COMMITTEE ON
SCIENCE, SPACE
AND TECHNOLOGY
CHAIRMAN BRIAN BABIN

SUBCOMMITTEE ON ENERGY

HEARING CHARTER

"Powering Demand: Nuclear Solutions for AI Infrastructure"

Thursday, June 12, 2025
10:00 a.m.
2318 Rayburn House Office Building

Purpose

This hearing will explore the role of advanced nuclear and its capacity to provide reliable baseload power for data centers. The Committee will examine the Department of Energy's (DOE) research, development, and demonstration activities to fully unlock nuclear power as well as improve the efficiency of data centers. This hearing will inform Members about the artificial intelligence (AI) data center buildout, how the two technologies fit together, and the importance of energy security for our technological future.

Witnesses

- **Mr. Pat Schweiger**, Chief Technology Officer, Oklo
- **Ms. Kathleen L. Barrón**, Executive Vice President and Chief Strategy and Growth Officer, Constellation Energy
- **Dr. Jeremy Renshaw**, Executive Director AI & Quantum, Electric Power Research Institute (EPRI)

Overarching Questions

- What role has the Department of Energy played in the development and deployment of powering data centers with next-generation reliable baseload power sources like nuclear? Has the recent DOE request for information (RFI) from developers led to any insight on how collocating at National Laboratory sites might proceed?
- How has recent government funding helped speed up the development and deployment of Small Modular Reactors (SMRs)? Will the recently signed Executive Orders from President Trump help address issues facing the industry or are there areas that still need

to be addressed?
- What consequences do taxpayers (consumers) face when it comes to collocation? Are there adverse consequences for behind-the-meter power generation?
- What bureaucratic red tape are companies and utilities coming across when trying to bring new nuclear online? How can Congress help alleviate the issues facing collocation?

Background

With the rapid development and deployment of AI, data centers will play a critical role as the backbone of this technology, driving economic and shaping the future. Due to the vast increase in the number of data centers needed to run AI models, the United States will face a tremendous surge in power demand and consumption, significantly transforming the energy landscape.

According Lawrence Berkeley National Laboratory's "2024 United States Data Center Energy Usage Report," published in December 2024, data centers consumed 4.4% of total U.S. electricity in 2023. That figure is projected to rise to between 6.7% to 12% by 2028.[1] The report estimates that data center energy consumption will increase from 176 terawatt-hours (TWh) in 2023 to around 325 to 580 TWh in 2028. For context, a large coal, natural gas, or nuclear power plant produces less than 10 TWh per year.[2] Furthermore, top-tier data center standards call for the "five 9s" uptime, or 99.999% availability—the equivalent of 5.25 minutes of downtime per year, according to a 2020 McKinsey report.[3]

As a result of this rapid growth and demand, the U.S. will need to greatly expand its energy infrastructure, including additional baseload power interconnects to the grid. Without this significant domestic investment, the United States risks becoming dependent on foreign energy sources. Hostile powers such as the Chinese Communist Party have already shown their willingness to weaponize energy and key materials like critical minerals.[4]

Given these long-term power concerns and the need for consistent power, technology companies and hyperscalers are taking a more proactive role in securing their own power, which is a shift from past practices. Based on their energy projections, many of these companies have made long-term strategic investments and partnerships with next-generation energy companies, including advanced nuclear designers. Active nuclear power generation facilities operate with a standard capacity factor of 92%, which is the ratio of actual power compared to if it ran continuously at full capacity throughout a year. This performance far exceeds other power options available to satisfy the needs of AI data centers.[5] Geothermal is the next closest energy source and has a standard capacity factor of roughly 65%, with natural gas following at 59.7%.

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[1] https://eta-publications.lbl.gov/sites/default/files/2024-12/lbnl-2024-united-states-data-center-energy-usage-report.pdf
[2] https://www.wearediagram.com/blog/rethinking-energy-in-age-of-ai
[3] https://www.powermag.com/addressing-data-center-growth-constraints-key-to-u-s-innovation-leadership-in-ai/
[4] https://www.cnn.com/2025/06/05/business/eu-china-rare-earth-export-controls-intl-hnk
[5] https://www.statista.com/statistics/191201/capacity-factor-of-nuclear-power-plants-in-the-us-since-1975/

As a result, over the last year, several high-profile partnerships have emerged: Kairos partnered with Google to provide 500 megawatts (MW); Amazon invested over $300 million to secure 5 gigawatts (GW) of power from X-Energy; and Switch and Oklo announced plans to deploy 12 GW.[6,7,8]

With these agreements, tech companies and nuclear companies are structuring power agreements based on their needs. The two approaches taken by industry are referred to as "front-of-the-meter" and "behind-the-meter". A front-of-the-meter power purchase agreement involves a utility owning and operating a power plant that delivers energy to the grid, which then distributes it to customers. In this approach, the end user is not only using power from the specific power plant, but from a variety of sources that are powering the larger grid. One example is the 20-year, 835 MW front-of-meter agreement between Microsoft and Constellation to restart Reactor One at Christopher M. Crane Clean Energy Center, formerly known as Three Mile Island—the second announced nuclear recommissioning in the U.S.[9]

In contrast, a behind-the-meter power purchase agreement is where a power plant generates power directly to the customer's asset through close proximity. This setup improves energy efficiency, lowers costs, and provides a reliable source of power. Amazon, for instance, has sought a behind-the-meter agreement with Talen Energy's nuclear reactor in Susquehanna, PA.[10] However, the Federal Energy Regulatory Commission (FERC) and its regulators initially pushed back due to concerns about reliability and increased costs on ratepayers.[11] Still, FERC has since limited that ruling and is working to provide clearer guidance on co-location agreements.[12]

Recognizing the importance of AI to national security and economic leadership, the Trump Administration acted quickly by issuing executive orders (EOs), such as EO 14179 "Removing Barriers to American Leadership in Artificial Intelligence," accelerating the development of AI.[13] In line with this order, on April 7, 2025, DOE issued a request for information (RFI) to gauge industry interest in using 16 DOE sites as locations for data centers.[14] Some of these sites have the potential to host data centers powered by nuclear reactors, given that many of these communities have a long history and with DOE's nuclear security missions.

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[6] https://oklo.com/newsroom/news-details/2024/Oklo-and-Switch-Form-Landmark-Strategic-Relationship-to-Deploy-12-Gigawatts-of-Advanced-Nuclear-Power-One-of-the-Largest-Corporate-Clean-Power-Agreements-Ever-Signed/default.aspx

[7] https://kairospower.com/external_updates/google-and-kairos-power-partner-to-deploy-500-mw-of-clean-electricity-generation/

[8] https://www.cascadepbs.org/news/2024/11/amazon-offers-334m-nuclear-reactors-be-built-hanford

[9] https://www.wsj.com/business/energy-oil/three-mile-islands-nuclear-plant-to-reopen-help-power-microsofts-ai-centers-aebfb3c8?mod=Searchresults_pos3&page=1

[10] https://www.datacenterdynamics.com/en/news/aws-acquires-talens-nuclear-data-center-campus-in-pennsylvania/

[11] https://www.ans.org/news/article-6534/ferc-rejects-interconnection-deal-for-talenamazon-data-centers/

[12] https://ferc.gov/news-events/news/ferc-orders-action-co-location-issues-related-data-centers-running-ai

[13] https://www.whitehouse.gov/presidential-actions/2025/01/removing-barriers-to-american-leadership-in-artificial-intelligence/

[14] https://www.federalregister.gov/documents/2025/04/07/2025-05936/request-for-information-on-artificial-intelligence-infrastructure-on-doe-lands

More recently, on May 23, 2025, President Trump signed four executive orders: (1) Deploying Advanced Nuclear Reactor Technologies for National Security, (2) Ordering The Reform of the Nuclear Regulatory Commission, (3) Reforming Nuclear Reactor Testing at the Department of Energy, and (4) Reinvigorating the Nuclear Industrial Base. These actions aim to fast-track advanced nuclear development, streamline licensing, strengthen the domestic supply chain, and boost the domestic nuclear industry.[15,16,17,18] Together with EO 14179 and DOE's April RFI, these initiatives promote faster and more affordable deployment of nuclear power for American consumers.

Through continued research, development, and demonstration programs within DOE's Office of Science, Energy Efficiency and Renewable Energy Office, and Office of Nuclear Energy, the Department is well-positioned to guide the evolution of AI and ensure American dominance in both energy and cutting-edge innovation.

DOE's Energy Efficient Computing and Energy Efficiency in Data Centers

The DOE has long been at the forefront of computational research and development. Research funded and conducted by DOE has been critical in creating the technologies we rely on today. Within the Department, the Advanced Scientific Computing Research (ASCR) Program, the Office of Energy Efficiency and Renewable Energy (EERE), and the Advanced Research Projects Agency – Energy (ARPA-E) recently played key roles in developing energy-efficient computing and improving energy efficiency in data centers. EERE, one of DOE's applied offices, supported the Department's efforts to enhance data center efficiency. Under the Energy Act of 2020, DOE was instructed to analyze measurements, best practices, and benchmarks related to data center efficiency. EERE subsequently provided this information to the Federal Energy Management Program (FEMP), offering guidance and resources to improve the efficiency of federally operated data centers. Additional best practices and resources were also outlined by the Center of Expertise (CoE) for Energy Efficiency in Data Centers and published in its guide to design energy-efficient data centers.[19]

Housed under the Office of Science, ASCR leads not only the nation but also the world in supercomputing and high-performance computing (HPC). Through basic research in areas like computational hardware, algorithmic and software improvements, and workflow optimization, ASCR helped create the most powerful supercomputer in the world while not sacrificing energy efficiency. Through the Exascale Computing Project (ECP), ASCR, in collaboration with the National Nuclear Security Administration (NNSA), developed the world's first exascale computer, Frontier.[20] Exascale performance is achieved once a system can perform a quintillion

[15] https://www.whitehouse.gov/presidential-actions/2025/05/deploying-advanced-nuclear-reactor-technologies-for-national-security/
[16] https://www.whitehouse.gov/presidential-actions/2025/05/ordering-the-reform-of-the-nuclear-regulatory-commission/
[17] https://www.whitehouse.gov/presidential-actions/2025/05/reforming-nuclear-reactor-testing-at-the-department-of-energy/
[18] https://www.whitehouse.gov/presidential-actions/2025/05/reinvigorating-the-nuclear-industrial-base/
[19] [19] https://www.energy.gov/femp/energy-efficiency-data-centers
[20] https://www.energy.gov/science/articles/frontier-doe-supercomputing-launches-exascale-era

(10^{18}) calculations per second.[21] This leap in performance was made possible by advances in energy-efficient computing, which addressed the significant challenges of heat generation, power consumption, and the size of the computer needed. According to the November 2024 edition of the TOP500, which is a biannual ranking of the world's fastest supercomputers, NNSA's supercomputer El Capitan was ranked the most powerful, followed by two ASCR supercomputers, Frontier and Aurora, in second and third place, respectively.[22] TOP500 also ranks the most energy-efficient high performance computer, called the Green500, where El Capitan placed 18th.[23]

ARPA-E, has also advanced energy efficiency with its COOLERCHIP program. Electrical energy that goes into the data center is released as heat in the system. As a result, up to 40% of the power used by a data center goes to cooling systems to ensure the chips do not overheat.[24] Data center developers utilize a variety of cooling systems, including air-based cooling, liquid cooling, immersion cooling, evaporative cooling, free cooling, or hybrid cooling systems.[25] This program is developing transformational, highly efficient, and reliable cooling technologies for data centers, targeting cooling energy expenditures below 5% of a typical data center's IT load at any time or location in the U.S.[26]

The Energy Act of 2020 instructed Lawrence Berkley National Laboratory (LBNL) to provide an update to its 2016 "United States Data Center Energy Usage Report," which was completed and released in December 2024.[27] Additionally, in the CHIPS and Science Act, Congress specifically directed the Secretary of Energy to set up a program for fundamental research, development, and demonstration of energy-efficient computing and data center technologies.[28]

DOE's Nuclear Energy Activities

The Office of Nuclear Energy (NE), an applied office, supports DOE's mission in nuclear science and technology through its research, development, and demonstration activities. Its goal is to support the existing nuclear fleet, develop advanced reactors and fuels, and educate the next generation workforce with its university partnership programs. NE manages various programs including the Advanced Reactor Demonstration Program (ARDP), High-Assay Low-Enriched Uranium (HALEU) Availability Program, Space Power Systems, Nuclear Fuel Security Act, and Fuel Cycle Technologies.

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21 https://www.ornl.gov/news/frontier-supercomputer-debuts-worlds-fastest-breaking-exascale-barrier
22 https://top500.org/lists/top500/2024/11/
23 https://top500.org/lists/green500/list/2024/11/
24 https://www.nrel.gov/news/detail/program/2025/reducing-data-center-peak-cooling-demand-and-energy-costs-with-underground-thermal-energy-storage
25 https://www.digitalrealty.com/resources/articles/future-of-data-center-cooling
26 https://arpa-e.energy.gov/programs-and-initiatives/view-all-programs/coolerchips
27 Shehabi, Arman, et al. 2024 United States Data Center Energy Usage Report. Lawrence Berkeley National Laboratory, 2024. Report No. LBNL-2001637. University of California eScholarship, https://escholarship.org/uc/item/32d6m0d1.
28 "Text - H.R.4346 - 117th Congress (2021-2022): CHIPS and Science Act." *Congress.gov*, Library of Congress, 9 August 2022, https://www.congress.gov/bill/117th-congress/house-bill/4346/text.

NE oversees a robust nuclear fuels program, including the HALEU Availability Program and the Nuclear Fuel Security Act—both critical to many new next-generation (GEN IV) reactors that depend on Low-Enriched Uranium (LEU) and HALEU. Under the Energy Act of 2020, Congress authorized the HALEU availability program to support the research, development, and demonstration of HALEU, which received $800 million in appropriations through the Inflation Reduction Act (IRA). In April, DOE announced conditional agreements to provide HALEU to five companies: TRISO-X, Kairos Power, Radiant Industries, Westinghouse, and TerraPower. These shipments are vital, as delays in HALEU availability could postpone reactor deployment by up to two years.[29] In a related but distinct effort, the Nuclear Fuel Security Act, authorized by Congress in response to the war in Ukraine and Russia's dominance in the nuclear fuel cycle market, received $2.7 billion in FY24 appropriations. In the fall of 2024, DOE selected six companies—BWXT, Centrus, Framtome, GE Veronva, Orano, and Westinghouse—to support both the fuel cycle for LEU as well as HALEU.[30] Given these investments by Congress, Orano announced that it will build a 750,000-square-foot facility to produce low-enriched fuel, with the potential to produce HALEU as well. Urenco also recently announced a 15% expansion to its capacity to support the existing nuclear fleet.[31]

To support the development of new nuclear reactors, NE manages two major demonstration programs: ARDP and a Generation III+ (GEN III+) small modular reactor. First funded through the Consolidated Appropriations Act of 2020 and later authorized by the Energy Act of 2020, the ARDP program supports the demonstration of advanced light-water and non-light water nuclear reactors through three commercial pathways: Advanced Reactor Demos (Demos), Risk Reduction for Future Demonstration (Risk Reduction), and Advanced Reactor Concepts-20 (ARC-20). Under the Demos program, DOE selected X-Energy's Xe-100 reactor and TerraPower's Natrium reactor, which are both non-water designs. Additional selections by DOE include Kairos Power LLC's Hermes, Westinghouse's eVinci, BWX Technologies Inc. (BWXT) BWXT Advanced Nuclear Reactor (BANR), Holtec's SMR, and Southern Company's Molten Chloride Reactor Experiment (MCRE). The Risk Reduction program is milestone-based, requiring participants to meet mutually agreed upon achievements to secure funding. Lastly, DOE selected General Atomics, Massachusetts Institute of Technology, and Advanced Reactor Concepts for the ARC-20. In 2021, Congress passed the Infrastructure, Investment, and Jobs Act (IIJA), which appropriated $2.447 billion for ARDP. Most of this funding was allocated to the Demos program, and Congress has continued to support ARDP through subsequent appropriations. Additionally, in the FY 2024 Appropriations bill, Congress appropriated $800 million to support the deployment of a Gen III+ reactor and another $100 million for design, licensing, supply chain, and site preparation. Currently, DOE is in the process of selecting an awardee for this program, which will be announced in the near future.

The Idaho National Laboratory (INL), DOE's applied energy lab under NE, serves as a testbed for new reactor technologies and fuels. It also hosts several important users and test facilities. One of its oldest facilities, the Advanced Test Reactor (ATR), is a 60-year-old test reactor that uses highly enriched uranium to irradiate fuels. ATR has been instrumental to

[29] https://www.reuters.com/business/energy/us-backed-high-tech-nuclear-plant-wyoming-delayed-2022-12-14/
[30] https://www.orano.group/usa/en/our-portfolio-expertise/project-ike-enrichment
[31] https://www.world-nuclear-news.org/articles/first-phase-of-us-enrichment-plant-expansion-starts-up

improving fuel efficiency for both the domestic nuclear fleet and the nuclear navy. It is important to note that although Congress authorized the next-generation facility, the Versatile Test Reactor (VTR), funding has not yet been appropriated.

Authorized in the Nuclear Energy Innovation and Capabilities Act (NEICA), the National Reactor Innovation Center (NRIC), is located at INL and hosts multiple research facilities: the Demonstration of Microreactor Experiments (DOME), Laboratory for Operation and Testing in the United States (LOTUS), Helium Component Test Facility (He-CTF), and Molten Salt Thermophysical Examination Capability (MSREC). Though still under construction, the DOME facility will advance the development of new microreactor technologies such as Westinghouse's eVinci and Radiant's Kaleidos.[32] DOME is vital as some industry players are interested in deploying 30 microreactors at one site to power a data center given its reliability and waste management benefits. Meanwhile, LOTUS provides a testbed for new experimental reactor concepts and may eventually host Southern Company and TerraPower's MCRE.[33] In the coming years, INL will also complete the Microreactor Applications Research Validation and Evaluation (MARVEL) Project, which will test the operational capabilities of microreactors and evaluate their real-world applications. Although still under development, these facilities are poised to accelerate the new generation of reactors—many of which could play a role in powering future data centers.

[32] https://www.energy.gov/ne/articles/doe-awards-5-million-second-phase-advanced-reactor-experiment-designs

[33] https://www.powermag.com/the-power-interview-does-unique-new-advanced-nuclear-reactor-test-beds/