

# LEED ACCREDITED PROFESSIONAL O+M TRAINING



May 12, 2009

Session 1 of 5

Presented by: CTG Energetics  
Celia Hammond & Lisa Stanley

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## CTG Energetics Inc.

Integrated Green Building Consulting Firm

- Washington, DC, Colorado, Northern California, Southern California, New England, and Nevada
- Sustainable Facilities
- LEED Program Facilitation
- Training Programs
- LEED Reviewers
- LEED O+M Core Committee
- Sustainability, Energy, & Climate Change Services

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## Class Introductions

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### Training Objectives

- Obtain knowledge to aid in taking the USGBC's LEED AP O+M Exam
- Gain the knowledge required to assist project teams in achieving the LEED O+M certification for buildings managed and owned by DGS
- Knowledge transfer shall equip attendee to help address and achieve the State of California's GHG emission reduction programs & green building initiatives

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### Today's Agenda

- Syllabus Update
- Material Explanation
- Green Building Concepts and Strategies
- LEED O+M Reference Guide Introduction
- LEED AP Exam Requirements and Sign Up Process

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### Syllabus Update

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Modified Syllabus		
<b>LEED AP O+M TRAINING COURSE SCHEDULE</b>		
Session One	Topic	Required Reading
May 12, 2009 – Tuesday 8:00 – 11:00 AM	Introduction Material	LEED EB O+M Reference Guide - Introduction;
Session Two	Topic	Required Reading
May 21, 2009 – Thursday 8:00 – 11:00 AM	Cost of Green	Cost of Green Revisited;
	Sustainable Sites	LEED EB O+M Reference Guide – Sustainable Sites;
	Innovations in Operations	LEED EB O+M Reference Guide – Innovation in Operations

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	<b>Materials Provided</b>
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**LEED O+M Reference Guide** 

GREEN  
BUILDING  
OPERATIONS AND  
MAINTENANCE

  
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**Reference Material** 

LEED for Existing  
Buildings

AP O+M Test Materials

  
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**Section I – Primary References** 

1. Cost of Green Building
2. Sustainable Building Techniques Manual  
Part II – Pre-Design Issues
3. Impact of HVAC Refrigerants
4. Innovation & Design Credits
5. Guidelines for CIR Customers

  
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## Section II – Ancillary References



1. Integrated Project Delivery (IPD) Guide 2007
2. ENERGY STAR Portfolio Manager Overview
3. ENERGY STAR Buildings & Plants
4. Best Practice ISO 14021
5. Submeter Energy Use
6. Review of ANSI-ASHRAE Standard 62.1-2004
7. Energy Performance of LEED Buildings
8. Guide to Purchasing Green Power
9. IESNA TM Light Emitting Diode LED
10. ICC Online Codes and Standards
11. Foundations of LEED for Market Transformation
12. GSA 2003 Facilities Standards
13. BLS Construction and Building Inspectors
14. ADA Standards for Accessible Design
15. A Guide to the New ADA-ABA Accessibility Guidelines

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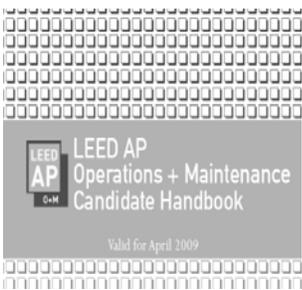
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## LEED AP O&M Candidate Handbook



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## GREEN BUILDING OBJECTIVES



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- **Green Building:** transform the way built environments are designed, built, and operated
- **Impact** earliest stages of planning to beyond the end of life
- **Encompass** production and fate of **every** substance that crosses into or out of a project



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### Green Building Movement:



- **Shift** prevailing design, planning, construction, and operational practices
- **Toward** lower-impact, more sustainable, ultimately regenerative built environments
- Today's "best practices" become tomorrow's standard practices and the foundation for ever higher levels of performance

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### US Buildings:

- 72% of electricity consumption
- 24-50% of energy use
- 38% of all carbon dioxide emissions
- 40% of raw materials use
- 30% of waste output
- 14% of potable water consumption

Green Building aims to **minimize** human impact on natural resources

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### Green Buildings:

- Generate economic benefits



- Are resource-efficient & comfortable



- Contain the amenities necessary for better quality of life

⌘ Governments are adopting more sustainable building practices- e.g. Federal General Services Administration requires all new buildings & renovations be LEED Silver

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### Green Buildings:

- Green building is propelled by belief that design/construction/operation of buildings can & should address:

- energy efficiency
- smart growth
- water conservation
- indoor environmental quality
- more



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### ⌘ Sustainability across the Lifecycle of Built Environments



- Sustainability not a singular event
- Consider sustainability in:
  - Planning
  - Design
  - Construction operations
  - Retirement and renewal
- **Intent:** constantly reduce the negative impacts of buildings and land use on people and the environment



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### Sustainability across the Lifecycle of Built Environments (cont'd)



- **Aspire** to create environments that truly regenerate surroundings
- **Balance** between focus on initial costs and costs incurred during operations and end-of-life
- **Analyze** Lifecycle costs to provide a process to estimate costs and compare different designs

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### The Integrative Approach



- Emphasizes **connections** and **communication** between professionals and throughout the life of a project
- Most often applied to new construction, but applicable to whole lifecycle of a project
- Input from all key stakeholders **BEFORE** schematic design begins.
- Focus on sustainability early in the process to prevent environmental impacts

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## LEED

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### U.S. Green Building Council



- Non-profit
- Nation's foremost coalition of green leaders
- Promotes environmentally responsible, profitable, and healthy buildings
- Members are from more than 15,000 diverse organizations
- More than 70 regional chapters

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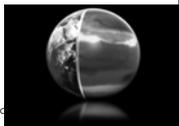
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### **LEED:** Leadership in Energy and Environmental Design

- Third-party green building certification program
- Nationally accepted benchmark for the design, construction, and operation of high performance green buildings.
- Voluntary, consensus-based, comprehensive, and flexible



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### **Triple Bottom Line:**

- Measures projects based on performance in society, environment, and economy  
(**people, planet, profit**)



- LEED was developed to measure/enhance the sustainability of buildings based on TBL
- **Refocuses** the measurement of corporate performance from shareholder's perspective (mostly financial) to a stakeholder's (any impact on anyone)

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**LEED**

- Provides **tools** to have an immediate and measurable impact on buildings' performance
- Promotes a **whole-building** approach to sustainability
- Recognizes **performance** in:
  - Sustainable site development
  - Water savings
  - Energy efficiency
  - Materials selection
  - Indoor environmental quality
  - Extra points for Innovative Design

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- LEED for New Construction
  - LEED for Existing Buildings
  - LEED for Commercial Interiors
- LEED for Homes
  - LEED for Core & Shell
- LEED for Schools
  - LEED for Retail
- LEED for Healthcare
  - LEED for Neighborhood Development

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- LEED for Homes
  - Step 1: Plan Review
  - Step 2: Meeting with builder
  - Step 3: Intermediate inspections and testing
  - Step 4: Final Rating
  - Step 5: Certification
- LEED for Neighborhood Development
  - Stage 1: Review prior to completion of permitting process
  - Stage 2: Certification of an approved development plan
  - Stage 3: Review of a completed neighborhood development
- LEED for Schools, Healthcare, and Retail are derivatives of LEED for New Construction or LEED for Commercial Interiors

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## LEED Prerequisites & Credits

- Prerequisites required, credits optional
- Generally 100 base points, 6 Innovation & Design points, 4 Regionalization points (110 total)
  
- Certified: 40-49 points      ● Gold: 60-79 points
- Silver: 50-59 points        ● Platinum: 80+ points



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## LEED Credit Weightings

- Points per credit reflect potential for mitigating negative or promoting positive environmental impacts
- Example- LEED Carbon Overlay
  - Tool to identify and prioritize LEED credits based on Greenhouse gas emissions
  - Quantitative index of the relative importance of individual credits
  - Credits addressing most important emissions sources receive highest scores



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## Green Building Costs & Benefits



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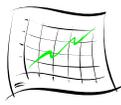
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### Green Building Benefits

- Green buildings **perform better** than conventional buildings:
  - Save energy
  - Use less water
  - Generate less waste
  - Provide healthier, more comfortable indoor environments, increasing productivity
- Green buildings have **higher revenue** and **asset value**, and command **higher rents**



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### Green Building Costs

- Public vastly overestimates cost of green building
- Green building is **not** a reliable predictor of building cost
- Effective integrative design balances added costs with new types of savings



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### Sustainable Sites

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## ation: the foundation for sustainability

- Considerations:
  - Transportation
  - Site Selection
  - Site design and management
  - Stormwater management



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## Green Building Concepts and Strategies

- Emphasize **interaction** between project and local circumstances
- Define opportunities to **minimize impacts** on ecosystems and water resources
- Recognize and reward contributions to **restoration** and reuse

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## Sustainable Sites Measures and Metrics

- Brownfield
- Native and Adaptive Plants
- Integrated Pest Management

- × Solar Reflectance Index (SRI)
- × Foot Candle
- × Imperviousness



- × Vehicle Miles Traveled (VMT)
- × Development Density
- × Floor-Area-Ratio

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### Transportation/Location

- 32% of total U.S. greenhouse gas emissions from transportation
- Buildings, neighborhoods, and land use generate much demand for transportation
  - **Strategy:** Build projects in areas already served by mass transit
  - **Strategy:** Take action to reduce parking for single-passenger vehicles
  - **Strategy:** Encourage carpooling, mass transit, and alternative-fuel vehicles by designating preferred parking and other incentive programs

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### Site Selection Strategies

- Increase density
- Develop on Brownfield sites
- Reduce demand for Greenfield sites
- Provide habitat protection



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### Site Design and Management Strategies

- Minimize building footprint
- Low-impact, low-maintenance landscaping
- Minimize hardscape
- Water efficient landscaping and irrigation
- Use reflective materials
- Sustainable Management Plans



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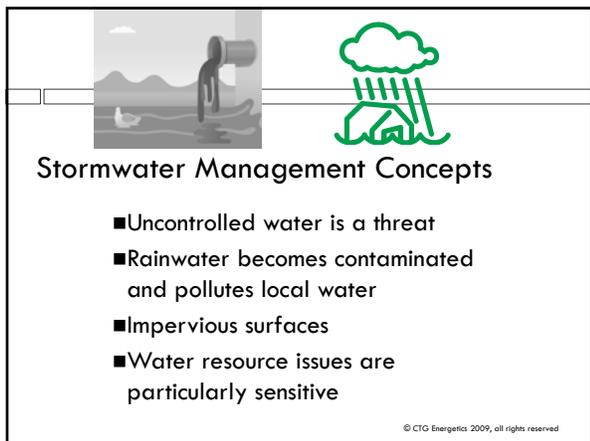
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**Stormwater Management Concepts**

- Uncontrolled water is a threat
- Rainwater becomes contaminated and pollutes local water
- Impervious surfaces
- Water resource issues are particularly sensitive

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**Stormwater Management Strategies**  
Sustainable Sites

- Minimize impervious areas
- Use pervious surfaces
- Retain stormwater on-site
- Reuse rainwater



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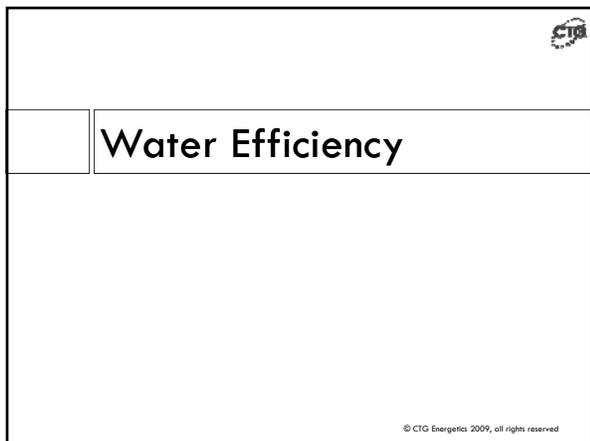
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**Water Efficiency**

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### Water Issues

High water demand **overwhelms** wastewater treatment facilities

Discharged water **contaminates** local water bodies

Efficiency measures **easily** and **significantly** reduce usage

LEED Water Efficiency category **designed** to:

- Highlight the importance and ease of conservation
- Provide strategies to reduce usage

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### Water Efficiency Measures & Metrics



- Gallons per flush (GPF)
- Gallons per minute (GPM)
- Baseline case versus design case
- Process Water

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### Indoor Regulated Water

■ Definition

■ Strategies to reduce indoor water use:

- Install efficient fixtures
- Use non-potable water
- Utilize metering



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## Outdoor Water



- ▣ Site irrigation largest use
- ▣ To reduce outdoor water use:
  - Plant native and adaptive plants
  - Install efficient irrigation systems
  - Use sub-metering

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## Process Water

Definition

Reduce Process Water use by:

- Installation of efficient equipment
- Using non-potable water
- Sub-meter to track and log water use

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## Energy & Atmosphere

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## ENERGY

- Critical economic issue and a top political priority
- Integrative design brings together:
  - Reducing **energy** demand
  - Using **energy** efficiently
  - Meeting demand with renewable **energy**
  - Achieving and **sustaining** performance



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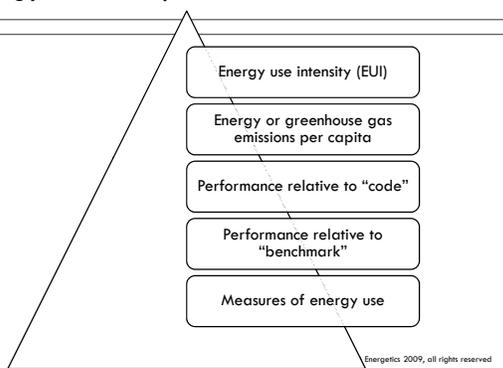
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## Energy & Atmosphere Measures & Metrics



- Energy use intensity (EUI)
- Energy or greenhouse gas emissions per capita
- Performance relative to "code"
- Performance relative to "benchmark"
- Measures of energy use

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## LEED in Practice:



- LEED for New Construction
  - Requires buildings exceed baseline energy performance standards
  - Uses whole building energy simulation
  - Distinguishes between process energy and regulated energy

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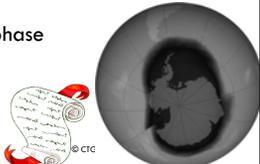
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### LEED and Refrigerants

- Refrigerant: working fluid which transfers thermal energy
- Dangers of refrigerants in Atmosphere
- Montreal Protocol
- New LEED buildings cannot have CFCs
- LEED existing buildings must phase out CFCs



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### Renewable Energy

- Generate on-site renewable energy
  - Photovoltaic electric cells
  - Solar hot water heaters
  - Geothermal heat pumps
- ✂ Purchase off-site renewable energy
  - Through regional utility company
  - Directly from renewable sources
  - Through purchase of RECs



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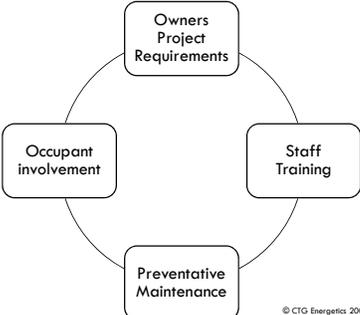
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### Achieving & sustaining performance during operation



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### Cost-effectiveness of Commissioning

- Engages skilled engineers
- Costs are often repaid with recovered performance
- Average simple payback period is .7 years for existing buildings, 4.8 years for new construction



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### Materials & Resources

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### Materials & Resources

- Buildings generate waste as a result of construction, building operations, and demolition
- Consider environmental impact of **each** material brought in to building
- **Minimize** landfill disposal for each material taken away

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### Measures & Metrics



- ▣ Building Reuse
- ▣ Building Size
- ▣ Waste Diversion
- ▣ Recycled Content
- ▣ Regional Materials
- ▣ Rapidly Renewable Materials
- ▣ Sustainable Forestry

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### Waste Management

- ▣ Reduce waste
- ▣ Construction Waste Management
- ▣ Recycling
- ▣ Composting



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### Key Resource: U.S. EPA Waste Reduction Model

- Set of tools to estimate emissions
- U.S. recycles **32%** of solid waste
- Recycling **35%** would save 5 million metric tons of carbon dioxide equivalent

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### Reduce Lifecycle Impacts



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Create a construction purchasing policy

Create an environmentally preferable purchasing policy

Monitor the effectiveness of these policies

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graph TD; A[Create a construction purchasing policy] --> B[Create an environmentally preferable purchasing policy]; B --> C[Monitor the effectiveness of these policies];
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### Key Resources: Tools for estimating lifecycle impacts

Quantitative Life Cycle Assessment (LCA)

EcoCalculator for Assemblies

BEES 3.0

Construction Carbon Calculator



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### Indoor Environmental Quality

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### Indoor Environmental Quality

- Americans spend 90% of time indoors
- ✂ Improving indoor air quality:
  - Enhances the lives of building occupants
  - Increases resale value of buildings
  - Reduces liability of owners
  - Improves employee health/productivity=large return on investment over long term



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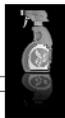
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### Indoor Air Quality Strategies

- No Smoking
- Ensure adequate ventilation rates
- Demand controlled ventilation
- High-efficiency air filtration
- Use low-emitting materials
- Protect air quality during construction
- Green Cleaning
- Integrated pest management



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### Thermal Comfort, Light, Acoustics Strategies

- Daylighting
- Operable windows
  - Occupant temperature control
  - Occupant ventilation control
  - Occupant surveys



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## Innovation & Design

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## Innovation & Design

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- ▣ Encourage projects to go above and beyond
- ▣ Recognition for exceptional performance
- ▣ Promising practices may become credits
- ▣ How are they achieved?



✕ E.G. Aldo Leopold Leadership Center

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## BREAK

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# LEED O+M REFERENCE GUIDE INTRODUCTION



May 12, 2009

Session 1 of 5

Presented by: CTG Energetics  
Celia Hammond & Lisa Stanley

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## Importance of Green Building Preface

### Why make a building Green?

- ❑ 5 BILLION gallons of potable water used each day for flushing toilets
- ❑ Buildings consume 30% of the total energy and 60% of the electricity in the U.S.



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## Why Make a Building Green?

### Results of Green operations & management:

- ❑ Reduce operating costs
- ❑ Enhance building marketability
- ❑ Increase worker's productivity
- ❑ Reduce potential liabilities



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**Why Make a Building Green?** 

SUCCESS STORIES...

- Joe Serna Jr. Environmental Protection Agency Headquarters Building generated \$610,000 in annual savings
- Denver Dry Goods building reduced operating expenses by approximately \$75,000 per year
- North Carolina students in day-lit schools score higher on tests

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**LEED Green Building Rating System - History** 



- USGBC was formed in 1993
- A need quickly realized for a system to **define** and **measure** green buildings
- LEED designed to meet that need

□ First committee comprised of: architects, real estate agents, a building owner, a lawyer, an environmentalist, and other industry representatives

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**LEED Green Building Rating System - History** 

LEED Categories:

- Sustainable Sites
- Water Efficiency
- Energy & Atmosphere
- Materials & Resources
- Indoor Environmental Quality
- Innovation and Design- to address expertise and design measures not covered



Voluntary, consensus-based, market-driven system based on existing proven technology

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### LEED Green Building Rating System - Present



- Balanced between known, established practices and emerging concepts
- Designed to be comprehensive in scope yet simple in operation
- Constantly evolving— projects should use the most current ratings system
- Evaluates performance from a whole-building perspective over a building's entire life-cycle

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### Overview and Process

- Prerequisites and credits have the same structure:
  - Intent
  - Requirements
  - Summary of referenced standards
  - Approach and implementation
  - Submittal documentation
  - Calculations
  - Considerations:
    - Environmental issues
    - Economic issues



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### When to use LEED O+M



**Supports:**

- Existing building operations
- Process & procedures
- Systems upgrades
- Minor space-use changes
- Minor facility alterations or additions

- Implement sustainable operations
- To certify and encourage the sustainability of ongoing operations in existing buildings

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### When to use LEED O+M

LEED O+M

Use for:

- Buildings previously certified under other LEED systems that need recertification or have been majorly renovated
- Some projects qualify for several LEED systems
- Whole building systems only- not individual tenant spaces

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### Registration and LEED Online

Projects must first **register** with USGBC at [www.usgbc.org](http://www.usgbc.org) under LEED

Registration establishes contact with USGBC and provides access to **tools, communication,** and other information

LEED Online: resource to compile and **store information** and calculations about the project

**Templates** & access to **CIR's** are on LEED Online

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### Credit Interpretation Requests (CIRs) and Rulings

CIR process designed to address:

- Instances where the Reference Guide does not sufficiently address a specific issue
- Instances when a conflict requires resolution

Process:

1. Review previously posted CIRs
2. If no existing CIRs are relevant, submit an online CIR request
3. USGBC will rule on the request electronically according to posted schedule



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### Using LEED O+M

- Review and Certification:** comply with all prerequisites and enough credits under the current rating system
- Appeals:** may be filed after the final review
- Fees:** USGBC acknowledges receipt and begins application review when payment has been received
- Updates and Addenda:** improvements and evolution format available to public

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### Minimum Program Requirements

**Project building(s) must be fully occupied**

- At least 75% of floor area physically occupied
  - Leased but unoccupied space does NOT meet the requirement
  - Unexpected occupancy drop after registration will not disqualify the project – submit with in 2 months



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### Minimum Program Requirements

- Project scope must include 100% of total floor area, potentially excluding up to 10%
- The building must be in compliance with federal, state, and local laws and regulations



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### Certification Strategy

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Teams may want to group credits by function:



- Materials In & Out
- Administration
- Green Cleaning
- Site Management
- Energy Metrics
- Occupant Health and Productivity
- Operational Effectiveness

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### Initial Certification vs. Recertification

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- What qualifies as Certification?
- Recertification?
- How does a project register for Recertification?
  - Separate project – same title but include "recertification"
- What are the fees for Recertification?
  - Free registration – you need to make sure they wave it
  - 50% of certification fee
- How often can a project apply for recertification?
  - Up to once a year at least every 5 years

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### Initial Certification vs. Recertification

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- Continuously train staff on best practices and keep accountability for maintaining policies
- Continuously record adherence to LEED-related policies and procedures

- Keep Recertification in mind when applying for initial certification
- Consider sustainability when bidding out new contracts

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### Initial Certification vs. Recertification

- Update policies and procedures as changes occur on-site
- Maintain the minimum occupancy level
- Track occupant satisfaction
- Stay informed of LEED EB updates
- Keep building components well-maintained



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### Performance Period (PP)

LEED O+M Performance Period for Certification

- May not have any gaps
- Gap= any period of time longer than one full week
- Differs for Certification and Recertification
- Continuous, unbroken time during which sustainable operations performance is being measured

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### PP Requirements: Initial Certification

- All Performance Periods must overlap and terminate within one week of each other
- Applications must be submitted for review within 60 calendar days of the end of the PP
- Minimum 3 months - Maximum 24 months
  - Except EAp2, Energy Star credit requires min 12 months
- Consistent start times and durations are preferred (not required)



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### Performance Period Best Practices

- Requirements should be fully implemented **before** the start of the PP
- If major changes occur during the PP, collect data for at least 3 months afterward
- USGBC encourages initial applicants to use a longer PP
- Ideally, all Performance Periods would be identical

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### PP Requirements: Recertification

- For credits previously earned under LEED O+M, PP is the **entire** period since certification
- Performance data is required for the **entire** time period between certification and recertification
- PP depends on whether the credit is newly pursued- 1<sup>st</sup> time credit PP requirements are the same as for initial certification

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### Submittals

All LEED O+M applicants must provide:

- Completed LEED Online submittal templates:
  - **General submittals** and all documentation
  - Templates for all **prerequisites** and documentation
  - Templates for all **pursued credits** and documentation
- Additional project narrative items 

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### General Submittals: Project Narrative

Project Narrative

LEED EB: O&M requires an overall project narrative, which must address:

- Project Summary and Scope
- Building and Site
- Occupancy and Usage

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### Optional Project Summary Elements

- Applicant Organization
- Building History
- Applicant Project Team
- Project Challenges



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### Quick quiz!

Does LEED O+M allow for credit substitution from other LEED Systems?

- A. Yes
- B. No

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### One more...

For certain credits, how much of the project can be potentially excluded from the total floor area?

- A. 15%
- B. 5%
- C. 1%
- D. 10%

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### Multitenant Buildings

- LEED O+M applies only to whole buildings
- Multitenant buildings must meet all LEED O+M minimum requirements
- Challenge: many credits require occupant commitment and cooperation
- Some credits offer a 10% floor area exemption-narrative required



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### Multitenant Buildings – 10% Exemption Credit List

<p><b>Materials and Resources:</b></p> <p>MRc1: Sustainable purchasing: ongoing consumables</p> <p>MRc2.1: Sustainable purchasing: durable goods electric</p> <p>MRc2.2: Sustainable purchasing: durable goods furniture</p> <p>MRc3: Sustainable purchasing: facility alterations and additions</p> <p>MRc4: Sustainable purchasing: reduced Mercury in lamps</p> <p>MRc5: Sustainable purchasing: food</p> <p>MRc8: Solid waste management: durable goods</p> <p>MRc9: Solid waste management: facility alterations and additions</p>	<p><b>Indoor Environmental Quality:</b></p> <p>IEQc1.2: IAQ Best management practices- outdoor air deliver monitoring</p> <p>IEQc3.2: Green Cleaning- custodial effectiveness assessment, score of ≤3</p> <p>IEQc3.3: Green Cleaning- custodial effectiveness assessment, score of ≤2</p> <p>IEQc3.4: Green Cleaning- sustainable cleaning products &amp; materials, 30%</p> <p>IEQc3.5: Green Cleaning- sustainable cleaning products &amp; materials, 60%</p> <p>IEQc3.6: Green Cleaning- sustainable cleaning products &amp; materials, 90%</p> <p>IEQc3.7: Green Cleaning- sustainable cleaning equipment</p>
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### Exemplary Performance Strategies

To qualify for exemplary performance credits – Innovation & Operations:

- Greatly exceed the performance level or expand the scope required by an existing credit
- Teams must meet the performance level defined by the next step in the threshold progression
- More than one compliance path? Get an IO credit by satisfying extra path(s)



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### Exemplary performance credits are available for:

Sustainable Sites: <input type="checkbox"/> SSc4 <input type="checkbox"/> SSc5 <input type="checkbox"/> SSc6 <input type="checkbox"/> SSc7.1 <input type="checkbox"/> SSc7.2 Energy & Atmosphere: <input type="checkbox"/> EAc4	Water Efficiency: <input type="checkbox"/> WEc1.2 <input type="checkbox"/> WEc2 <input type="checkbox"/> WEc4.2 Materials & Resources: <input type="checkbox"/> MRc1 <input type="checkbox"/> MRc2.1 <input type="checkbox"/> MRc2.2 <input type="checkbox"/> MRc3	<input type="checkbox"/> MRc4 <input type="checkbox"/> MRc5 <input type="checkbox"/> MRc7 <input type="checkbox"/> MRc8 <input type="checkbox"/> MRc9 Indoor Environmental Quality: <input type="checkbox"/> IEQc2.2 <input type="checkbox"/> IEQc2.4 <input type="checkbox"/> IEQc2.5
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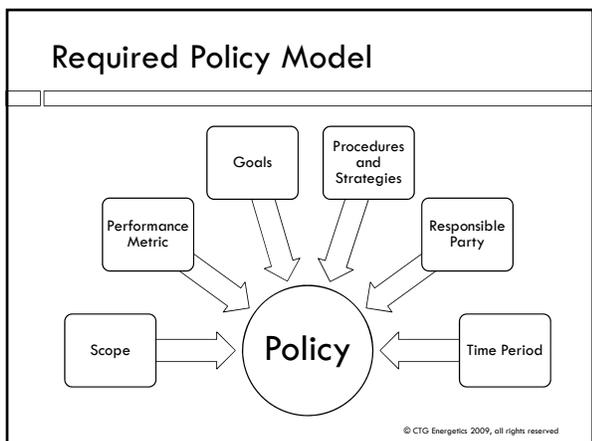
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### Tools for Registered Projects:

- Narrative requirements – length, format, etc
- Policy, program, and plan models
- Declarant definitions and other definitions
- Offline credit calculators



Stream Line Options:

- Design & construction streamlined credits
- Licensed professional exemption form

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### Definitions

- Building engineer
- Building operating plan
- Declarant
- Facility manager
- Full-time equivalent (FTE)
- Groundskeeper
- Owner
- Project building
- Property manager
- Regular building occupant
- Sequence of operations
- Systems narrative



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### Sample Test Question



Pop Quiz

- Approximately how many gallons of potable water is used each day to flush toilets in the United States?
  - A. 10 million
  - B. 5 million
  - C. 1 billion
  - D. 5 billion

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Questions?

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Next Session – Thursday, May 21

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Prepare

- Cost of Green - Revisited
- Reference Guide – Sustainable Sites (SS)
- Reference Guide – Innovation in Operations (IO)

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