LEED Green Associate Study Session

Introductions

- Name
- Role
- Experience with LEED
O’Brien & Company

Creating Value through Sustainable Building

- Built projects: commercial, educational, residential
- Program and policy development: green building programs, city sustainability strategies
- Education and training: green jobs training, curriculum development

Training & Education Products

- Boost your marketability with a credential: LEED v4 Exam Prep Courses, Green Advantage Exam Prep Course, Envision SP Exam Prep
- Apply big picture thinking to get practical results: Better Performance through Integrative Process, Mind the Gap Workshops
- Manage LEED projects with confidence: Build It LEED Training, Build It LEED Toolkit
- Get project specific field support: Trades Training, Technical Assistance
Our LEED Study Session Instructors

Elizabeth Powers
LEED AP BD+C
Principal
O’Brien & Company

Justus Stewart
ENV-SP, LEED Green Associate
Project Associate
O’Brien & Company

Agenda

Today
- Introduction
- LEED 101
- Quiz #1
- Site and Water
- Break
- Quiz #2
- Energy and IEQ
- Materials
- Exam sign up help

Brown Bags

January 24
- Process
- Exam Prep and Study Tips
- Mini-Practice Exam

January 26
- Reference Standard Review
- Case Studies
- Full Practice Exam Review
Our Teaching Philosophy

Learning Pyramid

- **Lecture**: 10%
- **Reading**: 20%
- **Audiovisual**: 30%
- **Demonstration**: 50%
- **Discussion**: 75%
- **Practice doing**: 90%

Average student retention rates

Source: National Training Laboratories, Bethel, Maine

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In this class that means….

- Flash slides
- Fill in the blank
- Quizzes
- A couple of exercises
LEED Green Associate

- Primary LEED credential
- Broad knowledge of green building concepts
- Overview of LEED Process
- Required to earn LEED Accredited Professional with specialty
Exam Specifications

Task Domains
I. LEED Green Associate Tasks

Knowledge Domains
I. LEED Process
II. Integrative Strategies
III. Location and Transportation
IV. Sustainable Sites
V. Water Efficiency
VI. Energy and Atmosphere
VII. Materials and Resources
VIII. Indoor Environmental Quality
IX. Project Surroundings and Public Outreach

Exam References
- Core Concepts Guide
- Excerpt from BD+C
- LEED Certification Guide
- Impact Categories
- LEEDv4 User Guide
- LEED Certification Fees
- Rating System Selection Guidance
- LEED Interpretations
Learning Objectives

Prepare participants for the LEED Green Associate Exam by providing:

- Thorough overview of the content and key issues
- Hands-on practice exams and quizzes
- Information about exam process and structure
- Recommendations on study approaches
- Additional study resources
- Build capacity of participants to effectively apply the concepts tested in the Green Associate exam in real world applications
LEED 101

**Task Domain:** LEED Green Associate Tasks

**Knowledge Domains:** LEED Process, Integrative Strategies (LEED Standards)

What does LEED Stand for?
Fill in the blank

People are ____________________
Buildings are ________________

What is the US Green Building Council?
What does the Green Building Certification Institute do?

Does GBCI certify products?
When can a project say it is LEED certified?

What are the two primary reference standards used by LEED to measure percent improvement in energy efficiency in buildings?
Name three types of alternative transportation recognized by LEED

What is an MPR?
Name four LEED Rating Systems

Indicate if the following is valid for innovation credit:

One LEED AP with appropriate specialty on the Project Team
How do you determine which regional credits are available to your project?

Indicate if the following is valid for innovation credit:

Green Housekeeping Program
Indicate if the following is valid for innovation credit:

20% On-site energy generation
(10% is the highest threshold)

Good Job!
USGBC vs. GBCI

US Green Building Council
- Non-profit
- Market Transformation Mission
- Developer of LEED (1998)
- Founded 1993

Green Building Certification Institute
- Non-profit
- Third-party certifying organization recognizing excellence in green building
- ANSI and ISO
- Founded 2008

What Should A LEED Building Accomplish?

- Enhance Community, Social Equity, Env. Justice & Quality of Life
- Reverse contribution to climate change
- Enhance human health and wellbeing
- Protect and restore water resources
- Promote sustainable and regenerative resource cycles
- Protect biodiversity and ecosystem services
- Build a greener economy

What Should a LEED Project Accomplish?
LEED Family of Rating Systems

- BD&C
- ID&C
- O&M
- ND
- Homes

Multiple Certifications

Scale
- CS
- CI
- ND
- Homes

Lifecycle
- ND
- OM
- NC
Mixed Use

Can't  40%  You Decide  60%  Must

LEED v4 Scorecard – New Construction
### A Closer Look

#### Integrative Process

<table>
<thead>
<tr>
<th>Yes</th>
<th>Maybe</th>
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Possible Points: 1

#### Location and Transportation

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<tr>
<th>Yes</th>
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Possible Points: 16

- LEED ND Location
- Sensitive Land Protection
- High Priority Site
- Surrounding Density and Diverse Uses
- Access to Quality Transit
- Bicycle Facilities
- Reduced Parking Footprint
- Green Vehicles

#### Sustainable Sites

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Possible Points: 10

- Phrasing
- Construction Activity Prevention
- Site Assessment
- Site Development: Protect or Restore Habitat
- Open Space
- Rainwater Management
- Heat Island Reduction
- Light Pollution Reduction
Levels of Certification

- LEED Certified: 40-49 Points
- LEED Silver: 50-59 Points
- LEED Gold: 60-79 Points
- LEED Platinum: 80+ Points

Certification Process

1. Confirm Eligibility
2. Register Project
3. Implementation
   - Apply
   - Review
4. Certify
Eligibility

Minimum Program Requirements

- Must be in a permanent location on existing land
- Must use reasonable LEED boundaries
- Must comply with project size requirements

Eligibility - Prerequisites

- Rating System Prerequisites
- Vary by rating system
- Typical
  - Construction Activity Pollution Prevention
  - Water use reduction
  - Commissioning
  - Minimum Energy Performance
  - Building meeting
  - No CFCs
  - Storage and collection of recyclables
  - Minimum IAQ performance
  - No Smoking
  - Minimum acoustic performance
Key Concepts in Eligibility and Implementation

- LEED Campus
  Program for projects on shared site, allows for campus-wide credits or certification of groups of similar buildings. Do not have to use.
  Schools, hospitals, resorts with several physically distinct structures as defined by ENERGY STAR can do a single certification without using campus.

- Renovations and Additions
  Renovations use NC or CI depending on scope.
  In additions, energy systems must be separate or part of a central system outside of the project building or space.

- Incomplete spaces and Tenant Sales and Lease Agreements
  Required commitments from owners and tenants for spaces in the building not built out as part of the project. Allows for project to take credit for green features planned for the spaces.
Project Registration

Register your project as early as possible:

- +/- $1000
- Discount for members $1200 for Non-Members
- LEED Online
- Website listing

Project Implementation

Reference Guides and USGBC website

LEED Online

![LEED Online Logo]
Credit Format & Structure

Construction Activity Pollution Prevention

This prerequisite applies to:
- New Construction
- Core and Shell
- Schools
- Retail
- Data Centers
- Warehouses and Distribution Centers
- Hospitality
- Healthcare

INTENT
To reduce pollution from construction activities by controlling soil erosion, waterway sedimentation, and airborne dust.

REQUIREMENTS
- Construct and implement an erosion and sedimentation control plan for all construction activities associated with the project. The plan must conform to the minimum and sedimentation control measures set forth by the U.S. Environmental Protection Agency (EPA). Contractors General Permit (CGP) for landfills, which is more stringent. Requirements apply the CGP regulations of the EPA. The plan must describe the measures implemented.

10 Common Reference Standards

<table>
<thead>
<tr>
<th>Standard</th>
<th>Topic</th>
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<tbody>
<tr>
<td>1. ASHRAE 90.1</td>
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<td>2. ASHRAE 62.1</td>
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<td>3. ASHRAE 55</td>
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<td>4. Energy Star</td>
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<td>5. Green-e</td>
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<td>6. EPACT 1992</td>
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<td>7. SMACNA</td>
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<td>8. FSC</td>
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<tr>
<td>9. SCAQMD</td>
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<tr>
<td>10. WaterSense</td>
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Apply - Credit Forms

When a question arises:

- Review the credit Intent and Requirements
- Consult the LEED Reference Guide
- Check the LEED Interpretations page for similar inquiries
- Contact Us form on USGBC.org
- Submit a Formal Inquiry (Project-Specific CIR)
  - $220 for project specific + $180 for official “LEED Interpretation”
  - Registered projects only
Review

Design Review
- After 100% Construction Documents (CDs)
- Anticipated achievement
- Pending
- Denied

Construction Review
- After Substantial Completion
- Credit Achieved
- Credit Denied

Level of certification based on points achieved
40 – Certified, 50 – Silver, 60 – Gold, 80 - Platinum

Appeal Process

- $500 per credit
- $800 for complex credits
- Complete project information
- Original & re-submittal for credit
Types of Extra Credit – 10 points

**Innovation**
- Exemplary Performance Credits from your Rating System
- Sustainable Strategies not addressed in your Rating System
- LEED Pilot Credits
- Credits from other rating systems

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<tr>
<th>LEED AP (part of Innovation section)</th>
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**Regional Priority Credits**
- 6 options per project
- Existing credits
- Max of 4 points

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<tr>
<th>Regional Credits Example</th>
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**Seattle, Washington**
- Demand response
- Renewable energy production
- Building product disclosure – EPD
- Building product disclosure – Raw materials
- Rainwater management
- Indoor water use reduction

**Eastern Washington**
- Demand response
- Renewable energy production
- Construction indoor air quality
- Building product disclosure – EPD
- Building product disclosure – Raw materials
- Indoor water use reduction

**Honolulu, Hawaii**
- Renewable energy production
- Optimize energy performance
- Building life-cycle impact reduction
- Construction and demolition waste management
- Outdoor water use reduction
- Indoor water use reduction
Use Policies

- Before certification
  - “targeting XX level” or
  - “is LEED registered”
- After certification
  - Use certification mark
  - “LEED XX”
  - “LEED XX certified”
- LEED Green Associate (not GA)
- LEED AP BD+C, ID+C, O+M, ND, Homes
- USGBC
- U.S. Green Building Council
- Member logo not product endorsement
How does LEED evolve and change?

**New versions**
- Every 3 to 5 years
- Volunteer committees and working groups contribute
- Comment periods
- Member voting

**Between versions**
- Pilot credits to test ideas
- LEED interpretations
- Addenda and errata

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**LEED Rating System Timelines**

<table>
<thead>
<tr>
<th>Year</th>
<th>Version</th>
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<tr>
<td>1998 '99 '00</td>
<td>v1.0 Pilot</td>
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<tr>
<td>2001 '02 '03 '04 '05 '06 '07 '08 '09 '10 '11 '12 '13 '14 '15 '16 '17 '18 '19 '20 '21</td>
<td></td>
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<tr>
<td>2009 (v3)</td>
<td>v2.0</td>
</tr>
<tr>
<td>2011</td>
<td>v2.1</td>
</tr>
<tr>
<td>2013</td>
<td>v2.2</td>
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<tr>
<td>2016</td>
<td>v4</td>
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What else is out there?
Question 1

In the LEED rating system, the Energy Policy Act of 1992 relates to:

a) Building commissioning  
b) Optimize energy efficiency  
c) Indoor water use efficiency  
d) Minimum energy performance
Question 2
Which one of the following is correct to use in marketing materials for a building under construction:

a) “…project is built to standards that would earn LEED Gold Certification.”

b) “…project is LEED Registered, targeting Platinum Certification, or at least 80 points out of 100.”

c) “…project will be LEED Gold Certified with at least 50 points out of 100.”

d) “…project is LEED Gold Registered, achieving at least 39 points out of 69.”

Question 3
Which of the following would be considered a benefit of increased use of public transportation (Choose two):

a) Reduced demand for fossil fuels
b) Increased stormwater management needed
c) Reduced greenhouse gas emissions
d) More hardscape necessary to accommodate increased traffic
Question 4

A Brownfield is a piece of land that:

a) Should be protected as a sensitive area during construction
b) If used, promotes infill and reduces sprawl
c) Has not been irrigated properly
d) Is contaminated beyond remediation

Question 5

Which of the following combinations of fixtures produces greywater:

a) Lavatories and showers
b) Lavatories and showers and washing machines
c) Lavatories and urinals
d) Water closets
Question 6
Which of the following does NOT help reduce heat island effect:

a) Pervious asphalt  
b) Grasscrete  
c) Standard concrete  
d) Landscaping

Question 7
The USGBC defines Solar Reflectance Index (SRI) as what?

a) A measure of how well a material reflects daylight into a space  
b) A measure of how well a material rejects solar heat  
c) A measure of how much daylight is reflected off a window as opposed to entering a space  
d) A measure of the amount of illumination falling on a surface
Question 8
Which is not a potential strategy to help achieve significant indoor water use reduction?

a) High-efficiency irrigation  
b) Rainwater collection  
c) Waterless urinal  
d) 1.4 gallon water closet  
e) Low flow showerheads

Question 9
How do you register a LEED project?

a) Call the USGBC Customer Service  
b) Fax GBCI the registration form that can be downloaded from the USGBC web site  
c) Call O’Brien & Company  
d) Complete the on-line registration section of the GBCI website
Question 10

You believe that your project meets the requirement for a certain credit, but in a slightly different way than the Rating System describes. To receive clarification, you should do all of the following, except:

a) Review the Rating System to make sure the proposed strategy meets the stated Intent of the credit
b) Review the Reference Guide for information that may pertain
c) Submit a Credit Interpretation Request
d) Call USGBC

Results

How’d you do?

8-10 out of 10 – Piece of Cake!
6-7 out of 10 – I think I can, I think I can!
4-5 out of 10 – Well, I’m just getting started.
3 or less … See me after class.
Site

**Task Domain:** LEED Green Associate Tasks

**Knowledge Domains:** Locations and Transportation, Sustainable Sites

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**Who cares?**

**Where to?**
Who cares?

- What are some benefits of building near existing infrastructure?

- What are some ways to protect and restore natural systems when developing in existing areas?

Brownfields
Pedestrian and Bike Access

- Allowing people to walk and bike safely to services without being blocked. Providing nearby connections, bridges, trails, ramps

- This:

---

Pedestrian and Bike Access

- Not this

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Where to?

Food, Glorious Food
Transportation

Fill in this list of strategies which reduce the impact of transportation needs of a building and its occupants:

Access to ________ Transportation
Access to _________ Storage & __________ Rooms
Preferred Parking for _________ & __________
Access to ___________ & __________ Vehicles
Parking for ____________ & __________ Vehicles
Reduced _________ Capacity
___________ Membership and Parking

Walk, Bike, Bus, & Trains

- Distance people will usually walk for a train/subway?

- Distance people will typically walk for a bus ride?

- What amenities do bikers need that other commuters don’t?
Better Parking/Driving

- “Preferred Parking”
  - Carpool/Vanpool
  - Fuel-efficient vehicles
- Electric Car Charging Stations
- Car share Programs
- Discounted parking

Site Assessment

- Topography
- Hydrology
- Climate
- Vegetation
- Soils
- Human use and impacts
Site Design & Management

- How to improve access to assets based on location or add more on site.
- Landscape design and practices to reduce impact and protect habitat (IPM, xeriscaping)
- Preventing light pollution
- Preserving open space
- Protecting water bodies
- Manage rainwater
- Reduce heat islands

Rainwater Management

- Minimize impervious areas
- Control rainwater
- Incorporate rainwater management into site design
Heat Islands

Heat islands are...

Heat Island - Roof
Heat Island - Roof
System Synergies with a Green Roof:
- Reduce heat island effect
- Manage stormwater quantity and quality
- Create open space
- Create habitat
- Increase roof’s thermal insulation value

Heat Island
Name at least three other strategies for reducing heat islands on roofs or ground level hardscape other than green roofs
Common Terms and Concepts

Shortest Path Analysis
- Shortest distance to walk
- Or bike to destination

Parking Capacity
- All off-street spaces available to users inside and outside LEED Boundary. Street parking doesn’t count.

BUG Method
- Backlight-Uplight-Glare – a method to calculate light pollution

SRI
- Solar reflective index measures a surface’s ability to reflect and remit heat. High good, low bad.

More Common Terms and Concepts

Previously Developed
- Altered by paving, construction, and land use that would have required permitting

Development Footprint
- Total land area covered by impervious surfaces

Density
- Ratio of building coverage to parcel size. Floor Area Ratio (FAR), Dwelling Units per Acre (DU/acre), etc.

Buildable Land
- Area of the site where construction can occur.
Water

Task Domain: LEED Green Associate Tasks
Knowledge Domains: Water Efficiency

Who Cares?

What are some impacts of water use?  
What is LEED’s approach to conserving water?

- Efficiency First
- Alternative Sources
- Reuse
Water Budgeting

- How much rainfalls on the site?
- How much water will be used?
- How can that be reduced?
- Where can water be reused?

Types of Water

Align the water quality with it’s definition:

- _________: Wastewater from toilets and urinals.
- _________: Untreated household waste water which has not come into contact with toilet waste.
- _________: Meets or exceeds EPA’s drinking water quality standards and is approved for human consumption by state or local authorities.

*Greywater    Blackwater    Potable*
Reuse

Indoor Water Efficiency
Irrigation

Design for no irrigation
- Xeriscaping
- Consider establishment period

Use reclaimed and recycled water for irrigation
- Reclaimed water = Treated wastewater
- Recycled water = Greywater or rainwater

Submeter
- Track use for irrigation

Measurement & Monitoring

- Track consumption trends
- Determine fixture performance
- Identify leaks
Common Terms and Concepts

- **EPACT 1992**
  Energy Policy Act of 1992, set efficiency standards for fixtures which are now code

- **Energy Star and Water Sense**
  EPA standards for energy and water efficiency in appliances

- **Regular Building Occupants**
  Full and part-time employees and volunteers in FTE
  
  \[
  \text{Full-Time Equivalents (FTE)} = \frac{\text{Total Staff Hours}}{8}
  \]
  
  Also includes residents, hotel guests, and inpatients

- **Visitors**
  Intermittent users of buildings like shoppers and students, also known as "transients"

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More Common Terms and Concepts

- **Daily average** = Average per day calculated on a yearly basis.

- **Peak average** = Highest occupancy in a 24-hour day.

- **Example:**
  A café expects to serve an estimated 7,000 customers over the course of a day (daily average). Though, at noon, their busiest time, the café can only hold a maximum of 250 customers (daily peak).
Question 1

The production of which refrigerant is banned, and which other refrigerant is being phased out under the Montreal Protocol?

a) CO2; CO  
b) CFC’s; HCFC’s  
c) CFC’s HFC’s  
d) IWS, GWB
Question 2

Which one of the combinations of LEED Rating Systems is not allowed for the same building or space?

a) LEED-ND + LEED for Homes
b) LEED-CS + LEED-CI
c) LEED-O&M + LEED for Homes
d) LEED-NC + LEED-O&M
e) LEED-ND + LEED-NC

Question 3

To be awarded a point under the LEED Accredited Professional credit:

a) At least one principal participant of the project team must be a LEED Accredited Professional (AP) with a specialty appropriate for the project.
b) At least one principal participant of the design team must be a LEED Accredited Professional (AP) with a specialty appropriate for the project.
c) All members of the project team must be a LEED Accredited Professional (AP)
Question 4
For Construction Waste Management, calculations are done by:

a) Weight
b) Volume
c) Weight or Volume
d) Weight and Volume

Question 5
Green Seal Standard GS-11 relates to:

a) Formaldehyde-free composite wood
b) Low-emitting adhesives
c) Recycled content drywall
d) Low-VOC, low-toxic paint and coatings
**Question 6**

Proper ventilation rates to be applied to projects are prescribed by which of the following standards?

a) IPMVP Option B  
b) ASHRAE 90.1  
c) SCAQMD Rule 1113  
d) ASHRAE 62.1

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**Question 7**

Which of the following is an example of post-consumer recycled material?

a) Composite board containing sawdust from lumber mill  
b) Concrete that contains fly ash from a local coal powered energy plant  
c) Carpet made from plastic water bottles  
d) Salvaged barn beam
Question 8
The effort to reduce global warming by the use of harmful refrigerants involves understanding there is a trade-off, meaning:

a) The trade-off is between natural and man-made refrigerants. Natural refrigerants are CO$_2$, NH$_3$, and propane, and only those should be used.

b) The trade-off is there is a treaty for reduction of ozone depletion, but not for global warming. The solution is to make a new international treaty that agrees global warming is a comparable threat to ozone depletion.

c) The trade-off is that either way, the refrigerant will have a harmful impact to the environment. This is because some refrigerants have a higher ODP and a low GWP, while others have a higher GWP and lower ODP.

d) The trade-off is that refrigerants will either contribute to global warming or contribute to depleting the ozone layer unless EnergyStar equipment is used.

Question 9
Green design involves addressing the regional environmental context in which a project occurs. Which of the following is an example of a regional environmental issue?

a) Endangered species

b) Green house gas emissions

c) Use of PCBs

d) Commissioning
Question 10
Which of the following types of power is NOT part of renewable energy certificate programs:

a) Solar electric
b) Wind
c) Biomass
d) Low impact hydro
e) Passive solar

Results
How'd you do?

8-10 out of 10 – Piece of Cake!
6-7 out of 10 – I think I can, I think I can!
4-5 out of 10 – Well, I’m just getting started.
3 or less … See me after class.
Who Cares?

Cars have long been blamed for global warming and thought of as the biggest culprit...Buildings are actually more harmful to the environment with their energy use than cars!

Buildings account for 40% of the energy used today, according to the UN Environmental Program.
Who Cares?

The Montreal Protocol was signed in 1987, signifying the intent by multiple world leaders to reduce the effects of global warming and the thinning ozone layer by eliminating the use of ozone depleting substances, such as harmful refrigerants or CFC’s.

Source: National Aeronautics Space Administration
Stratospheric ozone thinning over the Antarctic, September 2000

Energy Reduction in Buildings

- Commissioning, M&V, Education
- Alternative Energy
- Efficient Systems
- Envelope
- Sizing, Massing and Orientation
- Set Goals
Refrigerants

Working fluids of a machine designed to pump heat from a lower to higher temperature.

List four key types of refrigerants:

Name an example of a natural refrigerant
Refrigerants

Align the refrigerant impact with its definition:

___________: ability to deplete the ozone through stratospheric chemical reaction

___________: ability to warm the atmosphere through absorption of the earth’s thermal emissions.

Ozone Depletion Potential (ODP)  Global Warming Potential (GWP)

Refrigerants

List at least three strategies for reducing the impact of refrigerants:
Refrigerants

Options for existing buildings and ongoing sustainable operations:

- Phase out through retrofit or replacement – all CFC based systems
- Follow EPA guidelines for refrigerant management and equipment maintenance.

Green Power

Which one does the USGBC consider green power?
Green Power

Green-e Certification:

- Run by Center for Resource Solutions
- Voluntary verification program for RECs
- Renewable power only
- No nuclear, large scale hydro

Managing Building Performance

Commissioning & Retro-commissioning

Measurement & Verification

Benchmark

Baseline

Establish building functions as designed
Resetting the building and identifying problems in systems
- Use data from M&V
- Occupant surveys

Systems to track actual performance
- Analyze and verify against benchmarks
- Identify problems or opportunities
- Make changes and improvements

Ways to express design performance goals or understand actual performance
- ENERGY STAR
- % improvement over ASHRAE
- HERS Score
- Architecture 2030 District

Commercial Building Energy Consumption Survey (CBECS) or ASHRAE 90.1 or Home Energy Rating System
Common Terms and Concepts (Summary)

- ANSI/ASHRAE/IESNA 90.1 2010
- ENERGY STAR
- CBECs
- HERS
- Demand Response
- Montreal Protocol
- Global Warming Potential
- Ozone Depletion Potential
- Renewable Energy
- Green Powers
Indoor Environmental Quality

Task Domain: LEED Green Associate Tasks
Knowledge Domains: Indoor Environmental Quality

Who Cares?

- What are some key components of indoor environmental quality
  __________, __________, __________, __________, __________,
  &________

- What are some benefits of better IEQ?
Who Cares?

Air Quality Contaminants
Protecting Air Quality

Lighting

Daylighting

Control
Lighting

Daylighting and Glare Control

Exterior shading

Automatic interior shades

Occupant comfort

- Acoustics
- Thermal comfort
- Personal control
- Views
- Post-occupancy follow up
Types of Space

Occupied
- IAQ, Thermal Comfort, Acoustics

Non-occupied
- Mechanical, Egress, Storage

Non regularly occupied
- Eg: Break room, lobby, bathroom

Regularly Occupied
- Lighting, Daylight, Views

Individual
- Individual control light and thermal

Multi
- Group control light and thermal

Densely
- Monitoring
Who Cares?

- The materials and resources category focuses on minimizing the embodied energy and other impacts associated with the ________, ________, ________, ________, ________, and ________ of building materials.

- What are some key strategies to reducing the impacts of a product’s life cycle?
  - ________________
  - ________________
  - ________________
  - ________________
Reuse

- The highest form of materials conservation
- Reduces the need for new/virgin materials
- Reduces landfill waste
- Cultural value, contextual relevancy
- Includes:
  - Whole building shell and structure
  - Furniture, fixtures, & equipment
  - Salvaged materials

Life Cycle Impacts

- Life Cycle Assessment (LCA):
**Waste – During Construction**

- Create a Detailed Plan
- Enforce with subs through good communication and signage

**Waste - Operations**

- Solid Waste Management Policy
- Waste Stream Audit/Monitor & Track
- Easy Access and Clear Signage
- Recycling for Durable Goods
Building Product Disclosure and Optimization

- Sourcing of Raw Materials
  - Extended producer responsibility
  - Recycled-content
  - FSC wood
  - Materials reuse
  - Bio-based materials
  - Local/Regional

Types of Recycled Content

Recycled Content $ = Material Cost x (Post-Consumer RC% + ½ Pre-Consumer RC%)

*Exclusions: shipping, labor (installation), mechanical, electrical, plumbing and equipment
Harvested/Extracted vs. Manufactured

Building Product Disclosure and Optimization

- Environmental Product Declarations (EPDs)
  - Material content
  - Recycled content
  - Service life
  - Global warming potential
  - Water consumption
  - Emissions to air and water
  - Waste generation
  - Ozone depletion potential
  - Respiratory effects
Building Product Disclosure and Optimization

- Material Ingredients
  - HPDs – Product nutrition label, identifies ingredients and compares against known hazard lists.
  - C2C – Proprietary info disclosure not required, five quality categories — material health, material reutilization, renewable energy and carbon management, water stewardship, and social fairness.

Purchasing Plans and Policies

- Develop a green materials/products purchasing plan:
  - Vendor Practices
  - Third-party Certifications
  - Cleaning Products and Equipment
Low-Emitting Materials

- VOC testing and verification documentation:
  - Paint & Coatings
  - Adhesives & Sealants
  - Flooring
  - Composite wood – CARB and ULEF
  - Insulation
  - Furniture

Common Terms and Concepts

- Defining a “Product”
  - Materials that create the building or are attached to it
  - Furniture not required to be included but may be included
  - Passive elements of mechanical, electrical, and plumbing systems may be included:
    - Piping
    - Plumbing fixtures
    - Ducts
    - Conduit
    - Pipe/duct Insulation
    - Lamp housings
  - Special equipment (elevators, escalators, fire suppression, etc.) excluded from all materials credits.
Product Cost, Location, and Assemblies

- Costs should include **all** taxes and expenses to deliver the material to the site but **excludes labor and equipment** for required for installation after delivery.

- **Actual vs. Default**
  - All materials being used on the project vs. 45% of total construction cost

- **Local** = 100 mile radius around project, measured “as the crow flies”.

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Questions?

- End of Four Hour Review

- On to Exam Registration

- Don’t forget Brown Bags on January 26 and 28 at 11:30 am!
Exam Registration

- **Step 1**: [www.usgbc.org](http://www.usgbc.org) – login and go to the Credentials on the left of your profile to pay.

- **Step 2**: [www.prometric.com/gbc](http://www.prometric.com/gbc) - to schedule the exam

! Your name in your USGBC account must match the name on the identification you will show at the testing center

! You must have your Corporate ID # to get member pricing

GLY ID #: **G617IMETJTJOFTJ**

Thank you!
Integrative Process and the Context of Green Building

**Task Domain:** LEED Green Associate Tasks
**Knowledge Domains:** LEED Processes (Impact Categories), Integrative Strategies (all), Project Surrounding and Public Outreach

Who Cares?

- Enhance Community, Social Equity, Env. Justice & Quality of Life
- Reverse contribution to climate change
- Enhance human health and wellbeing
- Protect and restore water resources
- Promote sustainable and regenerative resource cycles
- Protect biodiversity and ecosystem services
- Build a greener economy

What Should a LEED Project Accomplish?
Green Building Builds Value

- Investors, such as insurance companies
- Managing long-term costs
- Increasing NOI
- To stay current with the market
- To get ahead of the market
- Resale/ROI
- To get specific tenants
- Mission
- Near and long-term risk mitigation
- Codes or incentives

Hard Costs

LEED vs. Non-LEED

There is no significant difference in average cost of green buildings as compared to non-green buildings

Davis Langdon's "Costs of Green Revisited" Study
**Soft costs**

By LEED Certification Level:

**Soft Cost Estimates**

(Incremental cost as a percentage of construction costs)

<table>
<thead>
<tr>
<th></th>
<th>Best Estimate</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design Costs</td>
<td>0.5%</td>
<td>0.4% - 0.6%</td>
</tr>
<tr>
<td>Commissioning</td>
<td>1%</td>
<td>0.5% - 1.5%</td>
</tr>
<tr>
<td>Documentation &amp; Fees</td>
<td>0.7%</td>
<td>0.5% - 0.9%</td>
</tr>
<tr>
<td>Energy Modeling</td>
<td>0.1%</td>
<td>0.1%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2.3%</strong></td>
<td><strong>1.5% - 3.1%</strong></td>
</tr>
</tbody>
</table>

Source: Analyzing the Cost of Green – The American Chemistry Council

**Improved performance**

- New Buildings Institute study showed average EUI in green buildings was 24% lower than typical buildings

- General Services Administration evaluation of federal green buildings:
  - 13% less maintenance costs
  - 26% less energy
  - 27% higher occupant satisfaction
  - 33% lower CO2 emissions
Role of Codes

Require green features or certain performance

Limit innovation, require non-green features

LEED Development Vision

<table>
<thead>
<tr>
<th>Certification Level</th>
<th>Platinum</th>
<th>Gold</th>
<th>Silver</th>
<th>Certified</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>++</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

Relationship of Rating Systems and Codes

Environmental Impact

Green Building Codes

Traditional Building Codes

Zero Impact

Current Day
Types of Codes that impact Green Building

- SEPA
- Land use
  - Open space/Green space
  - Parking requirements
  - View corridors/solar access
- Street standards
- Energy codes
- Waste regulations
- Ventilation/IAQ codes
- Health dept regs
- EPACT 1992
- Endangered species act
- Contaminated site clean up regs
- NPDES

Code Exercise

Identify 3 green building strategies that code can help or hurt? How?
Conventional Design Team

Integrated Project Team

- Client
- Architect
- Builder
- Interior Designer
- Civil Engineer
- Mechanical Engineer
- Landscape Architect
- Acoustical Engineer
- Subcontractors
- Suppliers
- Investors
- Facilities
- User Groups
- Govt Agencies
- Community Members
- Commissioning Authority
End Goal Obscured

Setting the Course

Testing the Course

Verifying the Course

End Goal In View
Collaborative Meetings

Energy Modeling in IP

Testing the course
  o Life-cycle costing
  o Daylight modeling
  o Energy modeling

Shoe box Energy Model
For sustainable strategies, the rule of thumb is the later you think of it, the more it will cost and the less benefit you’ll get.”
– Kathleen O’Brien
Process

- Hold an Eco-Charrette
- __________________________________________
- __________________________________________
- LEED Credit Item Cost Analysis
- Design Credits Submittal to USGBC via LEED Online
- __________________________________________

Submit Project Certification Application: Construction Submittal
LEED Workshop
Evaluate which LEED Rating System applies

Analysis, Measurement & Verification

- Set Energy and Daylight Goals
- Energy & Daylight Modeling
- __________________________________________
- Incorporate final Daylight and Energy strategies
- __________________________________________
- __________________________________________

Commissioning
Occupancy Survey
Correct Daylight and Energy based on verification
Exam Overview

In this section we’ll discuss:
- Purpose and benefits of taking the exam
- Types of content and questions

References:
LEED Green Associate Candidate Handbook
www.GBCI.org
Who is the Green Associate Exam For?

- Individuals involved in built environment non-technical fields of practice
- Green building design, construction, and operation professionals

“Provides employers, policymakers, and other stakeholders with assurances of an individual’s current level of competence and is a mark of the most qualified, educated, and influential green building professionals in the marketplace.”

Benefits

- Strengthen your green building qualifications
- Market your green building knowledge to potential employers and clients
- Contribute to your professional development
- Earn recognition with the nation’s predominant green building professional credential
- Receive a Green Associate certificate and opt to be listed in GBCI’s online directory
- Prerequisite for taking a LEED Specialization exam
Exam Info

- 2 hours
  - 2 hours, 20 minutes = total seat time
  - Begins with 10 minute tutorial and ends with 10 minute satisfaction survey
- Computer-based exam
- 100 randomly-delivered, multiple-choice questions
- Scaled scoring: 125 – 200, 170 is passing
- Exam Fee: $200 for Members, $250 for Non-Members

Exam

- Multiple Choice
- Some simple math – calculators are available on the computer
- Can change answers and flag them for later review
- Track incomplete answers
- Double negatives
- Tricky questions & "most correct answer" logic
- Story problems w/ multiple answers
- Expect questions pertaining to:
  - Refrigerants
  - Community connectivity
  - Construction waste management
  - Implementation
Exam Specifications

Task Domains

I. LEED Green Associate Tasks

Knowledge Domains

I. LEED Process
II. Integrative Strategies
III. Location and Transportation
IV. Sustainable Sites
V. Water Efficiency
VI. Energy and Atmosphere
VII. Materials and Resources
VIII. Indoor Environmental Quality
IX. Project Surroundings and Public Outreach

Exam References

- Core Concepts Guide
- Excerpt from BD+C
- LEED Certification Guide
- Impact Categories
- LEEDv4 User Guide
- LEED Certification Fees
- Rating System Selection Guidance
- LEED Interpretations
Question Types

- Recognize & recall factual material
- Apply material to scenarios
- Analyze relationships and interactions

Sample Question #1

When applying for innovation credits, a project team:

a) Cannot submit any previously awarded innovation credit.

b) May receive credit for performance that doubles a credit requirement threshold.

c) May submit a product or strategy that is being used in an existing LEED® credit.

d) May receive a credit for each LEED Accredited Professional that is on the project team.
Sample Question #2

A developer wants to make a profit by building a new office that maximizes daylighting and views. What actions might the developer take to fulfill all parts of the triple bottom line?

a) Restore habitat onsite  
b) Purchase ergonomic furniture  
c) Pursue local grants and incentives  
d) Provide lighting controllability for occupants
Exam Prep

In this section we’ll...

- Review how to register
- Recommend study approaches
- Provide study tips and advice
Exam Registration

- **Step 1**: [www.usgbc.org](http://www.usgbc.org) – login and go to the Credentials on the left of your profile to pay and get eligibility ID.

- **Step 2**: [www.prometric.com/gbci](http://www.prometric.com/gbci) - to schedule the exam

**IMPORTANT TO NOTE**

- Your name in your USGBC account must match the name on the identification you will show at the testing center
- You must have your Corporate ID # to get member pricing
- Changes or cancellations must be submitted prior to midnight three days before your exam
- DO NOT be late
- DO NOT forget your ID
Prometric Testing Center

- Arrive 30 minutes in advance
- Nothing goes into the exam room
  - Facilities have free lockers for personal items
- Must provide Photo ID
- You will be provided materials for taking notes
  - Paper and #2 pencil
  - Erasable whiteboard and pen

Skills Tested

Things you need to know how to do with the information you study:

- Recognize and recall factual material
- Apply material to scenarios
- Analyze relationships and interactions
Study Methods

Big Picture vs. Detailed

Big Picture
- Limited knowledge and use for LEED
- Not a numbers person

Detailed
- Build and use knowledge of LEED
- Like rules and numbers

The Plan

1. Start with memorizing the basics
2. Learn to apply knowledge to scenarios
3. Analyze relationships, interactions
4. Practice
5. Get support
6. Develop a test taking strategy
7. Go for it
Basics

- Review all References
- Look for definitions and concepts list in Specifications
- Make flashcards, lists, diagrams
- Review notebook from training and study tools

LEED Matrix

If you choose the “LEED” approach, for each credit know:

- Intent Key Requirements
- Reference Standards
- Terms
Apply

Next – Case studies
  o Find case studies
    • USGBC Project
    • High Performance Building database
    • Cascadia GBC
  o Review descriptions and identify which principles in the “Specifications” list green features described contribute too.
  o Look for synergies and relationships
Apply

Last, relationships
1. Pick one concept in the specifications
2. Draw, write, diagram how it relates to at least two others
3. Repeat
Practice

- Gather up practice exams
- Practice open book
- Practice closed book
- Practice with a time limit
- Practice online

Get Support

Don’t do it alone!
- Study Groups
- Online forums
## Test Strategy
- Morning vs. Afternoon
- Cram vs. Routine studying
- The brain dump
- Charge right through vs. Steady pace
- Time checks regardless
- Answer every question

## Tips
- Eliminate obviously wrong answers
- ALWAYS choose the BEST answer not necessarily the RIGHT answer
- Do a time check every 30 minutes
- Answer everything, no penalty for wrong answers
- Statistically the right answer is “B”… or was it “C”? 
**Tips**

Know your refrigerants

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**Study Tools**

**After complete survey**
- PDF of presentation
- 100 question practice exam
- LEED Matrix
- Reference Standard Flashcards
- Acronym list

**Online**
- GBCI
- USGBC Exam Prep materials
- LEED User (from BuildingGreen)
- Green Building Education Services
**Life after the Exam**

- You receive your score immediately
- Of course…you passed!
- Begin using “LEED Green Associate” title and logo immediately
- Receive e-mail from GBCI when your accreditation is posted to the website
- Certificate sent via mail 2-3 months later
- Two years to complete 15 hours of continuing education
- OR…don’t stop, proceed directly to registration for your LEED-AP technical exam

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**Thank you!**