



The webinar will start momentarily....



Tour of the Center of Expertise (CoE) Data Center Energy Efficiency Toolkit

November 16, 2023



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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**CENTER OF
EXPERTISE**
FOR ENERGY EFFICIENCY IN DATA CENTERS

Webinar Agenda

Agenda

- | | |
|------|--|
| I. | Introduction |
| II. | Berkeley Lab's Center of Expertise for Energy Efficiency in Data Centers (CoE) |
| III. | CoE Data Center Energy Efficiency Toolkit |
| IV. | Training opportunities |

Learning Objectives

- Understand the overall CoE Data Center Energy Efficiency Toolkit
- Recognize the CoE manuals, worksheets, templates, and listings
- Recognize the CoE data center energy assessment simulation tools
- Be aware of the DOE DCEP energy assessment training

Purpose of Today's Presentation

The main objective of this webinar is to provide a tour of the Center of Expertise (CoE*) Data Center Energy Efficiency Toolkit and its resources. The Toolkit provides guidance on using the CoE tools in order to achieve energy efficiency and decarbonization in data centers.

Another objective is to increase the awareness of courses offered by the Data Center Energy Practitioner (DCEP) program. These courses include training on most of the resources in the CoE Toolkit.

*Center of Expertise for Energy Efficiency in Data Centers at Berkeley Lab

Center of Expertise (CoE) Website

Our main
focus today

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

Choose from live webinars, pre-recorded trainings, and live online Data Center Energy Practitioner (DCEP) trainings.

Filter CoE's many resources by type and topic.

Search resources by topic(s) of interest.

The screenshot shows the CoE website homepage. At the top is a dark blue header with the CoE logo (a stylized 'E' inside a circle) and the text "CENTER OF EXPERTISE FOR ENERGY EFFICIENCY IN DATA CENTERS". Below the header is a navigation bar with links: "Tools", "Technologies", "Training", "Focus Areas", and "Library". A search bar is located to the right of the navigation bar. A red circle highlights the "Tools" link, with a callout box stating "Use CoE's Energy Efficiency Toolkit, including simulation tools." and the text "Our main focus today". A blue circle highlights the "Training" link, with a callout box stating "Choose from live webinars, pre-recorded trainings, and live online Data Center Energy Practitioner (DCEP) trainings." A blue circle highlights the "Library" link, with a callout box stating "Filter CoE's many resources by type and topic." A blue circle highlights the search bar, with a callout box stating "Search resources by topic(s) of interest." Below the navigation bar is a white section with the text "We offer tools, technologies and analysis to enhance energy performance in datacenters." and a "Featured Work" section. The "Featured Work" section contains three cards: "Electrical Power Chain Tool" (with an image of a hand holding a pen over a laptop), "NEW! Accessing Onboard Server Sensors for Energy Efficiency in Data Centers" (with an image of server racks), and "NEW! Computer Server Selection Guidelines for Energy Efficiency and Decarbonization in Data Centers" (with an image of server racks).

CENTER OF EXPERTISE
FOR ENERGY EFFICIENCY IN DATA CENTERS

Tools Technologies Training Focus Areas Library

About us

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

Featured Work

Electrical Power Chain Tool

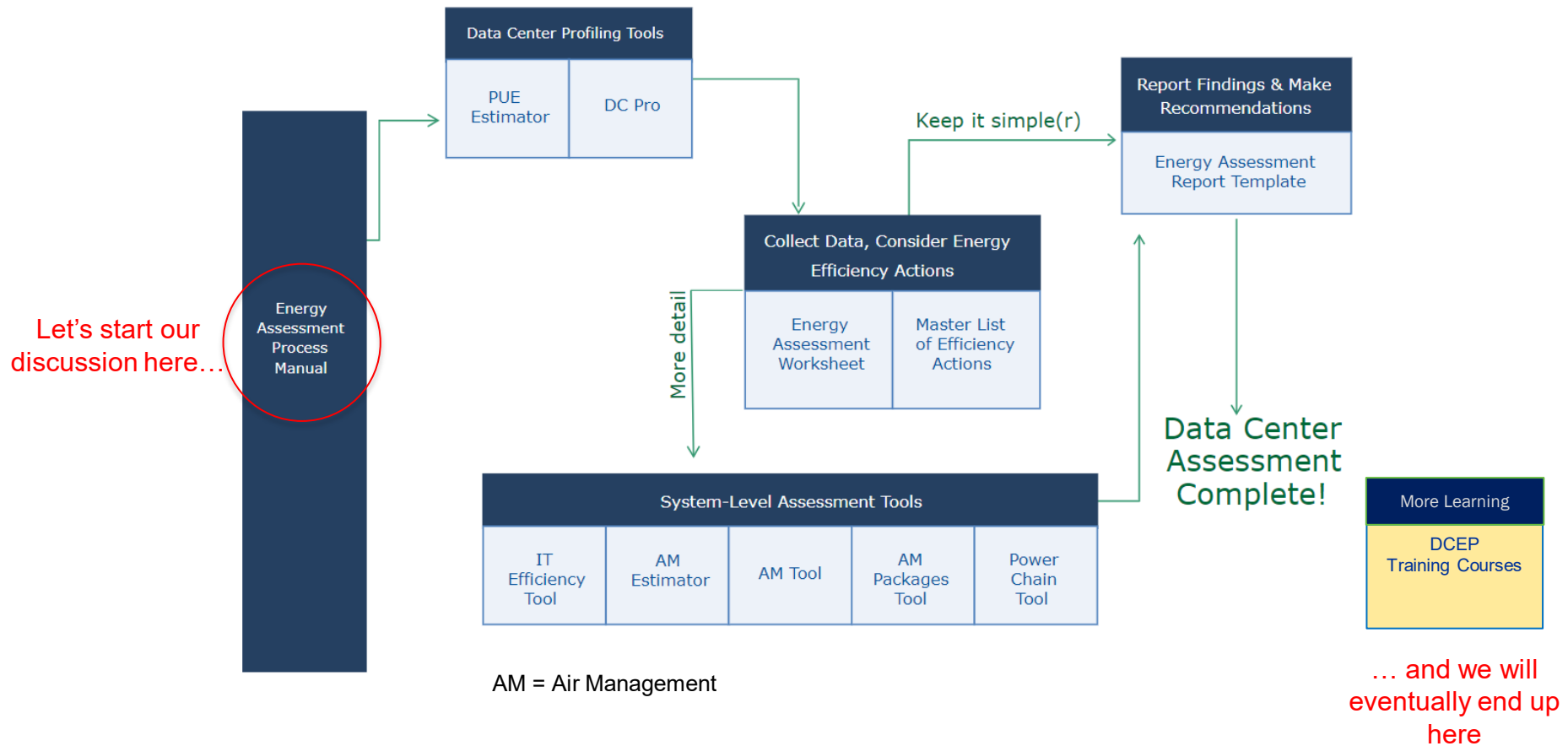
NEW! Accessing Onboard Server Sensors for Energy Efficiency in Data Centers

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

<http://datacenters.lbl.gov>

CoE Data Center Energy Efficiency Toolkit

A “tool” refers to any resource for facilitating energy assessments.



<http://datacenters.lbl.gov/Tools>

CoE Data Center Energy Efficiency Toolkit

How can the Toolkit help the practitioner?

It assists in:

- organizing the energy assessment
- collecting the necessary data
- processing the data
- calculating actionable metrics
- suggesting hands-on actions

Energy Assessment Process Manual

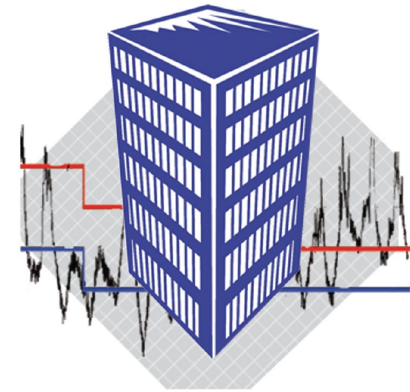
- The Process Manual provides *administrative* step-by-step instructions for conducting an energy assessment before, during, and after the onsite assessment.
- Multiple appendices include useful templates for the assessments.

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

The Assessment Process

The assessment process is broken down into four logical phases and ten steps.

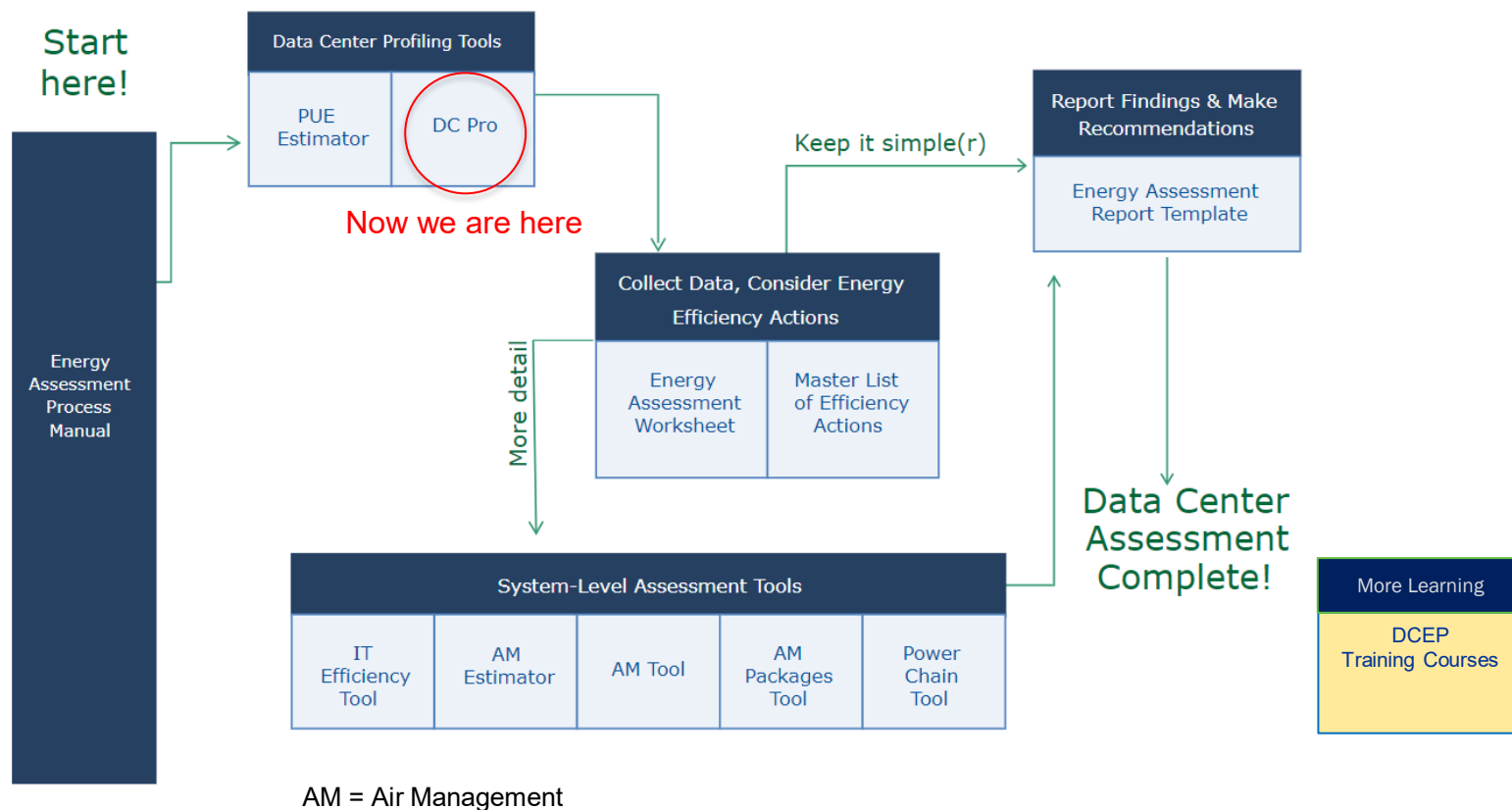
- **Phase 1: Assessment Initiation**
 - Steps 1 and 2
- **Phase 2: Pre-Onsite Preparation**
 - Steps 3 and 4
- **Phase 3: Onsite Activities**
 - Steps 5 through 8
- **Phase 4: Post-Onsite Activities**
 - Steps 9 and 10



Example: Initiation & Pre-Onsite Preparation

#	Process Step Description	Available Resources
1	<u>Phase 1: Assessment Initiation</u> Introduce the DOE Assessment Process. Identify preliminary goals, scope, onsite activities, and key personnel. Arrange for onsite logistics.	
2	Preliminary assessment by Site Lead using the DOE High-Level DC Pro Profiling Tool.	* Profiling Tool/Manuals
3	<u>Phase 2: Pre-Onsite Preparation</u> Kick-off conference call <ul style="list-style-type: none">- Review scope, onsite activities, team, and logistics- Identify target systems, tools, and data to collect- Identify safety issues.	* Profiling Tool results * Target System List (App. E) * Select System Tool(s)/Manuals
4	Off-site compilation of information <ul style="list-style-type: none">- Collect technical info from drawings, logs, etc.- Collect Site Description Survey- Collect Energy Management Practices Survey- Review required measurement equipment- Ensure functioning select DOE System Tool(s) onsite- Review Safety, Health, and Environmental Training- Review confidentiality agreements.	* Select System Tool(s)/Manuals * Assessment Worksheets * Site Survey (App. C) * Practices Survey (App. D)

Data Center Profiler (DC Pro) Tool



<http://datacenters.lbl.gov/Tools>

DC Pro Tool

DC Pro is an online *early-stage* profiling tool designed for data center operators to diagnose how energy is used in their data centers and determine ways to save energy and money.

DC Pro includes many energy-saving measures, allowing for various what-if scenarios. It provides:

- Hands-on recommendations
- Power Usage Effectiveness (PUE)
- Energy Use Distribution

DC Pro covers all seven major energy consuming systems in data centers.

Information

Either click on one of the headers to go to those questions, or click on the 'Continue' button to be taken to the next set of questions.

By clicking on the 'Previous' or 'Next' Section buttons, you will have the option to save your profile and you will be able to exit the application without losing your data.

Items with a Light background contribute to the PUE calculation. Please make sure to answer all of them to get a more accurate calculation.

Clicking on a ? will give you more information about the selected row.

A * signifies a required field. This is required in order for the report to save, and only exists in the first section.

Continue

1. Data Center General Information

2.1 Energy Use Systems - Energy Management

2.2 Energy Use Systems - IT Equipment

2.3 Energy Use Systems - Environmental Conditions

2.4 Energy Use Systems - Air Management

2.5 Energy Use Systems - Cooling

2.6 Energy Use Systems - IT Equipment Power Chain

2.7 Energy Use Systems - Lighting

3. Results

4. Recommended Tasks

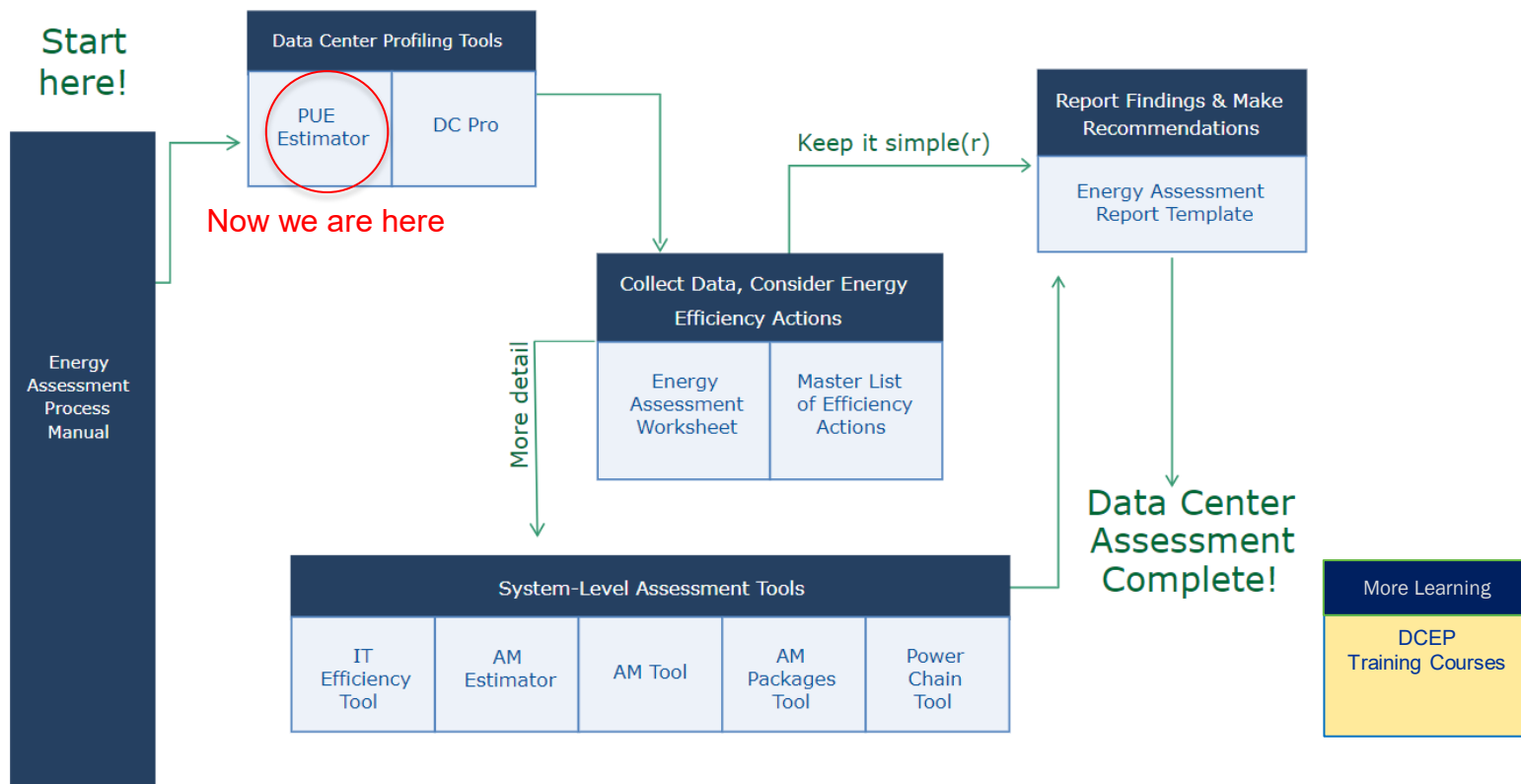
Power Usage Effectiveness (PUE)

1.7

Energy Use Distribution

System	Percentage
IT Equipment	~55%
Cooling	~25%
Fans	~10%
Power Chain	~5%
Lights	~5%

PUE Estimator




AM = Air Management

<http://datacenters.lbl.gov/Tools>

PUE Estimator

The PUE Estimator uses the same “engine” as DC Pro but with reduced input and output for improved clarity and speed.

PUE Estimator


Clicking on a  will give you more information about the selected row.


You can choose your climate zone manually by checking this box: ☐
(Required for data centers located outside the United States)


* State/Region:


* County:


Climate Zone: 3A Determined by entries above.


* What is a typical (average) air temperature leaving the cooling coils (supply)? 


* What is a typical (average) air temperature entering the cooling coils (return)? 

* Do you have active, working humidification controls? ☐ Yes ☐ No 

* Do you have active, working dehumidification controls? ☐ Yes ☐ No 

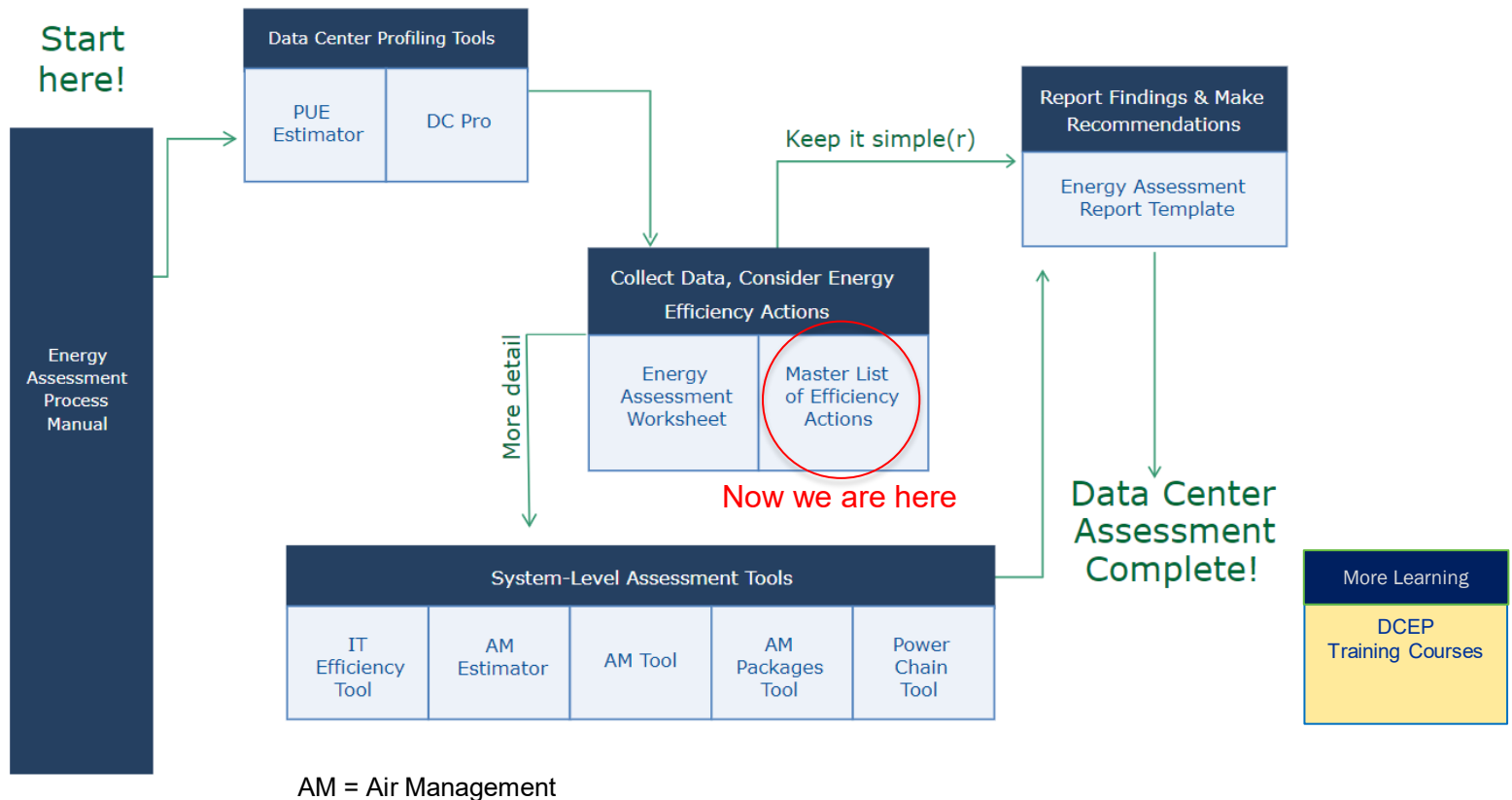
* Does the CRAC/CRAH/AHU have a free cooling coil (water side economizer)? ☐ Yes ☐ No 

* Is there air-side free cooling? ☐ Yes ☐ No 

* Cooling System Type? 

* Is there an Uninterruptible Power Supply (UPS)? ☐ Yes ☐ No If a UPS exists but is not used, answer No.

Master List of Energy Efficiency Actions



<http://datacenters.lbl.gov/Tools>

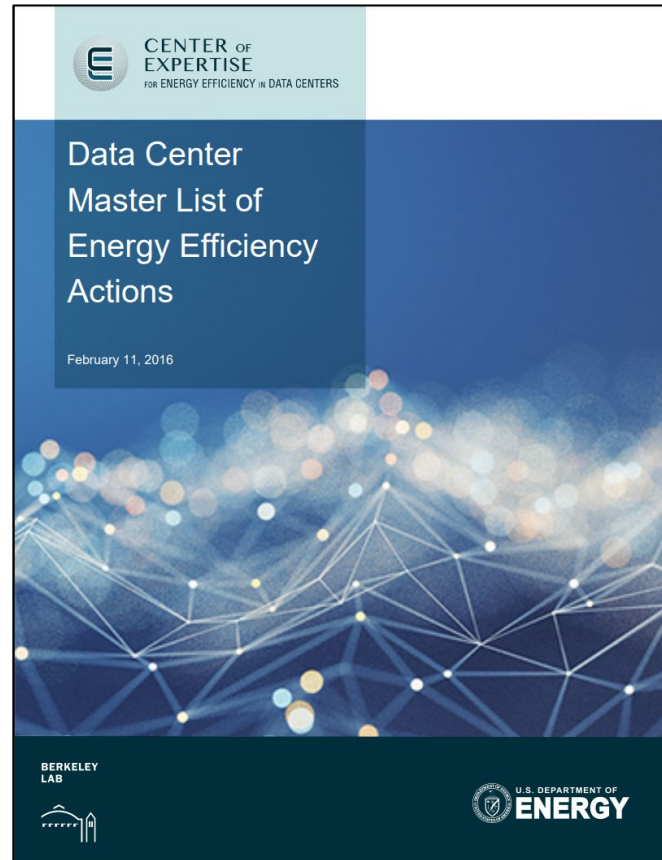
Master List of Energy Efficiency Actions

- Living encyclopedia of data center EEMs*
 - An essential desk reference
 - 250 energy-saving measures
- For each measure, the Master List explains the principles involved and how energy savings are generated plus tips on implementation.
- Individuals can copy and paste relevant actions into an action plan or into an energy assessment report.

*EEM = Energy-Efficiency Measure

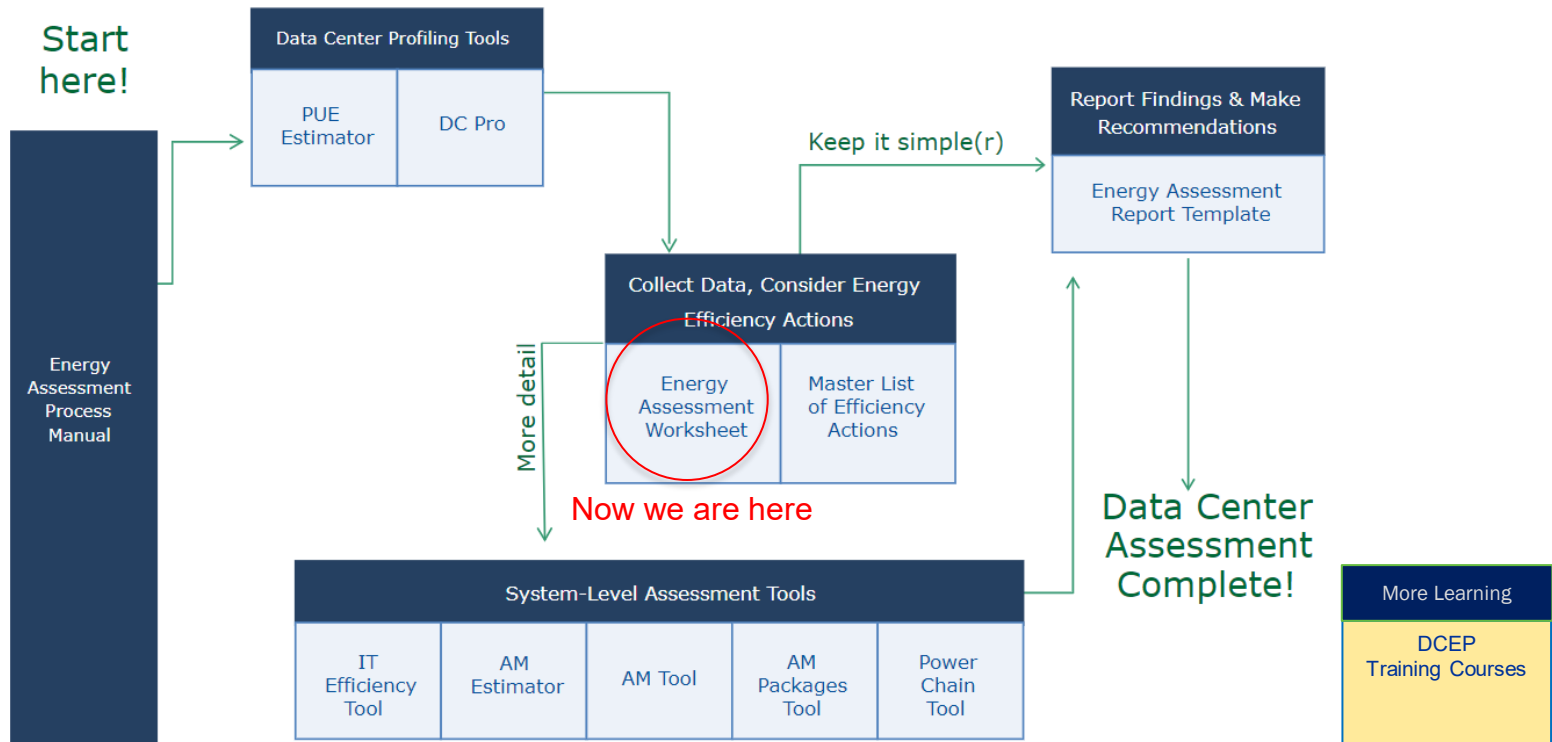
Master List of Energy Efficiency Actions

Comprehensive
48-page document



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

Energy Efficiency Assessment Worksheet



AM = Air Management

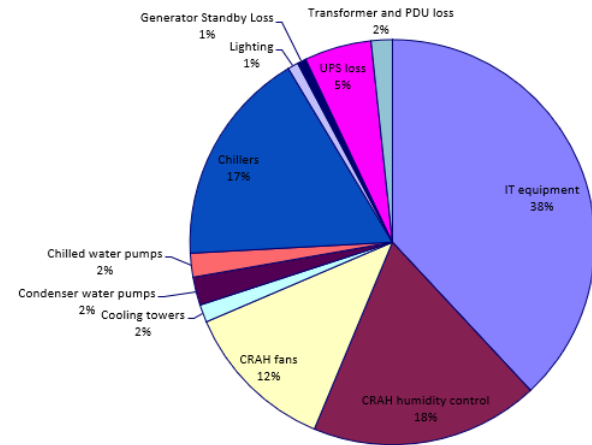
<http://datacenters.lbl.gov/Tools>

Energy Efficiency Assessment Worksheet

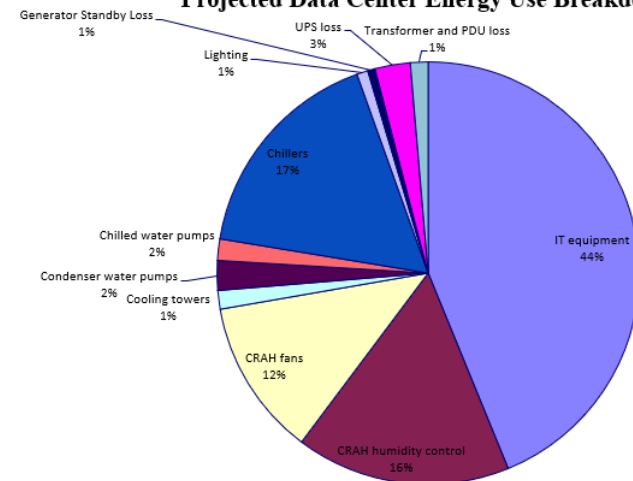
This is an Excel-based workbook to document metrics, actions, and measurements. It allows different levels of analysis. The workbook can be used in parallel with any of the CoE's simulation tools and the Report Template (discussed later).

<http://datacenters.lbl.gov/resources/energy-assessment-worksheet>

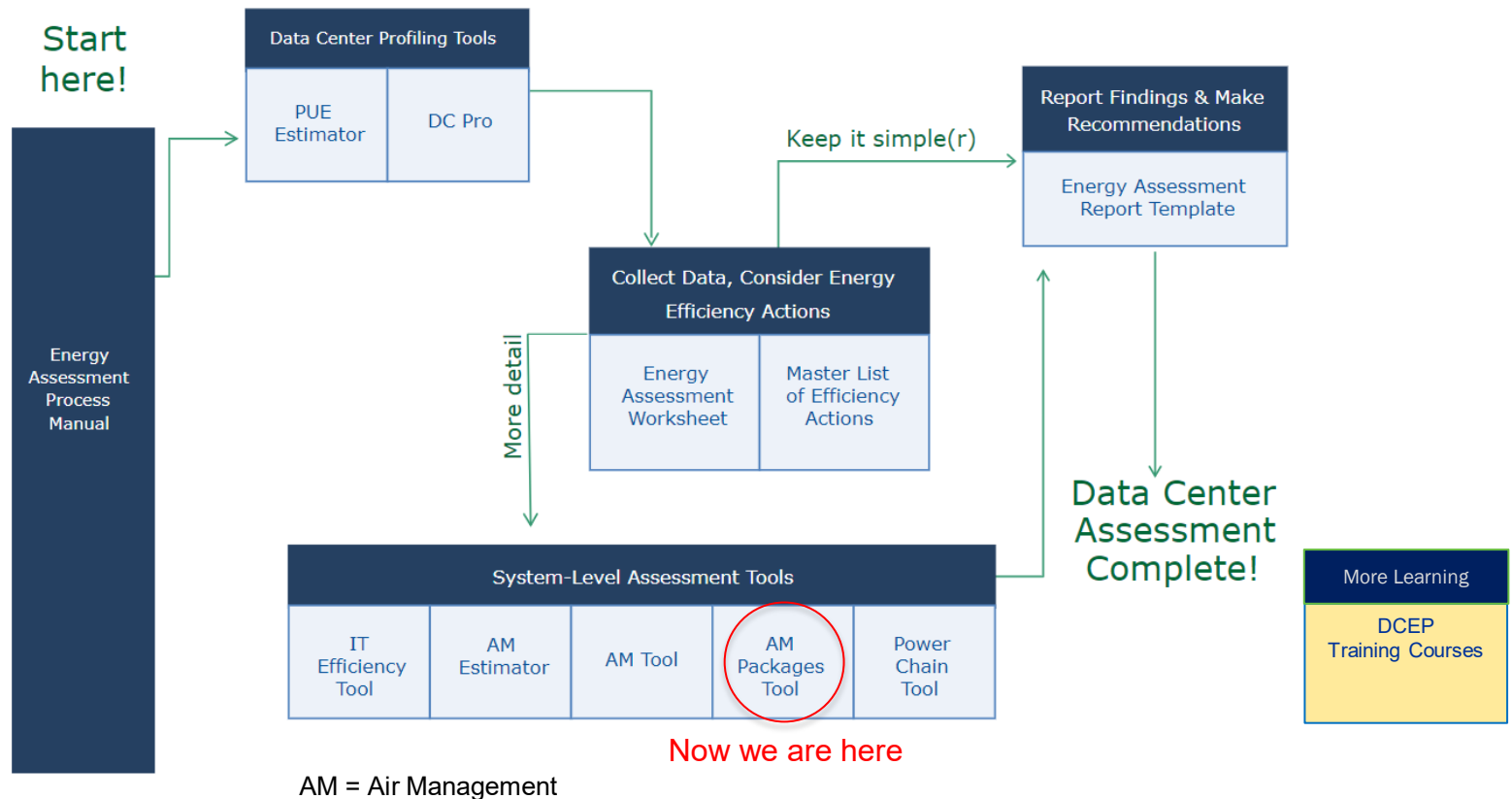
Current Data Center Energy Use Breakdown



Projected Data Center Energy Use Breakdown



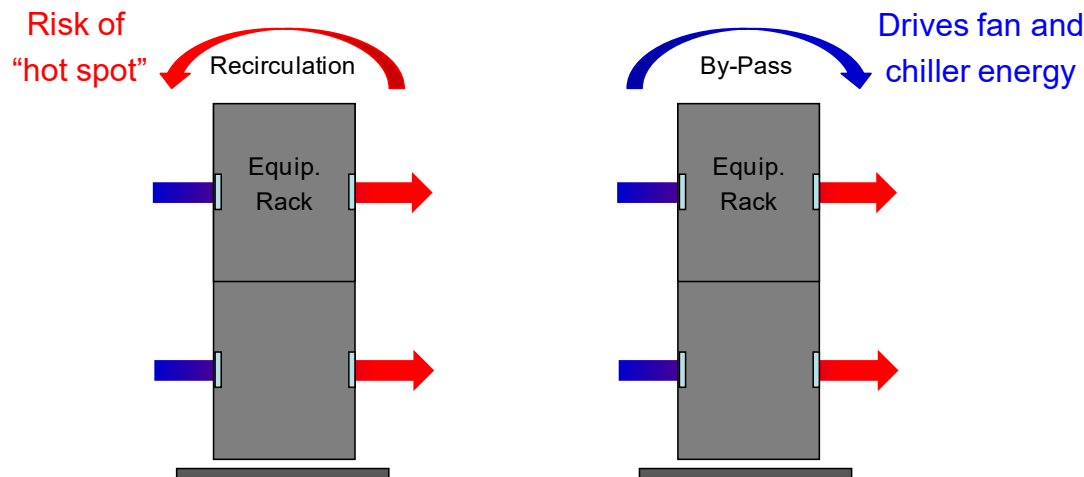
Air Management Look-Up Tables



<http://datacenters.lbl.gov/Tools>

What is Air Management?

The goal of air management is to minimize mixing of hot and cold air streams in the data center by reducing air recirculation of hot air and reducing by-pass of cold air. Both measures result in energy savings and better thermal conditions.



Side view of two equipment racks


Air Management Look-Up Tables

Want a quick and easy way to estimate air management savings without a simulation tool?


Berkeley Lab research report “Air Management Look-up Tables” presents estimated energy savings in a tabular format for air management upgrades.

If these scenarios do not fit a particular data center, the Air Management Tool (discussed next) can be used to calculate a wide range of data centers and air management measures.

Air Management Look-Up Tables



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**Guide for Quickly Estimating Air Management
Energy Savings in Small Data Centers:
Air Management Look-up Tables**

June 19, 2020

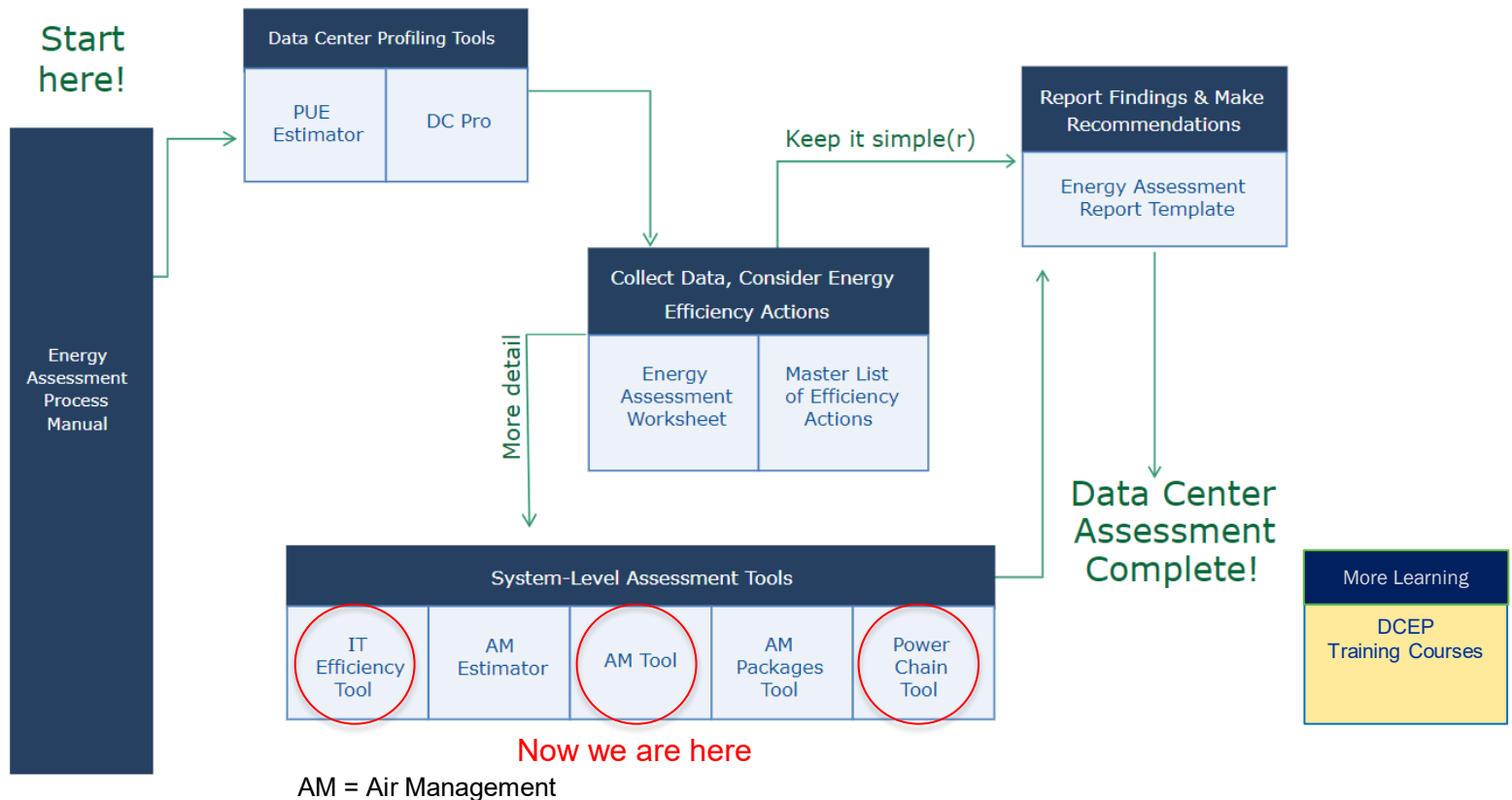
Fan Energy	Target				
Match	P1	P3	P2	P4	P5
Ref. 2.51 (typical) CAV	0%	0%	-72%	-76%	-87%
P1 - 2.51 CAV		0%	-72%	-76%	-87%
P3 - 2.51 CAV			-72%	-76%	-87%
P2 - 1.6 VAV				-17%	-55%
P4 - 1.5 VAV					-46%
CRAC/IT Airflow	2.51	2.51	1.6	1.5	1.2
	CAV	CAV	VAV	VAV	VAV

1



<https://datacenters.lbl.gov/resources/air-management-packages-tool>

Excel System-Level Simulation Tools



<http://datacenters.lbl.gov/Tools>

Data Center System-Level Simulation Tools

The Air Management Tool helps optimize air management to improve energy efficiency and the thermal IT environment. It computes RCI* and RTI*.

The IT Equipment Tool helps estimate energy and carbon savings by improving IT design and operation. IT power also drives demand for power and cooling.

The Electrical Power Chain Tool estimates potential savings from efficiency actions in the electrical power chain (e.g., UPSs and PDUs).

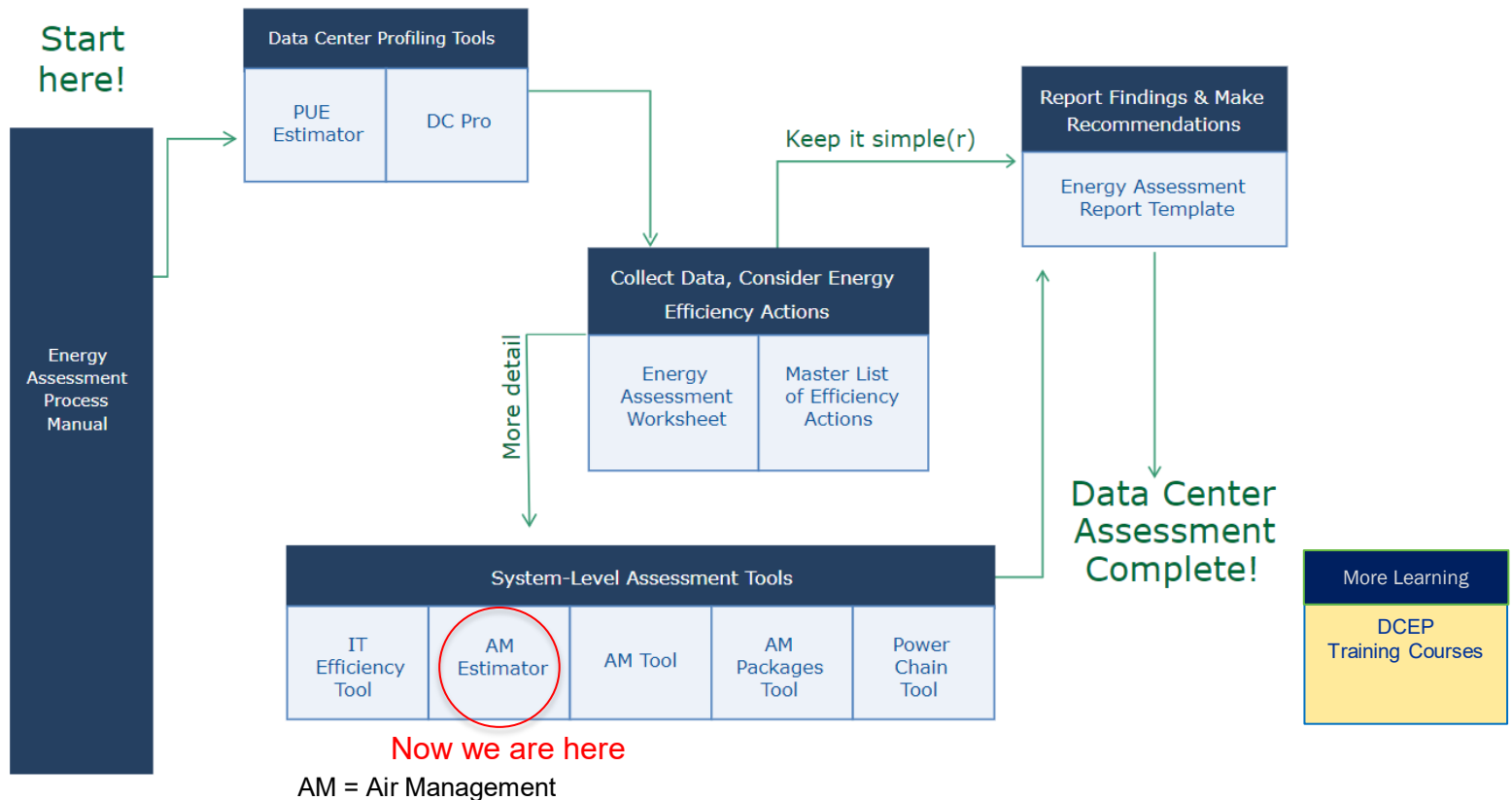
* Important air management metrics

Shared Features

The CoE's three Excel-based system tools typically have the following features in common:

- What-if scenarios
- Hands-on recommendations
- Energy and cost savings
- CO₂ reductions
- Water usage
- Simple payback for energy-saving measures
- Export/import data to/from other CoE System Tools

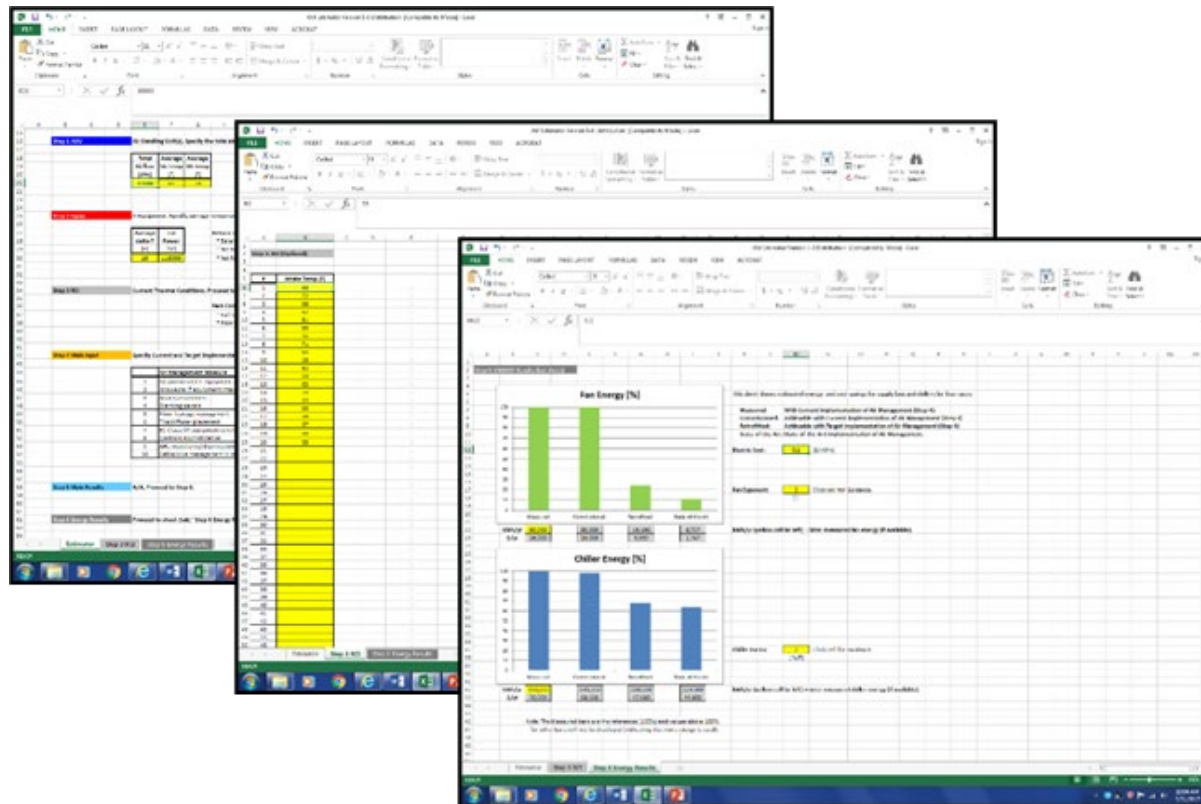
Air Management Estimator



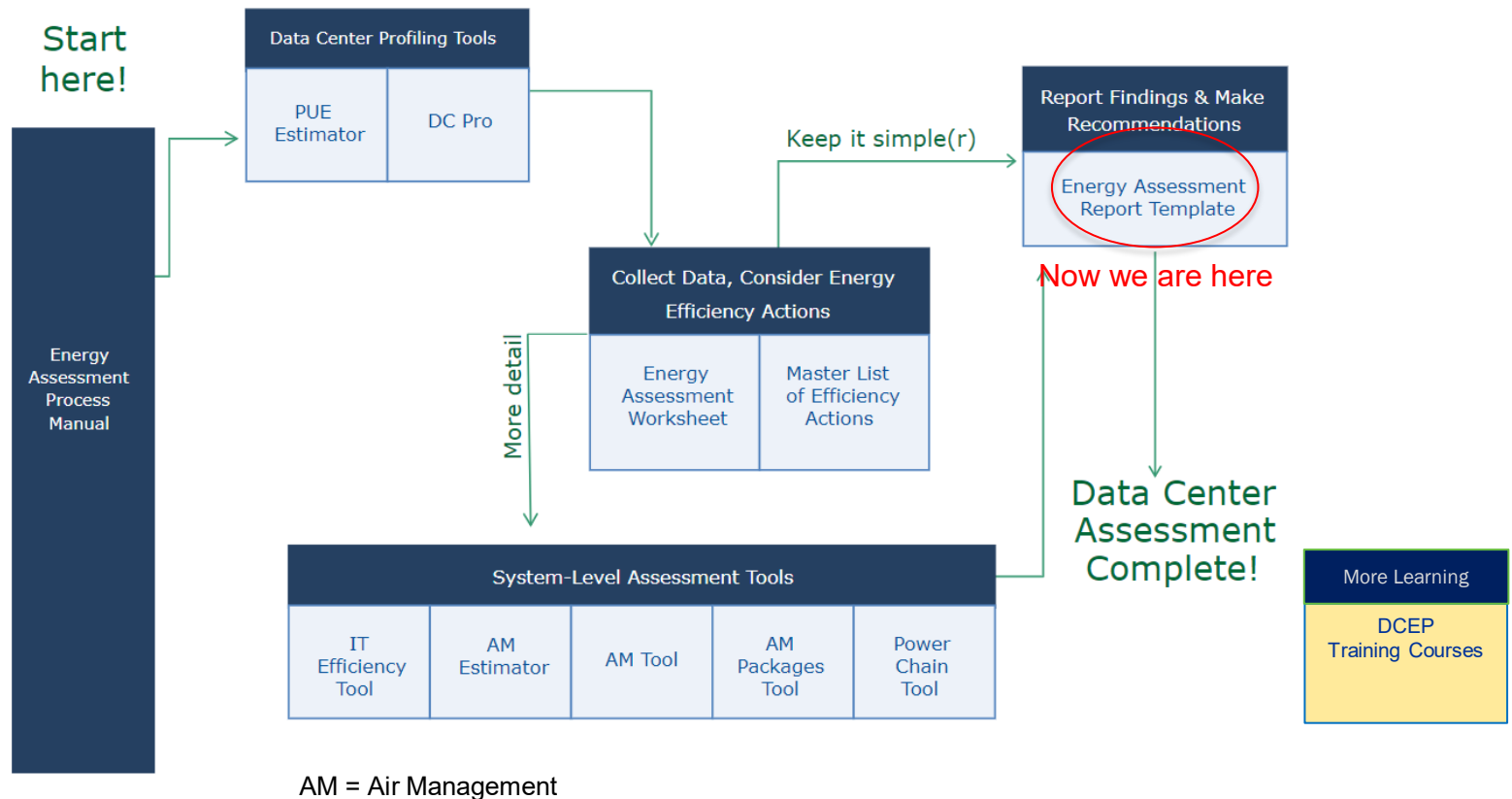
<http://datacenters.lbl.gov/Tools>

Air Management Estimator

The Air Management Estimator uses the same “engine” as the Air Management Tool but with reduced input and output for improved clarity and speed.



Energy Efficiency Assessment Report Template



<http://datacenters.lbl.gov/Tools>

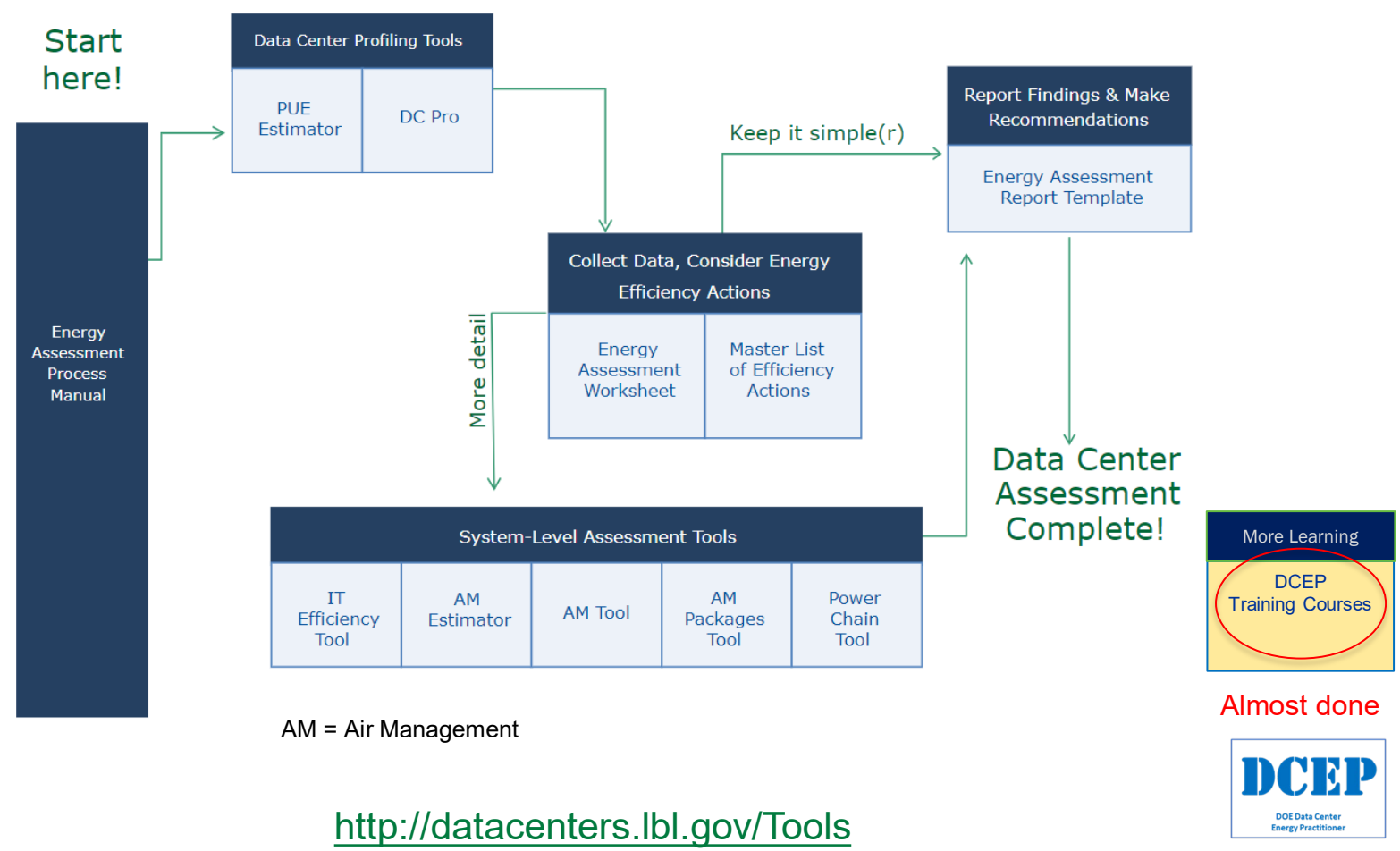
Energy Efficiency Assessment Report Template

Extensive (160 pages) Microsoft Word template for crafting a data center energy efficiency assessment report that can be tailored to site-specific needs.

The template provides a framework for reporting the results of an assessment, and it helps speed up the report writing and ensure that nothing is forgotten.

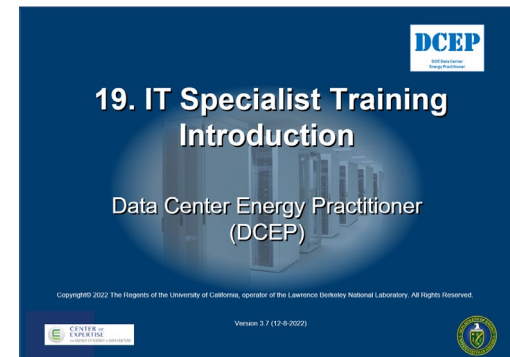
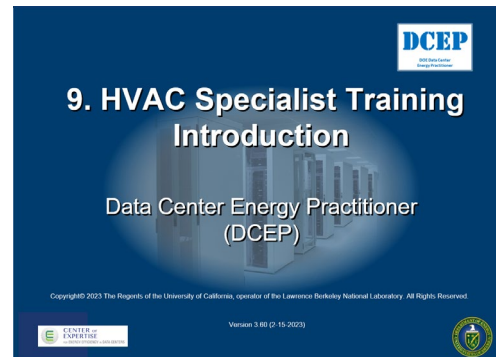
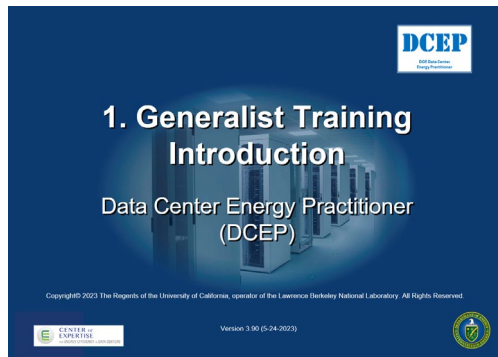
<http://datacenters.lbl.gov/resources/energy-efficiency-assessment-report>

DCEP Training Courses



DCEP Training Courses - Overview

The comprehensive DOE Data Center Energy Practitioner (DCEP) training is intended to help those managing data centers to reduce energy use and carbon footprint. These courses include training on most of the resources in the CoE Toolkit.



DCEP Training Courses

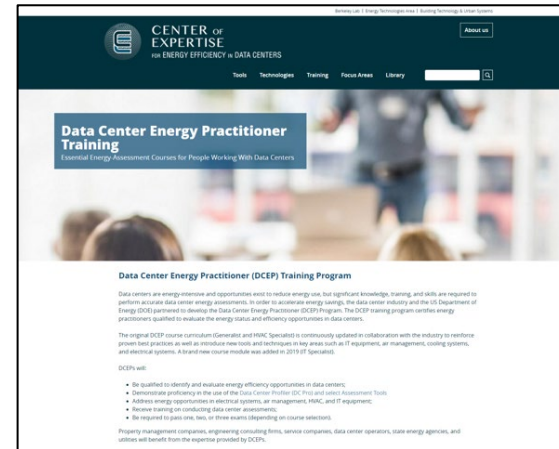
There are three DCEP courses:

- The one-day Generalist course provides a high-level view of IT and support systems + DC Pro and the Electrical Tool.
- The two-day HVAC Specialist course is an in-depth review of HVAC/mechanical systems + the Air Management Tool.
- The one-day IT Specialist course is an in-depth review of IT systems + the IT Equipment Tool.

Official DCEP Website and LinkedIn Group

DCEP Website

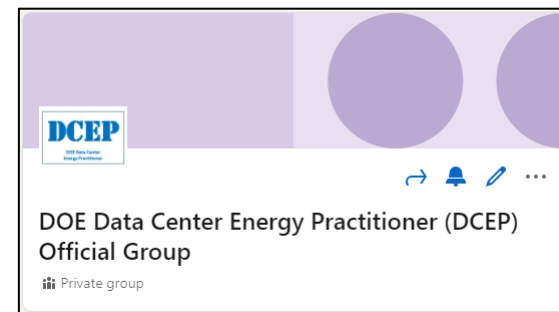
- Program overview/description
- Training calendar, sign-up links
- Listing of program developers, instructors, and DCEPs



<http://datacenters.lbl.gov/DCEP>

DCEP LinkedIn Group

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



<https://www.linkedin.com/groups/9223041/>

Summary

The objective of this webinar is to provide a high-level tour of the Center of Expertise (CoE) Toolkit. These resources provide guidance on achieving energy efficiency and decarbonization in data centers.

Specifically, we review a number of CoE manuals, worksheets, templates, listings, and simulation software. These resources provide a rich set of useful information.

We finally addressed the DCEP training since it includes training on most of the resources in the Toolkit.



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 energy and water systems in data centers.

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

- [Data Center Energy Practitioner \(DCEP\) Trainings](#)
- [Better Buildings webinar series](#)
- [Nine on-demand FEMP data center trainings](#)
- [Center of Expertise Webinars](#)

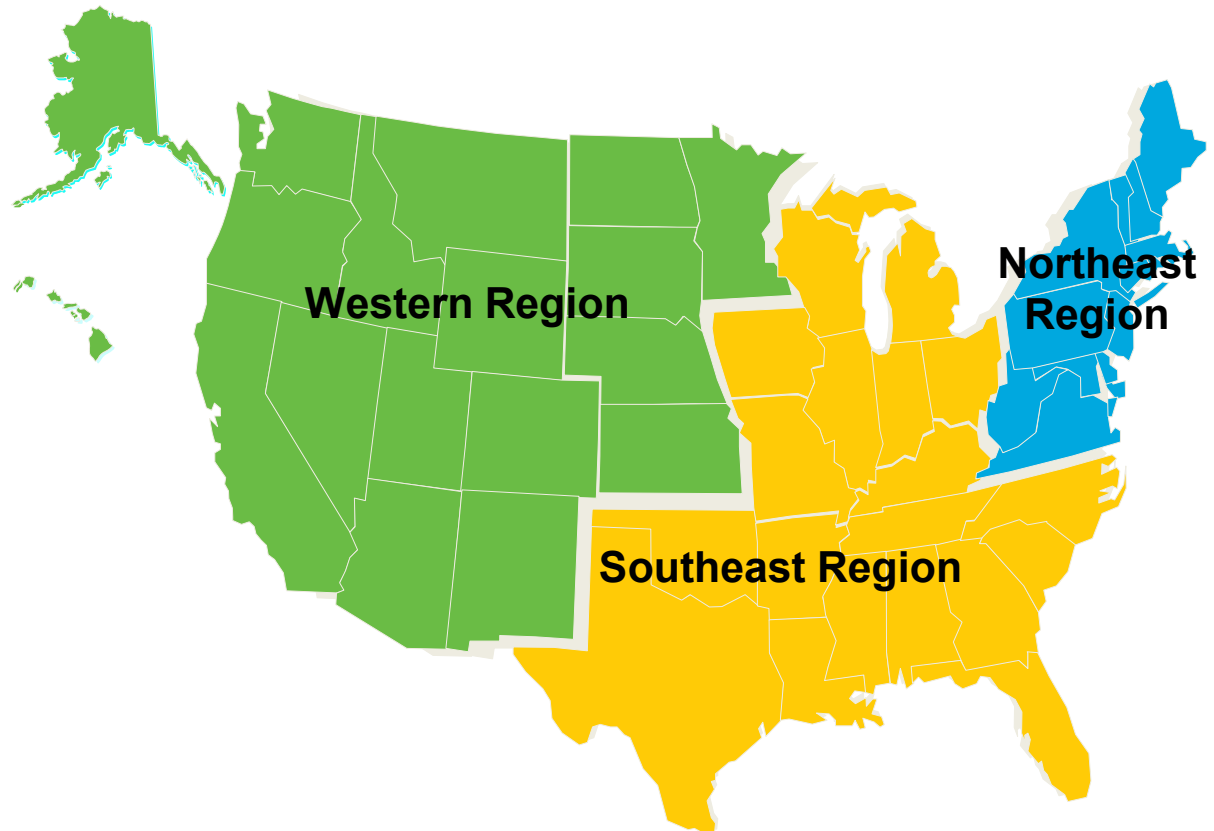
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Questions?

IACET Credit for Webinar



The National Institute of Building Sciences' (NIBS) Whole Building Design Guide (WBDG) hosts the FEMP training program's learning management system (LMS).

The WBDG LMS:

- Allows for taking multiple trainings from multiple organizations through one platform.
- 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.

Visit the WBDG at www.wbdg.org to view courses and create an account

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/femplw02142023>

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.