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REPORT

THE STATE OF NUCLEAR 2025

NEW LEADERSHIP, NEW CHALLENGES, NEW OPPORTUNITIES

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THE STATE OF NUCLEAR 2025: NEW LEADERSHIP, NEW CHALLENGES, NEW OPPORTUNITIES

2024 was marked by significant developments in the nuclear energy sector, shaped by evolving regulatory frameworks, legislative action, and growing global interest in nuclear power. In the United States the Accelerating Deployment of Versatile, Advanced Nuclear for Clean Energy Act (ADVANCE Act) was a major milestone, created to streamline regulatory processes and accelerate the deployment of advanced nuclear technologies. The extension of the Price-Anderson Act also reinforced long-term industry stability, ensuring continued liability protections for commercial reactors and US Department of Energy (DOE) contractors through 2065.

At the regulatory level, the Nuclear Regulatory Commission (NRC or Commission) continued multiple rulemaking efforts, including for the new 10 CFR Part 53 intended to modernize licensing for next-generation reactors. Internationally, momentum for nuclear energy continued to build as the first-ever Nuclear Energy Summit in Brussels saw world leaders reaffirm their commitment to nuclear power as a cornerstone of energy security and climate goals.

As the nuclear industry moves into 2025, shifting regulatory priorities, changing energy policies, and increased demand for reliable power are expected to form its trajectory. With new leadership at the NRC and a focus from the new administration on streamlining permitting of energy projects, attention will turn to how the agency balances efficiency with oversight, as well as how it implements the ADVANCE Act to refine its regulatory processes.

The rising energy demands of AI and data centers are also accelerating interest in nuclear power as a long-term, reliable, carbon-free solution, while federal policy changes, executive orders, and new tax credit guidance will play a key role in shaping nuclear investment and development. This report explores these emerging trends and their potential impacts, with an analysis of the key developments that will shape the nuclear industry in 2025.

RISE OF AI AND DATA CENTERS

The rapid expansion of artificial intelligence (AI) and digital infrastructure is fueling an unprecedented surge in energy demand, intensifying pressure on the power grid and challenging existing supply capabilities. AI workloads are projected to grow at an estimated 39% annually, while global data center electricity consumption is expected to nearly double to 835 terawatt-hours (TWh) by 2026, a figure that almost matches Japan's total national energy usage. As energy-intensive AI applications continue to scale, the industry is increasingly looking to reliable, carbon-free power sources. Nuclear energy, with its 93% capacity factor in the United States, has emerged as a leading solution due to its ability to provide stable, around-the-clock baseload power, and multiple data center companies have announced partnerships with nuclear power companies.

The nuclear industry has already taken notable steps to keep pace with rising energy demand, exploring advancements to enhance efficiency and improve reliability. The NRC has also begun evaluating how AI can enhance regulatory oversight, licensing, and operational efficiencies. In the months following the rollout of its AI Strategic Plan (NUREG-2261), the NRC issued a report outlining 36 potential AI use cases within the agency, including automating public comment reviews, aiding inspectors in scheduling, and implementing predictive analytics to improve regulatory decision-making. While the NRC does not

currently employ AI technologies, it has acknowledged the necessity of preparing for AI's expanding role in both the nuclear industry and its regulatory functions.

Nuclear Plant Restarts and the Further Development of Small Modular Reactors

Nuclear operators are actively exploring ways to expand capacity to keep pace with rising energy demand. The owners of three large light-water reactors that are currently shutdown—Palisades in Michigan, Three Mile Island Unit 1 in Pennsylvania, and Duane Arnold in Iowa—have announced efforts to restart their plants to bolster the nation's energy supply. Many plant owners are considering power "uprates" to increase the output of existing facilities, and nearly all operators across the existing fleet are planning to seek license renewals to allow continued operation for decades to come. Upon receipt of regulatory approvals from the NRC, these facilities will provide a significant boost to the domestic grid, helping to alleviate strain from growing industrial power consumption.

In addition to existing plant activities, operators and investors are exploring new reactor development projects across the full spectrum of sizes and technologies, from traditional large light-water reactors to small modular reactors (SMRs) to microreactors. While large traditional plants offer the greatest output, smaller options offer scalable, lower-cost alternatives and could provide a more flexible solution for meeting the energy needs of both electric utilities and AI-driven industries. The deployment of new reactors will require licensing approvals from the NRC and development of sustainable supply chains for components and fuels to facilitate their commercial viability.

Looking Ahead: The Future of Nuclear in AI-Powered Energy Demand

- **How will the growing energy demands of AI-driven workloads impact long-term power procurement strategies?** AI-related computing demands are expected to grow exponentially, leading data center operators to explore direct power purchase agreements (PPAs) and behind-the-meter nuclear co-location to ensure reliable, large-scale energy supply.
- **Will more tech companies turn to nuclear?** As major technology firms seek carbon-free power solutions, new public-private partnerships, infrastructure investments, and policy incentives are likely to play an increasingly important role in accelerating nuclear adoption.
- **What will regulatory decisions on data center co-location at nuclear plants mean for the industry?** With growing interest in behind-the-meter nuclear energy solutions, policymakers and regulators will need to clarify frameworks governing co-location feasibility, permitting, and compliance.

As AI technologies reshape the global energy landscape, commercial nuclear power stands at the forefront of efforts to provide sustainable, high-capacity solutions to meet the ever-growing demands of data-driven industries.

LEGAL DEVELOPMENTS IMPACTING NUCLEAR REGULATION AND NUCLEAR HAZARDS INDEMNITIES

National Environmental Policy Act (NEPA)

The DC Circuit Court's November 2024 decision in *Marin Audubon Society v. Federal Aviation Administration* was a landmark moment in environmental law, with the court issuing a stunning ruling that the Council on Environmental Quality (CEQ) lacks statutory authority to issue binding environmental

regulations implementing NEPA. This decision upended decades of administrative practice, raising questions about the implications for federal agencies that are subject to NEPA obligations. A few months later, CEQ issued an interim final rule rescinding those regulations altogether.

Despite the broad implications of these actions across the executive branch, they are not expected to significantly impact the NRC. The NRC's NEPA regulations, codified at 10 CFR Part 51, were developed independently, with the Commission explicitly stating in its 1984 Final Rule that it is not bound by CEQ's NEPA regulations. As a result, the NRC's approach to environmental reviews is expected to remain largely unaffected by these actions. However, we expect the NRC will take other actions to streamline its NEPA process, consistent with broader federal agency trends, and implement efficiencies mandated by the Fiscal Responsibility Act of 2023.

Ongoing Litigation on Spent Fuel Storage and the Price-Anderson Act

The NRC's authority to license Independent Spent Fuel Storage Installations is facing legal scrutiny, reflecting broader tensions over the federal government's role in managing nuclear waste. Pending litigation in Texas and New Mexico centers on whether the NRC exceeded its statutory authority in issuing licenses for private spent fuel storage at locations considered to be far away from the reactor sites. These cases will have broader implications for the long-term management of nuclear waste and could influence future policy decisions on consolidated interim storage. The US Supreme Court decision should be issued this summer.

Additionally, a recent ruling from the US Court of Appeals for the Federal Circuit reaffirmed the broad scope of the government's indemnification obligations under the Price-Anderson Act. The court found that the act requires the federal government to indemnify not just direct contractors but also third parties that may face liability for handling radioactive materials. This decision could have significant implications for companies involved in nuclear fuel transportation, storage, and disposal, reinforcing the government's responsibility for public liability arising from nuclear incidents. It too may appear before the Supreme Court.

Separately, in *Mazzocchio v. Cotter Corporation*, 120 F.4th 565 (8th Cir. 2024), the US Court of Appeals for the Eighth Circuit departed from the decisions of several of its sister circuits in holding that the applicable standard of care in a federal public liability action under the Price-Anderson Act is not the uniform federal dose limits, but rather is whatever individual local tort law standard might exist in the state where the lawsuit was filed. The standard-of-care issue is of particular interest to nuclear power companies because it will lead to inconsistencies in the legal standards applicable to nuclear plants and potentially increase costs of compliance and operations. A petition for writ of certiorari is pending with the Supreme Court.

Chevron Overturned: Limited Impact on NRC's Authority

The Supreme Court's *Loper Bright* decision overturned the long-standing Chevron deference, a judicial doctrine that previously required courts to defer to agency interpretations of ambiguous statutes. This ruling could lead to a rise in legal challenges against federal agency rulemaking but, as with *Marin Audubon*, its impact on the NRC is expected to be limited.

The NRC's broad discretionary authority, first established by the Atomic Energy Act of 1954 (AEA), has historically led courts to defer to its decisions without relying on Chevron. Courts have consistently recognized the US Congress's unique delegation of authority to the NRC, often applying a heightened level of deference to its regulatory decisions. Unlike other agencies that may now face greater judicial scrutiny, the NRC's statutory mandate and longstanding independence are likely to insulate it from major regulatory upheaval. A lawsuit filed in 2024 by Texas, Utah, and a startup reactor company challenging

the NRC's authority under the AEA to regulate very small reactors also may test the bounds of judicial deference to the NRC, assuming the case survives the government's dismissal motion.

Looking Ahead: Key Legal and Regulatory Questions for 2025

- **How will the NRC's independent approach to NEPA evolve in 2025?** With the rescission of CEQ regulations, many federal agencies will have to reassess their entire environmental review processes; in contrast, the NRC's self-contained NEPA framework remains largely intact but likely will see changes aimed at efficiency improvements.
- **Will policymakers push for long-term spent fuel solutions?** Ongoing litigation over private spent fuel storage is expected to reignite policy discussions around a permanent geologic repository and could spur new public-private storage initiatives.
- **How will the *Loper Bright* ruling shape future nuclear regulatory disputes?** While the NRC's authority is expected to remain strong, the post–*Loper Bright* legal landscape could open the door to new challenges that test the boundaries of agency discretion.

With legal and regulatory landscapes continuing to evolve, nuclear industry stakeholders should remain attentive to potential policy shifts, judicial decisions, and regulatory challenges that could shape nuclear licensing, environmental compliance, and liability frameworks in 2025 and beyond.

LEGISLATIVE, REGULATORY, AND POLICY UPDATES

The ADVANCE Act: Modernizing Nuclear Energy Regulation

Signed into law on July 9, 2024, the ADVANCE Act represented one of the most significant legislative efforts to modernize nuclear regulation and deployment in the United States. With overwhelming bipartisan support, the act aimed to streamline regulatory processes, reduce licensing costs, and position the country as a leader in advanced nuclear technology.

Among its many provisions, the act mandated fast-track licensing for nuclear projects at brownfield and retired fossil fuel sites, recognizing the economic and logistical advantages of repurposing existing infrastructure. The NRC was required to develop regulatory strategies or initiate rulemaking within two years to facilitate licensing at these sites. The act also sets strict deadlines for reviewing combined license applications for new reactors at existing or adjacent sites, establishing a 25-month timeline for final licensing decisions.

Beyond regulatory reforms, the ADVANCE Act also expanded opportunities for foreign investment by modifying longstanding ownership restrictions under the AEA. For the first time, entities from 39 allied nations are allowed to hold majority ownership stakes in US nuclear projects without NRC review over concerns about foreign ownership, control, and domination (FOCD) provided that the NRC determined such ownership posed no risk to national security, public health, or common defense.

NRC Mission Statement

Another key provision of the ADVANCE Act required the NRC to update its mission statement, ensuring that the agency's regulatory approach did not unnecessarily limit the development of nuclear energy. While this directive did not alter the NRC's nonpromotional role, it signaled a need for stronger policy emphasis on efficiency and regulatory predictability.

Following several months of internal debate within the Commission, an updated and approved mission statement was issued in January 2025, emphasizing a more proactive and enabling regulatory role:

> The NRC protects public health and safety and advances the nation's common defense and security by enabling the safe and secure use and deployment of civilian nuclear energy technologies and radioactive materials through efficient and reliable licensing, oversight, and regulation for the benefit of society and the environment.

Newly appointed NRC Chairman David Wright has underscored that the revised statement reflects a congressional directive to ensure the agency serves as an enabler of innovation while remaining grounded in the core principles of the AEA.

Looking Ahead: Charting the NRC's Next Steps

- **How will regulatory agencies translate the law into action?** Early implementation of the ADVANCE Act will be important to watch as it may offer insight into how the NRC balances such competing mandates as streamlining regulation, supporting innovation, and maintaining its core safety mission.
- **Will the mission statement change lead to tangible results?** The NRC is taking steps to ensure that its shift toward a more enabling mission is more than just lip service; it is developing implementation guidance for various agency functions and intends to require training for agency personnel aimed at supporting regulatory confidence while reinforcing a strong safety culture.

Taken together, these reforms signal a new era for the NRC—one focused on agility, transparency, and global leadership. In the coming months, as implementation continues, attention will turn to how the agency balances efficiency with oversight, fosters a resilient safety culture, and navigates new responsibilities in an evolving policy landscape.

2025 OUTLOOK: WHAT TO WATCH

2025 marks a critical period for nuclear energy as stakeholders continue to closely monitor how new leadership, evolving policy priorities, and regulatory reforms will shape the industry's trajectory. With growing national and international interest in nuclear energy, this year may prove pivotal in determining the pace and direction of deployment, oversight, and innovation.

Nuclear Energy Expansion, Investment, and Innovation

On the ground, the anticipated restart of the Palisades, Three Mile Island Unit 1, and Duane Arnold facilities, along with subsequent license renewals and power uprates, could significantly expand domestic capacity in the near-term, while new reactor deployments will continue that trend across the coming decades.

Internationally, tax credit guidance and foreign investment incentives may catalyze new deployments of advanced nuclear technologies, especially with the ADVANCE Act's relaxation on FOCD requirements and the new administration's push to bring foreign investment into the country. The impact of tariffs on the cost of steel and reactor components originating outside the United States also could affect the cost of advanced reactors. Whether these signals translate into long-term investment and project development will be a key story to watch in the months ahead.

Future of the NRC

NRC Chairman Wright steps into the role at a time when the agency faces a dual mandate: regulate the expansion of nuclear energy while also complying with broader federal efforts to streamline government operations. How the NRC navigates these pressures will be crucial. Questions remain about whether staffing and resource constraints could delay licensing reviews and how the agency will implement the ADVANCE Act's ambitious streamlining goals. The Commission's progress on the Part 53 rulemaking—and then how it implements the new regulations—also will serve as a key indicator of whether the NRC is prepared to modernize its approach and accelerate licensing for next-generation reactors.

Judicial and Legislative Uncertainty

Recent court decisions—particularly the overturning of *Chevron*—could lead to increased litigation and/or legislative responses that impact the NRC's regulatory framework. The industry will be watching for how these developments influence agency discretion and environmental review processes in 2025 and beyond.

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