

# PUBLIC SUBMISSION

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**Comment On:** NSF-2025-OGC-0001-0001  
Request for Information: Development of a 2025 National Artificial Intelligence Research and Development Strategic Plan

**Document:** NSF-2025-OGC-0001-DRAFT-0192  
Comment on FR Doc # 2025-07332

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## Submitter Information

**Organization:** Liquid Cooling Coalition

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## General Comment

Please see the Liquid Cooling Coalition's attached submission to the Request for Information on the Development of a 2025 National Artificial Intelligence Research and Development Strategic Plan - Docket ID No. NSF-2025-OGC-0001. This has also been submitted via email to [ostp-ai-rd-sp-rfi@nitrd.gov](mailto:ostp-ai-rd-sp-rfi@nitrd.gov)

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## Attachments

NSF RFI R and D 20250529 LCC

May 29, 2025

Attn: Faisal D'Souza, NCO  
AI Action Plan  
2415 Eisenhower Avenue  
Alexandria, VA 22314  
Via email: [ostp-ai-rd-sp-rfi@nitrd.gov](mailto:ostp-ai-rd-sp-rfi@nitrd.gov) and <https://www.regulations.gov>

**Re: Request for Information on the Development of a 2025 National Artificial Intelligence (AI) Research and Development Strategic Plan - Docket ID No. NSF-2025-OGC- 0001**

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**To Whom It May Concern:**

The Liquid Cooling Coalition (LCC) appreciates the opportunity to provide comments on the [Request for Information on the Development of a 2025 National Artificial Intelligence \(AI\) Research and Development \(R&D\) Strategic Plan](#) issued by the Networking and Information Technology Research and Development (NITRD) National Coordination Office (NCO), National Science Foundation on April 29, 2025.

The LCC<sup>1</sup> is an industry coalition dedicated to advancing the adoption of liquid cooling to enable a sustainable future for data centers. Our members include industrial coolant producers, original equipment manufacturers, original device manufacturers, operators of high-performance computing (HPC) applications, and data center providers. **Liquid cooling** uses a liquid coolant, like water, to absorb and transfer heat away from electronic components, offering more efficient and effective cooling than air cooling.

We understand that this RFI will directly feed into the AI Action Plan to advance America's AI leadership as called for under [Executive Order 14179](#), "Removing Barriers to American Leadership in Artificial Intelligence" in order "to establish a U.S. policy for

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<sup>1</sup> [www.lccoalition.com](http://www.lccoalition.com).

sustaining and enhancing America’s AI dominance in order to promote human flourishing, economic competitiveness, and national security.” We also understand that this RFI is intended to collect input for identifying Federal strategic priorities for AI research and development, with particular attention on areas that industry is unlikely to address on its own. Furthermore, this RFI is aimed at identifying “research needs and development challenges that the Federal government should prioritize over the next 3 to 5 years, along with ideas for novel mechanisms for research partnerships with industry and/or academia.”

The growth of AI is a transformative force, shaping the economic, technological, and industrial landscape in the United States. However, there is a critical need for additional focus on the infrastructure needs that are critical to enabling the full deployment of AI technologies. Unfortunately, as it stands, many of the U.S.’ existing data centers are not optimized for accelerated computing capabilities including AI, HPC, and Quantum computing. (**Note:** for the purposes of these comments, all categories of accelerated computing are categorized as “AI computing”).

Our comments are focused on proposals for R&D that will help address fundamental changes to data center cooling systems required to support AI. Specifically, we are emphasizing R&D that will help ensure the necessary technologies are developed to ensure U.S. data centers have the advanced cooling capabilities necessary to unlock the full potential of AI applications.

## The Importance of Liquid Cooling in AI Data Centers

The *2024 United States Data Center Energy Usage Report* published by Lawrence Berkeley National Laboratory indicates that data centers accounted for **4.4 percent of total U.S. electricity consumption in 2023**, up from **1.9 percent in 2018**.<sup>2</sup> The report further projects that data centers could represent **between 6.7 percent and 12.8 percent of total electricity consumption by 2028**, due to the rapid growth of artificial intelligence (AI), cloud computing, and other digital technologies.

This significant increase in electricity demand presents challenges to the resilience, reliability, and affordability of the electric grid. Improving energy efficiency in data centers is essential to managing this demand. Traditionally, most data centers have relied on air cooling to keep servers cool. However, **liquid cooling technologies**—which directly cool heat-generating components with liquids rather than air—have

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<sup>2</sup> Arman Shehabi et al., *2024 United States Data Center Energy Usage Report* (Berkeley, CA: Lawrence Berkeley National Laboratory, December 2024), <https://eta-publications.lbl.gov/sites/default/files/2024-12/lbnl-2024-united-states-data-center-energy-usage-report.pdf>.

emerged as a more effective and efficient approach for increasing thermal efficiency and reducing power use in high-performance computing environments.

According to server manufacturer reports, including product data published in 2023, **liquid-cooled AI server systems have demonstrated up to a 40 percent reduction in total data center power consumption** compared to air-cooled systems.<sup>3</sup> Broader deployment of liquid cooling can also significantly reduce the carbon intensity and energy footprint of U.S. data centers while supporting American innovation and competitiveness in the global digital economy.

Furthermore, liquid cooling is becoming increasingly essential for AI computing. According to The Green Grid, an industry consortium focused on data center energy efficiency, air-cooled racks reach their limit at 15 to 25 kilowatts (kW) per rack, beyond which liquid cooling is required.<sup>4</sup> Since 2024, each new generation of AI chips has significantly increased in computing capacity, driving power densities and heat loads well beyond the 23kW threshold identified by The Green Grid as the upper limit for air cooling. These advancements have made liquid-cooled architectures not only advantageous but necessary to support the thermal demands of high-performance AI systems.<sup>5,6</sup>

Additionally, because liquid cooling systems are more efficient in capturing heat, they make it possible to reuse excess heat for other purposes, such as heating nearby buildings or industrial processes, thereby enhancing overall energy efficiency and sustainability.

## Recommendations for R&D for Advanced Cooling for AI

We recommend that the AI Action Plan create a special program in one or more of the Department of Energy's (DOE) National Laboratories or establish a collaboration with a laboratory at an existing university to promote advanced cooling for AI data centers. This program should focus on public-private collaboration, with DOE playing a key role in co-designing advanced cooling solutions that address public sector needs and the rapidly increasing thermal densities of computing chips, which traditional air-cooling systems cannot manage. Such a program should be designed to ensure that, while the

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<sup>3</sup> Supermicro. "Supermicro Launches Industry's First NVIDIA HGX H100 8 and 4-GPU H100 Servers with Liquid Cooling." Supermicro Investor Relations. May 21, 2023. <https://ir.supermicro.com/news/news-details/2023/Supermicro-Launches-Industrys-First-NVIDIA-HGX-H100-8-and-4-GPU-H100-Servers-with-Liquid-Cooling---Reduces-Data-Center-Power-Costs-by-Up-to-40/default.aspx>.

<sup>4</sup> The Green Grid, "Liquid Cooling Technology Update," accessed April 22, 2025, <https://www.thegreengrid.org/en/resources/library-and-tools/442-WP%23-70---Liquid-Cooling-Technology-Update>.

<sup>5</sup> AMAX, "Top 5 Considerations for Deploying NVIDIA Blackwell," accessed April 22, 2025, <https://www.amax.com/top-5-considerations-for-deploying-nvidia-blackwell/>.

<sup>6</sup> NVIDIA's Rubin Ultra NVL576 Rack Expected to Be 600kW, Coming in the Second Half of 2027," Data Center Dynamics, accessed April 22, 2025, <https://www.datacenterdynamics.com/en/news/nvidias-rubin-ultra-nvl576-rack-expected-to-be-600kw-coming-second-half-of-2027/>.

private sector is focused on commercialization, DOE prioritizes AI applications directed towards societal benefits. Some of the topics for AI computing that we recommend be included in such a research program are:

- i. The most optimal cooling system capable of managing thermal densities of 600+kw rack densities.
- ii. Reliability and compatibility of various liquid cooling fluids with electronics equipment.
- iii. Lifecycle management best practices for environmental and human safety and health for fluids.
- iv. Feasibility of heat reuse in data centers in order to improve overall energy efficiency, power management, and waste reduction. Research on heat reuse could promote new economic opportunities for industry, increase support for data centers, and promote new economic opportunities for U.S. industry.

It is critical that the U.S. government conduct and support R&D to ensure that U.S. data centers are fit for purpose for the age of AI computing. To that end, funding should be provided to ensure the efficient and strategic integration of liquid cooling in new and existing data centers. This goes beyond a mere hardware swap from air to liquid cooling systems. Optimal liquid cooling effectiveness hinges on holistic design integration from the chip level throughout the entire data center infrastructure. This necessitates close collaboration between researchers, design engineers and IT specialists.

## **Conclusion**

The LCC is happy to coordinate with industry stakeholders to identify more specific advanced cooling research topics and partners.

Respectfully submitted,

Erica Thomas  
Executive Director  
**Liquid Cooling Coalition**