Data Center Energy Practitioner (DCEP) Training – Informational Webinar

February 14, 2023

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CENTER OF EXPERTISE
FOR ENERGY EFFICIENCY IN DATA CENTERS

Webinar Agenda

| Agenda	
I.	Introduction
II.	Context of Energy Efficiency and Decarbonization
III.	DCEP Training Courses and Software Tools
IV.	Resources and Q&A

Learning Objectives

- Understand importance of energy efficiency and decarbonization in data centers

- Recognize the DOE DCEP data center energy-assessment training courses

- Recognize related LBNL research reports

- Recognize the DOE data center energy-assessment software tools.

Purpose of Webinar

The objective of this webinar is to make the Department of Energy (DOE) Data Center Energy Practitioner (DCEP) Program better known to help reduce energy use and the carbon footprint of both information technology (IT) equipment and facility infrastructure in data centers.

The DCEP training is a comprehensive program spanning over 1-4 days. The curriculum includes several software tools with what-if capabilities to enhance the learning experience.

http://datacenters.lbl.gov/DCEP

DCEP
DOE Data Center
Energy Practitioner
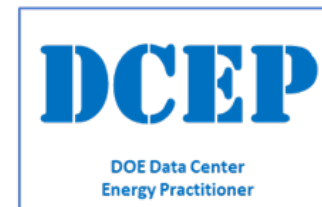
Essential Energy-Assessment Courses for People Working with Data Centers (DC)

DCEP Training Courses

High-Level "Generalist" Training/Exam on All Disciplines + DC Pro online Tool

IT-Equipment, Air-Management, Cooling Systems, and Electrical Systems

In-Depth "Specialist" Training/Exam on Select Disciplines and Excel System Tools

Cooling Systems	Air Management	IT Equipment	Electrical Systems

"HVAC" (Available)

(Available)

(TBD)

Certified DCEPs completed training on performing energy assessments in data centers and passed exams demonstrating their proficiency in the use of the high-level online DC Pro Tool and selected in-depth Excel Assessment System Tools.

Federal Mandates

- **The Federal Energy Act of 2020 provides mandates for maintaining the DCEP program in collaboration with key stakeholders.**

- **The Energy Act states that each federal agency shall consider having its data centers evaluated every 4 years by DCEPs.**

- The Data Center Optimization Initiative (DCOI) requests that each federal tiered data center that has not submitted a DC Pro assessment via eDARS* in the past two years, have an assessment conducted by a certified DCEP.

42 U.S. Code § 17112 - Energy efficiency for data center buildings | U.S. Code | US Law | LII / Legal Information Institute (cornell.edu)

* eDARS = DOE Enterprise Data Analytics Repository System

Context of Energy Efficiency and Decarbonization in Data Centers

Importance of Energy Efficiency

During 2014, 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.

* https://datacenters.lbl.gov/sites/default/files/DataCenterEnergyReport2016_0.pdf

Importance of Decarbonization

Climate change is a concern to all of us, and carbon dioxide (CO_2) emissions are at the center of increased global temperatures. It is undeniable that human activity has caused higher CO_2 levels, and higher levels trap more heat.
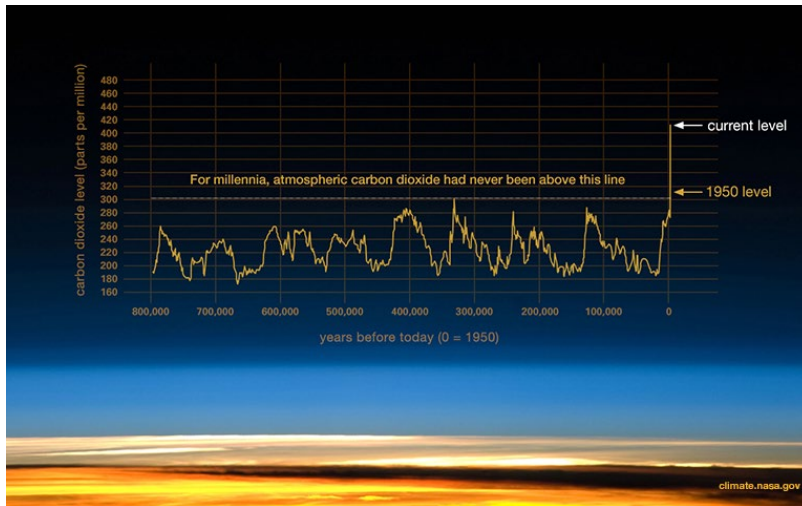

CO_2 Concentration

Temperature

http://climate.nasa.gov
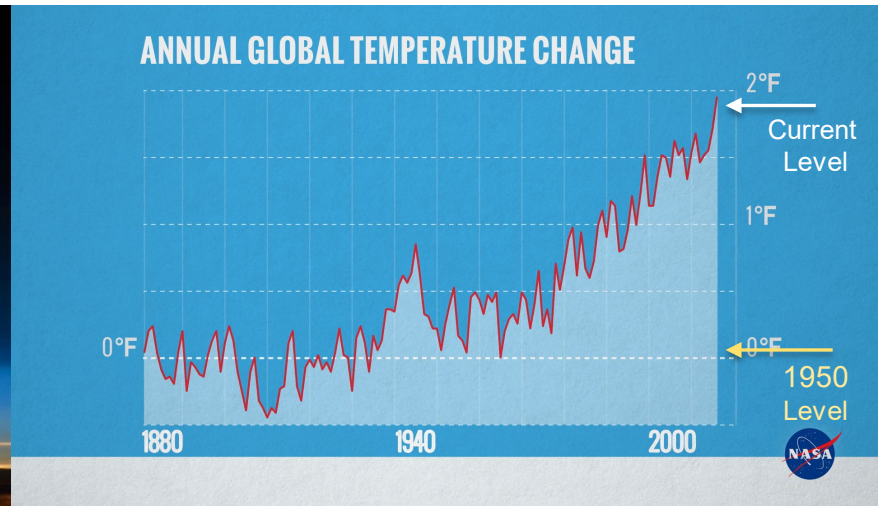
Understanding the Carbon Emission Rate

The carbon emission rates vary with the way electricity is produced. Hydro, geothermal, wind, solar, and nuclear power plants have low emissions.

The Carbon Emission Rate is measured in pounds of CO_2 released per kWh electricity produced at the plant.

Knowing the plant's Carbon Emission Rate, the Transmission and Distribution (T&D) losses, and the data center energy use allows an estimation of the CO_2 emissions.

State Average Carbon Dioxide Emission Rates
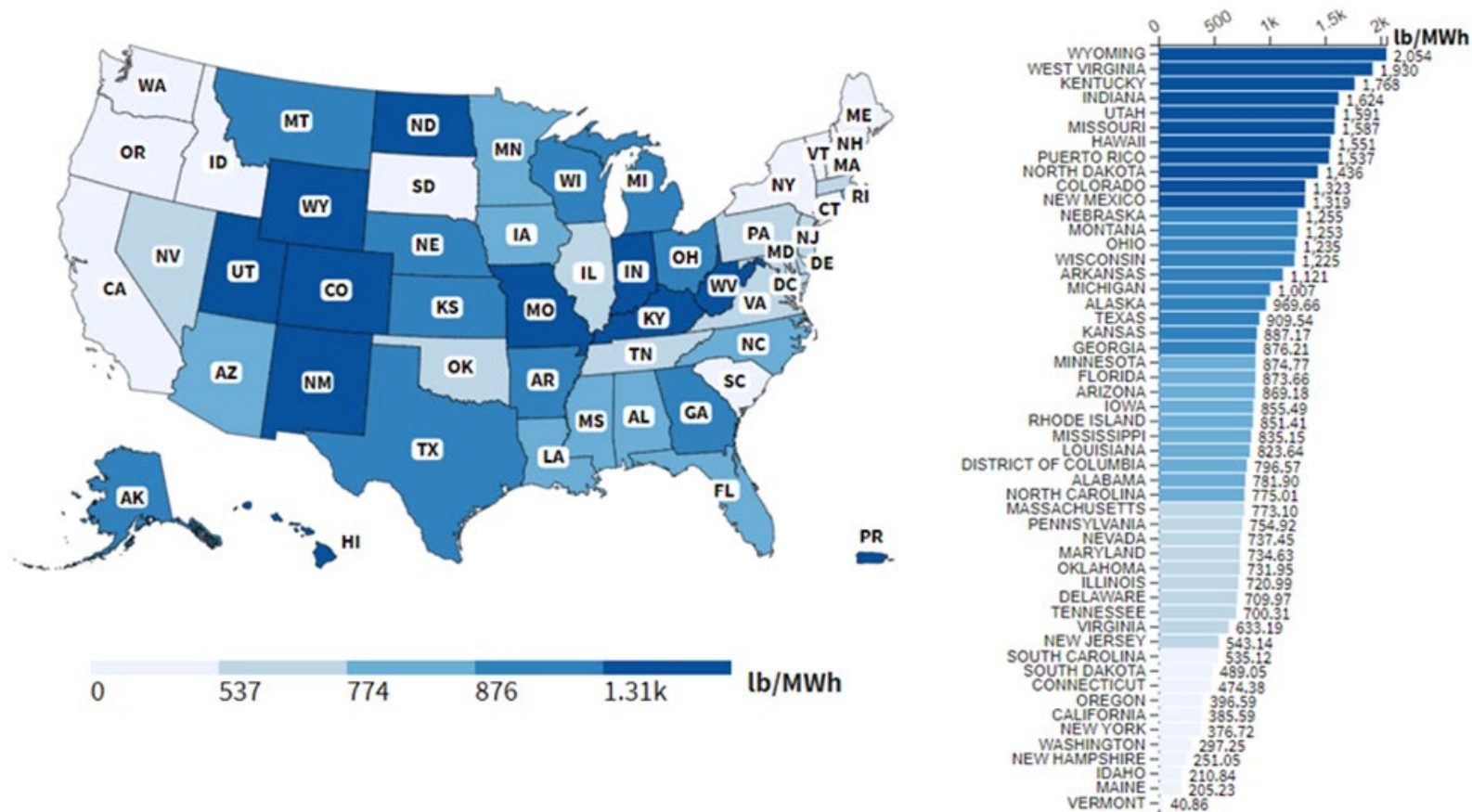
CO$_2$ emission rate (lb/MWh – average annual) by state, 2019 (eGRID, 2021)

www.epa.gov/egrid/data-explorer

DCEP Training Courses

Why and How Developed

Data centers are energy intensive and opportunities exist to reduce energy use, but significant knowledge and skills are required to perform energy assessments.

To accelerate savings, DOE and the data center industry partnered to develop the DCEP Program. Lawrence Berkely National Laboratory (LBNL) was tasked to lead this effort.

The DCEP program certifies practitioners qualified to evaluate the energy status as well as efficiency and decarbonization opportunities in data centers.

Typical Participants

- Federal agencies

- Data center operators

- Property management companies

- Engineering consulting firms

- State energy agencies

- Utilities

- Equipment manufacturers

Qualifications of DCEPs

- Qualified to identify and evaluate energy efficiency opportunities in data centers

- Address energy opportunities in electrical systems, air management; heating, ventilation, and air conditioning (HVAC); and IT equipment

- Proficient in the use of selected energy-assessment software tools

- Understand how to conduct data center assessments from an administrative point of view

- Passed one, two, or three exams (depending on course selection).

DCEP Training Courses - Overview

There are three DCEP courses: Generalist, HVAC Specialist, and IT Specialist.

- The one-day **Generalist** course provides a high-level view of different IT and support systems
- The two-day **HVAC Specialist** course is an in-depth review of HVAC/mechanical systems
- The one-day **IT Specialist** course is an in-depth review of IT systems. This course is explicitly designed for both IT and infrastructure professionals.

One-Day Generalist Course

DC Pro Tool

IT Equipment

Air Management
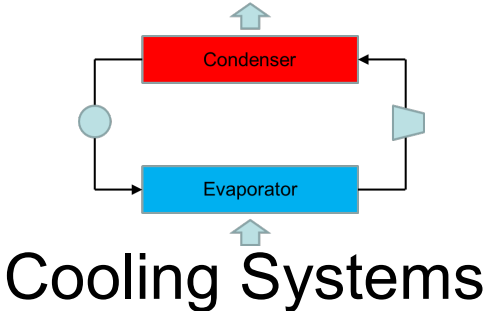
Cooling Systems

Electrical Systems
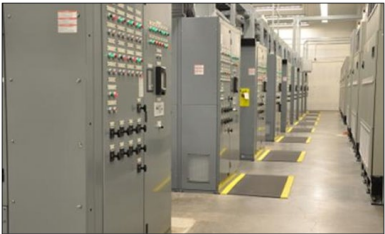
Electrical Power Chain Tool
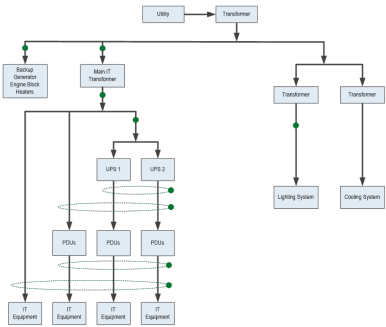
Two-Day HVAC Specialist Course

Air Conditioners

Liquid Cooling

Chilled Water Plants
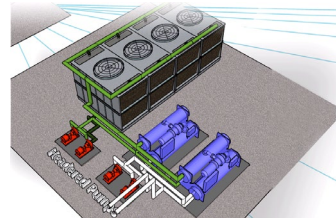
Cooling System Controls
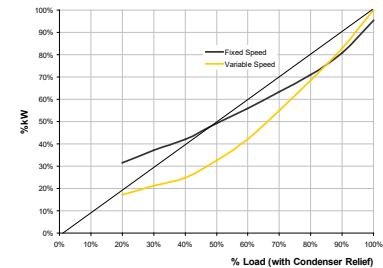
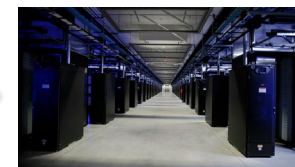Environmental Requirements
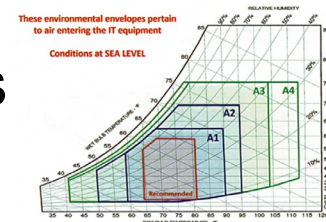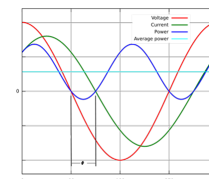
Airflow/Temperature Management
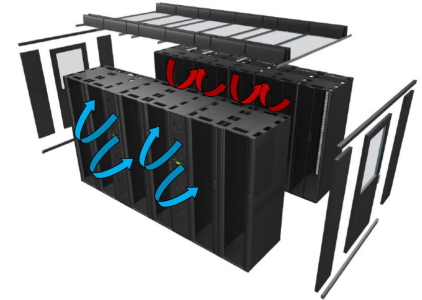
Air Management Tool
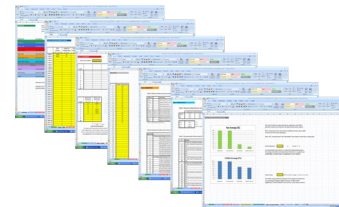
One-Day IT Specialist Course

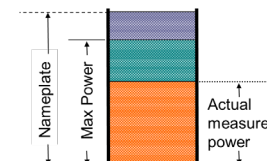IT as Basis for Data Centers

Energy Terms and Metrics

IT Asset Performance

IT Energy Usage

Predicting and Measuring Energy Use

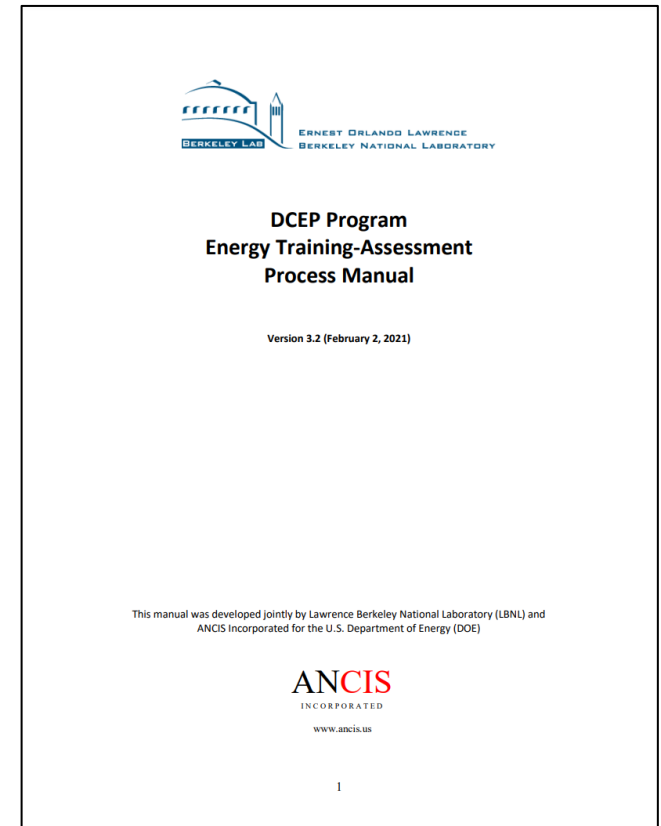Controlling IT Energy Use – Remediation & Mitigation

IT Equipment Tool

# Complementary LBNL Research Reports

Process Manual

The Process Manual provides non-technical, administrative step-by-step instructions for energy assessment before, during, and after an on-site data center assessment.

https://datacenters.lbl.gov/resources/dcep-process-manual

Accessing Onboard Server Data

"Accessing Onboard Server Sensors for Energy Efficiency in Data Centers" provides a roadmap to accessing and using computer server onboard physical data.

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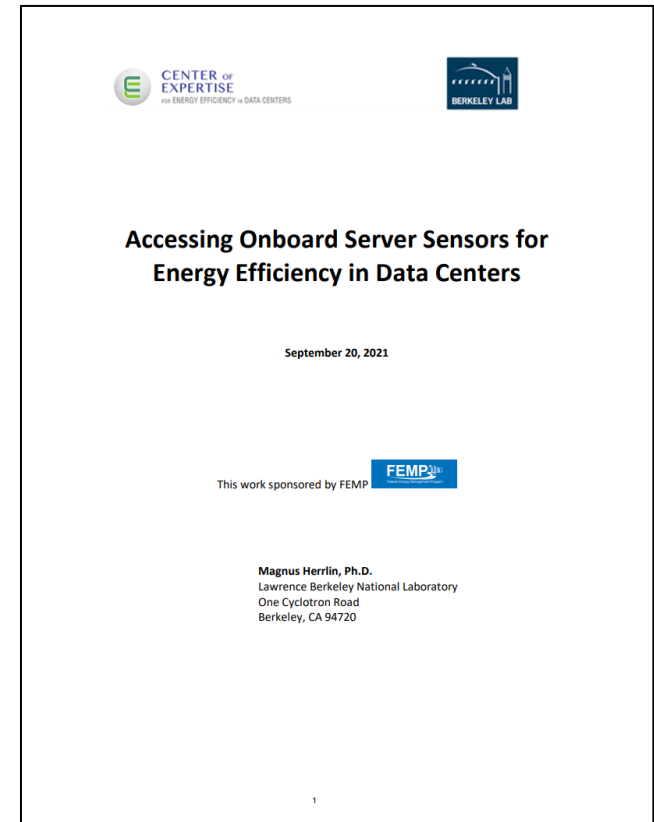
Selecting Server Equipment

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

https://datacenters.lbl.gov/ServerSelectionGuidelines
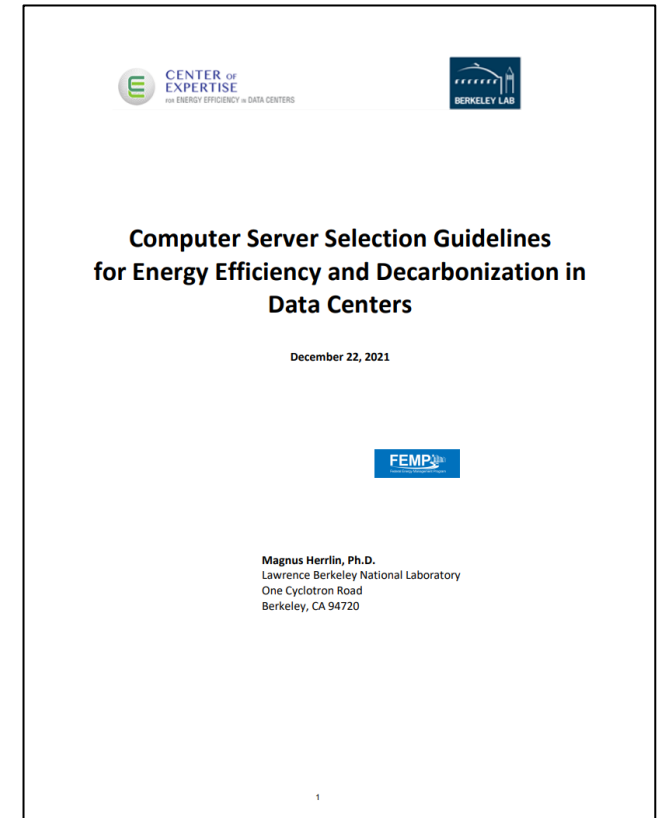
Thermal Guidelines

This report provides guidance on temperature and humidity for IT equipment and IT equipment spaces as well as how to show compliance with those physical parameters.

http://datacenters.lbl.gov/resources/thermal-guidelines-and-temperature
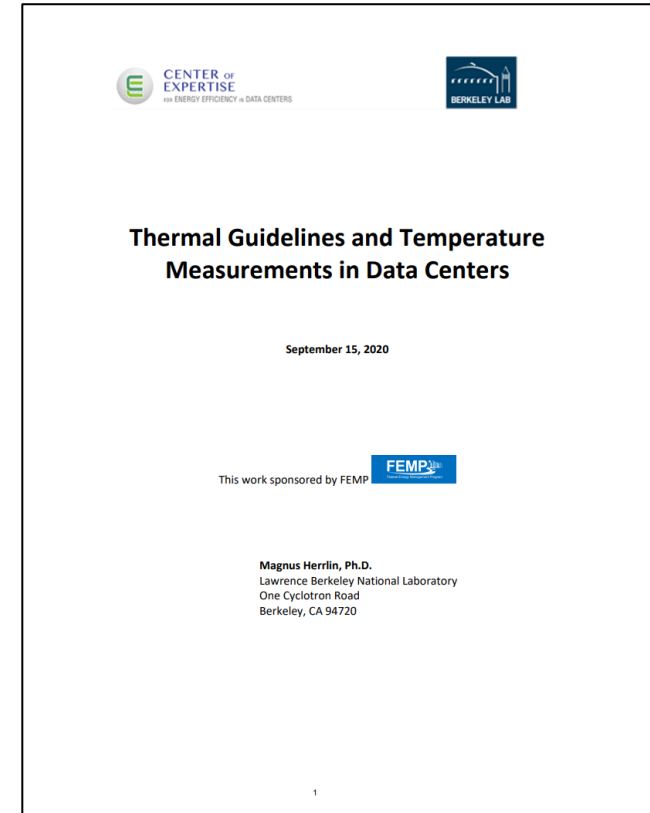
Master List of DC Energy Efficiency Measures

It is expected that the authors of data center assessment reports will copy and paste material from this 48-page master list in to their reports as they see fit. Many of the actions (recommendations) listed in this document appear in the DOE Tool Suite.

http://datacenters.lbl.gov/resources/data-center-master-list-energy

DCEP Software Tools

DCEP Software Tools

A "System Tool" focuses on a single energy consuming system (e.g., IT, HVAC, Electrical) to produce an estimate of energy saving from energy-saving measures.

The DC Pro tool, on the other hand, covers all major energy consuming systems in data centers at a much higher level (profiling) and is thus included in the Generalist course.

All DCEP tools are part of LBNL's Center of Expertise (CoE) Data Center Energy Efficiency Toolkit (next slide).

CoE* Data Center Energy Efficiency Toolkit
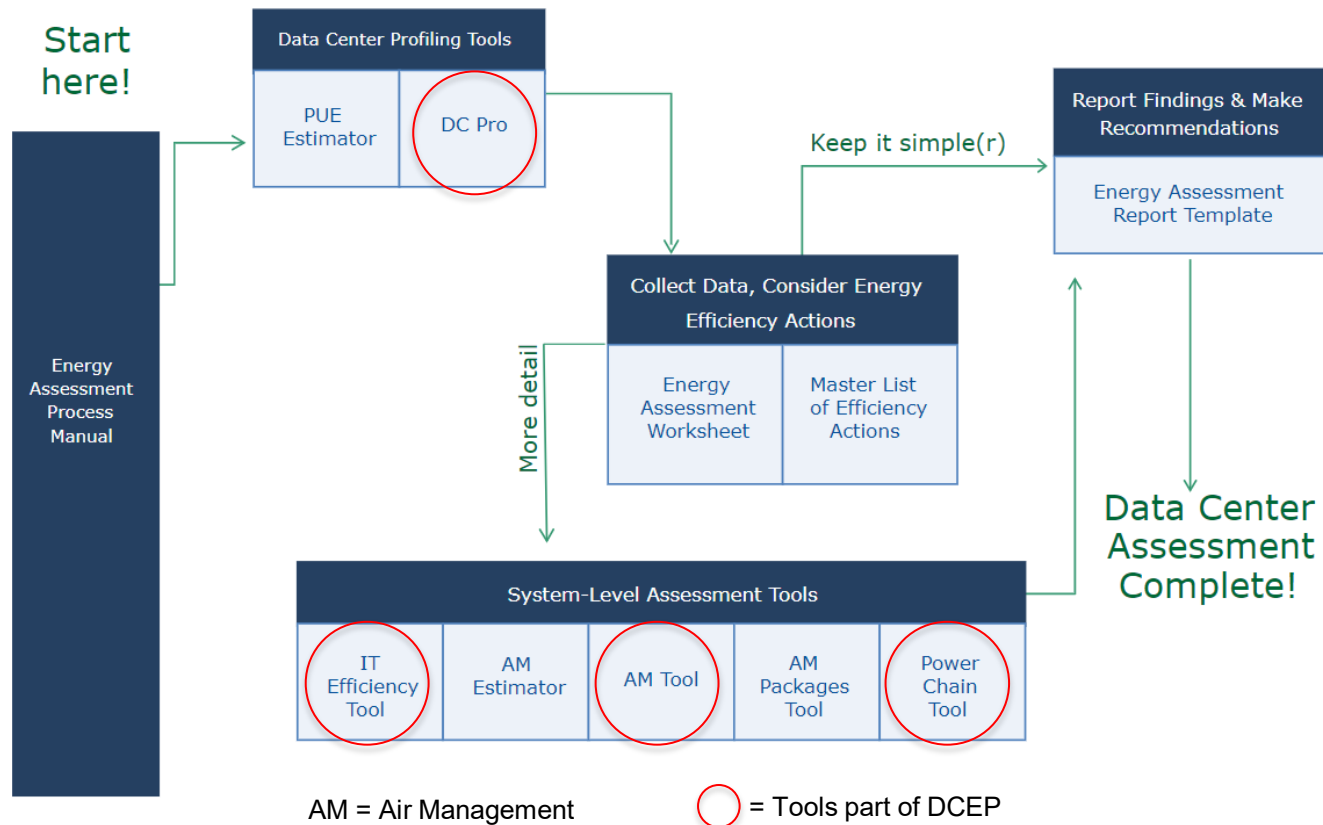
*CoE = Center of Expertise for Energy Efficiency in Data Centers at LBNL

http://datacenters.lbl.gov/Tools

First: The Online DC Pro Tool

DC Pro was developed to help understand energy savings associated with overall improved data center design and operation. It contains numerous energy-saving measures, allowing for various what-if scenarios. It provides:

- Hands-on recommendations (actions)
- Power Utilization Effectiveness (PUE), current/potential
- Energy Use Distribution, current/potential.

The Data Center Optimization Initiative requires all "tiered" federal data centers to conduct an energy assessment every few years using DC Pro and DCEPs.

Second: The IT Equipment Tool (xls)

The IT Equipment Tool was developed to help understand energy savings associated with improved IT equipment design and operation. It contains numerous energy-saving measures, allowing for various what-if scenarios. It provides:

- Hands-on recommendations (actions)
- Power Utilization (%)
- IT and Infrastructure Power Savings (W)
- Energy (kWh/year) and Energy Cost ($/year) savings
- State average Emission Rates (lb/kWh)
- CO_2 reductions
- Simple Payback for energy-saving measures
- Export of data to the other DCEP System Tools.

IT Tool Documentation
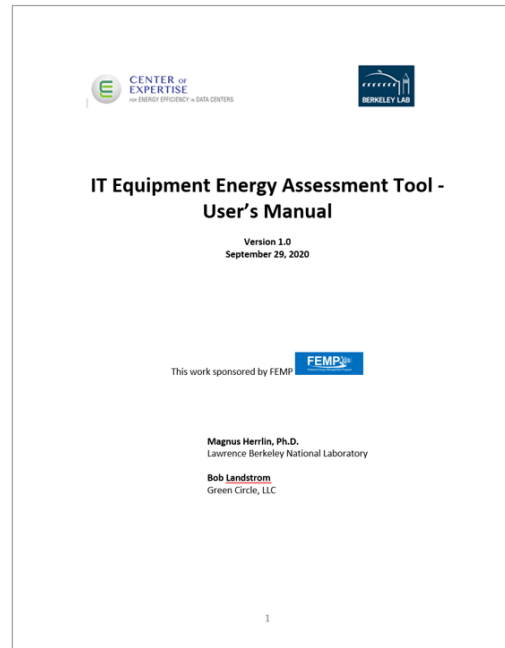
This User's Manual is the official resource in using the
DOE IT Equipment Tool

http://datacenters.lbl.gov/Tools

Third: The Air Management Tool (xls)

The Air Management Tool was developed to help improve air management without negatively affecting the thermal IT equipment environment. It includes many energy-saving measures, allowing for what-if analyses. The Tool provides:

- Hands-on recommendations (actions)
- RCI and RTI air management compliance metrics
- Energy savings (kWh/year) for fans and chillers
- Energy cost savings ($/year) for fans and chillers
- State average Emission Rates (lb/kWh)
- CO_2 reductions
- Simple Payback for energy-saving measures
- Import of data from the IT Equipment Tool.

Air Management Tool Documentation
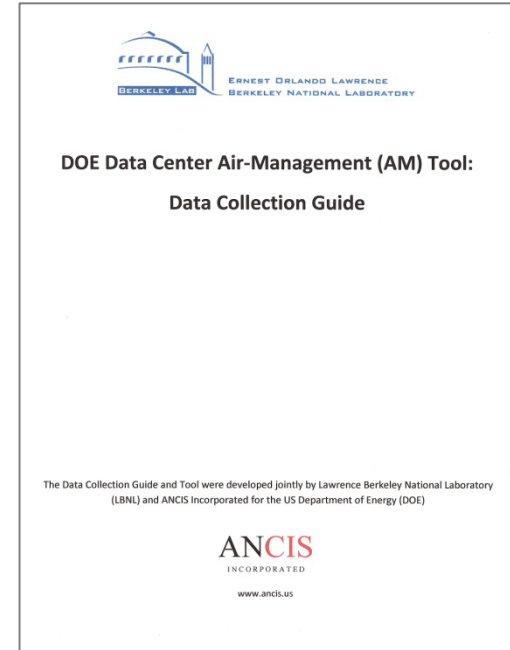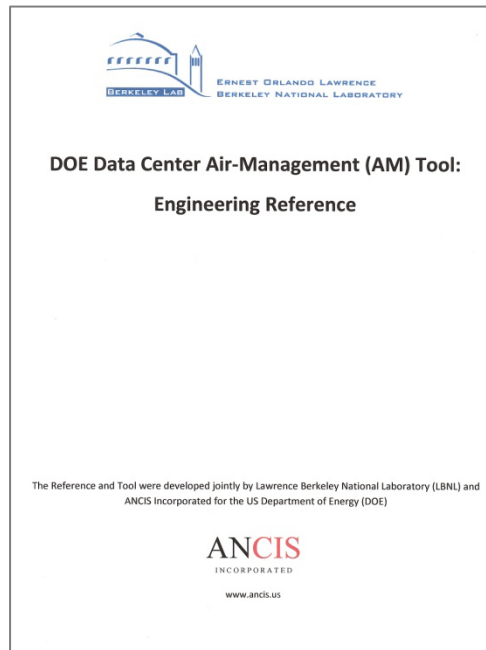
These documents are the official resources in using the DOE Air Management Tool

http://datacenters.lbl.gov/Tools

Fourth: The Electrical Power Chain Tool (xls)

The Electrical Power Chain Tool was developed to help reduce electrical losses. It takes into account transformers, generators, UPSs, PDUs, and lighting. It contains numerous energy-saving measures – allows various what-if scenarios. The Tool provides:

- Hands-on recommends (actions)
- Energy savings (kWh/year)
- Energy cost savings ($/year)
- Peer comparison to LBNL database
- State average Emission Rates (lb/kWh)
- CO_2 reductions
- Simple Payback for energy-saving measures
- Import of data from the IT Equipment Tool.

Tool Documentation

The Electrical Power Chain Tool does not have a separate User's Manual but guidance is provided in the tool itself (example below).
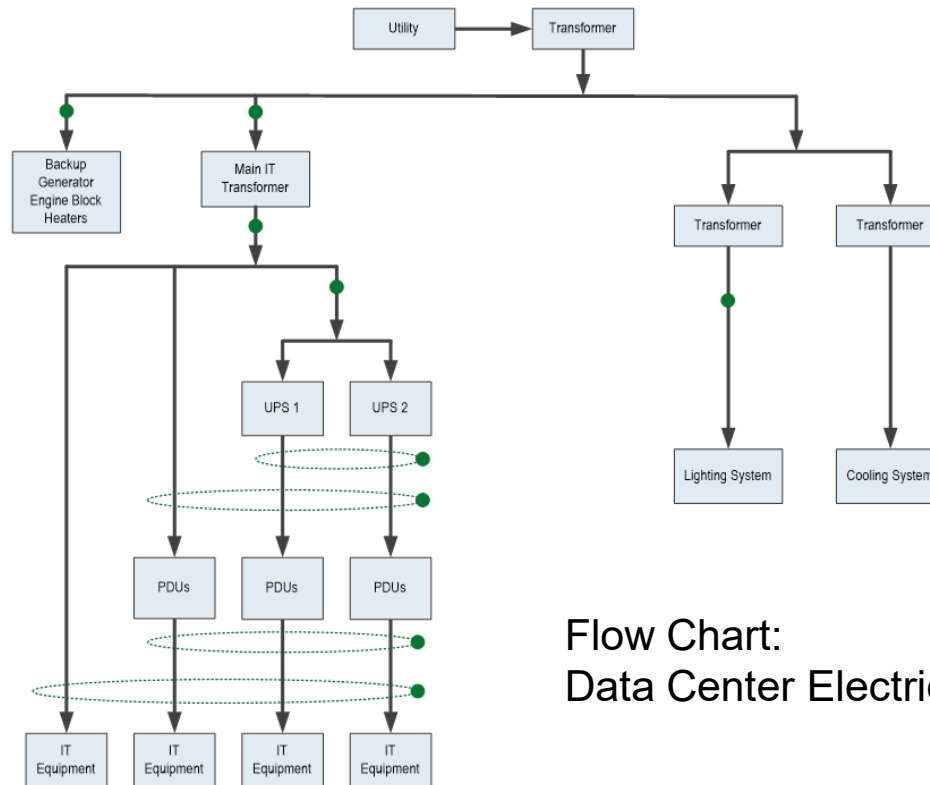
Flow Chart:
Data Center Electrical Power Chain

Official DCEP Website and LinkedIn Group

DCEP Website

- Program Overview/Description
- Administrator, Training Orgs
- Training Calendar, sign-up links
- Other Resources, including Training Agenda and listing of Program Developers, Instructors, and certified DCEPs.

http://datacenters.lbl.gov/DCEP
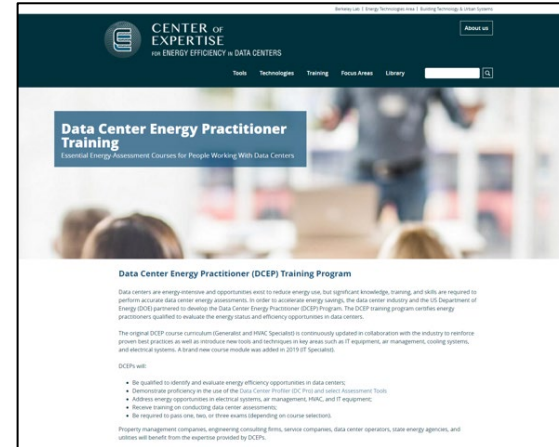
DCEP LinkedIn Group

Anyone interested in energy efficiency and decarbonization in data centers can join this Group. The DCEP team monitors posts and respond to questions as well as posts program news.

https://www.linkedin.com/groups/9223041/
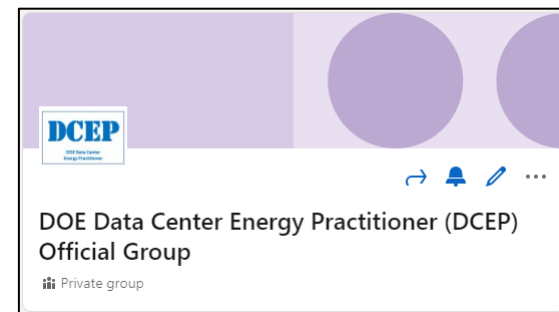
Summary

- The objective of this webinar was to increase the awareness of the DCEP training program to help reduce IT equipment and facility energy use and carbon footprint in data centers.

- We reviewed the available training courses: Generalist (one-day), IT equipment (one-day), and HVAC systems (two-day).

- We reviewed related LBNL research reports that provide important up-to-date information for the DCEP curriculum.

- We reviewed the software tools that are an integral part of the DCEP training to enhance the learning experience.

- And we addressed the Official DCEP webpage and the Official DCEP LinkedIn Group.

References

DCEP Home Page
http://datacenters.lbl.gov/DCEP

DCEP LinkedIn Group
https://www.linkedin.com/groups/9223041/

CoE Home Page
http://datacenters.lbl.gov

CoE Data Center Energy Efficiency Toolkit
http://datacenters.lbl.gov/tools

Resources

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

Berkeley Lab's Center of Expertise (CoE)

Use CoE's Energy Efficiency Toolkit, including simulation tools.

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We offer tools, technologies and analysis to enhance energy performance in datacenters.

Featured Work

Electrical Power Chain Tool

NEW! Accessing Onboard Server Sensors for Energy Efficiency in Data Centers

NEW! Computer Server Selection Guidelines for Energy Efficiency and Decarbonization in Data Centers

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