BWRX-300 is a Generation III+ light-water reactor based on proven technology, with relatively low capital costs, making it a strong candidate for adoption by other developers in the future.

Among the 34 reactor designs under development in the US, most are either water-cooled or molten-salt-cooled, highlighting a focus on both proven and advanced technologies (Figure 2). Water-cooled SMRs build on the extensive operating experience of traditional nuclear reactors, while molten-salt reactors represent a push toward next-generation technologies that promise enhanced safety features and greater efficiency but have only been built as experimental prototypes.

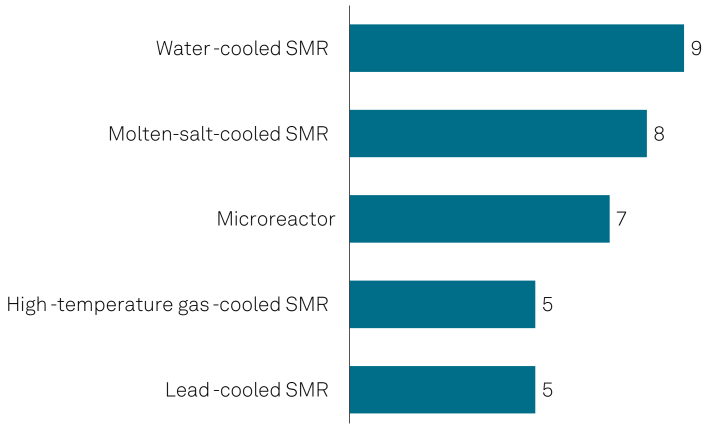
A diversity of reactor designs can foster innovation, but it is not a prerequisite for successful deployment. Pursuing dozens of competing SMR concepts may dilute resources and slow progress. Achieving widespread deployment will require narrowing the choice to a select few proven, optimal designs. Concentrating industry, regulatory and investment efforts on one or two designs will accelerate commercialization, reduce costs, and build public and stakeholder confidence.

Figure 1. Announced SMR capacity in the United States by project status (MWe)



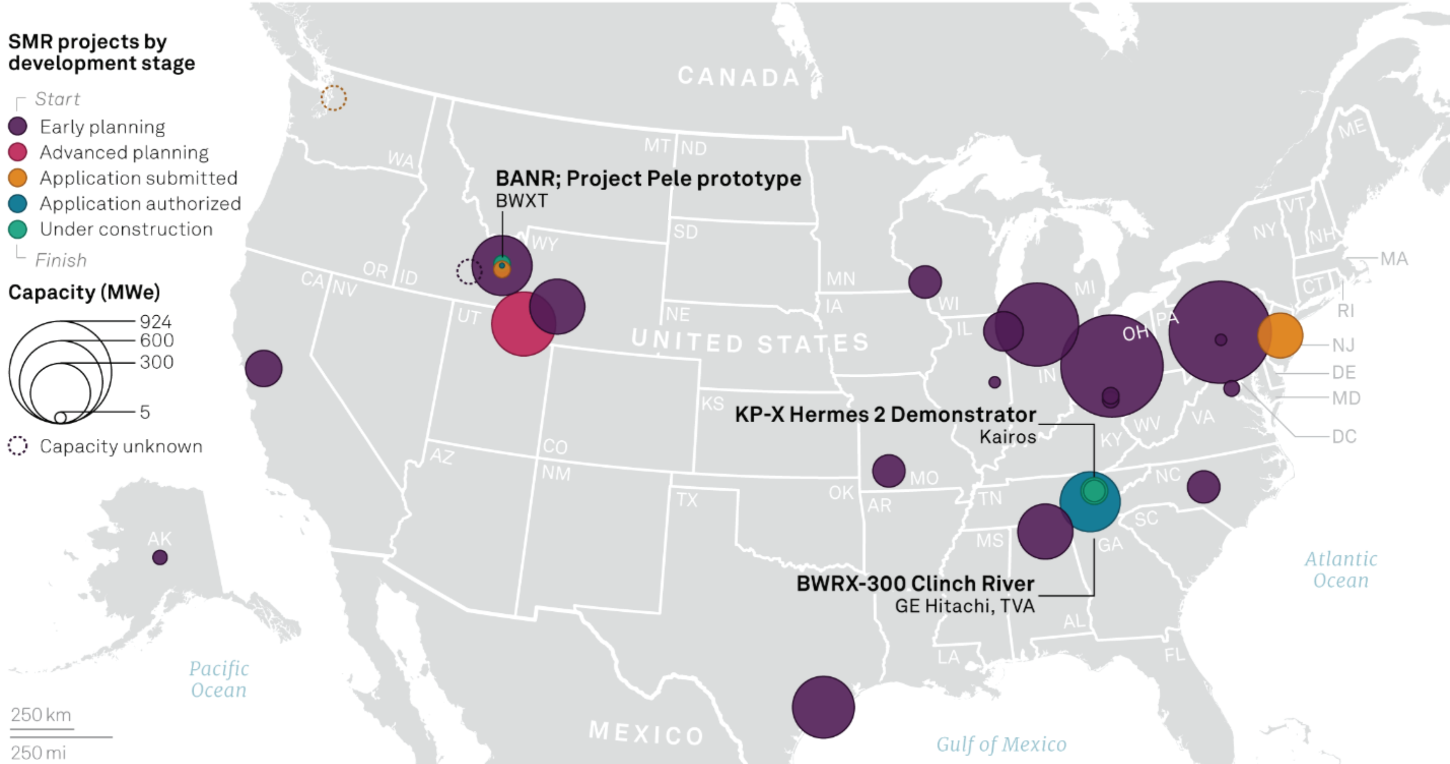
As of March 31, 2025
Note: Includes non-power capacity
Source: S&P Global Commodity Insights

Figure 2. Number of reactor designs in the US by type



As of March 31, 2025
Source: S&P Global Commodity Insights

Figure 3. Announced SMR projects in the United States



As of March 31, 2025.
Locations for KRONOS MMR Alaska, KRONOX MMR Idaho, LFTR Wyoming, Nuscale ENTRA1 Ohio, and Nuscale ENTRA1 Pennsylvania projects are approximate.
Westinghouse AP300 United States, KP-FHR Commercial, and Exodys Up-Cycle (formerly MCSFR) projects are not shown since location is unknown.

Credit: CI Content Design
Source: S&P Global Commodity Insights

Emerging Business Models: Balancing Risk and Reward

Several business models are emerging to support the deployment of SMRs in the US and globally (Table 1). These models are still evolving, often adapting approaches from the broader energy sector, but with added technical and regulatory complexity. Each model assigns financial, technology, construction, market and operational risk differently among stakeholders, and no single 'one-size-fits-all' model has yet emerged as dominant.

In the US, most commercial SMR projects in the pipeline fall under one of these categories: utility-owned, behind-the-meter (BTM), or merchant/independent power producer (IPP). The utility-owned model concentrates most risks and costs within the utility—along with its ratepayers in the event of cost overruns—but benefits from regulatory cost recovery and long-term rate-based returns.

The BTM model, meanwhile, is gaining traction among industrial users looking to decarbonize their operations by siting SMRs onsite to supply electricity and process heat. In this model, risks are typically shared between the developer and the industrial host. One high-profile example is the Long Mott Generating Station, which is a collaborative project between X-energy and Dow to deploy the Xe-100 high-temperature gas-cooled reactor at Dow's Seadrift chemical facility on the Gulf Coast.

The merchant/IPP model refers to SMR projects that would sell electricity into wholesale markets or through negotiated long-term power purchase agreements. This model involves higher market exposure, but it also enables more flexible risk-sharing arrangements among investors, contractors, and operators. As large energy users such as datacenters seek reliable, low-carbon power, this model may become increasingly attractive for SMR developers looking to serve customers with around-the-clock power needs.

Table 1. Business models for SMR deployment

Business model	Description	Pros	Cons	Risks
Utility-Owned	Financed and owned by the utility. Typically built under EPC contract. Output is rate-based or contracted	▪ Stable, long-term revenue ▪ Utilities familiar with regulatory processes	▪ Burden on ratepayers in case of overrun costs ▪ Potentially slower decision-making	Most risks are borne by the utility. Market risk is minimal due to regulated cost recovery
Behind-the-Meter	Customer (e.g., industrial facility) finances or co-finances, owns or co-owns the SMR together with third party. Supplies electricity and/or heat directly to the host	▪ Revenue certainty due to long-term contracts ▪ Long-term cost savings for host	▪ Limited to customers with suitable load profiles	Construction, operational, and technology risks fall on the host and/or developer
Merchant/ Independent Power Producer	Owned by the IPP and often built under EPC or Build-Own-Operate model. Output is sold into wholesale markets or via power purchase agreements	▪ Flexible deployment ▪ Potential for high returns	▪ Higher market risk ▪ Less predictable revenue ▪ Financing is difficult/ more expensive	The owner bears market risk. Other risks can be shared with investors, contractors and operators
Government-Owned	Government funds or co-funds the SMR; ownership may be partial or full	▪ Lower risks for private parties, if involved ▪ Ready access to capital	▪ Risk of shifting political support	Government either bears most risks or shares them with private investors
Microgrid/Military/ Research	Government, utility, or IPP finances and owns the SMR. Often serves critical infrastructure or remote locations. Output is used on-site or sold through long-term contracts	▪ Energy resilience ▪ Tailored to national security or local needs	▪ Limited scalability ▪ Customer concentration risk	Risks are often shared among the developer, utility, and government. Construction and tech risks may be subsidized. Market risk is low
Leasing/Energy as a Service	Third-party (often developer or IPP) owns and operates the SMR. Customers access electricity and/ or heat through subscription-based or usage-based contracts	▪ Low upfront cost for customer ▪ Recurring revenue for vendor	▪ Limited to specific use cases ▪ High upfront costs for vendor	Vendor bears most risks

Source: S&P Global Commodity Insights

The successful commercialization of SMRs depends largely on the choice of business model. A model that works for a first-of-a-kind (FOAK) project may not be the right one for a nth-of-a-kind (NOAK). A critical consideration for SMR deployment is the financial structure and cost of capital. Given the long development timelines and capital-intensive nature of nuclear projects, developers must carefully design the capital stack to align with risk, timing and return expectations. With several years likely to pass before SMRs begin generating revenue, securing low-cost, patient capital is essential.

This is especially important for high-risk FOAK projects. Without strong financial structuring—such as public-private partnerships or cost-sharing agreements—these projects may falter under the weight of upfront costs and long timelines. Tools such as loan guarantees from the DOE Loan Programs Office and federal tax incentives, including the Investment Tax Credit and the Production Tax Credit, can further strengthen the capital structure and reduce the overall cost of capital.

Besides financing, customer assurance and market demand must also be factored into the SMR business model. Long-term offtake agreements and utility ownership structures can help secure revenue streams and improve bankability. Recognising these needs, several non-governmental organizations, such as the Energy Futures Initiative Foundation, are actively working on aggregating customer demand.

Effective risk allocation is equally important. Business models must clearly distribute technical, financial, regulatory, and operational risks among developers, utilities, governments, and end-users. Models that overload developers with risk, or fail to protect investors against regulatory delays, are unlikely to attract the sustained private investment needed for scaling.

Business models also need to support multiple-unit orders and repeatable deployments to unlock cost reductions through learning curves and supply-chain development. Standardization and fleet deployment strategies are essential for SMRs to become economically competitive with other clean energy technologies.

Lastly, community and stakeholder trust must be woven into the business approach. Models that include early engagement with local governments, regulators, and the public will better navigate political and social acceptance challenges.

A cautionary example is NuScale's Carbon Free Power Project, highlighting the repercussions of failing to adequately address risks. The project was structured as a consortium of municipal utilities, in partnership with Utah Associated Municipal Power Systems, to build a 720 MW SMR plant at INL, supported by a $1.4 billion DOE cost-sharing agreement. The project was fully contracted out with municpal customers, but each time costs increased, they were allowed to withdraw their commitments. The lack of strong guarantees and an effective risk-sharing framework created too much uncertainty. As a result, customer attrition increased with each cost escalation, ultimately leading to the project's cancellation in 2023.

SMR Deployment Lessons from China and Russia

Only a small number of SMRs are operational today, primarily in China and Russia, where deployment has been driven by sustained government support.

China leads globally with over 540 MW of operational SMR capacity, including its flagship 210 MW high-temperature gas-cooled reactor pebble-bed module (HTR-PM) in Shandong. The reactor began selling electricity to the regional grid in 2023. The project was jointly developed by Tsinghua University (technical lead), state-owned utility Huaneng (owner and operator), and China National Nuclear Corporation (EPC contractor and fuel supplier). This state-backed, multi-stakeholder model helped mitigate the risks typical of FOAK deployments by distributing financial, technical, and construction responsibilities among partners with complementary capabilities.

With over 230 MW of operating capacity, Russia has the second-largest fleet of SMRs. A standout example is the Akademik Lomonosov, a floating nuclear power plant equipped with two marine-type KLT-40S reactors, each producing 35 MWe. Located in Pevek, in Russia's eastern Arctic, the plant entered commercial operation in 2020 and now supplies district heating to the town and electricity to surrounding regions. The KLT-40S project exemplifies a fully government-owned, vertically integrated business model—it was financed, developed, owned and operated by Rosatom, Russia's state-owned nuclear corporation. The reactor was designed by Rosatom's nuclear engineering subsidiary and assembled by a state-owned shipbuilding company. Operations are managed by Rosatom's power generation subsidiary.

In both China and Russia, government support—whether through direct ownership, multi-party risk-sharing frameworks, or long-term strategic support—has played a decisive role in de-risking projects and enabling deployment. While such an approach may not be easily replicable or viable in the US context, it underscores a key insight—SMRs require mechanisms to redistribute risk across stakeholders to scale.

The Path Toward Widespread SMR Deployment

For SMRs to achieve broader commercialization in the US, further business model innovation is essential. Specifically, successful deployment will require a shift of risk to parties best equipped to manage it—such as the government providing guarantees or direct procurement, hyperscalers seeking firm clean power for datacenters, or vertically integrated utilities that can integrate SMRs into their regulated asset base. This reallocation is critical because the commercialization risk for SMRs remains high, and private developers or merchant generators are unlikely to shoulder this burden alone.

Beyond business model innovation, simplifying the licensing and permitting process is crucial. Current regulatory frameworks, often designed for large conventional reactors, are ill-suited to the smaller scale and modular nature of SMRs. One of the Trump Administration's Executive Orders aims to alleviate this issue by reforming Nuclear Regulatory Commission and enabling streamlined, technology-appropriate pathways that would reduce uncertainty and accelerate timelines.

Finally, robust state and local support, including incentives, infrastructure investments and clear siting policies will be needed to create environments where SMR projects can succeed.

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Natallia is a seasoned expert in the nuclear power industry with over a decade of consulting experience and an engineering background. Currently a Director in the North American Power and Renewables team at S&P Global, she has led numerous high-impact projects across the nuclear value chain—from fuel cycle economics and supply chain integration to commercial strategy and localization. Her work includes developing public-private partnership strategies for global nuclear plant deployment, optimizing procurement and integration strategies for multi-billion-dollar nuclear utilities, and enhancing the economics of existing nuclear operations, delivering tens of millions in savings. With prior roles at General Electric and AEP as a nuclear engineer, and consulting positions at Roland Berger, Booz (now Strategy&), and ATKearney, Natallia brings a unique blend of deep technical knowledge and strategic insight to the evolving nuclear landscape.

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