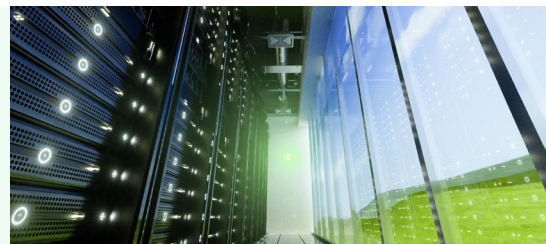


Artificial Intelligence-Related Data Center Electricity Use and Emissions Workshop



In recent years, the global adoption of artificial intelligence (AI) has spurred significant construction and investment in new data centers and cloud computing. These data centers require large-scale continuous power, posing challenges for local electric grids and broader climate goals. This workshop will explore how to map, measure, and mitigate the impacts of AI data center electricity usage. Speakers from the computing industry, utilities, and government will discuss how recent AI developments can impact energy demands, identify options to mitigate increased electricity use and emissions, and consider regional implications related to data center siting and renewable resource availability.

TUESDAY, NOVEMBER 12, 2024

- Purpose**
- Zero in on AI trends that necessitate the growth of data centers
 - Explore advances in data center infrastructure and grid integration
 - Discuss the sustainability analyses of data centers from local and academic perspectives

8:00–8:30¹ BREAKFAST

8:30–9:00 Welcome and Opening Remarks

Kasia Kornecki, National Academies Board on Energy and Environmental Systems
Benjamin Lee, University of Pennsylvania, *Planning Committee Chair*

9:00–9:30 Keynote Presentation – Evolution of Data Center Energy Use

Lawrence Berkeley National Laboratory (LBNL) has studied and modeled the growth of data center energy use for over 25 years. Dr. Arman Shehabi (LBNL) will describe how data center energy use has evolved over the past two decades, sometimes rapidly increasing and at other times remaining relatively flat and discuss the drivers of that change. Dr. Shehabi will also present findings from the upcoming 2024 Data Center Energy Report to Congress and how the rise of highly specialized hardware and artificial intelligence are changing the data center landscape and creating new opportunities for efficiency and decarbonization. A Q&A session with the audience will follow.

¹ All times shown in ET

9:40–11:00 Moderated Panel Discussion – AI Technologies: Trends and Future Use Cases

This session will examine the trajectory of artificial intelligence, taking a holistic view of data processing, training, and inference. Opening remarks will elevate emerging models and applications driving future computational demands. The following moderated discussion will explore the implications of future use cases on electricity use and computing resource demands.

Moderator: Benjamin Lee, University of Pennsylvania, *Planning Committee Chair*
Speakers:

- Eric Xing, Carnegie Mellon University
- Prakhar Mehrotra, Blackstone

11:10–12:40 Moderated Panel Discussion – Data Center Infrastructure

This session will examine how data center design and operations adapt—and should continue to evolve—to meet the rising energy demands of AI workloads. Opening remarks will explore how data centers can achieve greater flexibility in their power consumption. A moderated panel discussion will focus on coupling flexible computing and infrastructure management, including cooling, with realistic performance and sustainability goals, ensuring scalability and responsiveness in the face of AI-driven demand.

Moderator: Ayse Coskun, Boston University, *Planning Committee Member*
Speakers:

- Adam Wierman, Caltech & Verrus
- Andrew Chien, University of Chicago
- Peter de Bock, U.S. Department of Energy, Advanced Research Projects Agency – Energy
- Ricardo Bianchini, Microsoft (Azure)

12:40–1:40 LUNCH

1:00-1:30 Fireside Chat – System Operator Perspectives on Connecting Grid-Friendly Data Centers

This session will highlight the on-the-ground experiences of utilities as more data centers are connected to the grid. Representatives from the Electric Reliability Council of Texas and Virginia's Dominion Energy will highlight the challenges and opportunities they are seeing in their states.

Moderator: K. John Holmes, National Academies Board on Energy and Environmental Systems

Speakers:

- Agee Springer, Electric Reliability Council of Texas
- Robert Wright, Dominion Energy

1:40–2:10 Keynote Presentation – Impact of Data Centers: Projected Power Use and Potential Implications for the Grid

Dr. Thomas Wilson (Electric Power Research Institute) will discuss projections of power use by U.S. data centers, requests for data center connections, and potential implications for the grid. The keynote presentation will also highlight the possibilities for more flexible data center operations to accelerate AI development while minimizing costs, lowering carbon emissions, and enhancing system reliability. A Q&A session with the audience will follow.

2:20–3:50 Moderated Panel Discussion – Impact of Data Centers on the Grid

This session will examine the increasing impact of large data centers on the electric power grid. A moderated discussion will elevate recommendations for how to handle load growth from data centers and maintain grid reliability.

Moderator: Thomas Wilson, Electric Power Research Institute

Speakers:

- Bruce Tsuchida, Brattle
- Costa Samaras, Carnegie Mellon University
- Line Roald, University of Wisconsin
- Ravi Jain, Tapestry (Google)

4:00–5:40 Moderated Panel Discussion – Sustainability Analysis of Data Centers

This session will discuss the sustainability impacts of data centers, including their environmental and human dimensions. Opening remarks will explore current data, methods, and standards, as well as gaps and hurdles, in analyzing energy, climate, water, waste, and community impacts of data centers from a life-cycle perspective. A moderated panel discussion will highlight potential solutions for addressing these gaps and identify areas that need further research.

Moderator: Eric Masanet, University of California - Santa Barbara, *Planning Committee Member*

Speakers:

- Cooper Elsworth, Google
- Davide D'Ambrosio, International Energy Agency
- Julie Bolthouse, Piedmont Environmental Council
- Laura Gonzalez Guerrero, Clean Virginia
- Sarah Boyd, Aligned Incentives

5:40–6:00 Closing Remarks

6:00 ADJOURN DAY 1

6:00–8:00 RECEPTION

WEDNESDAY, NOVEMBER 13, 2024

Purpose

- Explore emerging technologies and hardware architectures that could improve energy efficiency
- Propose technical and policy solutions for efficient and sustainable data centers

8:30–9:00 BREAKFAST

9:00–9:05 Welcome and Opening Remarks

Benjamin Lee, University of Pennsylvania, *Planning Committee Chair*

9:05–9:35 Keynote Presentation - Efficiency through Technology Advancement: Hardware-Software Interactions

Modern large language models (LLMs) have generated tremendous value and productivity improvements across almost all areas of human endeavor and, as a result, demand for both training and inference is growing at exponential rates which in turn drives a huge demand for energy. Over the last decade, numerous hardware improvements have improved the energy efficiency of LLM inference by 1000x. Similar gains have been made on the software (model) side. Dr. William Dally (NVIDIA) will describe the major contributors to this efficiency gain and the expected trend in hardware and model efficiency. A Q&A session with the audience will follow.

9:45–11:15 Moderated Panel Discussion – Efficiency through Technology Advancement: Hardware-Software Interactions

This session will examine opportunities to improve carbon efficiency and sustainability through the coordinated design of hardware and software. Opening remarks will define the landscape of hardware platforms and the role of specialized architectures for artificial intelligence. A moderated panel discussion will explore the software strategies required to achieve high performance and efficiency on these architectures.

Moderator: Carole-Jean Wu, Meta, *Planning Committee Member*

Speakers:

- Milos Popovic, Ayar Labs
- Tamar Eilam, International Business Machines Corporation
- Valerie Taylor, Argonne National Laboratory
- Vivienne Sze, Massachusetts Institute of Technology
- William Dally, NVIDIA

11:25–12:55 Moderated Panel Discussion – Societal Considerations of Data Center Expansion

This session will consider the impact of data center expansion on local economies and communities. A moderated panel discussion will highlight concerns related to local energy consumption, environmental impact, and workforce, weighing these aspects alongside the potential benefits of growth in AI.

Moderator: Prashant Shenoy, University of Massachusetts - Amherst, *Planning Committee Member*

Speakers:

- Kelly Sanders, University of Southern California
- Nate Benforado, Southern Environmental Law Center
- Tim Cywinski, Sierra Club
- Varun Rai, University of Texas, Austin

1:00–2:00 Closing Remarks

This concluding session will take a forward-looking perspective on AI and data centers. Each planning committee member will discuss their perspective on the challenges discussed through the workshop and the role of industry, academic research, and policymakers in contributing to the solution space.

Speakers:

- Benjamin Lee, University of Pennsylvania, *Planning Committee Chair*
- Ayse Coskun, Boston University
- Eric Masanet, University of California - Santa Barbara
- Prashant Shenoy, University of Massachusetts – Amherst
- Carole-Jean Wu, Meta

2:00

WORKSHOP ADJOURNS