LEED v4 RATING SYSTEM REVIEW

LOCATION & TRANSPORTATION
SUSTAINABLE SITES
WATER EFFICIENCY
ENERGY & ATMOSPHERE
MATERIALS & RESOURCES
INDOOR ENVIRONMENTAL QUALITY

LEED FOR BUILDING OPERATIONS AND MAINTENANCE

PRESENTED BY USGBC

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MODERATOR

Jenny Carney

LEED AP O+M

Principal, YR&G

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WHAT

WHY

WHEN

WHO

HOW

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WHAT

WHY

WHEN

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WHAT

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LEED v4 RATING SYSTEM REVIEW

LOCATION & TRANSPORTATION
SUSTAINABLE SITES
WATER EFFICIENCY
ENERGY & ATMOSPHERE
MATERIALS & RESOURCES
INDOOR ENVIRONMENTAL QUALITY

LEED FOR BUILDING OPERATIONS AND MAINTENANCE

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LEARNING OBJECTIVES

1

Identify the **intent, requirements,** and **strategies** for success with Energy and Atmosphere credits.

2

Recognize how a holistic approach of addressing the **reduction of energy use, ongoing system performance,** and **renewable energy** applications are reflected in the credits.

3

Recognize how to **implement energy metering** to support better energy management.

4

Identify **synergies** between multiple credits.

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SPEAKERS

Jeremy Poling

PE, LEED AP BD+C and O+M
Senior Energy Engineer
Goby, LLC

Tia Henegan

LEED AP O+M
President
Zia for Buildings

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QUESTION and ANSWER

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QUESTION

In general, what do project teams need to know to be successful with EA credits?

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ENERGY
& ATMOSPHERE

LEED FOR BUILDING
OPERATIONS AND MAINTENANCE

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CL200 240V 3W TYPE C2S0D 30TA 1.0Kh
DE 2812689 HW3
1NF 2812689 1858
DTE Energy
306 495 056
OpenWay
USA

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ENERGY & ATMOSPHERE	
PREREQUISITE	CREDIT
Energy efficient best management practices	Existing building commissioning—analysis Existing building commissioning—implementation Ongoing commissioning
Minimum energy performance	Optimize energy performance
Building-level energy metering	Advanced energy metering
Fundamental refrigerant management	Enhanced refrigerant management

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EA Prerequisite

Energy Efficiency
Best Management Practices

Evaluate and establish operating strategies

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ESTABLISHMENT

1. Conduct energy audit

2. Create current facilities requirements

3. Create operations and maintenance plan

WHAT — WHY — WHEN — WHO — HOW

©USGBC

CFR

current facilities requirements

©USGBC

O&M plan

operations and maintenance plan

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ELEMENTS OF O&M PLAN

- Current sequence of operations
- Occupancy schedule
- Equipment run-time schedules
- Setpoints for HVAC equipment
- Setpoints for lighting levels
- Minimum outside air requirements
- Changes in schedules or setpoints
- Systems narrative
- Preventive maintenance plan

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WHO?
BUILDING ENGINEER
COMMUNITY MEMBERS
FACILITIES MANAGER
OWNER
GEOLOGIST
COST ESTIMATOR
CONTRACTOR
NATURAL RESOURCE SPECIALIST
CONSTRUCTION MANAGER
SOIL SCIENTIST
DAYLIGHT/ ENERGY ANALYST
ENERGY AUDITOR
DEVELOPER
PLANNING STAFF
LANDSCAPE ARCHITECT
ARCHITECT
STRUCTURAL ENGINEER
LOCAL HISTORIAN
BUILDING USERS

©USGBC

Document current facility requirements and O&M plans

WHAT — WHY — WHEN — WHO — **HOW**

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ELEMENTS OF CFR

Functional space requirements

Operational space requirements

Building drawings

WHAT — WHY — WHEN — WHO — HOW

©USGBC

FUNCTIONAL SPACE REQUIREMENTS

Building functions by space type

Occupancy schedules

Cleaning schedules

OPERATIONAL SPACE REQUIREMENTS

Temperature setpoints

Lighting levels

Humidity setpoints

BUILDING DRAWINGS

As-built drawings

Tenant drawings

MEP schedules

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O&M PLAN

Systems narrative

Description of building systems

Building operating plan

Sequences of operation

Preventive maintenance plan

©USGBC

SYSTEMS NARRATIVE INCLUDES

- HVAC
- Electrical
- Plumbing
- Building automation system (BAS)
- Process equipment
- Heating and cooling systems for process equipment
- Supplemental heating and cooling systems

©USGBC

BUILDING OPERATING PLAN

- Building occupancy schedule
- Equipment run-time schedule
- Setpoints for HVAC and lighting
- Unoccupied setpoints
- Vacant-space setpoints
- Minimum outside air requirements
- Temperature requirements
- Humidity requirements
- CO_2 level requirements
- Seasonal, day of week, and time of day differences

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SEQUENCE OF OPERATIONS/ CONTROL SEQUENCES

Programmed system responses to external conditions

©USGBC

PREVENTIVE MAINTENANCE PLAN

Schedule of maintenance activities for all building systems and equipment

Manufacturer recommendations

Specific tasks to be completed

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REFERENCED STANDARD

ASHRAE Procedures for Commercial Building Energy Audits

www.ashrae.org

©USGBC

Identify team to conduct audit

©USGBC

WHO?
ENERGY AUDIT TEAM
GENERAL MANAGER
ENGINEER
COMMUNITY MEMBERS
FACILITIES MANAGER
OWNER
GEOLOGIST
COST ESTIMATOR
ENERGY AUDITOR
NATURAL RESOURCE SPECIALIST
BUILDING ENGINEERING STAFF
SOIL SCIENTIST
CONTROLS CONTRACTOR
LAND PLANNER
DEVELOPER
PROPERTY MANAGER
LANDSCAPE ARCHITECT
ARCHITECT
STRUCTURAL ENGINEER
LOCAL HISTORIAN

©USGBC

WHO?
OPERATIONAL TEAM
GENERAL MANAGER
ENGINEER
ELECTRICAL, AND PLUMBING SERVICE PROVIDERS
LOCAL HISTORIAN
FACILITIES MANAGER
MECHANICAL
OWNER
ARCHITECT
GEOLOGIST
LANDSCAPE ARCHITECT
COST ESTIMATOR
PROPERTY MANAGER
ENERGY AUDITOR
MAINTENANCE STAFF
NATURAL RESOURCE SPECIALIST
LAND PLANNER
CONTROLS CONTRACTOR
SOIL SCIENTIST
TESTING AND BALANCING CONTRACTOR

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CREATE IMPLEMENTATION PLAN FOR ENERGY AUDIT

WHAT | WHY | WHEN | WHO | **HOW**

©USGBC

12

months

improved energy consumption data needed

©USGBC

Conduct preliminary energy use analysis to establish baseline for building performance

WHAT — WHY — WHEN — WHO — HOW

©USGBC

Collect 1-3 years of utility bills

Develop energy cost, demand, and use indexes

WHAT — WHY — WHEN — WHO — HOW

©USGBC

ENERGY STAR Portfolio Manager

CBECS

Labs21

WHAT — WHY — WHEN — WHO — HOW

©USGBC

Establish target for energy and cost reduction goals

WHAT — WHY — WHEN — WHO — HOW

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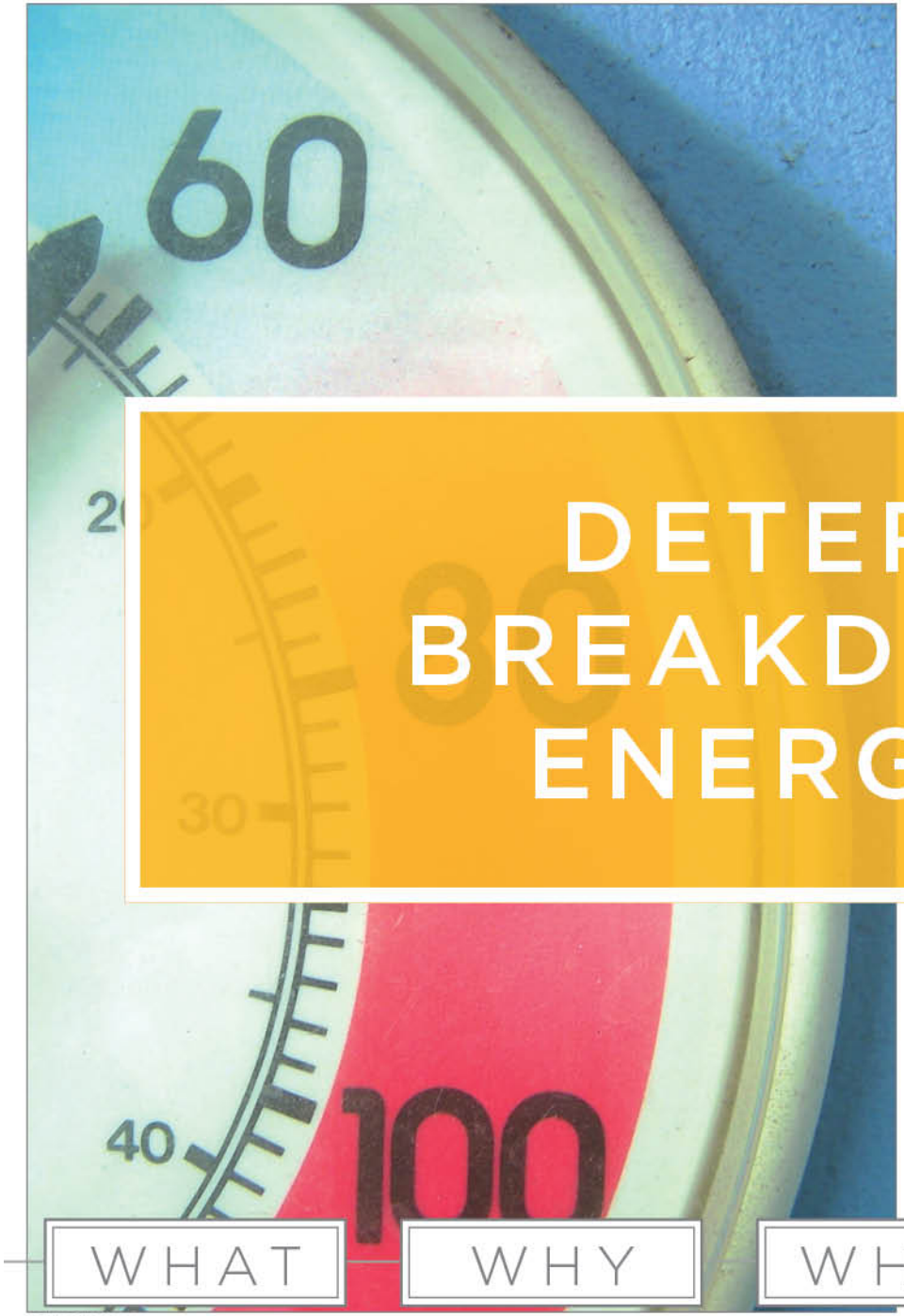
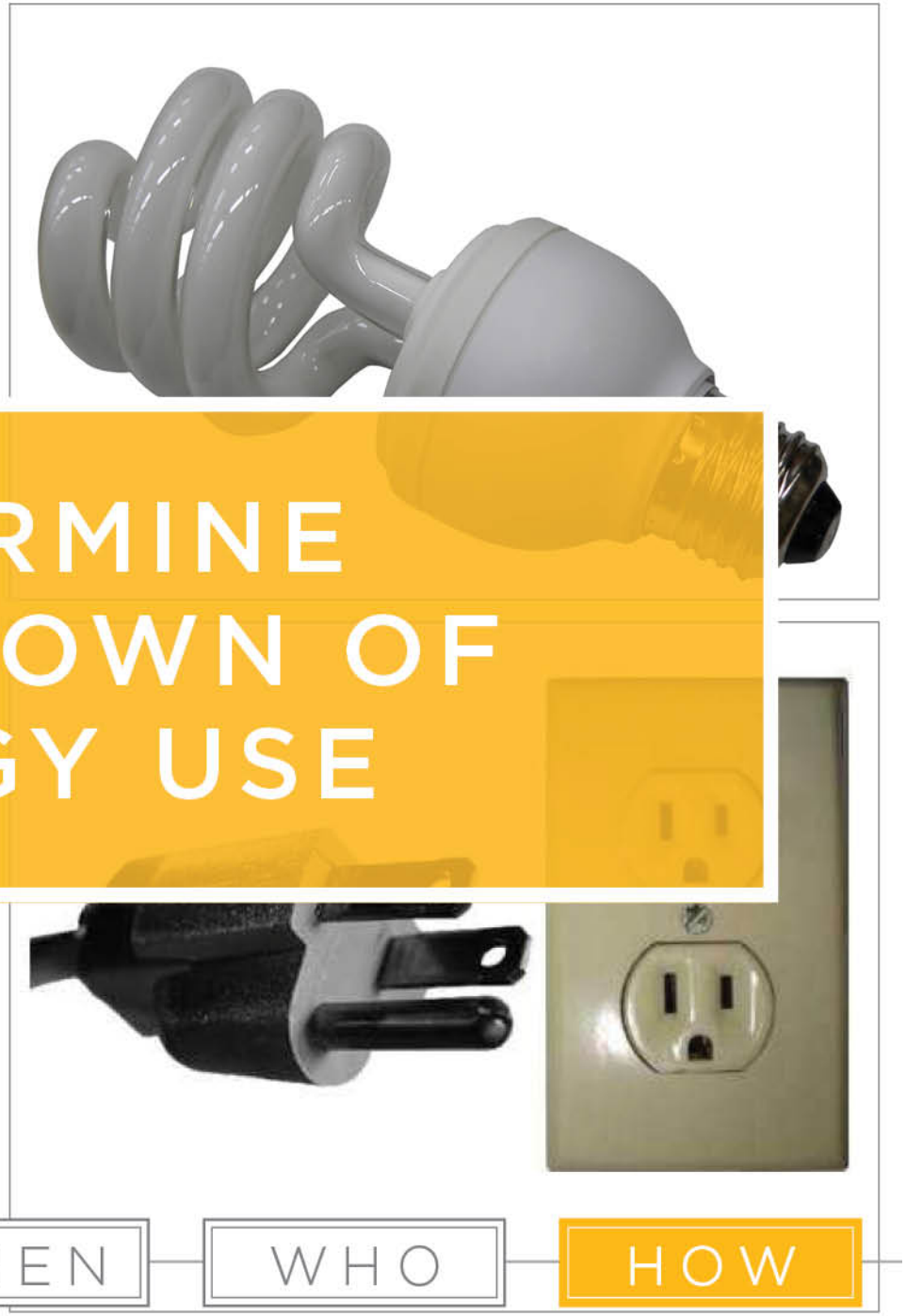
DETERMINE BREAKDOWN OF ENERGY USE





WHAT | WHY | WHEN | WHO | **HOW**

©USGBC

Perform ASHRAE Level 1 walk-through assessment

WHAT — WHY — WHEN — WHO — **HOW**

©USGBC

GENERATE LIST OF POTENTIAL IMPROVEMENTS

WHAT | WHY | WHEN | WHO | HOW

©USGBC

ASHRAE LEVEL 1 REPORT

Comparison with similar building types

Current energy indexes

Energy use breakdown

Financial assessment, maintenance implications of improvement opportunities

WHAT | WHY | WHEN | WHO | HOW

©USGBC

Make necessary modifications to CFR and O&M plans

WHAT — WHY — WHEN — WHO — **HOW**

©USGBC

DATA CENTERS

ADAPTATION SPECIFIC CREDITS

Use web-based DC Pro Profiling tool

If using DES, include downstream building systems

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EA Prerequisite and Credit

PREREQUISITE
Minimum Energy Performance

CREDIT
Optimize Energy Performance

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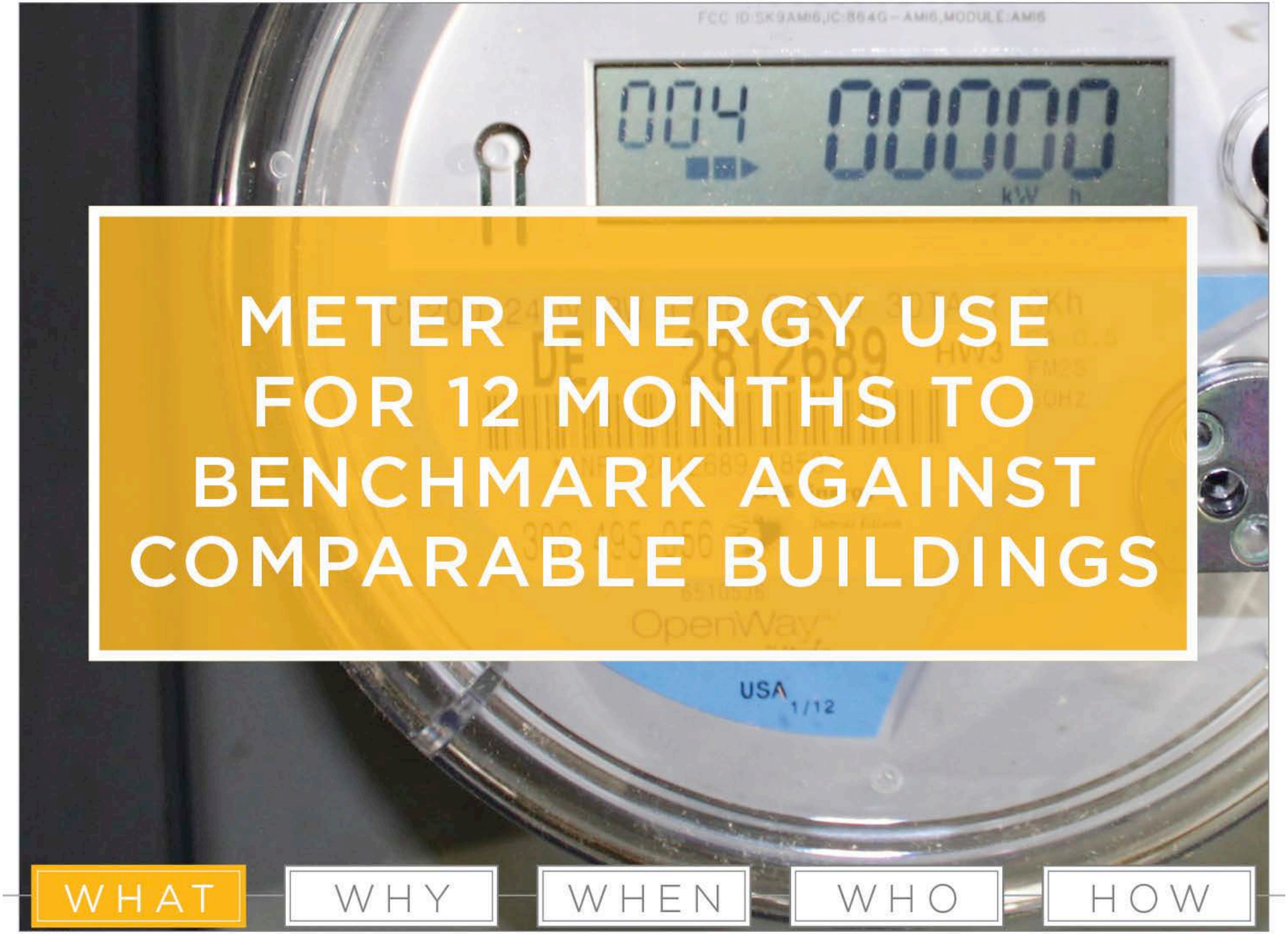

METER ENERGY USE FOR 12 MONTHS TO BENCHMARK AGAINST COMPARABLE BUILDINGS

WHAT | WHY | WHEN | WHO | HOW

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EA Prerequisite
Minimum Energy Performance

EA Credit
Optimize Energy Performance

CASE 1. ENERGY STAR Rating

Minimum score 75 (Prerequisite)
Score 76-95 = 3-20 Points (Credit)

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EA Prerequisite
Minimum Energy Performance

EA Credit
Optimize Energy Performance

CASE 2. Projects not eligible for ENERGY STAR Rating

OPTION 1
Benchmark against comparable buildings

PATH 1. National data available

PATH 2. National data not available

or

OPTION 2
Benchmark against historical data

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EA Prerequisite
Minimum Energy Performance

EA Credit
Optimize Energy Performance

CASE 2. Projects not eligible for ENERGY STAR Rating

OPTION 1
Benchmark against comparable buildings

PATH 1. National data available
25% better than median (Prerequisite)
26-45% better = 1-20 Points (Credit)

PATH 2. National data not available
25% improvement over comparable buildings (Prerequisite)
27-45% improvement = 2-14 Points (Credit)

or

OPTION 2
Benchmark against historical data

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EA Prerequisite
Minimum Energy Performance

EA Credit
Optimize Energy Performance

CASE 2. Projects not eligible for ENERGY STAR Rating

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25% improvement over comparable buildings (Prerequisite)
27-45% improvement = 2-14 Points (Credit)

or

OPTION 2
Benchmark against historical data

25% improvement (Prerequisite)

26-45% better = 2-14 Points (Credit)

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PREREQUISITE

ESTABLISHMENT

Calibrate energy meters

PERFORMANCE

Meter energy use and achieve levels of efficiency

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CREDIT

ESTABLISHMENT	PERFORMANCE
None	Demonstrate increased energy efficiency

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WHO?
ENGINEER
COMMUNITY MEMBERS
FACILITY MANAGER
OWNER
GEOLOGIST
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NATURAL RESOURCE SPECIALIST
COMMISSIONING AGENT
SOIL SCIENTIST
DAYLIGHT/ ENERGY ANALYST
LAND PLANNER
DEVELOPER
PLANNING STAFF
AUDITING TEAMS
ARCHITECT
STRUCTURAL ENGINEER
LOCAL HISTORIAN
BUILDING USERS

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Confirm building's energy metering

WHAT — WHY — WHEN — WHO — HOW

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DATA CENTERS

ADAPTATION SPECIFIC CREDITS

Meter and record data center space separately

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Set up ENERGY STAR Portfolio Manager profile

©USGBC

PORTFOLIO MANAGER CONSIDERATIONS

1. **Create account and profile for each building**
2. Determine gross area of each space type
3. Account for all energy sources
4. Exclude up to 10% of floor area if under separate management and control
5. Enter number of computers and servers
6. Enter operating hours, if required
7. Normalize data according to climate

©USGBC

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©USGBC

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4. Exclude up to 10% of floor area if under separate management and control
5. Enter number of computers and servers
6. Enter operating hours, if required
7. **Normalize data according to climate**

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Share account access with USGBC

Determine start of 12 month performance period

Conduct preliminary benchmarking before performance period

WHAT — WHY — WHEN — WHO — **HOW**

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IMPROVE ENERGY PERFORMANCE

Implement major efficiency upgrades

Adjust and optimize existing equipment

Utilize ASHRAE Level 1 Energy Audit results

Consider advanced energy audit or commissioning

WHAT — WHY — WHEN — WHO — **HOW**

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EA Prerequisite and Credit

CASE 1

ENERGY STAR Rating

or

CASE 2

Projects not eligible for ENERGY STAR Rating

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ENERGY STAR ELIGIBLE

BANK BRANCH

WHOLESALE CLUB/SUPERCENTER

BARRACKS

OFFICE

FINANCIAL OFFICE

DATA CENTER

K-12 SCHOOL

SUPERMARKET/GROCERY STORE

MEDICAL OFFICE

HOSPITAL (GENERAL MEDICAL & SURGICAL)

SENIOR CARE COMMUNITY

DISTRIBUTION CENTER

RESIDENCE HALL/ DORMITORY

NON-REFRIGERATED WAREHOUSE

WASTEWATER TREATMENT PLANT

REFRIGERATED WAREHOUSE

WORSHIP FACILITY

COURTHOUSE

HOTEL

RETAIL STORE

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INELIGIBLE FOR ENERGY STAR

Space type not listed

"Other" space area >10%

Multifamily space >10%

Less than 12 consecutive months of data

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EA Prerequisite and Credit

CASE 2. ENERGY STAR Rating

Projects not eligible for ENERGY STAR Rating

OPTION 1

Benchmark against typical building

PATH 1. National data available
PATH 2. National data not available

Demonstrate 25% better than peer building

WHAT | WHY | WHEN | WHO | HOW

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EA Prerequisite and Credit

CASE 2. ENERGY STAR Rating

Projects not eligible for ENERGY STAR Rating

OPTION 2

Benchmark against historical data

25% improvement from baseline (Prerequisite)

Further improvements (Credit)

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EA Prerequisite and Credit

CASE 2. ENERGY STAR Rating

Projects not eligible for ENERGY STAR Rating

OPTION 3

Benchmark against both similar buildings and historical data

Additional points under credit

WHAT | WHY | WHEN | WHO | HOW

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Normalize energy use intensity (EUI) according to climate zone

Convert site energy use to source energy use

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Enter performance period dates

Collect and upload metered energy data

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Benchmark data according to case, option, and path selected

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Confirm prerequisite performance requirements are met

Determine credit points based on performance results

WHAT — WHY — WHEN — WHO — HOW

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Update benchmarking data routinely

WHAT — WHY — WHEN — WHO — HOW

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DATA CENTERS

ADAPTATION SPECIFIC CREDITS

Segregate data center spaces within larger building

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EA Prerequisite

Building-level Energy Metering

Capture data on total building-level energy consumption

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EA Credit

Advanced Energy Metering (1 Point)

Track system-level energy use

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ESTABLISHMENT

Install or use energy meters

PERFORMANCE

Compile data and share with USGBC

Program systems to alarm when readings deviate more than 5% from expected

WHAT | WHY | WHEN | WHO | HOW

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WHO?
BUILDING OPERATOR
ENGINEER
COMMUNITY MEMBERS
FACILITIES MANAGER
OWNER
GEOLOGIST
COST ESTIMATOR
CONTRACTOR
NATURAL RESOURCE SPECIALIST
CONSTRUCTION MANAGER
SOIL SCIENTIST
DAYLIGHT/ ENERGY ANALYST
LAND PLANNER
THIRD PARTY CONTROLS CONTRACTOR
PLANNING STAFF
LANDSCAPE ARCHITECT
ARCHITECT
STRUCTURAL ENGINEER
LOCAL HISTORIAN

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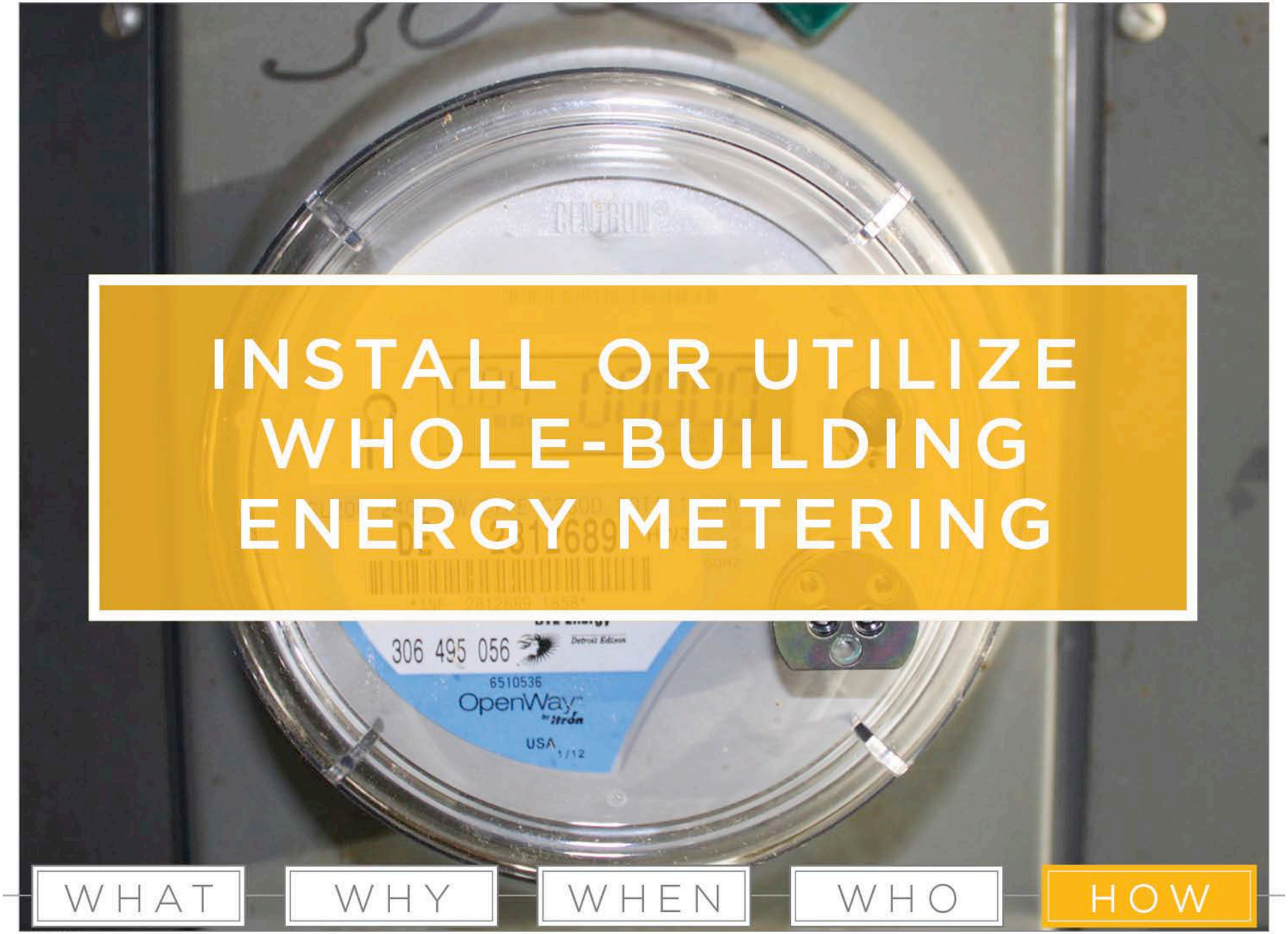

INSTALL OR UTILIZE WHOLE-BUILDING ENERGY METERING

WHAT | WHY | WHEN | WHO | HOW

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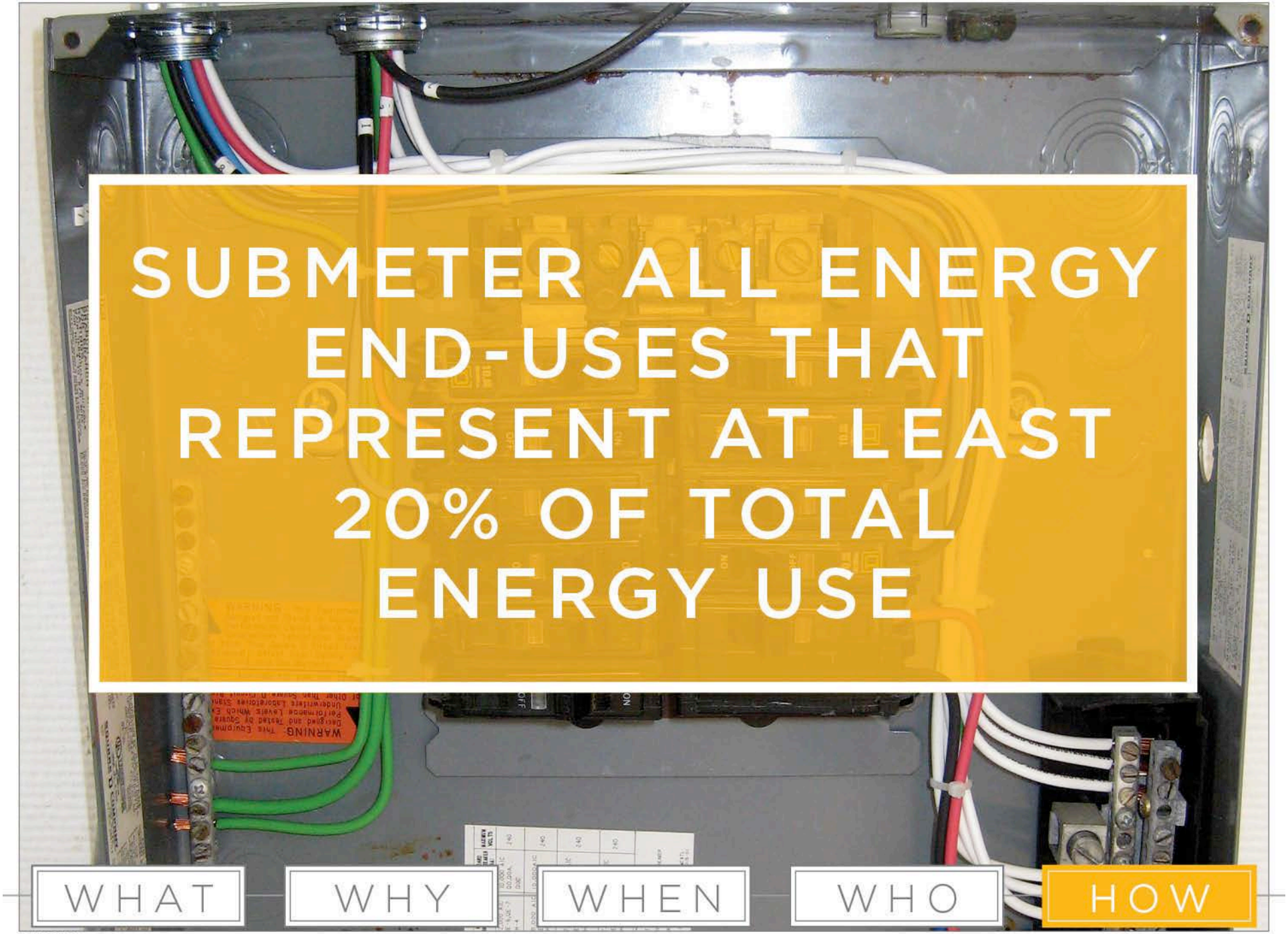

SUBMETER ALL ENERGY END-USES THAT REPRESENT AT LEAST 20% OF TOTAL ENERGY USE

WHAT | WHY | WHEN | WHO | **HOW**

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Use ASHRAE Level 1 (and Level 2 if completed) walk-through analysis results if end-use data not available

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SYSTEM METERING EXAMPLES

Chilled water system - chillers, chilled water pumps

Condenser water system - cooling tower, condenser water pumps

Air-handling system - supply fan, return fan, damper motors

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COMMERCIAL BUILDING ENERGY CONSUMPTION SURVEY (2003)

End-Use Consumption Tables for Non-Mall Buildings

End-Use Consumption Tables for All Buildings

©USGBC

Strike a balance when determining what information to share with building operators

WHAT — WHY — WHEN — WHO — **HOW**

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EA CREDIT ADVANCED ENERGY METERING

Use building automation system or software for data collection

System must generate alarm if more than 5% demand or consumption over set interval

WHAT — WHY — WHEN — WHO — HOW

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EA CREDIT ADVANCED ENERGY METERING

Record and compare peak demand and total consumption each month

WHAT — WHY — WHEN — WHO — HOW

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DATA CENTERS

ADAPTATION SPECIFIC CREDITS

IT energy metered separately

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EA Prerequisite and Credit

PREREQUISITE
Fundamental Refrigerant Management

CREDIT
Enhanced Refrigerant Management

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EA PREREQUISITE Fundamental Refrigerant Management

Do not use chlorofluorocarbon (CFC)-based refrigerants

or

Complete CFC phase-out or conversion

WHAT | WHY | WHEN | WHO | HOW

©USGBC

EA Credit

Enhanced Refrigerant Management

OPTION 1

No refrigerants or use low impact refrigerants only

or

OPTION 2

Calculate refrigerant impact to ensure within ODP and GWP limits

WHAT | WHY | WHEN | WHO | HOW

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ozone depletion
potential (ODP)

global warming
potential (GWP)

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WHO?
BUILDING USERS
ENGINEER
COMMUNITY MEMBERS
LOCAL HISTORIAN
FACILITIES MANAGER
STRUCTURAL ENGINEER
OPERATIONS
ARCHITECT
GEOLOGIST
LANDSCAPE ARCHITECT
COST ESTIMATOR
PLANNING STAFF
CONTRACTOR
MAINTENANCE STAFF
NATURAL RESOURCE SPECIALIST
LAND PLANNER
DAYLIGHT/ ENERGY ANALYST
SOIL SCIENTIST
CONSTRUCTION MANAGER

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EA PREREQUISITE FUNDAMENTAL REFRIGERANT MANAGEMENT

Identify all HVAC and equipment that uses refrigerants

WHAT — WHY — WHEN — WHO — **HOW**

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REPLACE OR RETROFIT EXISTING EQUIPMENT THAT USES CFC REFRIGERANTS

(exempt: small equipment with < 0.5 lbs (225g) refrigerant)

WHAT | WHY | WHEN | WHO | HOW

©USGBC

PAYBACK ANALYSIS

$$\text{simple payback} = \frac{\text{cost of replacement or conversion}}{\text{resulting annual energy cost difference} + \text{resulting annual maintenance and refrigerant cost difference}} > 10$$

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MAINTAIN EQUIPMENT

5% and **30%**

or less annual leakage

or less total lifetime leakage

WHAT — WHY — WHEN — WHO — **HOW**

©USGBC

EA Credit

Enhanced Refrigerant Management

OPTION 1

No refrigerants or low-impact refrigerants

1 POINT

or

OPTION 2

Calculation of refrigerant impact

1 POINT

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REFRIGERANT ODP/GWP (EXAMPLES)

REFRIGERANT	ODPr	GWPr	COMMON BUILDING APPLICATIONS
CHLOROFLUOROCARBONS			
CFC-11	1.0	4,680	Centrifugal chillers
CFC-12	1.0	10,720	Refrigerators, chillers
HYDROCHLOROFLUOROCARBONS			
HCFC-123	0.02	76	CFC-11 replacement
HYDROFLUOROCARBONS			
HFC-23	~0	12,240	Ultra-low-temperature refrigeration
NATURAL REFRIGERANTS			
Carbon dioxide (CO_2)	0	1.0	
Ammonia (NH_3)	0	0	

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refrigerant charge (Rc)

(noun)

ratio of the total refrigerant used to the cooling capacity measured in lbs/ton (kg/kW)

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RETAIL

ADAPTATION SPECIFIC CREDITS

Additional requirements for commercial refrigeration

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Cx

Commissioning

©USGBC

EA Credit

Existing Building Commissioning – Analysis

Evaluate performance relative to CFR and O&M plan

(2 Points)

©USGBC

EA Credit

Existing Building Commissioning – Analysis

OPTION 1

Existing building commissioning

or

OPTION 2

Energy audit

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ESTABLISHMENT

Prepare for commissioning or audit

PERFORMANCE

Conduct commissioning or audit

©USGBC

EA Credit

Existing Building Commissioning – Analysis

OPTION 1

Existing building commissioning

or

OPTION 2

Energy audit

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WHO?
CONTROLS CONTRACTOR
COMMUNITY MEMBERS
FACILITIES MANAGER
OWNER
GEOLOGIST
COST ESTIMATOR
ENERGY AUDITOR
NATURAL RESOURCE SPECIALIST
BUILDING ENGINEERING STAFF
SOIL SCIENTIST
DAYLIGHT/ ENERGY ANALYST
COMMISSIONING AUTHORITY
DEVELOPER
PROPERTY MANAGER
LANDSCAPE ARCHITECT
ARCHITECT
GENERAL MANAGER
LOCAL HISTORIAN
BUILDING USERS

©USGBC

©USGBC

Review the CFR and O&M plan

WHAT — WHY — WHEN — WHO — HOW

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Estimate or measure resources used by each major energy end use

WHAT — WHY — WHEN — WHO — HOW

©USGBC

Develop existing building Cx or energy audit plan

WHAT — WHY — WHEN — WHO — HOW

©USGBC

EA Credit

Existing Building Commissioning – Analysis

OPTION 1

Existing building commissioning:
Develop Cx schedule

or

OPTION 2

Energy audit

©USGBC

Develop testing procedures

©USGBC

DATA CENTERS

ADAPTATION SPECIFIC CREDITS

Use web-based DC Pro tools

©USGBC

Determine criteria for evaluating and prioritizing issues and opportunities

WHAT — WHY — WHEN — WHO — HOW

©USGBC

EXECUTE Cx PLAN DURING PERFORMANCE PERIOD AND DOCUMENT RESULTS

WHAT | WHY | WHEN | WHO | **HOW**

©USGBC

EA Credit

Existing Building Commissioning – Analysis

OPTION 1

Existing building commissioning:
Develop Cx schedule

or

OPTION 2

Energy audit:
Develop audit schedule
Perform ASHRAE Level 2 audit

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Determine approach and develop reporting format

WHAT — WHY — WHEN — WHO — HOW

©USGBC

Perform energy audit following ASHRAE Procedures for Commercial Building Energy Audits

WHAT — WHY — WHEN — WHO — **HOW**

©USGBC

ECM

energy conservation measure

©USGBC

Document any changes and update documents

WHAT — WHY — WHEN — WHO — HOW

©USGBC

EA Credit

Existing Building Commissioning – Implementation

Implement no- or low-cost improvements and develop five-year plan for upgrades (2 points)

©USGBC

©USGBC

ESTABLISHMENT

Meet requirements of EA Credit Existing building commissioning – analysis

PERFORMANCE

Implement improvements

Confirm staff training

Develop tracking and verification program

Update O&M Plan

WHAT — WHY — WHEN — WHO — HOW

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WHO?
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BUILDING USERS

©USGBC

Create plan to implement no- and low-cost measures

Prepare implementation schedule

Determine responsibility for implementation

WHAT — WHY — WHEN — WHO — **HOW**

©USGBC

Implement the no- and low-cost measures during the performance period

WHAT — WHY — WHEN — WHO — **HOW**

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Create five-year plan for equipment replacement and major upgrades

WHAT — WHY — WHEN — WHO — HOW

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Provide training for building operations staff

WHAT — WHY — WHEN — WHO — HOW

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TRACKING AND VERIFICATION

Verification of effectiveness

Observed costs

Operational benefits

Environmental benefits

Human health and comfort benefits

©USGBC

Update CFR and O&M plan

WHAT — WHY — WHEN — WHO — HOW

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EA Credit

Ongoing Commissioning

Establish ongoing commissioning process

(3 Points)

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WHO?
CONTROLS CONTRACTOR
COMMUNITY MEMBERS
FACILITIES MANAGER
OWNER
GEOLOGIST
COST ESTIMATOR
ENERGY AUDITOR
NATURAL RESOURCE SPECIALIST
BUILDING ENGINEERING STAFF
SOIL SCIENTIST
DAYLIGHT/ ENERGY ANALYST
COMMISSIONING AUTHORITY
DEVELOPER
PROPERTY MANAGER
LANDSCAPE ARCHITECT
ARCHITECT
GENERAL MANAGER
LOCAL HISTORIAN
BUILDING USERS

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ESTABLISHMENT

Meet requirements for other Cx credits

Establish Cx process

Develop Cx plan

PERFORMANCE

Update systems manual

Provide quarterly reports

Update O&M plan and CFR

WHAT | WHY | WHEN | WHO | HOW

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Confirm compliance with Cx analysis and Implementation credits

WHAT — WHY — WHEN — WHO — HOW

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Modify existing building Cx plan

or

Review overlap between Cx credit and audit plan

WHAT — WHY — WHEN — WHO — **HOW**

©USGBC

Assign roles and responsibilities

©USGBC

Review and update functional testing process

or

Create testing procedures

WHAT — WHY — WHEN — WHO — **HOW**

©USGBC

Determine schedule for ongoing Cx

WHAT — WHY — WHEN — WHO — HOW

©USGBC

Review existing building automation systems or submeters to determine systems to monitor and trend

WHAT — WHY — WHEN — WHO — HOW

©USGBC

ACTION PLAN

Develop process to identify operational errors and deficiencies

Establish plan for correcting

Create process to evaluate

Add plan to tracking and verification program

WHAT — WHY — WHEN — WHO — HOW

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NON-OPTIMAL OPERATION

Conflicts between systems, such as simultaneous heating and cooling

Out-of-sequence operation of systems components

Unexpected energy and water usage profiles

Recurring system alarms

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Create ongoing commissioning report template

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ENERGY STAR IMPROVEMENTS DUE TO ONGOING Cx PROGRAM

BUILDING	ENERGY STAR RATING	
	9/30/2011	7/31/2012
A	90	92
B	87	89
C	87	88
D	85	90

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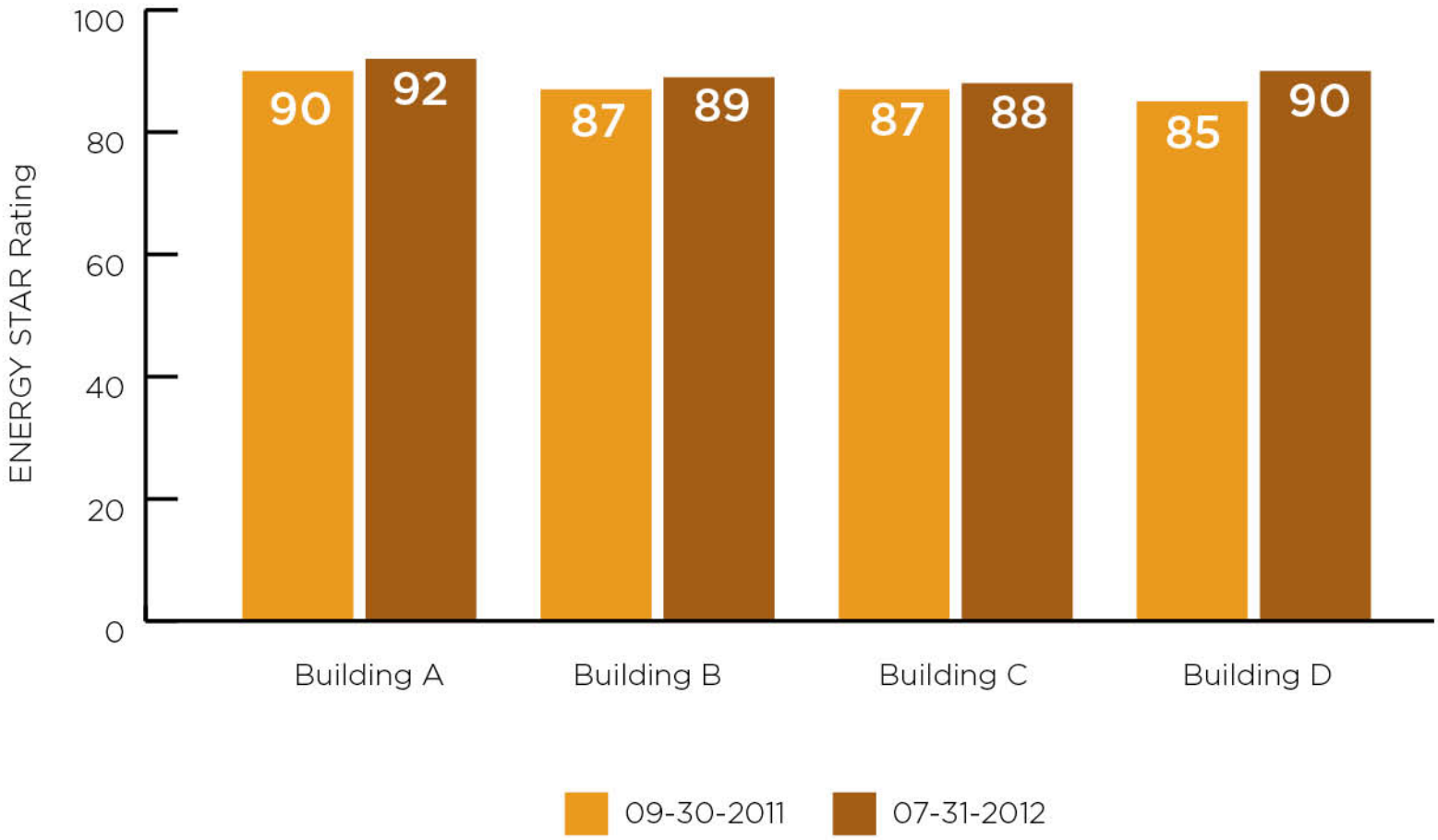
ENERGY STAR IMPROVEMENTS DUE TO ONGOING Cx PROGRAM



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Cx

Commissioning

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QUESTION and ANSWER

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QUESTION

What is the importance of commissioning in LEED for Building Operations & Maintenance?

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EA Credit

Demand Response

CASE 1	or	CASE 2	or	CASE 3
Demand response program available		Demand response program not available		Permanent load shifting
3 POINTS		1 POINT		2 POINTS

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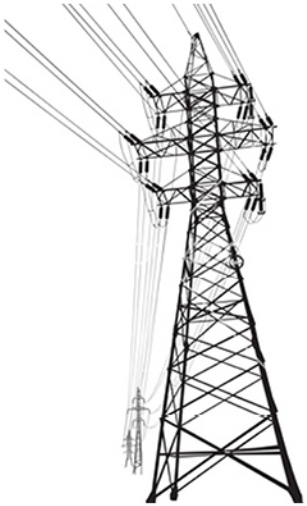
DEMAND RESPONSE

BUILDING NEEDS 80 MW



POWER GRID ONLY HAS 70 MW

POWER GRID PAYS CONSUMERS TO REDUCE 10 MW TO BALANCE SUPPLY & DEMAND

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WHO?
BUILDING OPERATORS
ENGINEER
COMMUNITY MEMBERS
FACILITY MANAGERS
OWNER
GEOLOGIST
COST ESTIMATOR
CONTRACTOR
NATURAL RESOURCE SPECIALIST
ENGINEER
SOIL SCIENTIST
DAYLIGHT/ ENERGY ANALYST
LAND PLANNER
DEVELOPER
CxA
LANDSCAPE ARCHITECT
ARCHITECT
ELECTRICITY PROVIDER
LOCAL HISTORIAN

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ESTABLISHMENT

Demand Response

CASE 1. Demand response program available
Participate in demand response programs

CASE 2. Demand response program not available
Provide infrastructure for future participation

CASE 3. Permanent load shifting
Shift electrical load from peak to off peak

WHAT — WHY — WHEN — WHO — HOW

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Contract between owner and service provider

or

Express interest in future program to local utility or service provider

WHAT — WHY — WHEN — WHO — **HOW**

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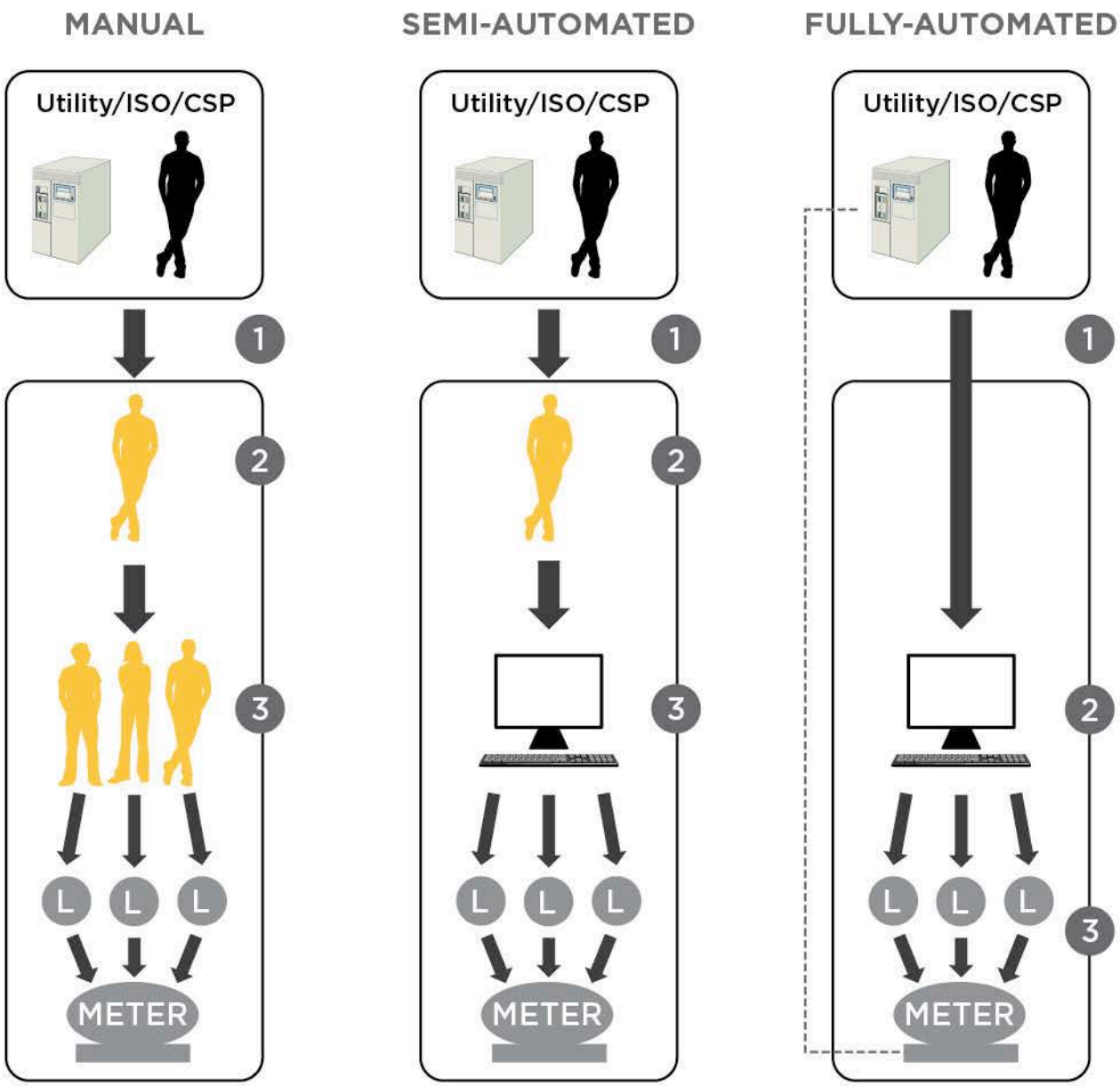

ISO = Independent System Operator CSP = Curtainment Service Provider L = Load

Source: LBNL

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10%

minimum reduction
in peak electricity demand

WHAT — WHY — WHEN — WHO — HOW

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Prepare peak demand response plan

WHAT — WHY — WHEN — WHO — **HOW**

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System must have capacity for full automation (but program can be semi-automated)

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1 year

minimum
contract length

WHAT — WHY — WHEN — WHO — HOW

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CASE 2.
Demand response not available

1. Confirm project capable of participating and system requirements met

2. Prepare plan for peak demand reduction

3. Conduct test of plan

4. Contact utility or service provider

WHAT — WHY — WHEN — WHO — **HOW**

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CASE 3.
Permanent load shifting

Maintain or install systems capable of shifting load to off-peak on continuous basis

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EA Credit

Renewable energy and carbon offsets

Meet some of energy use with renewable energy or purchase green power, carbon offsets or RECs

(1-5 Points)

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ESTABLISHMENT

Demonstrate portion of energy use met with renewable systems and/or contract in place to purchase resources

PERFORMANCE

Meet portion of energy use with renewable systems and/or purchase green power, carbon offsets, or RECs

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WHO?
BUILDING USERS
ENGINEER
COMMUNITY MEMBERS
LOCAL HISTORIAN
ARCHITECT
STRUCTURAL ENGINEER
OWNER
FACILITY MANAGER
GEOLOGIST
LANDSCAPE ARCHITECT
COST ESTIMATOR
PLANNING STAFF
CONTRACTOR
DEVELOPER
NATURAL RESOURCE SPECIALIST
LAND PLANNER
DAYLIGHT/ ENERGY ANALYST
SOIL SCIENTIST
CONSTRUCTION MANAGER

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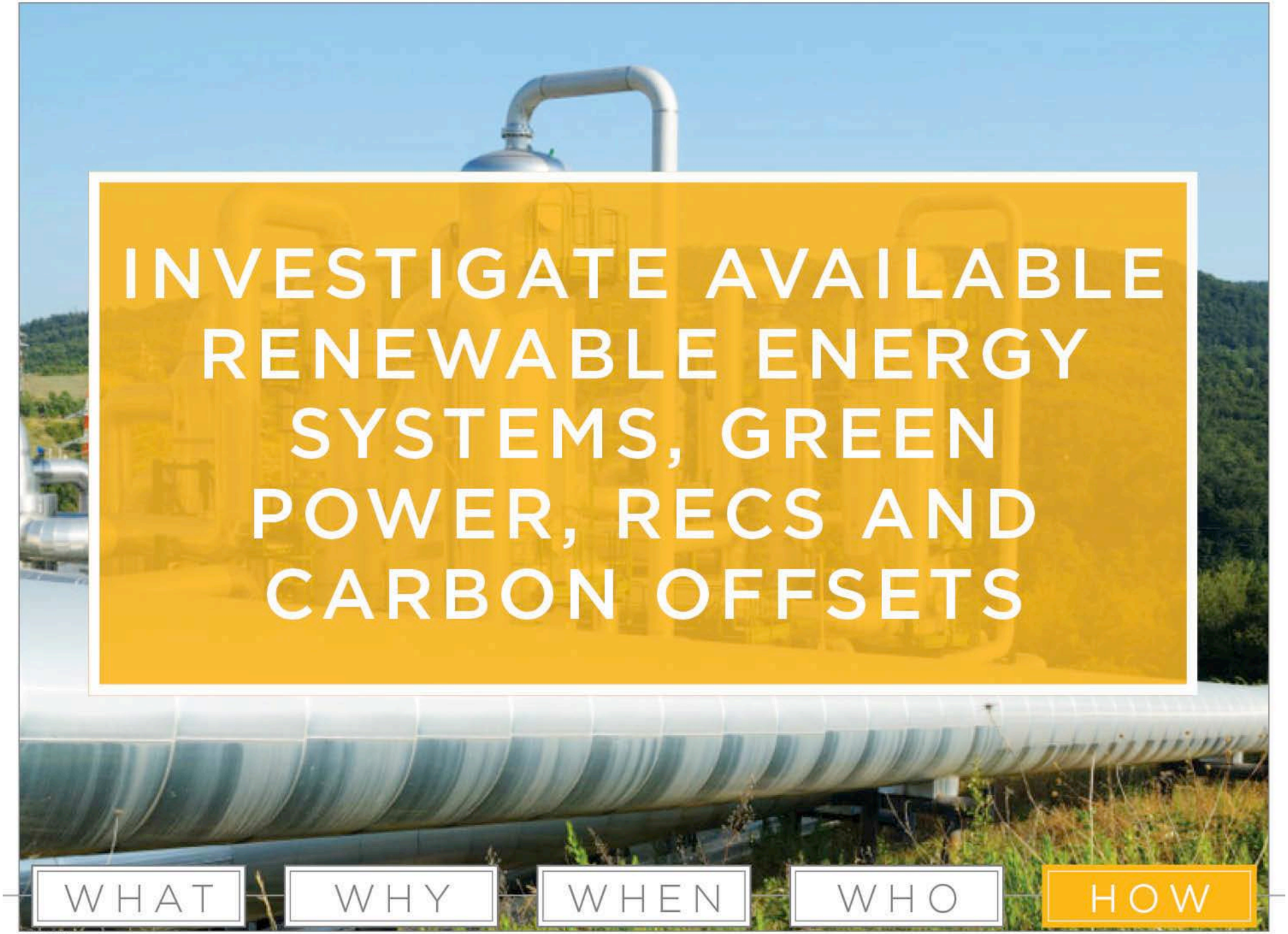

INVESTIGATE AVAILABLE RENEWABLE ENERGY SYSTEMS, GREEN POWER, RECS AND CARBON OFFSETS

WHAT | WHY | WHEN | WHO | HOW

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SCOPE 1

Direct greenhouse gas emissions from sources owned/controlled by the entity

SCOPE 2

Indirect GHG emissions associated with generation of purchased electricity, steam, hot water, or chilled water

WHAT — WHY — WHEN — WHO — HOW

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APPLICATION OF OPTIONS

SOURCE	OPTIONS
non-electricity used on site	carbon offsets
electricity or purchased energy	REC's, green power, or carbon offsets

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SCOPE 1

Direct greenhouse gas emissions from sources owned/controlled by the entity

SCOPE 2

Indirect GHG emissions associated with generation of purchased electricity, steam, hot water, or chilled water

WHAT | WHY | WHEN | WHO | HOW

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Conduct cost-benefit analysis

WHAT — WHY — WHEN — WHO — HOW

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ELIGIBLE RENEWABLE ENERGY TYPES

Photovoltaic

Solar thermal

Wind

Low-impact hydroelectricity

Wave and tidal energy

Geothermal energy (some cases)

Biofuel (some cases)

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SET GOAL FOR AMOUNT OF ENERGY OR EMISSIONS TO ADDRESS THROUGH GENERATION AND PURCHASING

WHAT | WHY | WHEN | WHO | HOW

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CALCULATE POINTS

$$\text{points} = \frac{\text{\% renewable energy generated}}{1.5\%} + \frac{\text{\% energy purchased/ offset (not to exceed 100\%)}}{25\%}$$

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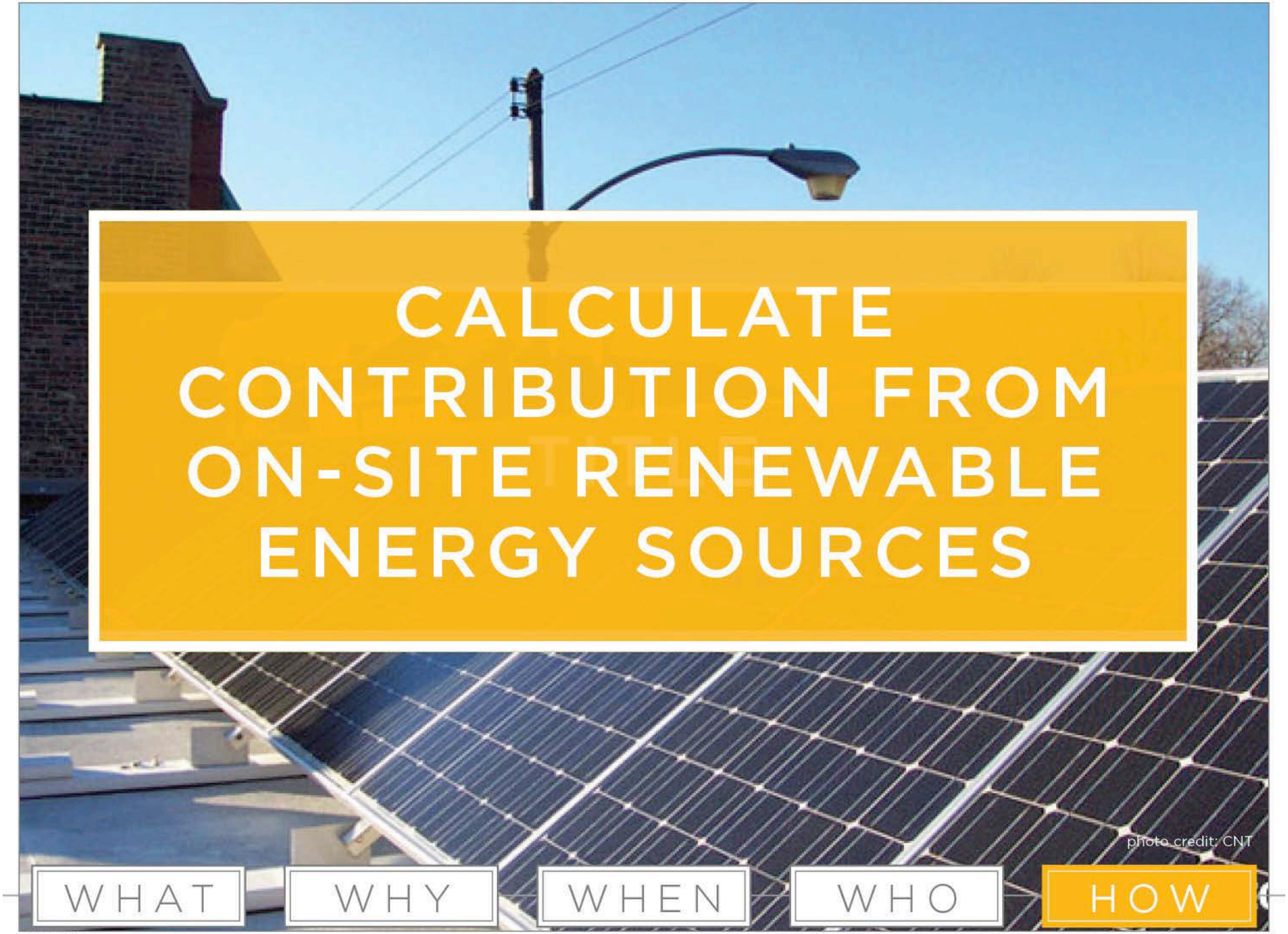

CALCULATE CONTRIBUTION FROM ON-SITE RENEWABLE ENERGY SOURCES

WHAT | WHY | WHEN | WHO | HOW

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7.5%

of energy consumed

during performance period = renewable

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Calculate total percentage of green power, RECs, and/or offsets required to meet goals

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PURCHASE FROM A GREEN-e PROVIDER

Green-e®

WHAT | WHY | WHEN | WHO | HOW

©USGBC

GLOBAL LEED

Green power, RECs and carbon offsets must be Green-e certified

or

Demonstrate equivalency

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years minimum contract length

with commitment to review

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CALCULATE POINTS

$$\text{points} = \frac{\text{\% renewable energy generated}}{1.5\%} + \frac{\text{\% energy purchased/ offset (not to exceed 100\%)}}{25\%}$$

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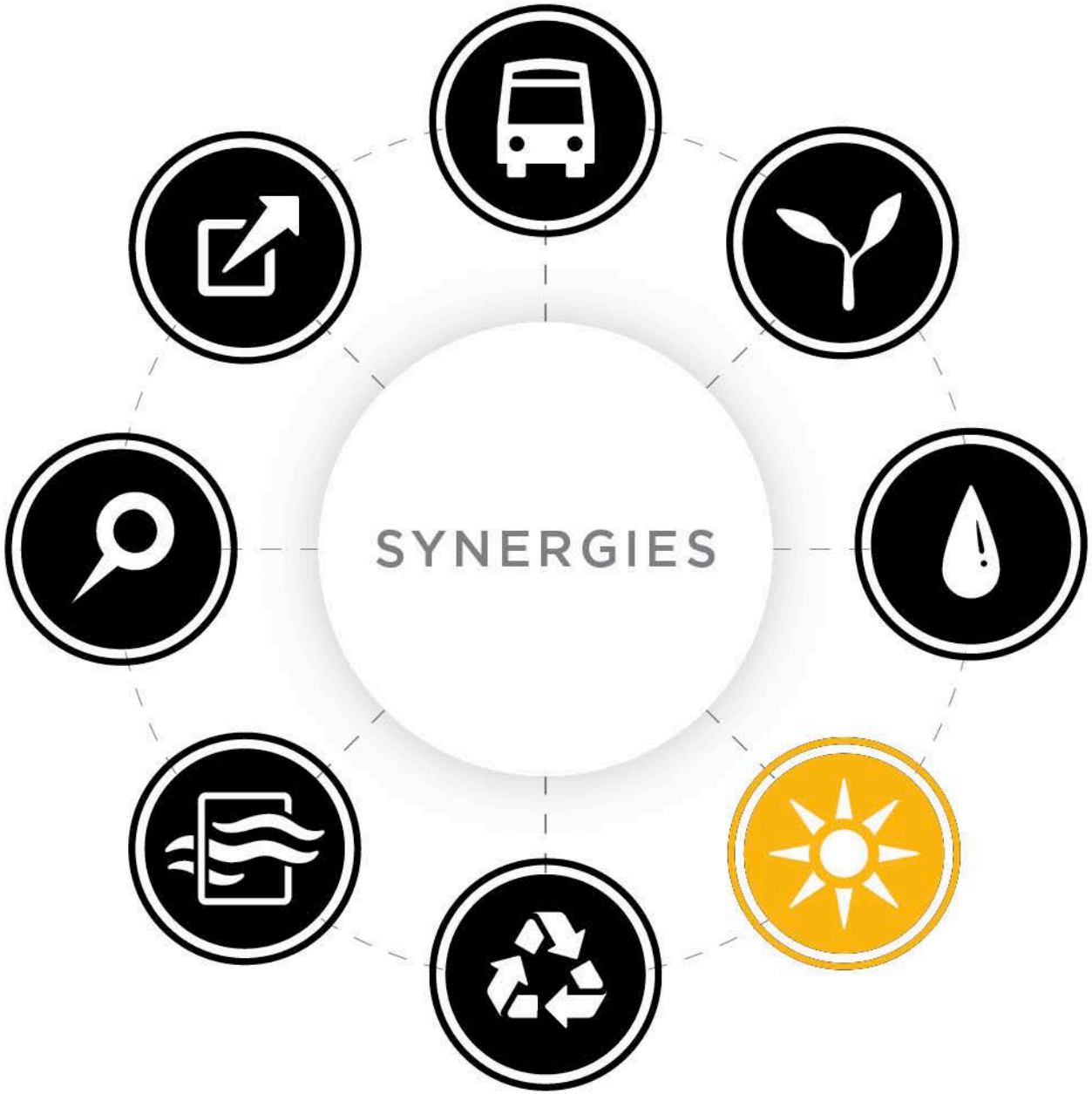

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EAp
Energy Efficiency Best Management Practices
EAp
Minimum Energy Performance
EAc
Optimize Energy Performance
EAc
Existing Building Commissioning

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EAp
Energy Efficiency
Best Management
Practices
EQp
Minimum Indoor
Air Quality

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EAp
Minimum Energy Efficiency
EAc
Optimize Energy Efficiency
EAp
Building-level Energy Metering
EAc
Renewable Energy and Carbon Offsets

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QUESTION and ANSWER

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QUESTION

How do the establishment/ performance aspects of O+M help project teams build on a D+C certification?

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ENERGY
& ATMOSPHERE

LEED FOR BUILDING
OPERATIONS AND MAINTENANCE

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USGBC

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LEED v4 RATING SYSTEM REVIEW

LOCATION & TRANSPORTATION
SUSTAINABLE SITES
WATER EFFICIENCY
ENERGY & ATMOSPHERE
MATERIALS & RESOURCES
INDOOR ENVIRONMENTAL QUALITY

LEED FOR BUILDING OPERATIONS AND MAINTENANCE

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