The webinar will start momentarily....
Webinar Logistics

• This webinar is being recorded. The Q&A section will not be made publically available.

• Your phone will be muted throughout the webinar.

• Enter any questions in the Question Box throughout the webinar.

• Instructions to take the quiz will be provided at the end of webinar.

• Slides will be sent out afterwards to those who attend the entire webinar.
Today’s Speakers

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# Webinar Agenda

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## Learning Objectives

- Appreciate the energy impact of computer server selection
- Become familiar with four key industry documents
- Understand what each document covers
- Understand how the documents complement one another.
Purpose of Webinar

The selection of computer servers can have a significant impact on energy efficiency and decarbonization in data centers.

The purpose of this webinar is to review key industry documents that help data centers operate more energy efficiently by purchasing computer servers that meet strict performance criteria.

The intent is to provide a clear understanding what each document covers and how the individual documents complement one another.
Context of Energy Efficiency and Decarbonization in Data Centers
Importance of Energy Efficiency

In 2014, the energy consumed by data centers was around 1.8%* of the total electric energy consumed in the US. This is a large amount of energy for a single type of facility.

Energy is a cost to the data center and energy efficiency is an important business consideration. There are also growing regulatory, compliance, and market pressures to reduce the energy usage to demonstrate leadership in energy efficiency and environmental stewardship.

Energy usage and carbon (CO$_2$) emissions are linked – higher energy usage will lead to higher release of carbon, which, in turn, are at the center of global warming.

http://climate.nasa.gov
Impact of Selection of Servers

Energy savings at the server level will cascade through the support systems. Thus, selecting energy efficient servers and operate them energy efficiently can have a profound impact on overall energy efficiency and decarbonization in data centers.

Selecting robust servers allows operating at high intake air temperatures. This is an opportunity to further reduce data center cooling since the efficiency of chillers improves with temperature.
Key Documents
Key Documents

- ASHRAE Thermal Guidelines (ASHRAE, 2021) provide standardized operating thermal environments for electronic equipment.


- EPEAT (Electronic Product Environmental Assessment Tool) is a rating system for greener electronics (EPEAT, 2022). The server category criteria are based on standard NSF/ANSI 426-2019.

The ASHRAE Thermal Guidelines for Data Processing Environments provide guidance on intake air temperature and humidity for IT equipment.

www.ashrae.org

ASHRAE: The American Society of Heating, Refrigerating, and Air-Conditioning Engineers
The thermal server environment is defined by the temperature of the air drawn into the air-cooled equipment, the temperature the electronics depends on for cooling. The ASHRAE Thermal Guidelines provide guidance on intake temperatures to maintain high reliability but yet operate energy efficiently.

Key nomenclature for understanding the ASHRAE Thermal Guidelines includes “recommended” and “allowable” intake air temperatures.
The ASHRAE recommended range (65-80F) is a statement of reliability whereas the Allowable ranges (A1-A4, H1) are statements of functionality. A1 has a range of 59-90F. The other allowable ranges are wider.
As we have seen, the Thermal Guidelines provide several standard operating environments, but it does not require a specific environment.

Adopting aggressive thermal environments provides opportunities to reduce cooling energy since the efficiency of the cooling gear improves with higher temperatures.

Most cooling gear increases its efficiency by 1-3% for each degree F increase in the data center temperature (LBNL, 2021a). Thus, the savings can be substantial.
The remaining documents discussed in this webinar either specify that servers must report intake air temperature based on onboard sensors or specify a certain standardized intake air temperature for increased cooling equipment efficiency.

The next document we will look at is “ENERGY STAR for Computer Servers”. It requires a compliant server to meet certain energy-efficiency criteria and report key physical parameters.
Energy Star for Computer Servers

ENERGY STAR for Computer Servers, issued by the Environmental Protection Agency (EPA), provides energy efficiency performance criteria and reporting requirements.

www.energystar.gov/products/spec/enterprise_servers_specification_version_3_0_pd
The ENERGY STAR document builds partially on the ASHRAE Thermal Guidelines. Like ASHRAE, ENERGY STAR does not require a specific operating environment.

1) It provides criteria for server efficiency, power supply efficiency, power factor, and power management.

2) It requires a server to report intake air temperature, input power, and CPU utilization.

The fact that the last three parameters are part of the requirements is a testament to the importance of the data to server and data center energy efficiency.
Energy Star for Computer Servers

ENERGY STAR qualified servers are a requirement for Federal agencies. Using the ENERGY STAR (2022) Product Finder, you can select from hundreds of certified servers.

https://www.energystar.gov/productfinder/product/certified-enterprise-servers/
The ENERGY STAR document was not designed to provide implementation guidance to meet the reporting requirements. Some data centers may need a bit of hand holding to access the data.

“Accessing Onboard Server Sensors for Energy Efficiency in Data Centers” (LBNL, 2021b) provides hands-on guidance on using onboard sensors for accessing physical parameters.

http://datacenters.lbl.gov/resources/accessing-onboard-server-sensors-energy
The next document we will look at is the “Electronic Product Environmental Assessment Tool” (EPEAT). EPEAT is a rating system for greener electronics. It has a number of product categories and among them are Computer Servers.
EPEAT is a global rating system for greener electronics. It ranks products and services on a number of criteria to identify greener electronics. 

https://epeat.net
Products currently meeting EPEAT criteria are listed on the EPEAT Registry (EPEAT, 2022). Purchasers can search for products based on product name, product type, manufacturer, location of use, EPEAT tier (Bronze/Silver/Gold), or status (active).

https://www.epeat.net/search-servers
For servers, the EPEAT criteria are based on standard NSF/ANSI 426-2019 Environmental Leadership and Corporate Social Responsibility Assessment of Servers (NSF, 2019).

Federal agencies *should consider* EPEAT-registered servers when upgrading or replacing hardware to maximize energy efficiency since the standard provides stricter performance requirements and criteria than ENERGY STAR.

The last document we will review is the NSF/ANSI 426-2019 standard published by the National Center for Sustainability Standards.
ANSI 426 establishes server environmental performance criteria and corporate performance metrics that demonstrate environmental leadership.

The standard can be used by purchasers for identifying environmentally preferable products. It spares them from defining environmental performance for servers.

The standard has eight Performance Categories with required and optional criteria:

- energy efficiency
- management of substances
- preferable materials use
- product packaging
- design for repair
- reuse and recycling
- product longevity
- responsible end-of-life management
- corporate responsibility.
Standard 426-2019 provides stricter energy performance requirements than ENERGY STAR. The standard requires not only the server to be ENERGY STAR certified but also to support operation in higher temperatures than the lowest ASHRAE “A1” class (i.e., more robust equipment).

Specifically, the required criteria states that products need to support ASHRAE Class A2 temperature range. Optional criteria go even farther: Server efficiency and support for ASHRAE Class A3/A4 ranges.
The documentation shall include the estimated number of hours per a specified time period that the server can operate in the allowable range without materially affecting the server reliability.

Specifying servers that are more energy efficient and thermally robust is imperative for meeting data center energy efficiency and decarbonization goals. Federal agencies should consider EPEAT-registered servers to maximize energy savings.
The bulk of this slide presentation is a summary of the LBNL (2021c) document “Computer Server Selection Guidelines for Energy Efficiency and Decarbonization in Data Centers”.

https://datacenters.lbl.gov/ServerSelectionGuidelines
Summary of Key Documents

Guidelines

Server Requirements

Requirement for Federal agencies

Stricter Requirements

Servers

Federal agencies should consider
Summary

- The objective of this webinar was to help data centers operate more energy efficiently by purchasing computer servers that meet strict performance criteria.
- The selection of computer servers can have a profound impact on overall energy efficiency and decarbonization efforts in data centers.
- Four key industry documents were reviewed to provide a clear understanding of what each document covers and how they complement one another.
- Energy efficient and thermally robust servers are imperative for data center energy efficiency and meeting decarbonization goals. Thus, federal agencies are required to purchase ENERGY STAR servers and they should consider EPEAT servers.
References

www.ashrae.org

ENERGY STAR, 2022. ENERGY STAR Product Finder  
https://www.energystar.gov/productfinder/product/certified-enterprise-servers/

www.energystar.gov/products/spec/enterprise_servers_specification_version_3_0_pd

www.epeat.net
References

LBNL, 2021a. DOE Air Management Tool

http://datacenters.lbl.gov/resources/accessing-onboard-server-sensors-energy

LBNL, 2021c. Computer Server Selection Guidelines for Energy Efficiency and Decarbonization in Data Centers
https://datacenters.lbl.gov/ServerSelectionGuidelines

Resources and Q&A
FEMP’s Data Center Program

FEMP’s Data Center program assists federal agencies and other organizations with optimizing the design and operation of data centers. Design and operation of energy and water systems in data centers to enhance agency’s mission.

### Assistance
- Project and technical assistance from the Center of Expertise including identifying and evaluating ECMs, M&V plan review, and project design review.
- Support agencies in meeting OMB’s Data Center Optimization Initiative requirements.

### Tools
- Data Center Profiler (DC Pro) Tools (x2)
- Air Management Tools (x3)
- IT Equipment Tool
- Electrical Power Chain Tool
- Energy Assessment Worksheets
- The Energy Assessment Process Manual

### Key Resources
- Better Buildings Data Center Challenge and Accelerator
- Small Data Centers, Big Energy Savings: An Introduction for Owners and Operators
- Data Center Master List of Energy Efficiency Actions

### Training
- Better Buildings webinar series
- Nine on-demand FEMP data center trainings
- Center of Expertise Webinars
- Data Center Energy Practitioner (DCEP) Trainings
LBNL’s Center of Expertise (CoE)

Use CoE’s Energy Efficiency Toolkit

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Search resources by topics of interest.

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Explore resources geared towards helping small data centers overcome the unique obstacles they face in reducing energy consumption and achieving monetary savings.

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CoE* Data Center Energy Efficiency Toolkit

Start here!

Energy Assessment Process Manual

Data Center Profiling Tools
- PUE Estimator
- DC Pro

Collect Data, Consider Energy Efficiency Actions
- Energy Assessment Worksheet
- Master List of Efficiency Actions

System-Level Assessment Tools
- IT Efficiency Tool
- AM Estimator
- AM Tool
- AM Packages Tool
- Power Chain Tool

Report Findings & Make Recommendations
- Energy Assessment Report Template

Keep it simple(r)

AM = Air Management

*CoE = Center of Expertise for Energy Efficiency in Data Centers at Berkeley Lab
http://datacenters.lbl.gov
DOE Tool Suite

- Data Center Profiler ("DC Pro"), online
- PUE Estimator, online
- Air Management Tool, Excel
- Air Management Estimator, Excel
- Electrical Power Chain Tool, Excel
- IT Equipment Tool, Excel.

http://datacenters.lbl.gov/tools
Previous Four-Part Webinar Series

This training series introduced a broad toolkit for identifying energy-saving opportunities in data centers.

A Suite of Energy Assessment Tools

Electric Power Chain Tool

Air Management Tools

IT Equipment Tool

Webinar 1

Webinar 2

Webinar 3

Webinar 4

https://www.wbdg.org/continuing-education/femp-courses/fempodw049

Slides from Webinars 2, 3, and 4 at
http://datacenters.lbl.gov/resources/energy-efficiency-toolkit-series
http://datacenters.lbl.gov/resources/energy-efficiency-toolkit-series-air
http://datacenters.lbl.gov/resources/energy-efficiency-toolkit-series-it
Energy Assessment Process Manual

- Multiple appendices include useful templates for the assessments.

Master List of DC Energy Efficiency Measures

• Living encyclopedia of all data center EEMs
  – Recognized as an essential desk reference for data center energy efficiency – top download for CoE
  – >250 energy-saving changes in components, operations or other actions

• Several tools recommend common EEMs:
  – DC Pro, Air Management Tool, Electric Power Chain Tool

• The Master List contains all common EEMs, plus many others that do not appear elsewhere in the toolkit.

• For each EEM, the list explains the principles involved and how energy cost savings are generated, plus tips on implementation and more in-depth references.
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Questions?
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The National Institute of Building Sciences’ (NIBS) Whole Building Design Guide (WBDG) hosts the FEMP training program’s learning management system (LMS).

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• Houses the assessments and evaluations for all accredited courses.
• Allows you to:
  – Track all of your trainings in one place.
  – Download your training certificates of completion.
• Eases the CEU-achievement process.

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IACET Credit for Webinar

To receive IACET-Certified CEUs, attendees must:

• Attend the training in full (no exceptions).
  – If you are sharing a web connection during the training, you must send an e-mail to Elena Meehan (elena.meehan@ee.doe.gov) and indicate who was on the connection and who showed as connected (will reflect in the WebEx roster).

• Complete an assessment demonstrating knowledge of course learning objectives and an evaluation within six weeks of the training. A minimum of 80% correct answers are required for the assessment.

To access the webinar assessment and evaluation, visit:

https://www.wbdg.org/continuing-education/femp-courses/femplw05132021

If you have a WBDG account and enrolled previously, simply log in and click the Continuing Education tab on the user account page. Click Proceed to Course next to the course title.