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AI's Power Hunger Meets Nuclear's Comeback How Big Tech Partnerships are Accelerating SMRs and Reshaping the Grid

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Abstract: Artificial intelligence is rapidly increasing global electricity demand, especially through the expansion of hyperscale data centers that require reliable, continuous, and low-carbon power. This rising energy need is fueling strategic partnerships between major technology companies and nuclear energy developers, particularly those focused on small modular reactors (SMRs). Unlike intermittent renewable sources, SMRs offer firm baseload electricity, compact design, modular deployment, and the potential for improved safety and cost control through factory-based manufacturing. As a result, SMRs are becoming attractive options for powering AI-driven digital infrastructure. This article examines how artificial intelligence is accelerating collaboration between Big Tech and nuclear energy producers, transforming SMRs from a long-term concept into a practical component of future energy planning. It discusses the growing electricity demands of AI systems, the limitations of existing grid infrastructure, and the role of SMRs in providing scalable and carbon-free power. The article also highlights how these partnerships are taking shape through power purchase agreements, direct investment, co-development strategies, and support for advanced fuel and reactor supply chains. In addition, the article explores the broader significance of these alliances for energy security, decarbonization, grid stability, and industrial innovation. While challenges remain, including licensing, financing, public acceptance, and first-of-a-kind (FOAK) deployment risk, the convergence of artificial intelligence and advanced nuclear energy may represent a major shift in both the digital economy and clean energy transition. The growing connection between AI expansion and SMR development suggests that nuclear energy could become a critical enabler of the next generation of technological growth.

Keywords: Artificial Intelligence (AI); Small Modular Reactors (SMRs); Big Tech Partnerships; Nuclear Energy; Data Centers; Clean Firm Power; Advanced Reactors; Energy Demand Growth; Decarbonization; Power Purchase Agreements (PPAs).

1. Introduction

The rapid expansion of Artificial Intelligence (AI) is fundamentally transforming the global energy landscape, creating an unprecedented surge in electricity demand driven by hyperscale data centers and advanced computing infrastructure. Unlike traditional digital services, AI workloads, particularly large-scale model training and real-time inference — require vast amounts of continuous, high-quality power, elevating energy from a background utility to a critical strategic resource. This shift has exposed significant limitations in existing energy systems, including grid congestion, transmission bottlenecks, and the intermittency of renewable energy sources. As a result, technology companies are increasingly seeking reliable, carbon-free power solutions that can meet both their operational needs and sustainability commitments. [1-5].

In this context, nuclear energy — and especially Small Modular Reactors (SMRs) have emerged as a compelling option. Per Figure-1 conceptual and holistic diagram, SMRs offer the promise of scalable, flexible, and continuous clean power that aligns well with the modular growth of data center infrastructure. Their

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ability to provide firm baseload electricity distinguishes them from variable renewables, making them particularly attractive for AI-driven operations that cannot tolerate power interruptions. Consequently, major technology firms are forming strategic partnerships with nuclear energy developers through mechanisms such as long-term power purchase agreements, direct investments, and collaborative development initiatives.

Note that: This single-frame diagram illustrates how Small Modular Reactors (SMRs) generate clean, reliable baseload power that is transmitted through smart grid infrastructure to support high-density AI data centers. It highlights the role of Big Tech in orchestrating energy optimization, workload management, and strategic partnerships with nuclear developers and utilities. The figure also emphasizes key deal structures — such as Power Purchase Agreements (PPAs), investments, and co-development — that enable scalable, low-carbon energy solutions for the AI era.

This article explores how AI is acting as a catalyst for renewed interest in nuclear energy, accelerating the development and deployment of SMRs. It highlights the evolving relationship between digital innovation and energy infrastructure, demonstrating how the convergence of these sectors is reshaping both the future of computing and the trajectory of global decarbonization efforts.

Fig. 1 AI-SMR integrated energy ecosystem: Powering hyperscale data centers with clean firm nuclear energy.
(Sour: Authors-generated conceptual diagram using AI tools (2026))

2. AI fuels Big Tech Partnerships With Nuclear Energy Producers Building SMRs

Artificial intelligence is rapidly increasing electricity demand, driving Big Tech companies to partner with nuclear energy developers to secure reliable, carbon-free power. Small Modular Reactors (SMRs) are emerging as a strategic solution, offering scalable and firm energy to support hyperscale AI data centers [9].

2.1 Why Is This Happening Now and AI Changing the Electricity Equation?

Our answer is summarized in the current wave of artificial intelligence, especially large-scale model training and inference — has turned computer into a primary industrial load, not a marginal IT add-on. The result is a power procurement problem that is simultaneously massive, urgent, and geographically constrained: data centers must be built where fiber, land, cooling, and interconnection are feasible, but also where firm, high-capacity electricity is available (see Fig. 2)

Recent U.S. government and lab analyses underline the scale. A U.S. Department of Energy report (drawing on Berkeley Lab analysis) estimated data centers used ~4.4% of U.S. electricity in 2023 and could reach ~6.7% to 12% by 2028, with annual consumption rising from 176 TWh (2023) to ~325-580 TWh by 2028. A Congressional Research Service report echoes similar projections and frames the issue as a fast-emerging infrastructure and policy challenge.

That growth is driven disproportionately by AI servers and accelerated computing. Even when Big Tech signs renewables contracts at scale, matching clean power "24/7" is hard because wind and solar are variable. Batteries help — but long-duration storage at the needed scale remains expensive and site-limited. This is the strategic opening for nuclear: it is carbon-free, high capacity-factor, and land-efficient, with predictable output.

But why SMRs (small modular reactors) and advanced reactors rather than only traditional gigawatt-scale units? Three reasons dominate (Fig. 3):

1) Siting and modular build strategy: factory repeatability and phased deployment match data-center growth.

2) Risk-sharing and financing innovation: corporate offtake agreements can reduce cost of capital.

3) Co-location logic: AI facilities often prefer adjacent/nearby firm generation to reduce transmission constraints and interconnection delays.

The partnerships we're seeing are, in effect, a market response to a grid bottleneck: AI is the demand shock; nuclear — especially modular nuclear — is one of the few scalable supply options that can plausibly deliver large amounts of clean firm power in the 2030s.

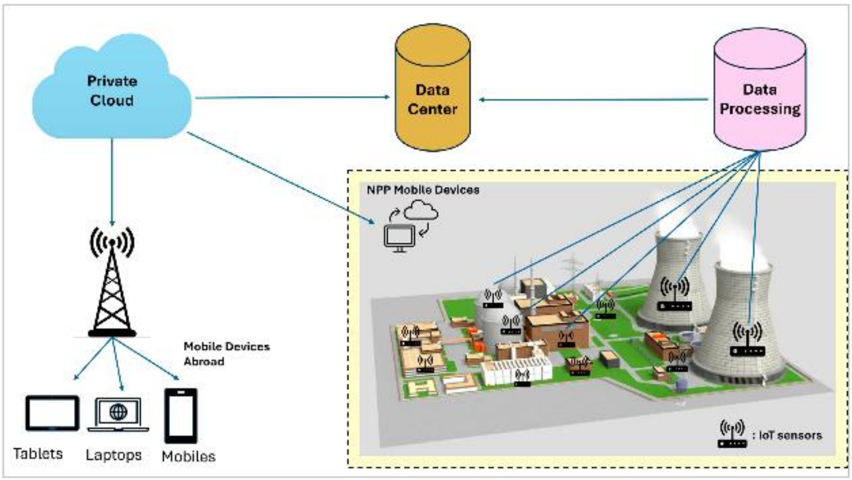

Fig. 2 SMR Driving Data Centers.
(Source: Authors-generated conceptual diagram using AI tools (2026))

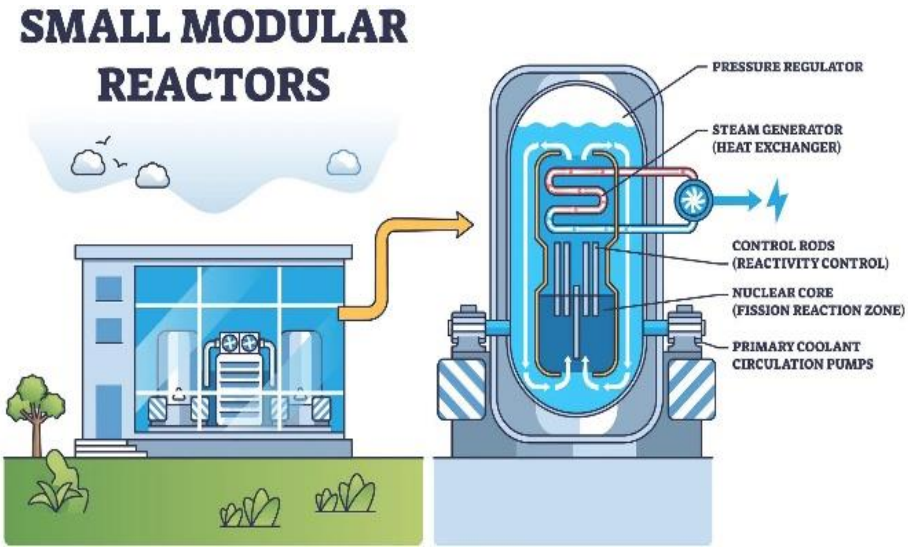

Fig. 3 Holistic SMRs View Layout.
(Sour: Authors-generated conceptual diagram using AI tools (2026))

2.2 Why SMRs are Especially Attractive to Hyper-scalers

SMRs and advanced reactors are being pulled into the spotlight because they offer a plausible "bridge" between:

- The need for large blocks of power, and
- The practical limits of deploying massive single-unit projects on tight timelines.

Key advantages that appeal to Big Tech buyers:

- Modular scaling aligned with campus growth

SMRs can be deployed in multi-unit configurations — adding capacity in increments that track data center expansion and reducing the "all-or-nothing" risk of a single giant unit [9].

- Factory-driven repeatability (the promise)

SMR vendors argue that standardized modules and repeat builds can move projects down the learning curve, potentially improving schedule predictability over time. (This is not guaranteed — FOAK units can still be expensive and slow — but it is central to the SMR investment thesis).

- Siting and integration flexibility

SMRs may enable brownfield siting (e.g., retiring fossil sites), industrial co-location, or deployment in regions that cannot easily host very large units — subject to licensing, cooling water access, and community acceptance.

- Grid services and "clean firm" value

Beyond energy, nuclear can supply ancillary services (frequency support, voltage, inertia-like services depending on plant and grid configuration) which can matter in renewable-heavy systems (see Fig. 4).

2.3 The Deal Structures: How Big Tech is Partnering with Nuclear Builders

Big Tech's nuclear partnerships are diversifying into several recognizable models, each mapping to a different time horizon and risk profile.

2.3.1 Model A — Long-term PPAs Tied to Existing Nuclear Assets or Restarts (Near-Term Reliability)

While not SMRs, these deals matter because they show hyper-scalers' willingness to sign long-duration contracts for firm clean power — and they often serve as a "bridge" while SMRs mature.

Fig. 4 Smart Grid.
(Source: Authors-generated conceptual diagram using AI tools (2026))

A prominent example: Constellation announced in September 2024 that it signed its largest-ever PPA with Microsoft to support the planned restart of Three Mile Island Unit 1 (renamed the Crane Clean Energy Center), adding ~835 MW of carbon-free energy. The U.S. Nuclear Regulatory Commission also documents the facility name change and related regulatory milestones.

This illustrates the core logic: AI demand is strong enough that tech buyers will underwrite nuclear availability — sometimes via bringing dormant capacity back.

2.3.2 Model B — SMR/Advanced Reactor PPAs (Mid-Term "Build New Clean Firm")

Google's agreement with Kairos Power is frequently cited as a landmark for corporate procurement of advanced nuclear. Google described it as a first corporate agreement to purchase power from multiple SMRs, aiming for a fleet totaling 500 MW by 2035, with the first deployment targeted by 2030. Kairos similarly described the structure as a series of PPAs for energy and related attributes supporting Google data centers.

Utility industry coverage emphasized that the arrangement targets a first unit around 2030 with additional plants through 2035 — signaling a fleet mindset rather than a one-off demonstration.

This model is crucial because PPAs create bankable revenue, which can reduce the financing premium that often makes FOAK nuclear prohibitive.

2.3.3 Model C — Equity Investment + Supply Chain/Fuel Industrialization (Ecosystem Building)

Amazon's partnership with X-energy shows how hyper-scalers are going beyond buying power into building enabling infrastructure.

X-energy announced in October 2024 that Amazon anchored a funding round to support the Xe-100 SMR and expand carbon-free power, highlighting the Xe-100's typical 80 MW per unit configuration and multi-unit plants that can scale from ~320 MW to ~960 MW.

A key feature is fuel: X-energy's TRISO-X fuel manufacturing effort in Oak Ridge, Tennessee, is positioned as a strategic bottleneck to solve (advanced reactors are often fuel-constrained as much as capital-constrained).

In parallel, Energy Northwest described plans in Washington state tied to the Xe-100 design — illustrating how hyper-scaler involvement can catalyze utility-led development pathways.

2.3.4 Model D — Portfolio Procurement/Multi-Counterparty Frameworks (Optionality at Scale)

Meta's approach has evolved toward portfolio-style contracting — securing both near-term nuclear supply and longer-term advanced reactor options. In December 2024, Utility Dive reported Meta sought up to 4 GW of new nuclear power beginning in the early 2030s.

By January 2026, Meta announced agreements with Vistra, TerraPower, and Oklo to extend/expand existing plant operations and support advanced nuclear development — framed as enabling up to 6.6 GW of new and existing capacity by 2035 (with an additional mention of an earlier Constellation-related agreement). A detailed industry commentary likewise characterized these as "anchor customer" style commitments aimed at extending aging plants and accelerating FOAK deployments.

This portfolio method reduces vendor and schedule risk: rather than betting on a single SMR design, buyers secure a pipeline of firm power.

2.3.5 Model E — Non-binding "Master" Agreements Signaling Massive Future Demand (Pipeline Creation)

Oklo's announcement of a non-binding master agreement framework with Switch (data center company) described a potential long-term relationship framed as up to 12 GW over time — illustrating how developers and large loads are trying to pre-assemble demand and project pipelines.

These frameworks are not the same as a project-financeable PPA, but they can attract investors and partners by demonstrating market pull.

2.4 What's Structurally Different Now: AI Changes Nuclear Economics

This wave of partnerships differs from prior "nuclear renaissance" cycles because of how AI shifts value:

(1) Reliability premium becomes explicit

AI workloads (especially latency-sensitive inference) and cloud service-level commitments make reliability more valuable. Nuclear provides predictable output that complements variable renewables.

(2) Long-duration contracting improves bankability

Nuclear's challenge in merchant markets has been revenue uncertainty. Hyper-scalers can sign long-term deals that stabilize cash flows, potentially lowering cost of capital — often the biggest driver of nuclear LCOE.

(3) Regional deliverability matters more than annual energy accounting

Corporate clean energy is moving beyond annual matching toward deliverable, time-matched energy — especially for firms pursuing "24/7" clean strategies. Nuclear fits this paradigm.

(4) Scale is large enough to justify supply chain investment

Amazon's emphasis on fuel and multi-unit scaling is an example of hyper-scalers treating advanced nuclear as a platform rather than a single project.

2.5 The Feedback Loop: AI Needs Nuclear, and AI can also Help Nuclear Deliver

It is not just that AI consumes electricity. AI technologies can also reduce cost and schedule risk across nuclear's lifecycle — if used conservatively and within regulatory expectations.

- Digital engineering and design acceleration

Physics-informed ML surrogates, automated design-space exploration, and uncertainty quantification can speed iteration — particularly in thermal-hydraulics, materials performance prediction, and system optimization.

- Licensing documentation efficiency

AI-assisted document management, requirements traceability, and consistency checking can reduce manual burden. This won't replace the need for rigorous safety analysis, but it can improve throughput.

- Construction QA/QC and productivity

Computer vision for inspection workflows, automated nonconformance detection, and predictive scheduling can reduce rework — historically a major cost driver in nuclear construction.

- Operations and predictive maintenance

For operating fleets, AI-based condition monitoring (vibration analysis, anomaly detection, thermal performance drift, valve diagnostics) supports the uptime that hyper-scalers pay for.

The synergy is straightforward: hyper-scalers bring AI capabilities, digital infrastructure expertise, and capital; nuclear developers bring firm clean power. Together, they can plausibly shorten time-to-delivery — one of SMR's largest uncertainties.

2.6 What Could Slow or Derail SMR-led Tech Procurement

Despite momentum, SMR deployment still faces constraints that AI demand alone cannot magically remove:

- FOAK cost and schedule risk

Early plants are likely to be expensive, and delays could force buyers to procure interim power (including gas) to meet data center timelines.

- Licensing pace and regulatory novelty

Advanced designs may involve first-of-kind licensing paths; even streamlined processes take time, and policy environments can shift.

- Fuel availability and manufacturing readiness

Some advanced reactors depend on specialized fuels and supply chains. Scaling fuel fabrication and qualification remains a gating factor (hence Amazon's interest in fuel capacity).

- Community acceptance and local infrastructure

Data centers already face scrutiny over water use and land; adding nuclear can heighten attention, even when benefits include jobs and local tax base.

- Transmission and interconnection bottlenecks

Even generation built "for" a load still often interacts with the grid. Interconnection approvals and system upgrades can delay timelines (though some nuclear restart efforts have sought expedited approaches, per reporting).

2.7 What to Watch Through 2035

If you want to judge whether this tech–nuclear alignment will become a durable pillar of decarbonization, watch for:

1) Conversion rate of frameworks into binding PPAs (bankable contracts with delivery terms).

2) FOAK milestones: first construction starts, first fuel loads, first grid synchronizations on advanced reactors.

3) Repeat builds: evidence that “modular” means replicable schedules and costs, not just smaller nameplate capacity.

4) Fuel and component throughput: commercial-scale production that can support fleets, not prototypes.

5) Grid cost-sharing models: whether hyper-scalers help fund transmission and interconnection upgrades to reduce backlash.

3. Conclusion

AI is reshaping the power sector by turning electricity supply into a strategic constraint on digital growth. Hyper-scalers increasingly need clean power that is not only low-carbon on paper, but deliverable, reliable, and scalable. Nuclear energy — and especially SMRs and advanced reactors — sits at the intersection of these requirements.

What makes the current cycle distinct is the emergence of credible, creditworthy corporate buyers willing to sign long-term agreements and, in some cases, invest in enabling infrastructure like fuel production. Deals such as Google–Kairos (advanced reactor PPAs), Amazon–X-energy (investment plus fuel scale-up), and Meta’s portfolio of nuclear agreements show that Big Tech is building a multi-track nuclear strategy: near-term firm supply via existing assets and restarts, plus longer-term SMR pathways intended to scale into the 2030s.

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