NASEO
National Association of State Energy Officials

NASEO Powering Up Data Centers Webinar

Energy Performance and Standards for Data Centers

September 15, 2026


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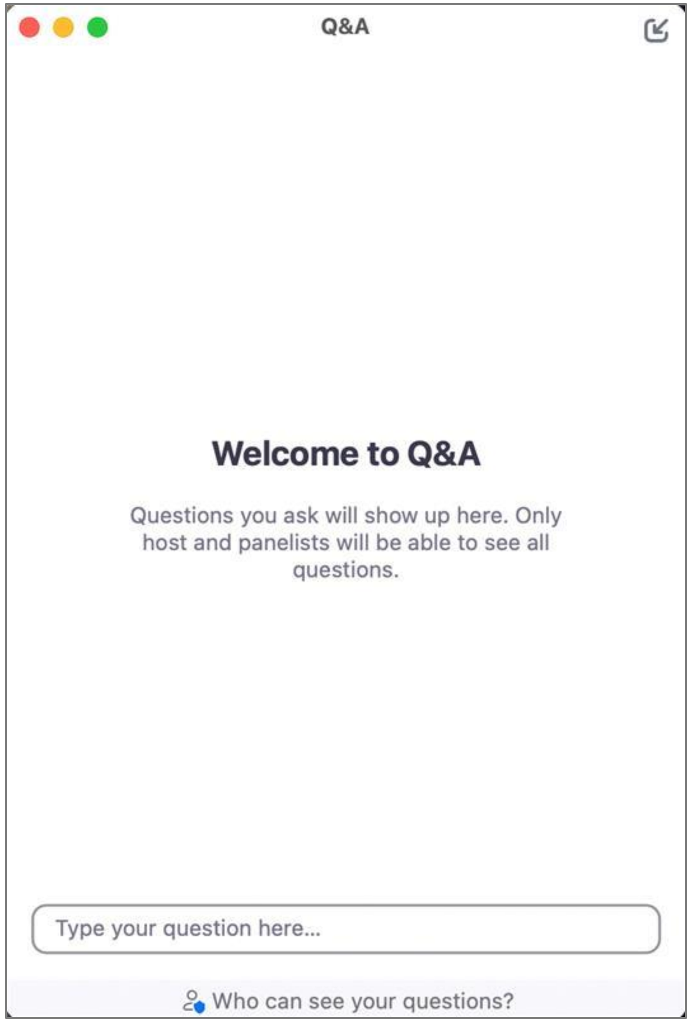
About NASEO

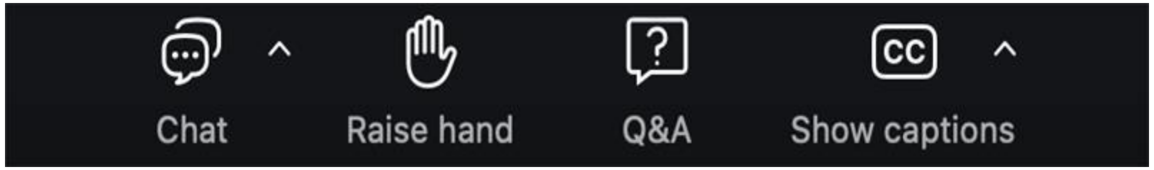
- The only national non-profit association for the governor-designated energy officials from each of the 56 states and territories
- Serves as a resource for and about the State Energy Offices through topical committees, regional dialogues, and informational events that facilitate peer learning, best practice sharing, and consensus building
- Advances the interests of the State and Territory Energy Offices before Congress and the Administration
- Learn more at www.naseo.org

Webinar Housekeeping

Recording
This webinar is being recorded.

Question and Answers
You are automatically muted during the webinar. To ask a question, please enter your question at any point into the Q&A box.





Agenda

2:05-2:10pm ET
Opening Remarks and Perspective from Oregon
Blake Shelide, Manager, Codes and Standards, Energy Planning and Innovation, Oregon Department of Energy

2:10-2:25pm ET
Remarks from ASHRAE
Marcus Hassen, Chair of ASHRAE 90.4 and Voting Member of ASHRAE Standards Committee

2:25-2:35pm ET
Remarks from New Buildings Institute (NBI)
Nora Wang Esram, Chief Executive Officer, NBI

2:35-2:40pm ET
Remarks from National Electrical Manufacturers Association (NEMA)
Todd Sims, Senior Director, Regulatory and Industry Affairs, NEMA

2:40–2:50pm ET
Moderated Discussion

2:50–3:00pm ET
Audience Q&A

Webinar #10

NASEO Powering Up Data Centers

Energy Performance and Standards for Data Centers

Marcus Hassen
Sr. Vice President
Director of Data Center Facilities

Truist

ASHRAE
SSPC 90.4 - Chair

AI Energy Framework
Contributing Author

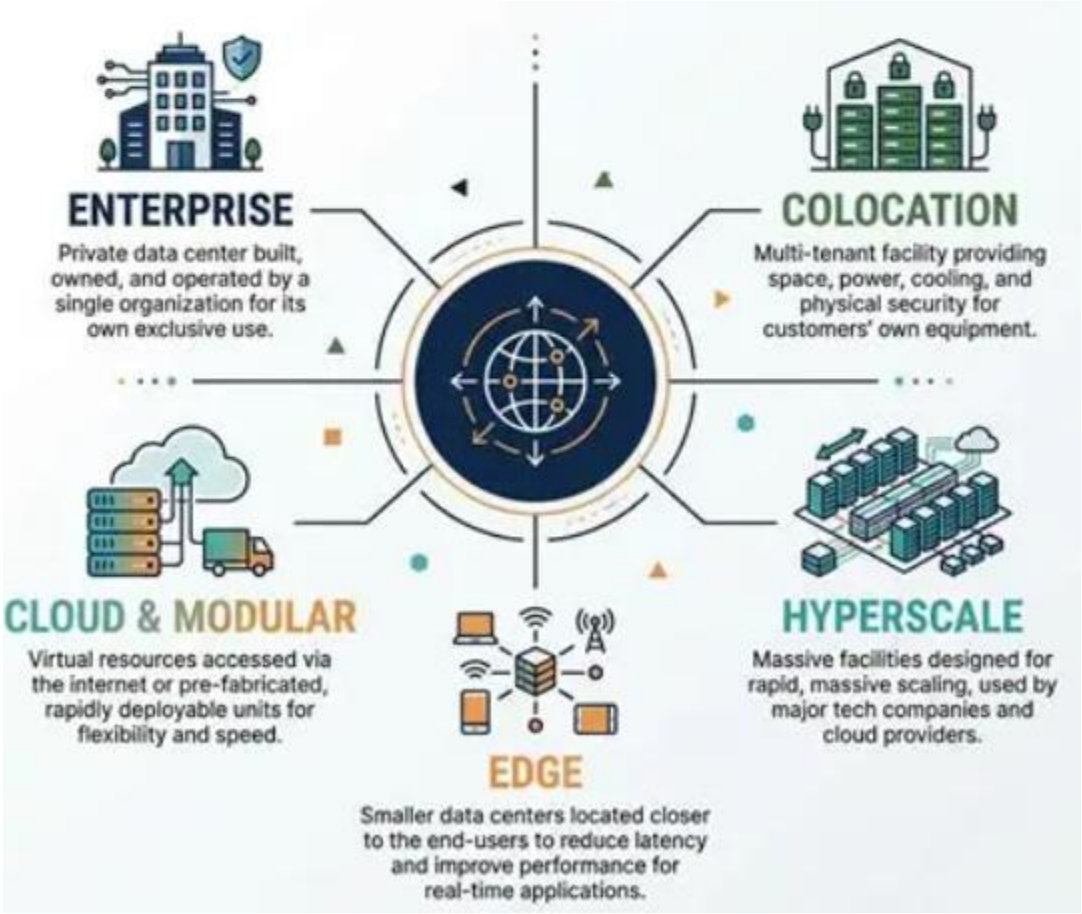
Green Building Initiative
Board of Directors

What is a Data Center?

A purpose-built facility that houses the computing, storage, and networking equipment organizations rely on – engineered so that equipment stays powered, cool, connected, and secure around the clock.

- Not just a room of servers – a coordinated system of electrical, mechanical, structural, security, IT, telecom, and architectural engineering.
- Designed to meet capacity and reliability needs.
- The physical foundation underneath every app, website, and AI model.

Types of Data Centers



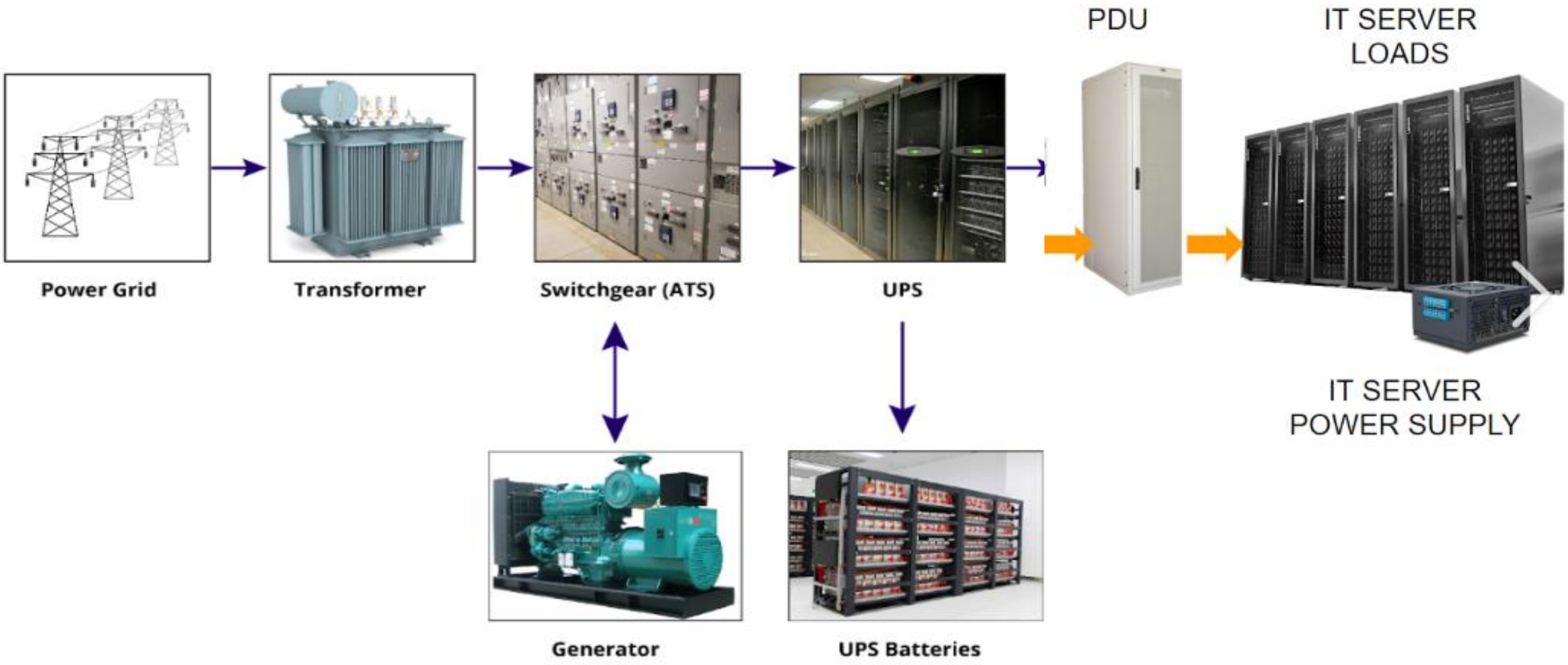
Edge

Small sites near users, cutting latency for real-time apps

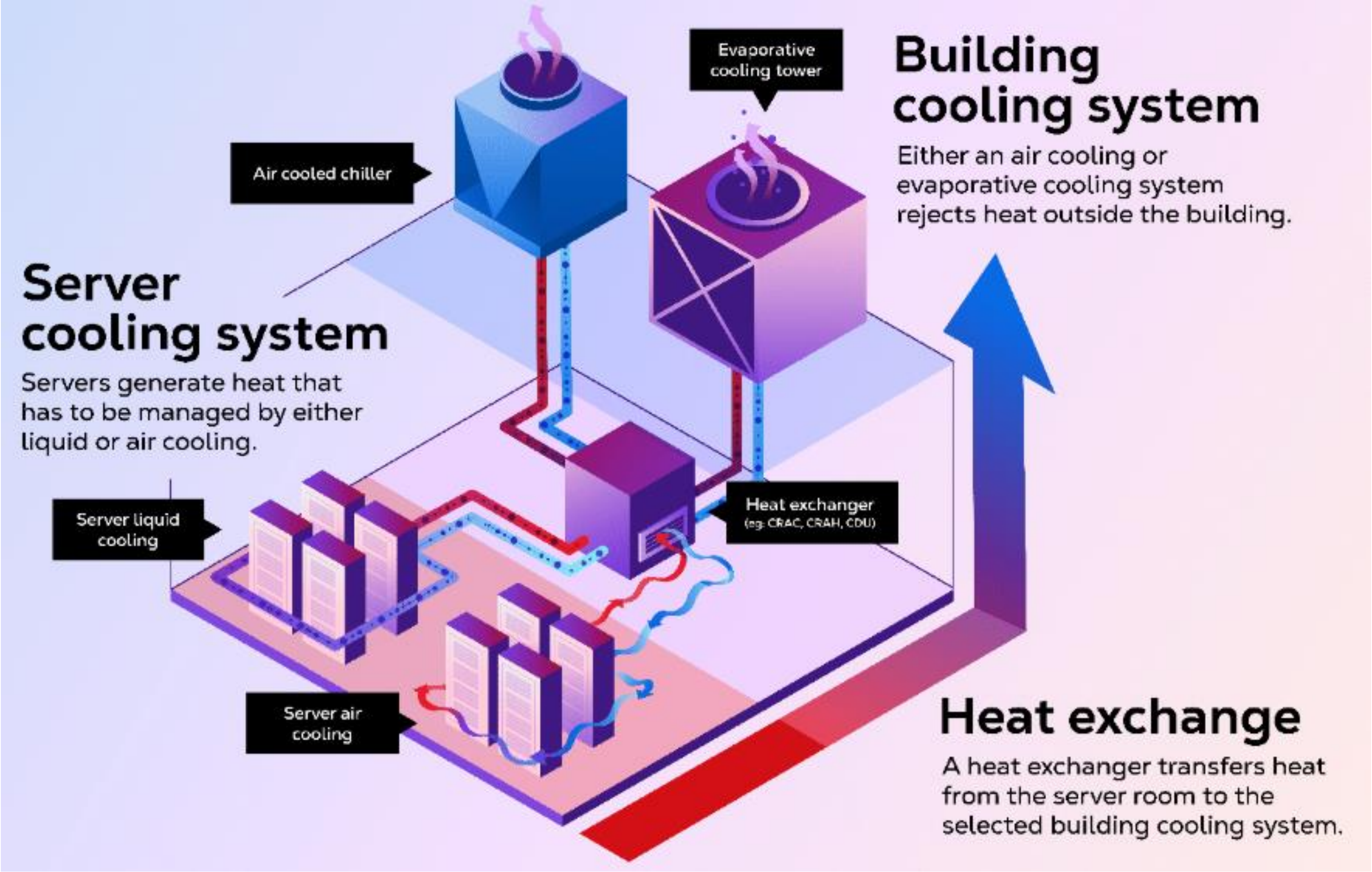
Cloud

Public, private & hybrid — compute delivered as a service, on someone else's hardware

Power Distribution



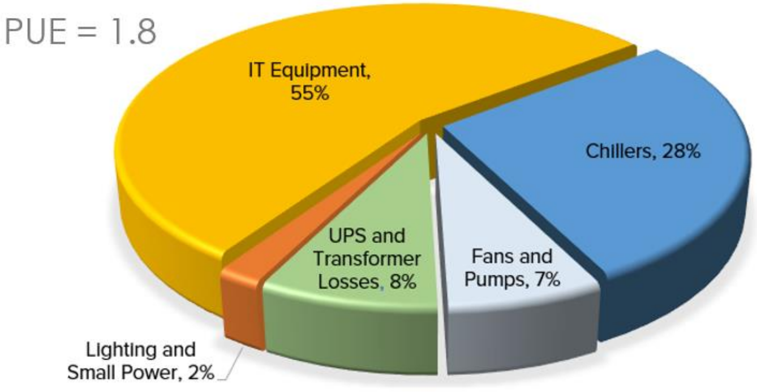
The Heat Journey



Power Usage Effectiveness (PUE)

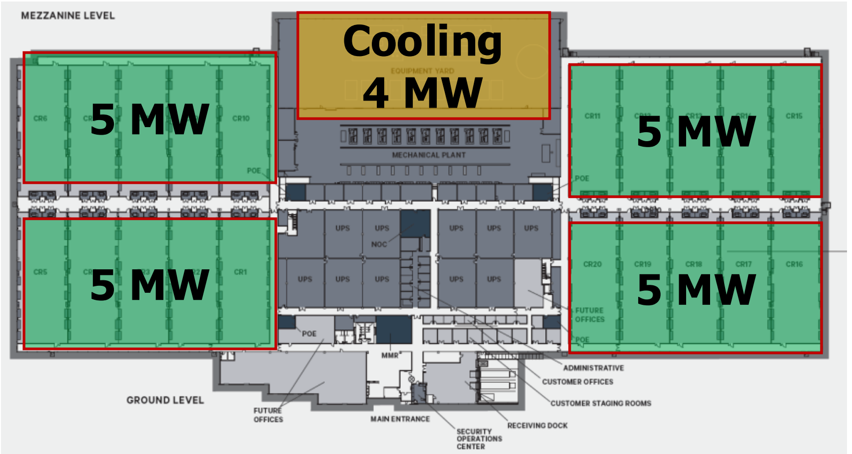
$$\text{PUE} = \frac{Total\ Building\ Power}{Total\ Critical\ Power}$$

Example 1



Better PUE → Higher Share of Consumption by ITE

Example 2



$$\text{PUE} = \frac{24\ MW}{20\ MW} = 1.2$$

Water Usage Effectiveness (WUE)

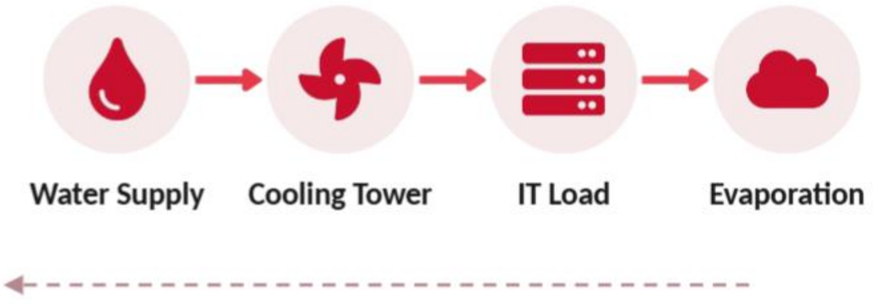
Definition

WUE is a sustainability metric that measures how much water a data center uses to cool and operate its IT equipment. It captures the water footprint of cooling systems such as evaporative cooling towers and humidification.

$$\text{WUE} = \frac{\text{Annual Site Water Usage (L)}}{\text{IT Equipment Energy (kWh)}}$$

Lower WUE = less water consumed per kWh of IT load.

The Cooling Water Cycle



Most water is lost to evaporation and blowdown; the rest is replaced with fresh makeup water — this replaced volume is what WUE tracks.

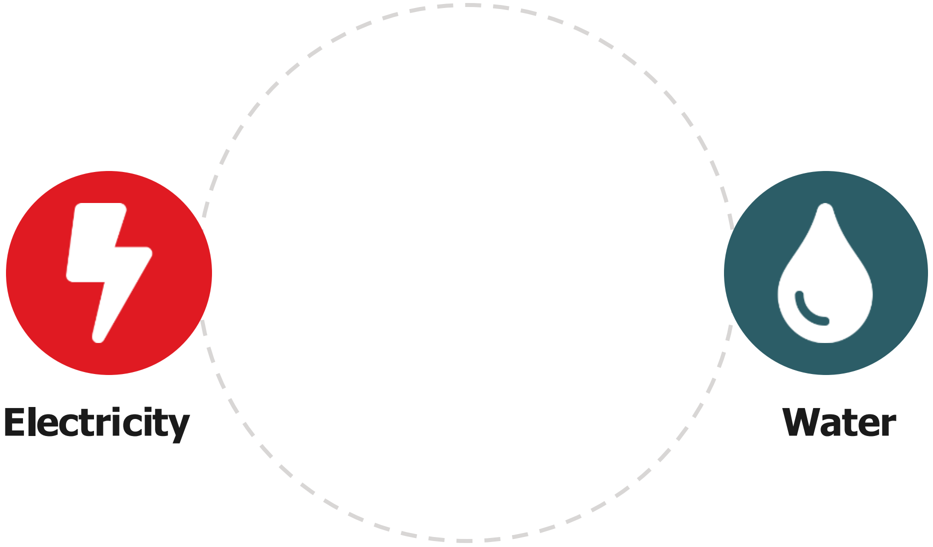
The Metric That Matters Most

Quantity of Work Delivered per unit Energy Consumed

Efficiency

Benchmarking

Power & Water Nexus



Generating electricity often consumes water. Cooling a data center often consumes water. The two are a closed loop, not two separate line items.

PUE ~1.2 to 1.45

Total Facility Power ÷ IT Power

Industry average has fallen from roughly 2.5 in 2007 to about 1.3 average today, driven by containment and free cooling.

WUE ~1.8 L/kWh

Site Water Used ÷ IT Energy Used

The water counterpart to PUE. Many facilities are pursuing zero-water cooling designs precisely to drive this down.

ASHRAE 90.4 Vitals

- Performance-based Design Standard Specifically for Data Centers
  - Recognizes “Mission Critical” Nature of Data Centers
  - Data Center Definition informs applicability of 90.1 and 90.4 [>10 kW and >20 W/sf]

- Comprised of Two Components
  - Mechanical Load Component (MLC)
    - Annualized Power of Compressors, Fans, Pumps, Cooling Towers, etc.
  - Electrical Loss Component (ELC)
    - UPS Segment Efficiency Losses
    - Distribution Segment Conductor/Transformer Losses

- Each Component Required to fall below or meet standard Maximums
  - Tradeoffs between ELC and MLC Allowed
  - Renewable Energy and Heat Recovery Credits Allowed

ASHRAE 90.4 v 90.1

Scope and Applicability

- **ASHRAE 90.1**: Broad energy standard for *all* commercial buildings except low-rise residential.
- **ASHRAE 90.4**: Purpose-built, *data-center-specific* energy standard focused on IT equipment, electrical infrastructure, and mechanical systems supporting continuous compute loads.

Design Focus

- **90.1** centers on traditional building systems—envelope, HVAC, lighting, service water heating—reflecting human-occupied spaces.
- **90.4** targets mission-critical systems—power distribution efficiency, cooling performance, redundancy, and high-density thermal management

Performance vs. Prescriptive Orientation

- **90.1** blends prescriptive and performance paths for general building efficiency.
- **90.4** provides a *performance-based* compliance path tailored to data centers, recognizing their unique operational profiles and 24/7 loads.

Energy Metrics

- **90.1** uses building-wide metrics aligned with typical commercial occupancy.
- **90.4** incorporates data-center-specific metrics and requirements tied to IT load and infrastructure efficiency.

ASHRAE 90.4 + 90.1

90.4 is an Alternate Compliance Path Under 90.1

90.4 is *not* a standalone code; it is formally structured as an alternate compliance path within **90.1** for data centers.

Normative Reference Relationship

90.4 relies on **90.1** as its normative reference, ensuring alignment and eliminating overlap between general building requirements and data-center-specific provisions.

Division of Responsibilities

- **90.1** governs non-data-center portions of a facility (office areas, support spaces).
- **90.4** governs the data-center portions (computer rooms, mechanical/electrical systems serving IT equipment).

Coordinated Updates

Each new edition of **90.4** references the corresponding edition of **90.1**, keeping both standards synchronized and ensuring consistent compliance pathways across energy codes such as IECC.

Publication and Adoption

Original Publication – 90.4-2016 (July 2026)

Continuous Maintenance and new edition every 3 years

- Current Edition: 90.4-2025

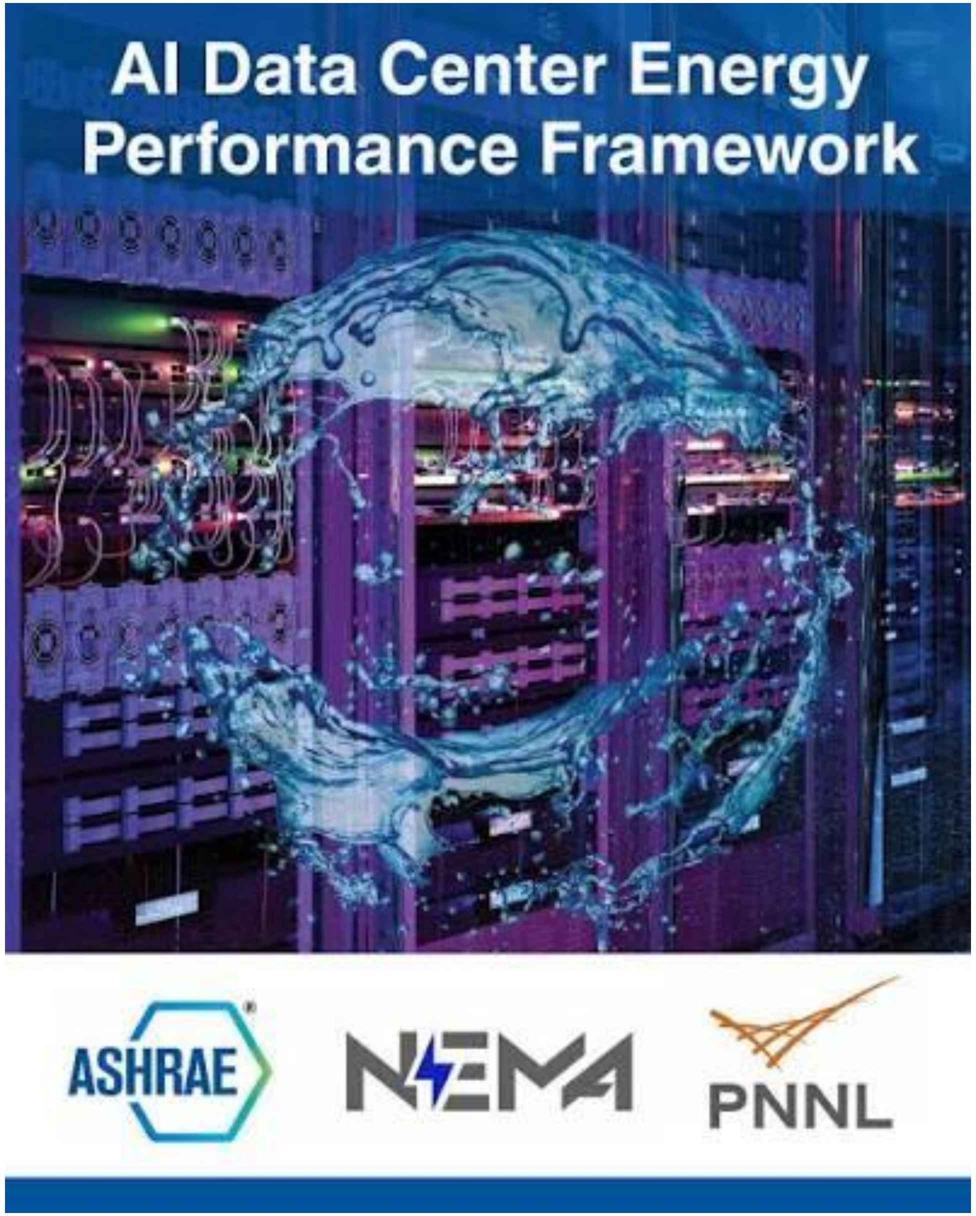
➢ Next Edition: 2028

Adoption

- ASHRAE 90.1 Alternate Compliance Path [90.1-2019]
- International Energy Conservation Code [IECC-2021]
- Washington State (WSEC)
- State of Oregon

Certification

- Green Building Initiative (GBI) – Green Globes Data Center Campus Certification



BUILDING A COMMON FRAMEWORK FOR AI DATA CENTER ENERGY PERFORMANCE

Publication Date: June 2026

OBJECTIVES OF THE FRAMEWORK

The three organizations, in conjunction with several industry partners, created the **AI Data Center Energy Performance Framework** with the following objectives:

- ❑ **Deliver a scalable framework** for the efficient design, commissioning, retrofit, and operation of AI data centers
- ❑ **Enhance energy and water efficiency** through adoption of advanced technologies and best practices
- ❑ **Support grid reliability and resilience** by promoting load flexibility and grid-interactive operations

Vision & Goals of the Framework

Core Objectives

Energy Efficiency: Recommendations and best practices for actions that can be implemented to build and operate energy-efficient data centers.

Resilience: Options and recommendations for design and operation of data centers that are resilient to natural disasters and grid and other energy supply interruption.

High Performance: Clear guidance on the impact of recommended measures on AI data center performance, enabling optimization of competing priorities.

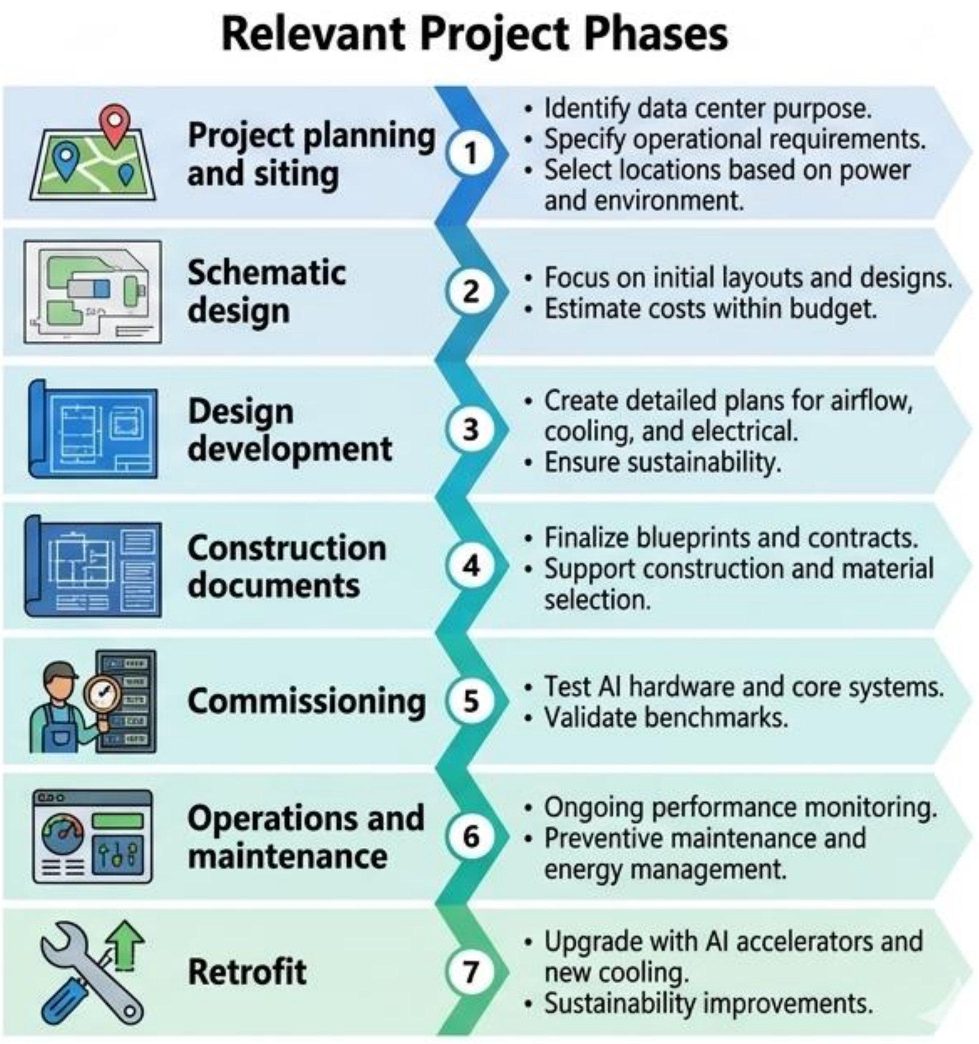
SCOPE OF THE FRAMEWORK

- The framework is constructed of sections covering all stages of planning, design, construction, operation, and retrofit.

- Content is Designed to guide AI data center development toward optimized and energy-efficient performance. It covers all aspects of energy sourcing, energy use, and water use in data center design, construction, and operation, and recommends the most effective solutions across a variety of facility climate zones and load densities.

- The framework provides opportunities to lessen impacts on communities surrounding data center developments.

- The framework does not establish mandatory requirements or supersede applicable codes and standards.



RESOURCES

ASHRAE DATA CENTER RESOURCES LANDING PAGE

- ASHRAE Data Center Resources | Data Centers

PNNL/ASHRAE/NEMA AI DATA CENTER ENERGY PERFORMANCE FRAMEWORK

- https://www.ashrae.org/technical-resources/ai-data-center-framework

AI Data Center Framework, NEMA hosted launch event

- https://www.youtube.com/watch?v=Y_oMmN9MbsY&t=1432s

ASHRAE STANDING STANDARD PROJECT COMMITTEE 90.4, SSPC-90.4

- https://tpc.ashrae.org/?cmtKey=e500d5cf-3968-4b53-b85e-04719e6ffe8b

ASHRAE TECHNICAL COMMITTEE 9.9

- https://tpc.ashrae.org/?cmtKey=fd4a4ee6-96a3-4f61-8b85-43418dfa988d

Center for Sustainable Landscapes | Pittsburgh, PA | Photo by Denmarsh Photography, Inc.

nbi new buildings institute

Energy Performance Evaluation Framework for Responsible Data Center Growth

Nora Esram, Ph.D.
CEO, New Buildings Institute
nora@newbuildings.org

NASEO Powering Up Data Centers Webinar: Energy Performance and Standards for Data Centers / Sep15, 2026

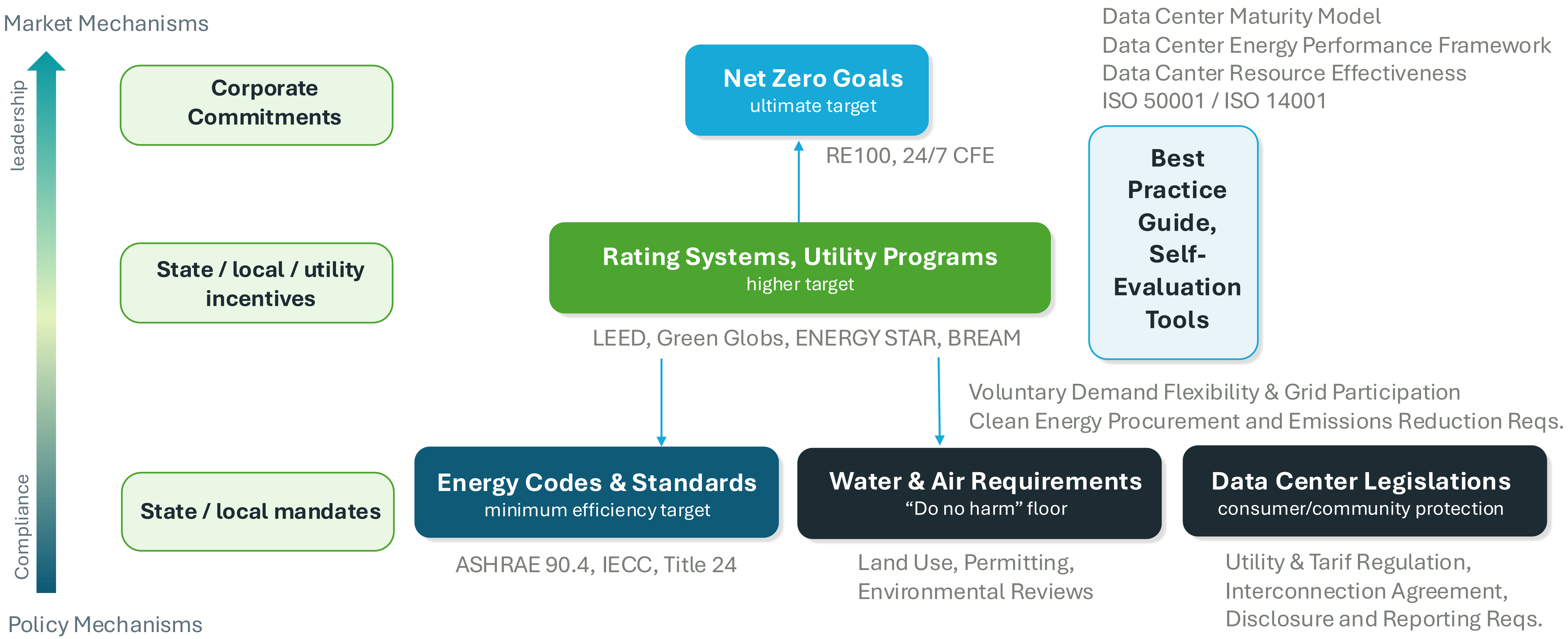
Codes, Standards, Rating Systems, and Frameworks Applicable to Data Centers

Standards / Frameworks	Description	What it covers	What it does NOT address
ASHRAE 90.1 / 90.4	Commercial building energy efficiency standard	Min. efficiency requirements for cooling and electrical infrastructure	- IT equipment (servers, storage, networking) - Compute efficiency (server utilization, workload optim.) - Water consumption - Onsite generation and emissions - Demand flexibility; actual operating efficiency
IECC / ICC Codes	General building and construction codes	Broader framework of building codes; Refers to 90.4 for DC design (different thresholds)	
Title 24	California building codes	Prescriptive requirements (economizer, variable-speed fan, fan-power, UPS, etc.)	
LEED, BREEAM, Green Globes	Sustainable building rating systems	Evaluate all aspects of sustainability (energy, water, embodied carbon, siting); Allow tradeoffs across categories	- Additional metrics beyond reference standards - Direct comparability across certifications
ENERGY STAR	Energy benchmarking / certification	Compares energy performance among peers	- Limited by underlying statistical data (a 2008 survey of 120 facilities)
ISO 50001 / ISO 14001	Environmental / energy management framework	Plan-Do-Check-Act approach for internal management (baselines, performance indicators, evaluation, improvement)	- Defining metrics or setting performance targets
RE100, 24/7 CFE	Voluntary clean-energy commitments	Leadership on renewable energy and carbon-free electricity	- Data center energy performance
Maturity Model, Performance Framework, Resource Effectiveness	Self- Evaluation and best-practice guides (iMasons, PNNL, ASHRAE, NEMA Green Grid)	Integrated design solutions, moving beyond single-metric evaluation	- Verified performance - Thresholds for min. requirements or target-setting

Existing Policies Shaping Data Centers

Policy Category	Purpose	Efficiency Topics Covered
Building energy performance	Set standards for equipment or whole building energy use.	System efficiency, whole building efficiency, cooling
Interconnection & energy reliability	Manage energy infrastructure/system constraints and reliability.	Data center queue management, reliability
Demand flex & grid participation	Manages energy system use/utilization and flexibility.	Demand response, demand flexibility, load shifting
Energy procurement & emissions	Addresses clean energy, decarbonization, or renewable goals.	Renewables and storage, emissions reduction
Utility & tariff regulation	Reallocate cost of energy and infrastructure & manage customer risk.	Cost recovery or customer cost management, incentives
Land use, permitting, & environmental issues	Local construction/physical building impacts.	Water, site, noise, air quality, permitting, zoning
Reporting & verification*	Verify data centers have been built and are operating to standards established.	Benchmarking, emissions or energy

*Reporting and verification is not yet widely adopted as a standalone policy pathway but is emerging as a potential mechanism.



Policy and market mechanisms exist to provide safeguards for responsible data center development.
However, the metrics and targets within these mechanisms are fragmented and insufficient to address grid and community challenges.

Data Center Energy Performance Evaluation Framework (DC-EPEF) CONCEPT

A tiered metric for every component - minimum floor to stretch targets
Goal: optimized data centers design and operation to balance the needs of owners, the local grid, and adjacent communities.

Facility Optimal

Mechanical Efficiency
ASHRAE, Energy Star, Green Grid

IT Efficiency
GEC, Energy Star

Electrical Efficiency
ASHRAE, Green Grid

Server Utilization
Uptime Institute

Grid Optimal

Peak-Time Reduction
EPRI, National Labs

Energy Arbitrage
EPRI, National Labs

Community Optimal

Local Water Impacts
Energy-water tradeoffs

Local Energy Benefits
Onsite renewables, storage, micro-grid, heat exchange

On-Site Emissions
Existing federal, state & local air regulations

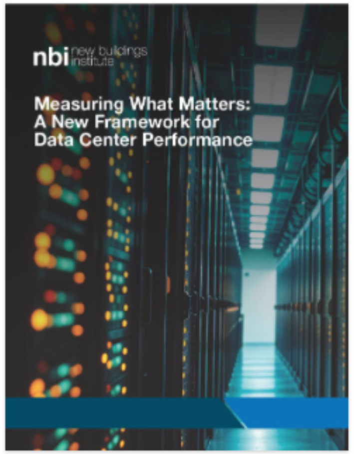
Each component carries a metric, a minimum requirement (which may vary by location), and tiered targets to differentiate performers.
Targets can be adopted as mandatory requirements, voluntary ratings, or incentive programs through existing policy and market mechanisms.

GETTING TO ZERO | B

Sign up for our data center updates!

DATA CENTER ENERGY PERFORMANCE EVALUATION FRAMEWORK (DC-EPEF)

Guideline / July 28, 2026



A new report on the Data Center Energy Performance Evaluation Framework (DC-EPEF) is coming soon. This resource page currently includes the executive summary and a form to be among the first to hear when the full report is released.

Sign up here to get notified when it is released.

Data centers that run AI workloads are among the fastest-growing sources of electricity demand in the United States. In many regions, data center developments are straining grid infrastructure, raising costs for ratepayers, and inciting strong community opposition. The lack of shared metrics, standards, and performance targets creates a critical gap in achieving data center development that balances the interests of data center owners, utilities, and surrounding communities, leaving stakeholders to pursue competing priorities.

NBI is introducing a **Data Center Energy Performance Evaluation Framework (DC-EPEF)**. The DC-EPEF is not intended to replace existing standards, certification systems, or performance metrics, nor does it create an entirely new set of requirements. Instead, it is designed to build upon and unite the substantial body of work already developed across industry, government, utilities, and standards organizations.

Data center performance measurement is unlikely to be transformed by a single new metric or standard. Instead, progress will come through the integration of existing tools and the gradual development of additional measures where important gaps exist. **By connecting established standards, emerging industry frameworks, and evolving policy objectives, the DC-EPEF provides a practical and adaptable structure for evaluating data center performance more holistically and consistently.** It is intended to help policymakers and market actors distinguish facilities that achieve efficiency gains in a single dimension from those that deliver broader benefits across energy, emissions, water, grid reliability, and resource stewardship.

Upcoming Events

Contact:
Anna Johnson, Ph.D.
Senior Manager, NBI
anna@newbuildings.org

Resignation Link:
https://events.teams.microsoft.com/event/061bc222-5e24-480e-9293-a9a1728e78ba@320ff1b7-de61-41f6-a300-97f2ef37cabf?source=copyLinkOneEventsShareDialog

Building Trust in Data Center Growth: Energy Standards for Grid, Climate, and Community Outcomes

Oct 5, 1:30-430 PM

USGBC, GBI, GEC, EXP, NASEO, EPRI, JCI, NCEL, and more…

Todd Sims

Senior Director
Regulatory & Industry Affairs, Built Environment
National Electrical Manufacturers Association (NEMA)

todd.sims@nema.org

Powering Progress. Fueling Prosperity.

The electroindustry supplies the critical infrastructure and guidance that enable AI data centers and economic growth

National Economic Contribution

Data centers, 2024

$927B *GDP Contribution*

5.5M *Jobs Supported*

$204B *Tax Revenues*

$525B *Labor Income*

NEMA

Private Sector, Public Benefit

United States

$1T+ invested in AI infrastructure

39% of U.S. GDP growth driven by AI-related investment in 2025

4.5X additional jobs supported per direct data center job

25K electroindustry jobs added over past 3 years

Local Revenue, Community Impact

Loudoun County, VA

199 data centers in the county with an additional 117 planned

50% of property tax revenue generated by data centers

$26 in county tax revenue for every $1 spent serving data centers

$112M in additional funding for local schools in 2025

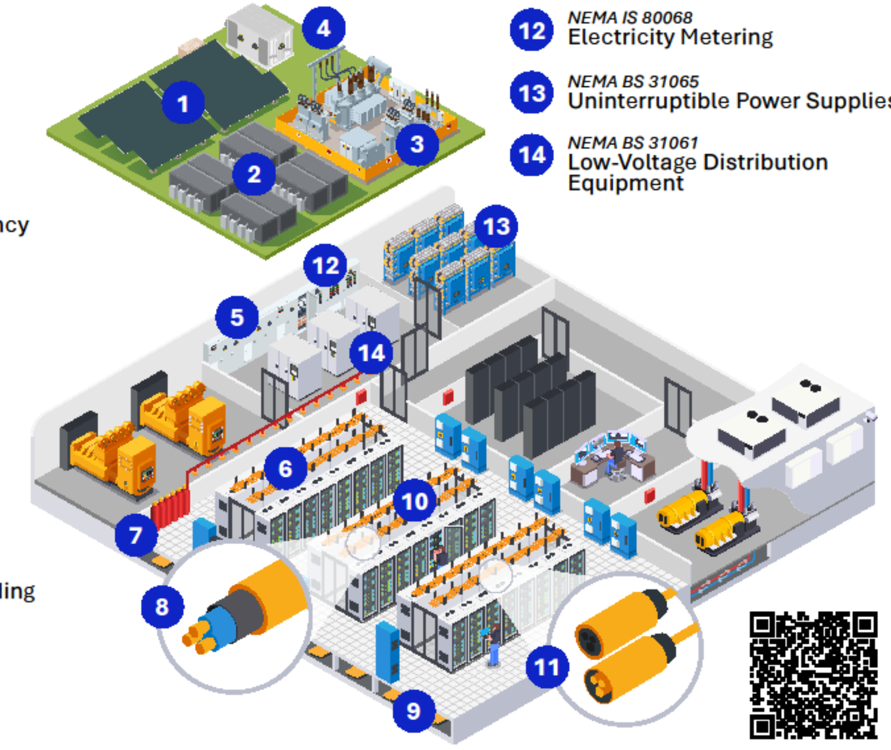
NEMA's Equation for American AI Dominance

Power Availability + Supply Chain Certainty + Technical Guidance = **U.S. AI Leadership**

NEMA's Data Center Framework

Advancing safety, efficiency, and resilience

1. *NEMA US 80075* Microgrid
2. *NEMA US 80074* Energy Storage
3. *NEMA US 80017* Transformers
4. *NEMA BS 31054* Data Center Resiliency and Efficiency
5. *NEMA US 80071* Switchgear
6. *NEMA WC 23008-2025* Wires and Cables / Conductors
7. *NEMA BS 31060* Fire & Life Safety
8. *NEMA IM 60005* Insulating Materials
9. *NEMA IS 10055* Grounding and Bonding
10. *NEMA CS 70015* DC Power
11. *NEMA PR 50094* Pin and Sleeve
12. *NEMA IS 80068* Electricity Metering
13. *NEMA BS 31065* Uninterruptible Power Supplies
14. *NEMA BS 31061* Low-Voltage Distribution Equipment



DC Power & Liquid Cooling Leadership

Developing guidance for the future of data centers

Integrated Design

Higher-voltage DC reduces conversion losses and heat generation; liquid cooling efficiently removes the remaining concentrated heat. The technologies reinforce each other.

Shared Safety

Introducing liquids near high-power DC equipment raises cross-cutting issues (enclosures, connectors, grounding, maintenance practices) that cannot be addressed in isolation.

Reliability & Performance

Fewer conversion stages plus effective thermal management improve system reliability and enable continued scaling of AI/HPC workloads.

Better Standards

Make better policies and better data centers

Moderated Discussion/Q&A

Thank you!

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