Shaping Tomorrow's Built Environment Today

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November 7, 2024

Mr. Charles Yang
AI and Supply Chain Policy Advisor
Office of Critical and Emerging Technologies
U.S. Department of Energy
1000 Independence Avenue Southwest
Washington, D.C. 20585

Re: Notice of Request for Information (RFI) on Frontiers in AI for Science, Security, and Technology (FASST) Initiative

Sent via email to: *FASST@hq.doe.gov*

Dear Mr. Yang:

Thank you for the opportunity to provide input on the September 12, 2024 Request for Information (RFI) issued by the U.S. Department of Energy's (DOE's) Office of Critical and Emerging Technologies (CET). We appreciate CET asking for comment to inform how DOE and its 17 national laboratories can leverage existing assets to provide a national artificial intelligence (AI) capability for the public interest. We also appreciate that you are seeking input to inform your proposed Frontiers in AI for Science, Security and Technology (FASST) Initiative, which seeks to build the world's most powerful, integrated scientific AI models for scientific discovery, applied energy deployment, and national security applications.

ASHRAE, the American Society of Heating, Refrigeration, and Air-conditioning Engineers, founded in 1894, is a technical society advancing human well-being through sustainable technology for the built environment. The Society and its more than 54,000 individual members – comprising engineers, academics and other professionals in the buildings industry – focus on building systems, energy efficiency, indoor air quality, refrigeration and sustainability within the industry. ASHRAE is actively engaged in the development of

voluntary consensus-based standards and is one of only six standards-developing organizations in the U.S. that can self- certify that its standards have followed procedures established by the American National Standards Institute (ANSI). ASHRAE has been at the forefront of developing standards for the data center industry for over 10 years. Our response to the specific questions presented in the RFI is provided in the attachment.

We appreciate your consideration of ASHRAE's input and would be happy to provide any additional information needed. If you would like any clarification on the submitted response or have any other questions, please contact GovAffairs@ashrae.org.

Sincerely,

M. Dennis Knight, P.E.
2024-2025 ASHRAE President

cc: Marcus Hassen, Chair, ASHRAE Standing Standard Project Committee 90.4

Enclosure: ASHRAE Response to RFI on Frontiers in AI for Science, Security, and Technology Initiative

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1(c) Are there partner organizations with relevant scientific or energy-related data that DOE should work with?

We recommend that DOE work with ASHRAE, specifically with its subject matter experts who focus on data centers design and operation:

ASHRAE Standing Standards Project Committee 90.4, *Energy Standard for Data Centers.* This committee is responsible for keeping Standard 90.4, Energy Standard for Data Centers, under continuous maintenance with regular updates and revisions. The purpose of this standard is to provide minimum energy efficiency requirements for the design and operation of data centers.

Standard 90.4 offers a framework for the energy efficient design of data centers with special consideration to their unique load requirements compared to other buildings. This includes the maximum mechanical load component (MLC) and electrical loss component (ELC) values required for compliance which have been lowered in recognition of the industry's changing technologies and improved efficiencies. MLC is the sum of all power required for cooling, fans, pumps and heat rejection equipment, divided by the power for the data center. ELC is calculated using the worst-case parts of each segment of the power chain to demonstrate a minimum level of electrically efficient design.

This standard was developed under the guiding principle that data centers are mission critical facilities demanding careful attention to the potential impact of its requirements. Since 2019, ASHRAE Standard 90.1 (*Energy Standard for Buildings Except Low-Rise Residential Buildings*) has referenced Standard 90.4 as an alternative compliance path for large computer rooms, i.e., data centers. ASHRAE Standard 90.1 is an alternative compliance path for the International Energy Conservation Code (IECC), and with more jurisdictions updating their codes for compliance, ASHRAE Standard 90.4 is now more relevant than ever as data center industries are continuing to expand to new parts of the country.

Standard 90.4 applies to data centers with a conditioned floor space that has a power density greater than 20 W/ft^2 and IT equipment loads greater than 10 kW. It contains specific requirements for mechanical and electrical systems installed in new data centers or in data

center additions/alterations that require new mechanical or electrical systems. It addresses a large number of facilities: there are millions of data centers in the U.S. alone, from small "Edge" rooms to large "Hyperscale" cloud facilities, which can include Artificial Intelligence facilities.

Standard 90.4 promotes energy-efficient designs that harness the increasing availability of improved systems and techniques to enhance data center performance without compromising availability or reliability. Heat generation also warrants consideration; a typical large data center will generate between 20 and 50 megawatts of heat. New opportunities for co-location near other facilities and campuses can reclaim this heat.

Standard 90.4 has been recognized or referenced directly by the following entities:

- The National Renewable Energy Laboratory (NREL) recommends that data centers follow the Standard 90.4 guidelines for data center temperature range but consider operating at the maximum allowable range as specified in the standard.[1]
- The State of Oregon requires compliance with Standard 90.4-2019 for power distribution systems and equipment serving a data center.
- Washington's energy code includes sections 6 and 8 of Standard 90.4-2019; Heating, Ventilation, and Air-Conditioning; and Power, respectively.
- The 2024 International Energy Conservation Code (IECC) Section C 403.1.2 requires systems to comply with Section 6 (Heating, Ventilation, and Air Conditioning) and Section 8 (Power) of Standard 90.4-2019.

Standard 90.4 has been improved and expanded in the following ways from the 2019 edition to the 2022 edition:

- Compliance can be achieved without the use of an economizer and while following ASHRAE TC 9.9 Thermal Guidelines.
- Provides new methodology to apply credit to MLC and ELC combined for on-site renewable energy deployment.
- Includes specific language to give credit for recovered heat (heat reclaim) shared with non-data center spaces.

[1] NREL. 2023. *Reducing Commercial Building Process Loads and Refrigeration Unit Energy Consumption*. https://betterbuildingssolutioncenter.energy.gov/sites/default/files/attachments/ReducingCommercialBuildingProcessLoads.pdf

- ELC removed the incoming service segment from its calculations and requirements, thereby lowering the threshold for meeting compliance.

ASHRAE Technical Committee 9.9, Mission Critical Facilities, Data Centers, Technology Spaces and Electronic Equipment. ASHRAE recommends that DOE also work with this technical committee, which is concerned with all aspects of mission critical facilities, technology spaces, and electronic equipment/systems. This includes data centers, computer rooms/closets, server rooms, raised floor environments, high-density loads, emergency network operations centers, telecom facilities, communications rooms/closets, and electronic equipment rooms/closets. One of the TC's flagship publications is the *Thermal Guidelines for Data Processing Environments*, which was first published in 2004 with the most recent fifth edition published in 2021. The Thermal Guidelines have become the global de facto industry standard for the data center industry. TC 9.9 serves as the cognizant technical committee within ASHRAE for questions and issues related to data center facilities and equipment.

ASHRAE TC 9.9 also has many other resources and guidance for data centers, including the Datacom Encyclopedia. This comprehensive online encyclopedia collects essential knowledge about important datacom topics such as facility design considerations, ITE design considerations, environmental guidelines, cooling technologies, and energy efficiency in a central hub, providing on-demand access to frequently updated datacom-related content. The Encyclopedia and other resources can be found on the ASHRAE website here: https://www.ashrae.org/technical-resources/bookstore/datacom-series

Additionally, TC 9.9 conducts research for the data center and datacom industry. On a broader note, TC 9.9 also is responsible for writing and updating 'Chapter 20: Data Centers and Telecommunication Facilities' of the well-known *"ASHRAE Handbook - HVAC Applications."* Information regarding content and updates with the datacom industry can be found here: https://www.ashrae.org/news/esociety/data-centers-telecommunications-facilities-handbook-chapter-updates

Each year TC 9.9 also publishes white papers, hosts fora, and provides conference presentations featuring emerging changes in the data center industry. These publications can be found at this link:
https://tpc.ashrae.org/Documents?cmtKey=fd4a4ee6-96a3-4f61-8b85-43418dfa988d

In addition to overseeing Standing Standards Project Committee 90.4, TC 9.9 also oversees Standing Standard Project Committee 127:

ANSI/ASHRAE Standard 127-2020: Method of Testing for Rating Air-Conditioning Units Serving Data Center (DC) and Other Information Technology Equipment (ITE) Spaces

The purpose of this standard is to establish a uniform set of test requirements for rating air-conditioning units in data center (DC) and other information technology equipment (ITE) spaces. At the request of DOE, this standard was updated in 2007 to modernize it in preparation for new Minimum Data Center Air Conditioning Equipment Federal efficiency requirements, which ultimately went into effect in 2016. At that time, the standard was referenced in the Federal Register until certification methods through AHRI 1360-2022 *"Performance Rating of Computer and Data Processing Room Air Conditioners"* were established. The standard was again updated in 2012 and 2020 to add newer types of equipment.

The standard applies to classes of air-conditioning units that are used to air condition DC and ITE spaces. Such units must be able to be tested using an air enthalpy method and facilitate heat transfer across at least one heat exchanger. The standard serves to provide overarching test methodologies for DC and ITE cooling technologies, regardless of their state of adoption, to support rapid product evolution.

Historically, the scope has been focused on equipment that cooled the air in Data Centers. In 2023, due to the Data Center Server industry returning in part to using liquid cooled server products, a change in the Title Purpose and Scope of ASHRAE 127 has been undertaken by a broad group of server and cooling equipment manufacturers to add new test and rating methods for equipment that provides cooling fluid to the servers in addition to the incumbent air-cooling products. A revised version is expected to be published in 2025 with expected ongoing revisions with advances in technology. Due to the high heat density and methods of cooling Artificial Intelligence servers, the method of test in ASHRAE 127 will continue to evolve.