PUBLIC COMMENT: FOUNDATION FOR DEFENSE OF DEMOCRACIES

Nuclear Regulatory Commission

Regulatory Framework for Fusion Machines

10 CFR Parts 20, 30, 37, 50, 51, 72, 110, 150, 170, and 171
[NRC-2023-0071]
RIN 3150-AL00

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Washington, DC
May 27, 2026

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Introduction

Within the next decade, a firm will likely announce that they have achieved commercial fusion energy. The real question is whether that firm will be Chinese or American.

Whether admitted or implied, both Washington and Beijing agree that a commercially viable source of fusion energy will fundamentally reshape global economic, technical, and military leadership. Beijing has surged ahead in its efforts to master fusion technology, pouring billions into state-backed programs not only to pursue basic research but to construct supply chains poised for aggressive industrial growth. The United States has also witnessed a historic pivot within its domestic fusion sector, as private firms attract a growing share of investment and continue to pioneer novel approaches to achieving and sustaining ignition. Washington also continues to work on fusion technology with its closest allies and partners, including the United Kingdom, Israel, and Japan, translating its technical capacity into a multilateral lattice of investments and supply chains.

These trends have elevated the importance of the Nuclear Regulatory Commission's (NRC's) role at the center of America's fusion sector. Though fusion remains an emerging technology, its future will soon no longer be confined to the laboratory, leaving the commission responsible for regulating a novel commercial market without established players — an opportunity to allow for open development and strong competition.

As private industry surges ahead of federal spending, the NRC will have significant influence in shaping the market for fusion power to allow for substantial innovation and contributing to public trust in nuclear power.

China Seeks To Master Commercial Fusion Technology

China is building out its national fusion program, with the aim of achieving commercialized small-scale fusion power by 2030 — an achievement which would place Beijing at the forefront of the next generation of nuclear technologies.

China is increasingly becoming a mature nuclear power in the fullest sense of the term. Beijing has accelerated its crash effort to build out a national fleet of advanced reactors to provide baseload power, phase out aging coal infrastructure, and develop the infrastructure required to export reactor technology at a scale competitive with the United States and Russia.[1] Over the past decade, China has collectively added 34 gigawatts of nuclear power to its grid — during the same period, the United States added effectively no new nuclear capacity, as the only additions came from the expansion of the Vogtle site in Georgia after billions in cost overruns.[2]

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[1] Jack Burnham, "Seeking to Expand Its Lead in Fusion Technology, China Accelerates Construction on New Reactor Project," *Foundation for Defense of Democracies*, May 2, 2025. (https://www.fdd.org/analysis/policy_briefs/2025/05/02/seeking-to-expand-its-lead-in-fusion-technology-china-accelerates-construction-on-new-reactor-project); Juzel Lloyd, "The Other Nuclear Race," *Foreign Affairs*, April 28, 2025. (https://www.foreignaffairs.com/china/other-nuclear-race)

[2] U.S. Energy Information Administration, "China continues rapid growth of nuclear power capacity," May 6, 2024. (https://www.eia.gov/todayinenergy/detail.php?id=61927); Jeff Amy, "Georgia nuclear rebirth arrives 7 years late, $17B over cost," *Associated Press*, May 25, 2023. (https://apnews.com/article/georgia-nuclear-power-plant-vogtle-

Beijing's efforts extend beyond the current scope of commercial activity and into the cutting edge of nuclear science. China has positioned fusion technology as a core political priority, listing it third in its 15th Five-Year Plan among emerging technologies that Beijing hopes to dominate by the end of the decade.[3] In seeking to scale the technology, Beijing plans to upgrade its tritium fuel supply chains, continue to conduct plasma operation experiments on deuterium-tritium fusion, and further other research and development activities.[4] This support will likely be channeled through the country's ongoing state-aligned fusion projects — the Experimental Advanced Superconducting Tokamak (EAST) and the Comprehensive Research Facility for Fusion Technology — along with future planned projects to develop next-generation reactors that combine proven fission technology with experimental fusion ignition mechanisms.[5]

China's projects have also a distinct military edge, particularly in the development of next-generation nuclear weapons. Beijing is currently engaged in a large-scale expansion of every facet of its nuclear arsenal, particularly its silo-based intercontinental ballistic missile capabilities.[6] Despite this rash of construction, however, China has limited practical experience testing its nuclear weapons program, having largely foresworn explosive tests in favor of computer simulations based on theoretical calculations and legacy data.[7]

As such, Beijing's investment in fusion and its associated infrastructure, particularly inertial confinement fusion, which uses lasers to squeeze fuel pellets together, offers a test environment to simulate the effects of hydrogen-based nuclear weapons, offering another avenue for the Chinese military to advance its weapons-related research efforts.[8] These tests may allow the Chinese military to design better warheads, shielding for critical components against the effects of a blast, and improve the reliability of its current arsenal, all without the political cost of restarting explosive testing.[9]

These efforts are supported by a public-private supply chain intended to spur eventual commercialization. China has developed a strong supply chain to produce *tokamaks*, the

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rates-costs-75c7a413cda3935dd551be9115e88a64). 34 gigawatts represent enough energy to power roughly 25 million homes for one year.

[3] "Authorized Release from the Two Sessions: Outline of the 15th Five-Year Plan for National Economic and Social Development of the People's Republic of China," *Xinhua* (China), March 13, 2026. (https://www.news.cn/politics/20260313/085af5de5a4b4268aa7d87d90817df2f/c.html)

[4] Ibid.

[5] Jack Burnham, "Seeking to Expand Its Lead in Fusion Technology, China Accelerates Construction on New Reactor Project," *Foundation for Defense of Democracies*, May 2, 2025. (https://www.fdd.org/analysis/policy_briefs/2025/05/02/seeking-to-expand-its-lead-in-fusion-technology-china-accelerates-construction-on-new-reactor-project)

[6] Jack Burnham and Andrea Stricker, "China's Covert Test May Signal a Shift in Beijing's Nuclear Posture," *Foundation for Defense of Democracies*, February 23, 2026. (https://www.fdd.org/analysis/2026/02/23/chinas-covert-test-may-signal-a-shift-in-beijings-nuclear-posture)

[7] Ibid.

[8] Jimmy Goodrich and David Feith," China May Grab a Lead in the Race for Military Fusion," *The Wall Street Journal*, February 23, 2026. (https://www.wsj.com/opinion/china-may-grab-a-lead-in-the-race-for-military-fusion-c5ab6d2b)

[9] Ibid; Jack Burnham and Andrea Stricker, "China's Covert Test May Signal a Shift in Beijing's Nuclear Posture," *Foundation for Defense of Democracies*, February 23, 2026. (https://www.fdd.org/analysis/2026/02/23/chinas-covert-test-may-signal-a-shift-in-beijings-nuclear-posture)

specialized machines designed for magnetic confinement fusion. These vessels, along with other methods of achieving fusion, often require highly defined metallic carpentry to produce components that can withstand the intense heat and pressure of the reaction — a natural avenue for China to transform its overarching lead in material science research into larger-scale industrial production.[10] This latent academic talent has also allowed China to become a global leader in filing fusion-related patents, gaining a commercial edge to eventually export the technology abroad.[11]

Tokamaks and other fusion devices also often require superconductive magnets to suspend the plasma and protect the reactor from the intense heat generated by fusion, a supply chain that China has long dominated given its monopoly over rare earth mining and refinement.[12] Rather than a hypothetical, this supply chain buildout also has current commercial dimensions, with Western fusion efforts often relying on critical magnet components from the Chinese Academy of Sciences' Institute of Plasma Physics.[13]

This supply chain, combined with intense state support for fusion technology, has allowed China's national fusion program to achieve several dramatic scientific achievements. In January, researchers at EAST reportedly increased the density of their plasma without producing instabilities, surpassing the Greenwald density limit, a metric historically associated with plasma instability.[14] China is also likely building facilities similar to the U.S. National Ignition Facility at the Livermore National Laboratory to potentially house either a laser-based fusion facility, which uses lasers to stimulate ignition, or a Z-pinch machine, which uses electrical currents to compress plasma into a dense column.[15]

America Relies on Private Investment To Spur Domestic Fusion Industry

To confront China's surging fusion sector and secure a leading edge in the race for commercialization, the United States should offer regulatory certainty to firms looking to invest

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[10] Mihir Torsekar, "Fusion and the Future of American Power," *The Coalition for a Prosperous America*, April 7, 2026. (https://prosperousamerica.org/fusion-and-the-future-of-american-power); Jennifer Wong Leung, Stephan Robin, and Danielle Cave, "ASPI's two-decade Critical Technology Tracker: The rewards of long-term research investment," *Australian Strategic Policy Institute*, August 2024. (https://ad-aspi.s3.ap-southeast-2.amazonaws.com/2024-08/ASPIs%20two-decade%20Critical%20Technology%20Tracker_1.pdf)
[11] Chris Qihan Zou, "China and the Race for Nuclear Fusion," *The Diplomat*, June 11, 2024. (https://thediplomat.com/2024/06/china-and-the-race-for-nuclear-fusion)
[12] Elaine K. Dezenski, Daniel Swift, and Susan Soh, "Forging a New Critical Minerals Reality," *Foundation for Defense of Democracies*, March 19, 2026. (https://www.fdd.org/analysis/2026/03/19/forging-a-new-critical-minerals-reality)
[13] "China Delivers Key Components for World's Largest 'Artificial Sun,'" *Chinese Academy of Sciences*, April 14, 2025. (https://english.cas.cn/newsroom/cas_media/202504/t20250414_1041124.shtml)
[14] Jiaxing Liu, Ping Zhu, Dominique Franck Escande, Wenbin Liu, Shiwei Xue, Xin Lin, Panjun Tang, Liang Wang, Ning Yan, Jinju Yang, Yanmin Duan, Kai Jia, Zhenwei Wu, Yunxin Cheng, Ling Zhang, Jinping Qian, Rui Ding, and Ruijie Zhou, "Accessing the density-free regime with ECRH-assisted ohmic start-up on EAST," *Science Advances*, January 1, 2026. (https://www.science.org/doi/10.1126/sciadv.adz3040)
[15] Jack Burnham, "Seeking to Expand Its Lead in Fusion Technology, China Accelerates Construction on New Reactor Project," *Foundation for Defense of Democracies*, May 2, 2025. (https://www.fdd.org/analysis/policy_briefs/2025/05/02/seeking-to-expand-its-lead-in-fusion-technology-china-accelerates-construction-on-new-reactor-project)

in fusion reactors, allowing private industry — the largest investor in the American fusion sector — to continue its current build-out of next-generation nuclear technologies.

While private fusion efforts have historically relied on federal research funding, this has become a complementary source of dollars as private investment has surged. Federal appropriations for fusion research reached roughly $1.5 billion in 2024, primarily funneled through the Department of Energy's (DOE's) Office of Fusion Energy Sciences and the National Nuclear Security Administration's (NNSA's) inertial confinement fusion program.[16] However, this number is likely biased upward in Washington's favor, as the NNSA is primarily responsible for the safeguarding of America's nuclear arsenal rather than developing commercial fusion technologies. These efforts have been joined with significant private funding, with Commonwealth Fusion earning $863 million in Series B2 funding, a major milestone for still-nascent technology.[17]

Moreover, federal spending is also primarily directed towards basic research — a critical investment for the long-term future of fusion, but not necessarily one tied directly to rapid commercialization. Though Washington was a founding contributor to the International Thermonuclear Experimental Reactor (ITER), a 35-nation project hosted in France that began in 2010 and is currently expected to begin deuterium–tritium fusion by 2039, U.S. funding has varied over the past several years.[18] This initiative was partially overtaken by the Innovation Network for Fusion Energy (INFUSE) program, which provided cost-sharing mechanisms to allow commercial firms and universities to study fusion-related technologies, but remains limited in its scope.[19] Washington also bolstered its investment in basic research via the launch of the Fusion Innovative Research Engine (FIRE), which was intended to lay the groundwork for commercial fusion power by the end of the decade by driving both basic research and supply chain development initiatives.[20]

In contrast, commercial firms have pioneered alternative methods to produce ignition and control fusion reactions. Commonwealth Fusion Systems, Helion, and Type One Energy have introduced a range of possible commercial technologies, from Commonwealth's tokamak to Type One's

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[16] "Congress Increases U.S. Funding for Fusion Energy Sciences Research," *Fusion Industry Association*, March 7, 2024. (https://www.fusionindustryassociation.org/congress-increases-u-s-funding-for-fusion-energy-sciences-research); Consolidated Appropriations Act, 2024, Pub. L. No. 118-42, 138 Stat. 25.

[17] "Commonwealth Fusion Systems Raises $863 Million Series B2 Round to Accelerate the Commercialization of Fusion Energy," Commonwealth Fusion Systems, August 28, 2025. (https://cfs.energy/news-and-media/commonwealth-fusion-systems-raises-863-million-series-b2-round-to-accelerate-the-commercialization-of-fusion-energy)

[18] Geert De Clercq, "ITER nuclear fusion project faces delay over Trump budget cuts," *Reuters*, December 7, 2017. (https://www.reuters.com/article/markets/currencies/iter-nuclear-fusion-project-faces-delay-over-trump-budget-cuts-idUSKBN1E01RS)

[19] Department of Energy, "Department of Energy Announces $5 Million for Fusion Research via Public-Private Partnerships," November 26, 2024. (https://www.energy.gov/science/articles/department-energy-announces-5-million-fusion-research-public-private-partnerships)

[20] Department of Energy, "U.S. Department of Energy Announces Selectees for $107 Million Fusion Innovation Research Engine Collaboratives, and Progress in Milestone Program Inspired by NASA," January 16, 2025. (https://www.energy.gov/articles/us-department-energy-announces-selectees-107-million-fusion-innovation-research-engine)

stellarator, which uses a system of coils to produce a twisted magnetic field to confine plasma.[21] While not yet stable as a source of commercial power, these technologies are increasingly viable, with newer high-temperature superconductors allowing firms to build fusion reactors on a smaller, more efficient scale than the NNSA's inertial confinement fusion program housed at Livermore National Laboratory.

Lastly, while some aspects of Washington's fusion agenda have expanded over the past several years, others have suffered significant cuts. While the NNSA was first in achieving "ignition," generating more energy from fusion than was used to produce the reaction, the agency suffered from significant personnel cuts that were partially reversed, producing upheaval across its range of research programs.[22] Moreover, DOE's newly created Office of Fusion, which is intended to consolidate ongoing fusion-related research, remains limited due to its recency, placing Washington at an institutional disadvantage to both the private sector and China's longer-running state-backed fusion initiatives.

Recommendations

The surge of Chinese investment in fusion technologies, coupled with a growing private industry in the United States, places the NRC at the center of shaping this emerging sector. The commission should focus on offering regulatory certainty by clarifying and easing the licensing regime needed to operate such devices, recognizing both the surge of private sector investment in fusion and the still-experimental nature of the technology. Moreover, the NRC should also ensure that its regulations uphold appropriate but rigorous health and safety standards to build out public trust in the nuclear industry, a key facet of any effort to ensure that the United States continues to lead in nuclear technologies.

- **The NRC should adopt the definition of a "fusion machine" in the ADVANCE Act.** The ADVANCE Act defines a fusion machine based on its operational capacity to transform atomic nuclei, through fusion processes, into different elements, isotopes, or other particles; and capture the resultant energy. This definition will allow the private sector to pursue a broad range of innovative mechanisms to achieve ignition without being overly prescriptive while allowing for adequate regulatory capture of emerging technologies.

- **The NRC should prioritize a risk-informed approach to regulating fusion machines under its existing byproduct materials framework.** The NRC's byproduct material license more accurately captures the experimental state of the fusion industry, rather than applying the standards imposed by a more onerous nuclear power plant license. As

[21] Zach Winn, "MIT spinout Commonwealth Fusion Systems unveils plans for the world's first fusion power plant," *MIT News*, December 17, 2024. (https://news.mit.edu/2024/commonwealth-fusion-systems-unveils-worlds-first-fusion-power-plant-1217); Tom Clynes, "Two Fusion Firms Unveil Stellarator Blueprints," *IEEE Spectrum*, April 9, 2025. (https://spectrum.ieee.org/stellarator)

[22] Geoff Brumfiel, "Trump firings cause chaos at agency responsible for America's nuclear weapons," *NPR*, February 14, 2025. (https://www.npr.org/2025/02/14/nx-s1-5298190/nuclear-agency-trump-firings-nnsa); Department of Energy, "NNSA and Lawrence Livermore National Laboratory Advance Laser Upgrade for Nuclear Stockpile Mission Ahead of Schedule," April 13, 2026. (https://www.energy.gov/nnsa/articles/nnsa-and-lawrence-livermore-national-laboratory-advance-laser-upgrade-nuclear-0)

ignition remains a relatively novel phenomenon, in contrast to nearly 70 years of commercial fission, the NRC should seek to regulate fusion reactors as emerging technologies rather than a more mature sector. Moreover, this approach will still ensure that fusion experiments and the associated byproducts do not pose a risk to workers, the public, or the environment.

- **The NRC should allow the Commerce Department to exert primary export control authority over fusion machines while considering supply chain requirements for applicants.** The NRC should continue to update export controls on fusion machines and related components as required, acting in conjunction with the International Atomic Energy Agency and relevant allies and partners collaborating on joint research projects. However, the NRC should also encourage proactive collaboration with the Bureau of Industry and Security, particularly as the race towards commercial fusion between China and the United States will likely intensify in the coming years. The NRC should also consider updating its regulatory authorities to request additional information on suppliers of fusion-related equipment into the United States, particularly components sourced from foreign adversaries.

- **The NRC should allow fusion-machine-produced byproduct material to be disposed at low-level radioactive waste disposal facilities.** Fusion machines primarily produce short-lived radioactive waste, particularly tritium, which typically has a half-life of 12.3 years — in contrast, plutonium and uranium fuel rods often have half-lives measured in tens of thousands of years. This distinction ensures that the NRC's current licensing requirements for the disposal of radioactive waste are sufficient for fusion byproducts, and that other byproducts generated by novel forms of fusion should similarly be capable of being stored at low-level radioactive waste facilities.

- **The NRC should ensure that an applicant submits an environmental report for the construction and operation of a fusion machine.** Applicants should maintain records of production of tritium and activation products to ensure that the commission can assess their capacity to adequately protect public health and safety and the environment. This process may also spur greater public confidence in the safety of America's nuclear industry, a perennial issue which has hindered the development of nuclear power.

Conclusion

As China increases its state-backed investments in fusion technology, the United States should rely on the strength of its private sector to develop commercialized fusion energy. To support this effort, the commission should prioritize regulatory certainty that underpins both investment and experimentation while building public trust in nuclear power.

Thank you for considering our comments. We look forward to seeing how our input is incorporated into the commission's ongoing policy work.