LEED GREEN ASSOCIATE V4 EXAM PREP

2015
With Lorne Mlotek

Course Description and Objectives

Description – Provide you with general knowledge of how LEED defines a ‘green building’ and the LEED process in its entirety.

Objectives:
- Understand the purpose of a third-party green building rating system in the 21st century
- Define LEED and its rating systems for different building types
- Describe how to define a green building using the LEED rating system
- Register and prepare for the LEED Green Associate Exam

Agenda

1. LEED OVERVIEW + INTRODUCTION
2. LEED BACKGROUND
   - How the point system works
   - Market Adaptations
   - USGBC, GBCI, new terms
3. THE NINE CATEGORIES
   - Integrative Process
   - Location and Transportation
   - Sustainable Sites
   - Water Efficiency
   - Energy & Atmosphere
   - Materials and Resources
   - Indoor Environmental Quality
   - Innovation in Design
   - Regional Priority
4. THE APPLICATION PROCESS (What to do next)

WHO AM I?

- Where I initially was exposed to LEED
- How I got involved in LEED Exam Prep
- What I am doing now
- Where to next?
- My Experience as a LEED consultant
- Why I chose to get involved in the green building industry
  - A great place to start
  - Multi-Disciplinary
  - It is the future of our built environment and humanity!

2 SIDES OF LEED – CERTIFICATION AND CREDENTIALS

LEED CREDENTIALING / ACCREDITATION

- GENERAL KNOWLEDGE
  - NO PREREQUISITE
  - 2 HOURS
  - 100 QUESTIONS
  - $200 - $250 FEE

- TECHNICAL KNOWLEDGE + COORDINATION
  - PREREQUISITE: LEED 6A $250 - $350
    - Combined: $400 - $550

- CREDENTIALS (PEOPLE)
  - LEED BD+C
  - G+M
  - ID+C
  - ND
  - HOMES

- FELLOW
  - LEED GA $250 - $350
  - LEED AP + 10 years green building experience
LEED Accreditation – Levels of Detail

- **BUILDING CODE / ZONING**
  - Construct a minimum of 1 parking space per apartment unit

- **GREEN ASSOCIATE**
  - Provide only (no additional) parking than required by building Code and provide preferred parking for green vehicles

- **ACCREDITED PROFESSIONAL**
  - Do not exceed minimum parking capacity requirements in code, reduce parking by 20% from ITE’s baseline study for 1 point, provide 5% of the FTEs with parking for carpools and 5% for green vehicles for 2 points.

LEED Credential Maintenance Program (CMP)

- Never have to re-test
- Every 2 Years must complete
  - LEED GA = 15 Continuing Education Hours (3 Specific)
  - LEED AP+ = 30 Continuing Education Hours (5 Specific)
  - Pay a $50 fee
- How to earn Continuing Education Hours?
  - Still a student – your green-related class hours count!
  - Classes at Conferences
  - Online Courses

USGBC - U.S. Green Building Council

- **USGBC’s mission** - To transform the way buildings and communities are designed
- **USGBC’s vision** - Buildings will sustain the health and vitality of all life within a generation.

1. Voluntary – not required by law
2. Consensus-Based – public comment and members vote
3. Market Driven Approach – advertise green + profit

- **Formally Acceptable**
  1. U.S. Green Building Council
  2. USGBC

Developing LEED rating Systems

There is no “S” in “LEED”

- Only buildings can become “LEED certified”
- Only people can become “LEED accredited”
- No products nor companies can ever become “LEED certified”
- Organizations can become USGBC members of national USGBC organization
  - $1,000 annual membership for State agencies
- Individuals can become members of USGBC chapters
  - $50 for NCC if organization is national member
- See [www.usgbc-ncc.org](http://www.usgbc-ncc.org) for events
LEED Principles – TRIPLE BOTTOM LINE

Examples of buildings that do not meet the 3 P's
1. Very energy efficient but lack of ventilation = sickness
2. Material with small economic footprint but made in a sweat shop
3. Eco-friendly resort that initially had to displace many species

LEED Overview – Familiar terms

- **Hard Costs**: Actual Construction (work + materials)
- **Soft Costs**: Design and Permit fees (not directly related to construction)
- **Value Engineering**: Project Cuts, Green are first to go
  - Code = Mandatory by law // LEED = Voluntary
- **Systems Thinking Approach** - Integration

LEED certification - certification process
LEED certified - project that has been certified to any level
LEED Certified - A project that has received Certified level

LEED Overview – THE NINE CATEGORIES

1. Integrative Process (IP)
2. Location and Transportation (L+T)
3. Sustainable Sites (SS)
4. Water Efficiency (WE)
5. Energy & Atmosphere (EA)
6. Materials and Resources (MR)
7. Indoor Environmental Quality (IEQ)
8. Innovation in Design (ID)
9. Regional Priority (RP)

LEED Overview – PROJECT REGISTRATION

- Register the project with **GBCI** via LEED Online (recall flow diagram)
- **Project Administrator** is the person who initially registers the project via LEED Online. They provide info, invite members to LEED Online and assign credit responsibility to team members
- **LEED Online** - Where teams manage the LEED certification process. Upload files, receive feedback.
- **LEED Credit Scorecard** – assess and track attempted credits

LEED Overview – LEED ONLINE

<table>
<thead>
<tr>
<th>LEED Project Name</th>
<th>100000 LEED v4 ROHC NC</th>
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<tbody>
<tr>
<td>PROJECT INFORMATION</td>
<td></td>
</tr>
<tr>
<td>INTEGRATIVE PROCESS</td>
<td>0 OF 1 AWARDED 0</td>
</tr>
<tr>
<td>LOCATION &amp; TRANSPORTATION</td>
<td>0 OF 16 AWARDED 0</td>
</tr>
<tr>
<td>SUSTAINABLE SITES</td>
<td>0 OF 10 AWARDED 0</td>
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<tr>
<td>WATER EFFICIENCY</td>
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<td>0 OF 33 AWARDED 0</td>
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<tr>
<td>MATERIALS &amp; RESOURCES</td>
<td>0 OF 13 AWARDED 0</td>
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<tr>
<td>INDOOR ENVIRONMENTAL QUALITY</td>
<td>0 OF 16 AWARDED 0</td>
</tr>
<tr>
<td>INNOVATION</td>
<td>0 OF 6 AWARDED 0</td>
</tr>
</tbody>
</table>

LEED V4 Impact Categories – Point Allocation Basis

1. Increasing Importance
2. Decreasing Importance

- **Enhance Communities, Social, & Economy**
- **Reduce contribution to climate change**
- **Enhance human health & wellbeing**
- **Promote sustainable and regenerative resource cycles**
- **Protect and restore water resources**
- **Protect biodiversity and ecosystem services**
- **Build a greener economy**

What Should a LEED Project Accomplish?

Decreasing Importance

- **Decreasing Importance**
- **Increasing Importance**

- **Reverse contribution to climate change**
- **Enhance human health and wellbeing**
- **Promote sustainable and regenerative resource cycles**
- **Protect and restore water resources**
- **Protect biodiversity and ecosystem services**
- **Build a greener economy**
LEED BUILDING DESIGN + CONSTRUCTION – Market Adaptations

New Construction
- New Building
- Major Renovation
- 50% of floor area
- HVAC Replacement

Core & Shell
- Building Envelope
- Mechanical, electrical, plumbing and fire systems
- Not Tenant fit-out

Schools
- New or existing
- Required for K-12
- Higher Education can choose

Healthcare
- Long term

Retail

Hospitality
- Short or long term

Warehouses and Distribution Centers

BD+C – entire new construction or major renovation

LEED for Interior Design and Construction – Market Adaptations

ID+C – Interior fit-out of tenant spaces

Commercial Interiors
- Worked hard in conjunction with LEED for Core + Shell
- Designer = C+S
- Tenant = CI

Hospitality
- Short or long term

LEED for Operations and Maintenance – Market Adaptations

O+M – Entire building undergoing improvement – minor or no construction

Existing Buildings
- New Buildings
- Major Renovation
- 50% of floor area
- HVAC Replacement

Existing Schools
- New or existing
- Required for K-12
- Higher Education can choose

Existing Retail

Existing Hospitality
- Short or long term

Existing Warehouses and Distribution Centers

LEED for Homes

Homes and Multifamily Lowrise
- 1 - 3 floors maximum
- Requires cooking and bathroom facilities (home definition)

Multifamily Midrise
- Residential Building
- 4 – 8 stories maximum

Unique Items
- Credits – Ex. Compact Development – smaller is better
- LEED for Homes Provider
- Green Rater
- NO LEED ONLINE

LEED for Neighbourhood Development

ND looks at the bigger picture – entire communities
- Walkability
- Watershed as a source of water
- Infrastructure connecting the buildings
- Mixture of uses

LEED Campus
- Multiple similar buildings on a site under control of a single entity (company HQ)

LEED Volume
- 25+ projects
- Example: 124 Target stores in Canada

SELECTING A RATING SYSTEMS

1. THE 40/60 RULE

Percentage of floor area appropriate for a particular rating system

<table>
<thead>
<tr>
<th>Percentage of Area</th>
<th>Appropriate for Rating System</th>
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<tr>
<td>0%</td>
<td>Should not use rating system</td>
</tr>
<tr>
<td>40%</td>
<td>Project team’s choice</td>
</tr>
<tr>
<td>60%</td>
<td>Should use rating system</td>
</tr>
<tr>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

2. Project team decides

Quote – “The entire gross floor area of a LEED project must be certified under a single rating system and is subject to all prerequisites and attempted credits in that rating system, regardless of mixed construction or space usage type.”
LEED Overview – THE POINT SYSTEM

100 possible points + 6 Innovation Design + 4 Regional = 110 Points Total

Minimum Program Requirements

1. Must be in a permanent location on existing land
   - Cannot be designed to move

2. Must use reasonable LEED boundaries
   - Include all contiguous land associated with the project
   - Ex: Hardscapes (sidewalks and parking), stormwater treatment and landscaping
   - Must not unreasonably exclude portions of the site which makes it easier for the project to meet credits and prerequisites - NO GERRYMANDERING
   - The Gross Floor Area of a LEED Project must exceed 2%

3. Must comply with project size requirements (GFA)
   - LEED BD+C: New Construction - a minimum of 100,000 square feet

LEED Overview – HOW TO EARN POINTS

Prerequisites

- Key criteria that define green building performance
- Worth no points
- Each category includes mandatory Prerequisites
- Must meet to be eligible for certification
- MANDATORY

Credits

- Credits earn points to receive a desired certification level
- OPTIONAL - Selected and pursued at your discretion

INTENTS

- Why the credit exists and how it promotes sustainability

REQUIREMENTS – out of scope, but helps understanding

- Different ways to achieve credits to receive points

Strategies – How to meet the Requirements

INTEGRATIVE Process (1 Point)

Intent: To support high-performance, cost-effective project outcomes through an early analysis of the interrelationships among systems.

- Early Stage Discussion of Goals and Requirements
- Interrelationships between team members to find synergies
  - Work together, not alone
- Holistic approach to design of building

Today's Sample Focus

LEED for New Construction Rating System
- Type: Commercial Office Tower
- Construction: New Construction
- Location: New York City
INTEGRATIVE Process
Terms:
LEED Charrette – Pre-pre design workshop with all principal team members
- A goal setting workshop

Owners Project Requirements (OPR) – Document which specifies the important concepts which will lead to a project’s success

Basis of Design (BoD) – The info needed to accomplish the OPR

Location and Transportation
- No Prerequisites
- Select a location which mitigates occupant’s impact by:
  - Selecting a location in an existing community
  - Providing transportation infrastructure
  - Providing walking paths to amenities
  - Discourage the use of private driven gas automobiles

Important Terms
- Building Footprint
- Development Footprint
- Development Hardscape Footprint
- Property Boundary
- LEED Project Boundary

LTc2 – Sensitive Land Protection (1 point)
Intent: To avoid sensitive lands & reduce impacts from location

Option 1 – Select a previously developed site – OR -
Option 2 - Do not develop on:
1. Prime Farmland
2. Flood Plains
3. Habitat for threatened or endangered species
4. Land within 50’ of wetlands
5. Land within 100’ of water body

LTc3 – High-Priority Site (1-3 points)
Intent: To encourage project location in areas with development constraints and promote the health of the surrounding area.

Promote the redevelopment of sites/areas deemed undesirable

Important Terms
Brownfield – previously developed site that is contaminated/polluted
Infill site – 75% of site is previously developed
Historic District – A group of buildings/structures that have been deemed significant to the area
Ltc3 – High-Priority Site (1-3 points)

Option 1: Historic District – or infill site (Distillery District)

Option 2: Priority Designation – identified by a government agency

Option 3: Brownfield Remediation - Remediate the land (+/-)

Ltc4 – Surrounding Density & Diverse Uses

Intent: To conserve land and habitats by developing in areas with existing infrastructure. To reduce driving to amenities

Important Terms

Buildable Land – land where construction can occur and excludes public right of way (IE. Roads)

Floor-Area Ratio – Density of non-residential land-use

\[
FAR = \frac{Building \ Floor \ Area \ (SF)}{buildable \ land \ area}
\]

Ltc4 – Surrounding Density & Diverse Uses

Option 1: Surrounding Density in quarter mile radius exceeds:

1. Residential Density = 7 Dwelling Units / Acre +
2. Non-Residential Density = 0.5 FAR +
3. Combined = 22000+SF/Acre BL

Residential Density (DU/acre)

<table>
<thead>
<tr>
<th>Units</th>
<th>Acre</th>
<th>DU</th>
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</thead>
<tbody>
<tr>
<td>50</td>
<td>5</td>
<td>10</td>
</tr>
</tbody>
</table>

Non-Residential Density (FAR)

<table>
<thead>
<tr>
<th>Building Area (SF)</th>
<th>Buildable Land (SF)</th>
<th>FAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>150000</td>
<td>200000</td>
<td>0.75</td>
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</table>

Ltc4 – Surounding Density & Diverse Uses

Option 2: Diverse Uses

- Site is within ½ mile walking distance (entrance to entrance) of 4+ or 8+ existing and publicly available diverse uses including:
  1. Category: Food Retail
     - Type: Supermarket, restaurant
  2. Category: Services
     - Type: Bank, theatre
  3. Category: Community Retail
     - Type: Convenience Store, Pharmacy
  4. Category: Civic & Community Uses
     - Type: Senior or Child care
  5. Category: Education Facility
     - Type: University

- Max 2 types per category
- Min. 3 categories represented

*Walking Distance = No Obstruction

Ltc5 – Access to Quality Transit (1-6 points)

Intent: To encourage development in locations shown to have multimodal transportation choices or otherwise reduced motor vehicle use

Any functional entry within ¼ mile of:

1. Bus stop
2. Streetcar stop
   - OR -
3. Rideshare Location
   - OR -

Any entry within ½ mile of:

1. Bus Rapid Transit
2. Light or Heavy Rail Station
   - OR -
3. Commuter rail or ferry terminals
   - OR -

*Items must meet minimum trip count

Transportation Accounts for 33% of our greenhouse gas production and 30% of our energy consumption[5]
**LTc5 – Access to Quality Transit (1-6 points)**

**Intent:** To promote biking & physical activity while reducing vehicle use

1. Connect to a Bicycle network (off or on street lanes)
2. Provide short and/or long term parking for a % of occupants
   a) Long-term = Covered parking that is easily accessible to residents and employees
   b) Short-term = Uncovered Parking used by visitors
3. Provide Showers for a % of occupants in commercial spaces

**LTc6 – Bicycle Facilities (1 point)**

**LTc7 – Reduced Parking Footprint (1 point)**

**Intent:** To minimize environmental damage due to parking facilities including automobile dependence, land consumption and stormwater runoff

- USA has twice as many parking spots as people!! – mostly impervious

  1. Do not exceed local zoning code requirement
  2. Reduce Parking capacity from Baseline (ITE Handbook Standard)
  3. Provide 5% preferred carpool parking

**LTc8 – Green Vehicles (1 point)**

**Intent:** To reduce pollution by encouraging alternative vehicles

1. Provide 5% preferred parking or a 20%+ discount for green vehicles
   a. American Council for an Energy Efficient Economy (ACEEE) score of 45+
   - AND DO ONE OF FOLLOWING -
   A. Provide Electric Vehicle Charging Stations
   - OR -
   B. Provide alternative refueling / battery switching stations

**LTc8 – Green Vehicles (1 point)**

**LTc1 – LEED ND Location (8 – 16 points)**

**Intent:** Avoid inappropriate sites, vehicle miles traveled and improve livability and human health by encouraging physical activity

- Incentivizes teams to locate in a LEED ND development
- Points increased depending on level on ND certification
  - LEED ND Certified - 8 points
  - LEED ND Silver - 10 points
  - LEED ND Gold - 12 points
  - LEED ND Platinum - 16 points
- All other credits ineligible
Sustainable Sites

• 60% of our ecosystems are degraded — UN

Sustainable Sites – Prerequisite

SSc1: Site Assessment (1 Point)

Intent: To assess site conditions before design to evaluate sustainable options and inform related decisions about site design.

• Part of the Integrative process
• Assessment must include:
  1. Topography
  2. Hydrology
  3. Climate
  4. Vegetation
  5. Soils
  6. Human Use
  7. Human Health Affects

SSc2: Site Development: Protect or Restore Habitat 1-2 pts.

Intent: To conserve existing natural areas and restore damaged areas to provide habitat and promote biodiversity.

1. Protect the greenfield area
   - AND -
   A. Restore if developed land with native/adaptive vegetation
   - OR -
   B. Provide financial support to a Land Trust Alliance organization

*Land Trust – non-profit organization that actively works to conserve land through conservation easement or acquisition

SSp1 – Construction Activity Pollution Prevention

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

Erosion and Sedimentation Control (ESC) plan:
• Prevent loss of soil
• Prevent Sedimentation pf storm sewers and streams
• Prevent Pollution of air with dust

Standard: Environmental Protection Agency (EPA)
Construction General Permit (CGP) - 2012
**SSc3: Site Development: Maximize Open Space (1 point)**

**Intent:** To create exterior open space that encourages interaction with the environment, social interaction, passive recreation, and physical activities.

**Site area** must be open outdoor space

– 25% of that outdoor space must be **vegetated** or tree canopied

**QUALITY Outdoor space** must be accessible and useable

![Open Space Image](image)

<table>
<thead>
<tr>
<th>SSc5.1</th>
<th>SSc5.2</th>
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</thead>
<tbody>
<tr>
<td>Total Ground Vegetated area M2</td>
<td>3059.7</td>
</tr>
<tr>
<td>Green Roof area M2</td>
<td>1535</td>
</tr>
<tr>
<td>TOTAL VEGETATED AREA M2</td>
<td>4594.7</td>
</tr>
<tr>
<td>Total Pedestrian Hardscape at Grade</td>
<td>1175.95</td>
</tr>
<tr>
<td>Total Vegetated Area at Grade</td>
<td>3060</td>
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<tr>
<td>Accessible Green Roof</td>
<td>469</td>
</tr>
<tr>
<td>Rooftop Pedestrian Hardscape</td>
<td>496</td>
</tr>
<tr>
<td>Total Open Space Area</td>
<td>5141 m2</td>
</tr>
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**SSc4: Rainwater Management (2-3 points)**

**Intent:** To reduce runoff volume and improve water quality by replicating the natural hydrology and water balance of the site

**Option 1** – Use Low Impact Development and Green Infrastructure

**Option 2** – Natural Land Cover Condition management (flow)

- Restore original site condition

![Rainwater Management Image](image)

**SSc4: Rainwater Management Strategies**

**Green Infrastructure** – soil and vegetation-based approach to rain water management allowing water infiltrate into the ground.

**Low Impact Development** - on-site natural features to protect water quality by addressing runoff close to its source (IE. rain gardens)

![Rainwater Management Image](image)

**SSc5: Heat Island Reduction (1-2 points)**

**Intent:** To minimize effects on microclimates and human and wildlife habitats by reducing heat islands.

- Heat Island Effect
  - Cities are hotter due to hardscapes (2 to 10 degrees)
  - Common surface materials act as heat sinks
  - Buildings block heat from radiating into cold night sky
  - Emissivity – emit heat once absorbed
  - Albedo – Solar Reflectance
  - Roofs: Solar Reflectance Index (SRI) – REJECTS HEAT (0 → 100)
  - Non-roof: Solar Reflectance (0 → 1)
    - 3 year SR/SRI = SR/SRI after 3 years of weather exposure

![Heat Island Reduction Image](image)
**SSc5: Heat Island Reduction (1-2 points)**

**Heat Island Effect Non-roof measures**
- Shade 50% of Hardscapes
- Reduce Hardscapes (roads, parking, sidewalks)
- Cool Pavement (High SRI)
- Open Grid Pavement (Perviousness > 50%)

**Heat Island Effect Roof**
- Cover with High SRI
- Vegetative Roofs
  - 50% roof area

**SSc6: Light Pollution Reduction (1 point)**

**Intent**: To increase night sky access, improve nighttime visibility, and reduce the consequences of development for wildlife and people.
1. Exterior Light Pollution – around building
2. Interior Light Pollution – Light Trespass and escaping light

Option 1 – BUG Method – Backlight – Uplight – Glare (IES Model)
Option 2 – Calculation Method – based on zone

**Water Efficiency – Terms to Know**
1. Potable Water
2. Blackwater
3. Graywater
4. Process water (make-up)
5. Purple Pipe (municipally reclaimed)
   - GPF
   - GPM
   - Evapotranspiration
   - FTE – Full Time Equivalent
   - Watersense Label – for fixture and faucets
Water Efficiency

If our present patterns continue, 2 out of 3 people will live in water-stressed conditions by 2025

19% of total energy consumption in California is due to pumping and treating water

Water Efficiency – Baseline Water-Use

1. Split FTE # = 0.5 Men and 0.5 Women
   • Women: 3 Toilet and 3 lavatories per day
   • Men: 2 Urinals, 1 Toilet and 3 Lavatories per day
2. EPAct of 1992:
   • Conventional toilets: 1.6 gpf
   • Conventional urinals: 1.0 gpf
   • Conventional lavatory (bathroom) faucets: 2.2 gpm
   • Conventional kitchen faucets: 2.2 gpm
   • Conventional showerheads: 2.5 gpm

Water Efficiency – Credits

<table>
<thead>
<tr>
<th>Percentage Reduction</th>
<th>Points (BD+C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20%</td>
<td>Prerequisite</td>
</tr>
<tr>
<td>25%</td>
<td>1</td>
</tr>
<tr>
<td>30%</td>
<td>2</td>
</tr>
<tr>
<td>35%</td>
<td>3</td>
</tr>
<tr>
<td>40%</td>
<td>4</td>
</tr>
<tr>
<td>45%</td>
<td>5</td>
</tr>
<tr>
<td>50%</td>
<td>6</td>
</tr>
<tr>
<td>55% (EP)</td>
<td>7</td>
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WEP2 + WEC2 - Indoor Water Use Reduction

Strategies:
- Low flow fixtures
- HET / Dual-Flush Toilets / Waterless Urinals /
  • ENERGY STAR – standard for appliances
- Use Recycled grey water for toilets or harvest rainwater

How we use our freshwater

In the last century, water consumption has grown at a faster rate than population growth
WEp1 + WEc1 - Outdoor Water Use Reduction

**Baseline** = Rate from peak watering month

<table>
<thead>
<tr>
<th>Percentage Reduction</th>
<th>Points (BD+C)</th>
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</thead>
<tbody>
<tr>
<td>30%</td>
<td>Prerequisite</td>
</tr>
<tr>
<td>50%</td>
<td>1</td>
</tr>
<tr>
<td>100%</td>
<td>2</td>
</tr>
</tbody>
</table>

**Strategies:**
1. Adaptive/Native Plants
2. Xeriscaping (100% nonpotable)
3. Efficient Irrigation – Drip (90%)
4. Demand Meters
5. Non-potable irrigation

WEp3 - Building-Level Water Metering

**Intent:** To support water management and identify opportunities for additional water savings by tracking water consumption.

**Prerequisite:** Install permanent water meters that measure the total potable water use in and around the building – share for 5 years with USGBC

WEc4 - Water Metering (1 Point)

**Intent:** To support water management and identify opportunities for additional water savings by tracking water consumption.

**Credit** – Install permanent submeter for 2+ of the following:
1. Irrigation water
2. Indoor plumbing fixtures and fittings
3. Domestic hot water
4. Boilers
5. Reclaimed water
6. Process water (80%+)
   - Humidification systems
   - Dishwashers
   - Clothes washers
   - Pools

WEc3 – Cooling tower water use (1-2 Points)

**Intent:** To conserve water used for cooling tower makeup while controlling microbes, corrosion, and scale in the condenser water system

**Conduct a one-time potable water analysis to measure chemicals**
- Each has a max concentration
- Use non-potable for make-up

Energy and Atmosphere

- Contains the most points available (all rating systems)
  - Greatest Potential Cost Savings
  - Greatest Potential Emission Reduction

1. Use less energy in a building
   - Use appropriate orientation, glazing and building materials
2. Support the use of more environmentally friendly energy sources
3. Reduce greenhouse gas emissions
4. Reduce ozone depletion and climate change

- 39%-50% of the energy and 74% of the electricity
**EAp1 – Fundamental Commissioning and Verification**

**Intent:** To support the design, construction, and eventual operation of a project that meets the owner’s project requirements for energy, water, indoor environmental quality, and durability.

- Commissioning - Verify and Document that all systems are:
  1. Planned
  2. Design
  3. Installed
  4. Tested
  5. Operations and Maintenance

**Commissioning Authority →**

-- Looks out for the owner

**EAp2 - Minimum Energy Performance**

**Intent:** To reduce the environmental and economic harms of excessive energy use by achieving a minimum level of energy efficiency for the building and its systems.

**Baseline established by ASHRAE 90.1-2010**

- Option 1 – Modeling - Whole Building Energy Simulation
- Option 2 + 3 – ASHRAE Prescriptive paths

**Some common CONSERVATION ONLY strategies**

- Minimize east/west windows & maximize south-facing windows
- Install a high SRI rooftop to reduce cooling load

**EAc1 – Enhanced Commissioning and Verification**

**Enhanced Systems Commissioning -**

1. Review contractor submittals.
2. Review building operations **10 months** after substantial completion.
3. Develop an on-going commissioning plan.
4. **Verify** Training

**EAc2 – Optimize Energy Performance**

**Intent:** To reduce the environmental and economic harms of excessive energy use by achieving a minimum level of energy efficiency for the building and its systems.

**Baseline established by ASHRAE 90.1-2010**

- Option 1 – Modeling - Whole Building Energy Simulation
- Option 2 – Prescriptive - ASHRAE 50% Advanced Energy Design Guide
- Option 3 – Prescriptive – Advanced Buildings Core Performance Guide

**Points based on percentage (%) of cost savings**
**EAc2 – Optimize Energy Performance**

<table>
<thead>
<tr>
<th>Energy Performance</th>
<th>Percentage Reduction</th>
<th>Points (BD+C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5%</td>
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</table>

**EAp3 – Building-Level Energy Metering**

**Intent:** To support energy management and identify opportunities for additional energy savings by tracking building-level energy use.

- **Install meters for whole building energy usage**
  - Share energy consumption data with USGBC for 5 years
- **Meter at least at 1 month intervals**

**EAc3 – Advanced Energy Metering**

**Intent:** To support energy management and identify opportunities for additional energy savings by tracking building-level and system-level energy use.

- **Install smart meters for 10%+ consumers**
  - Record at hourly intervals
  - Transmit data to Remote Location

**EAp4 – Fundamental Refrigerant Management**

**Intent:** To reduce stratospheric ozone depletion.

- **Important Terms:**
  - Ozone Depletion Potential (ODP)
  - Global Warming Potential (GWP)
  - CFC (ChloroFluorCarbons) – HIGHEST ODP + GWP – Prerequisite
  - AKA Freon
  - HCFC (HydroChloroFluorCarbons) – LOWER ODP – 2030 phase out
  - HFC (HydroFluorCarbons) – NO ODP, HIGH GWP
  - Halocarbons – Fire Suppression
  - Natural Refrigerants
  - Montreal Protocol - 1987
  - ODP phase out by project completion
  - Textbook

**EAc6 – Enhanced Refrigerant Management (1 point)**

**Intent:** To reduce ozone depletion and support early compliance with the Montreal Protocol while minimizing direct contributions to climate change

**Option 1 – No refrigerants used**

**Option 2 – Calculation**

- ODP + GWP < X

**Subtract cost savings from on-site renewable energy**
EAc4 – Demand Response (1-2 points)

**Intent:** To increase participation in demand response technologies and programs that make energy generation and distribution systems more efficient, increase grid reliability, and reduce greenhouse gas emissions.

**Time-of-use Pricing in simplest terms**

How energy rates can change throughout the day

PEAKER PLANTS

**Demand Response Program**

- The project agrees to voluntarily have their power shut off in peak periods from the utility provider
  - Building operator must adapt to the program (BAS)
  - Monetary incentive

*If no DR program available – create a plan to demonstrate reducing peak usage*

How Demand Response Works

BPA Residential Auto Direct Load Control Pilot

EAc5 – Renewable Energy Production (1-3 points)

**Intent:** To reduce the environmental and economic harms associated with fossil fuel energy by increasing self-supply of renewable energy.

\[
\% \text{ Renewable} = \frac{\text{Equivalent of usable energy}}{\text{Total building annual energy cost}}
\]

**Denominator based on:**

1. EAp2 – Whole Building Energy Simulation
2. US DoE’s Commercial Buildings Energy Consumption Survey database (Prescriptive)

<table>
<thead>
<tr>
<th>Renewable Energy</th>
<th>Percentage Reduction</th>
<th>Points (BD+C)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1%</td>
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<td>10%</td>
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</table>

EAc7 – Green Power and Carbon Offsets (1-2 points)

**Intent:** To encourage the reduction of greenhouse gas emissions through the use of grid-source, renewable energy technologies and carbon mitigation projects.

**1. DIRECT**
- **Source for a Green-e supplier** (Center for Resource Solutions)
  - Certifies renewable energy source
- **5 year contract from a resource which came online after Jan-2005**
- **Based on energy consumed from grid, NOT COST**

\[
\% \text{ Reduction} = \frac{\text{Percentage of green power or carbon offset (kwh or CO}_2\text{e)}}{\text{Total building annual energy usage (kwh or CO}_2\text{e)}}
\]

<table>
<thead>
<tr>
<th>Green Power &amp; Carbon Offsets</th>
<th>Percentage Reduction</th>
<th>Points (BD+C)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>50%</td>
<td>1</td>
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<td>100%</td>
<td>2</td>
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</table>

**2. INDIRECT**

A. **REC = Renewable Energy Certificates = 1 MWh eq.**

B. **Carbon Offsets** measured in metric tonnes of CO\(_2\)e
  - Reduces same amount of CO\(_2\) somewhere else

**Scope 1 emissions** – Direct emissions - natural gas burned on site (IE. Boiler) – mitigated by carbon offsets

**Scope 2 emissions** – Indirect emissions – greenhouse gas (IE. Purchased electricity) - mitigated by green power or RECs
Materials and Resources

- Material Selection and subsequent Disposal
- Embodied Energy
- Life Cycle Assessment – market driver
- Reduce, Reuse Recycle is a pillar
- Cradle to Cradle
- TRANSPARENCY

MRp1 – Storage and Collection of Recyclables

Intent: To reduce the waste that is generated by building occupants and hauled to and disposed of in landfills

- Designated Recycling area for:
  1. Paper
  2. Cardboard
  3. Glass
  4. Plastics
  5. Metals
- And choose 2 of the following:
  1. Batteries
  2. Electronics
  3. Mercury containing Lamps

  • Easily accessible to haulers and protected from the elements
  • Can be separated or commingled on site

MRp2 – Construction and Demolition Waste Mgmt.

Intent: To reduce construction and demolition waste disposed of in landfills and incineration facilities by recovering, reusing, and recycling materials

1. Identify at least top 5 materials
2. Separated or commingled
3. Provide major waste streams and diversion rates
   - But no minimum required

MRc5 – Construction and Demolition Waste Mgmt. (1-2 points)

Option 1 – Diversion into multiple waste streams
Calculated by weight or volume as a percentage of total waste

Option 2 – Reduction of Total waste material (Source Reduction)
- Maximum of 2.5 pounds of construction waste / square foot of buildings floor area

Construction Waste

<table>
<thead>
<tr>
<th>Percentage Diverted</th>
<th>Points (BD+C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50% + 3 streams</td>
<td>1</td>
</tr>
<tr>
<td>75% + 4 streams</td>
<td>2</td>
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</tbody>
</table>

Page 1
MRc1 – Building life-cycle impact reduction (2-5 Points)

**Intent:** To encourage adaptive reuse and optimize the environmental performance of products and materials.

**Option 1 – Historic Building (5 points)**

*+ = Minimize Construction Debris >
* - = Energy performance of an existing building

**Option 2 – Abandoned or Blighted Building (5 points)**

- Maintain 50% of surface area
  - Ex. Detroit’s plants

**Option 3 – Building and Material Reuse (2-4 Points)**

Maintain structural + permanent Elements

- **Structural** = Skin and framing
- **Non-Structural** = Walls, doors and floor coverings

**Option 4 – Whole Building Life Cycle – New Construction (3 points)**

- Cradle to Grave analysis
- Reduction of 3 of the following impact categories:
  1. Global warming potential
  2. Depletion of the stratospheric ozone layer
  3. Acidification
  4. Eutrophication
  5. Tropospheric ozone
  6. Depletion of nonrenewable energy

MRc2-4 – Building product disclosure and optimization – 3 credits

**Intent:** To encourage the use of products and materials for which life-cycle information is available and that have environmentally, economically, and socially preferable life-cycle impacts.

- Points based on **cost of materials**
  - **Actual cost** = Total cost of all materials excluding labour
  - **Default Cost** = 45% of total construction costs
- **Permanently** installed materials ONLY
- **MEP** + furniture materials are optional
  - Mechanical, Electrical + Plumbing
- Including furniture is optional
- Cost includes **delivery + tax**

MRc2 – BPDO - Environmental Product Declarations (1-2 points)

**Intent:** To reward project teams for selecting products from manufacturers who have verified improved environmental life-cycle impacts.

Terms:

- **Environmental Product Declarations** – environmental affects of:
  - Raw material Extraction
  - Chemical Makeup
  - Waste Generation
  - Emissions to Air, soil and Water

ISO - International Organization for Standardization

- **Basis of EPD’s**

Cradle to Gate – from extraction to factory’s gate (before end consumer)
- Scope of EPD’s

MRc2 – BPDO - Environmental Product Declarations (1-2 points)

**OPTION 1 - Environmental Product Declarations**

20+ permanent Products from 5+ Manufacturers require EPDs

**Option 2 – Multi-Attribute Optimization**

- 3rd party certified products that demonstrate reduction of 3+ of:
  1. Global warming potential
  2. Depletion of the stratospheric ozone layer
  3. Acidification
  4. Eutrophication
  5. Tropospheric ozone
  6. Depletion of nonrenewable energy

- 50% by cost, of the total value of permanently installed products

MRc2-4 – Location Valuation Factor

**Intent:** Add value to locally produced materials which reduces transportation emissions and supports local economy.

Products must be:

1. Extracted
2. Manufactured +
3. Purchased

Within 100 miles (160km) of the site

Local materials are worth **200% of cost**

* Used to be a credit in 2009
MRc3 – BPDO – Sourcing of Raw Materials (1-2 points)

Intent: To reward project teams for selecting products verified to have been extracted or sourced in a responsible manner

**OPTION 1 - Raw Material Reporting**

20+ permanent Products from 5+ Manufacturers require CSR

- A. 3rd Party verified CSR report OR
- B. A Self-declared raw material supplier report

**CSRs:** Corporate Sustainability Reports based on recognized standards

MRc4 – BPDO – Material Ingredients (1-2 points)

**Intent:** Reward manufacturers for verifying minimal use of harmful chemicals

**Option 1 – Material Ingredient Reporting (1 Point)**

- Public
- GreenScreen for safer chemicals
- Health Product Declaration Open
- Cradle to Cradle

**And/or Option 2 – Ingredient Optimization (1 Point)**

- Cradle to Cradle
- REACH GREEN SCREEN

**And/or Option 3 – Supply Chain Optimization (1 Point)**

Measured by cost or number of products meeting standards

MRHealthCare – Design for Flexibility (1 Point)

**Intent:** Conserve resources associated with the construction and management of buildings by designing for flexibility and ease of future adaptation and for the service life of components and assemblies.

**USE:**
- Interstitial Space – essentially an extra floor (6-9’ tall) between floors to allow for easy renovation
- Shell space – an area designed to be fitted out for future expansion
- Soft space – an area whose functions can be easily changed

Modular equipment and future-proofing for expansion is encouraged

Indoor Environmental Quality

People who occupy a building are the greatest cost to a building owner

- $318/sq.ft/yr
- $20/sq.ft/yr
- $2.25/sq.ft/yr

Green buildings create a better indoor environment, a better indoor environment results in higher productivity and higher productivity materializes into better economic performance based on employee productivity
Indoor Environmental Quality

- Occupant Comfort + Health
  - Occupant Productivity
- Sick Building Syndrome (SBS)
- 90%+ of our time indoors
  - Higher Pollution Indoors
- Indoor environmental quality (IEQ)
  - Indoor air quality (IAQ)
- Densely occupied space (25:1000)
- Volatile organic compound (VOC)
- Non-regularly Occupied Space (1 hour)
  - Hallways and Washrooms

IEQp1 - Minimum indoor air quality performance

Intent: To contribute to the comfort and well-being of building occupants by establishing minimum standards for indoor air quality

- Mechanically Ventilated Spaces (HVAC)
  - Minimum Outdoor Air Intake - ASHRAE 62.1-2010:
    - Monitoring Required

IEQp2 - Environmental tobacco smoke control

Intent: To prevent or minimize exposure of building occupants, indoor surfaces, and ventilation air distribution systems to environmental tobacco smoke.

Commercial + Residential Requirements
1. No Smoking in the building
2. Smoking areas must be 25' from windows/entries/air intakes
3. Provide Signage within 10' of entrance

Residential ONLY Requirements
1. Weather-strip doors or put halls under positive pressure
2. Blower Door Test

IEQc1 - Enhanced indoor air quality strategies (1-2 points)

Option 1 – Enhanced IAQ Strategies:
1. Entryway Systems (10' long grates or mats cleaned weekly)
2. Interior Cross-contamination Prevention (Exhaust contamination!)
3. MERV (Minimum Efficiency Reporting Value) 13+ filters

Option 2 – Additional Enhanced IAQ Strategies (Select one):
1. Model IAQ
2. Increased ventilation (30% above IEp1)
3. Carbon dioxide monitoring for densely occupied spaces
4. Alarm for set point deviation
IEQc2 - Low-Emitting Materials (1-3 Points)

**Intent:** To reduce concentrations of chemical contaminants that can damage air quality, human health, productivity, and the environment.

<table>
<thead>
<tr>
<th>Category</th>
<th>Threshold</th>
<th>Emissions and content requirements</th>
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</thead>
<tbody>
<tr>
<td>Interior paints and coatings applied on site</td>
<td>At least 90%, by volume, for emissions; 100% for VOC content</td>
<td>General Emissions Evaluation: CDPH Standard Method v.1.1-2010 South Coast Air Quality Management District (SCAQMD) Rule 1113</td>
</tr>
<tr>
<td>Interior adhesives and sealants applied on site (including flooring adhesives)</td>
<td>At least 90%, by volume, for emissions; 100% for VOC content</td>
<td>General Emissions Evaluation: CDPH Standard Method v.1.1-2010 South Coast Air Quality Management District (SCAQMD) Rule 1113</td>
</tr>
</tbody>
</table>

**VOC content:**
- Composite wood: 100% not covered by other categories
- Ceilings, walls, thermal, and acoustic insulation: 100%
- Furniture: At least 90%, by cost
- Exterior Applied Products: At least 90%, by cost

---

IEQc3 - Construction indoor air quality mgmt. plan (1 Point)

**Intent:** Minimize indoor air quality problems associated with construction + renovation

Follow Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines

- HVAC Protection (MERV 8 Filter)
- Scheduling
- Source Control
- Pathway Interruption
- Housekeeping

---

IEQc4 - Indoor air quality assessment (1-2 Points)

**Intent:** To establish better quality indoor air in the building after construction and during occupancy

**Option 1/2 - Full Building flushout (14000cf-air/sf-floor area) – 1 point**

**OR**

**Option 3 - IAQ Test after construction, before occupancy - 1 point**

- Formaldehyde
- Carbon monoxide (CO)

---

IEQc5 - Thermal comfort (1 Point)

**Intent:** To promote occupants’ productivity, comfort, and well-being by providing quality thermal comfort.

1. Building Envelope and HVAC+R must meet ASHRAE 55-2010
2. Thermal Control
   - 50% for individual occupants
   - 100% for multiple occupant spaces
IEQc6 – Interior Lighting (1-2 Points)

**Option 1 – Lighting Control**
- 90% for individual control
- (with on/off/midlevel levels)
- 100% for multiple occupant spaces

**Option 2 – Lighting Quality** (Choose 4 of 8)
1. Minimize objectionable glare
2. Approximate natural light
3. Maximize lamp life
4. Minimize direct-only overhead lighting
5. Specify high-reflecting surfaces
6. Minimize contrast x
7. Minimize contrast y
8. Minimize contrast z

IEQc7 – Daylight (1-3 Points)

**Intent:** To connect building occupants with the outdoors, reinforce circadian rhythms, and reduce use of electrical lighting by introducing daylight into the space.

Provide manual or automatic glare control devices for all regularly occupied spaces +

**Option 1 – Simulation: Spatial Daylight Autonomy**

**Option 2 – Simulation: Illuminance Calculations**

**Option 3 – Measurement**

IEQc8 – Quality Views (1 Point)

**Intent:** To give building occupants a connection to the natural outdoor environment by providing quality views.

1. 75% of regularly occupied space have a direct line of site +
2. Two of the following views:
   1. multiple lines of sight 90° apart
   2. Be able to see the sky, movement or objects 25′ from window
   3. Unobstructed views within 3 times the head height of vision glazing
   4. View factor of 3 or greater
IEQc9 – Acoustical Performance (1 Point)

Intent: To provide workspaces and classrooms that promote occupants’ well-being, productivity, and communications through effective acoustic design.

Strategies to follow for building’s shell:
- Minimize background noise (HVAC)
- Reverberation time (Echoes in restaurant)
- Noise Reduction Coefficients

Innovation in Design
- 1-6 Points total
- ID for NC projects

- ID type 1 = Innovative Performance
- ID type 2 = Exemplary Performance
- ID type 3 = Pilot Credit
- ID type 4 = LEED AP

IDc1- Innovative Performance (1-3 Points)

Must be outside the scope of the current LEED system
- Quantifiable
- Comprehensive
- Transferable and repeatable
- EXAMPLES:
  - GREEN CLEANING / EDUCATION

IDc2 – Pilot Credit (1-3 Points)

Achieve one pilot credit from USGBC's LEED Pilot Credit Library

U.S. GREEN BUILDING COUNCIL
LEED Education Resources News & Events
Home / LEED / LEED Resources / LEED Pilot Credit Library

The LEED Pilot Credit Library is intended to facilitate the introduction of new requirements through LEED 2009 project evaluations before they are sent through the balloting process. LEED 2009 project teams are encouraged to review the pilot credits currently available.
**Exemplary Performance**

- Not available for every LEED credit
- Next quantifiable threshold
- May be able to double the levels
  - Ex. 4 years instead of 2, or reach the next incremental threshold

**LEED Accredited Professional**

- LEED AP+ specific to your LEED Rating System

---

**Regional Priority**

- 4/6 max. possible points
- To account for GEOGRAPHIC LOCATION
- Determined which credits are RP when register on LEED Online
- DETERMINED BASED ON (X, Y) coordinates GIS-based program
- Local chapter of volunteers vote on them
- www.usgbc.org/rpc

---

**LEED Overview — Credit Interpretation Ruling Requests (CIRs)**

1. Review the reference guide
2. Contact USGBC customer service
3. Submit a CIR
   - CIR
     - 600 words
     - The Ruling doesn’t guarantee the prereq, credit or MPR will be satisfied
     - $220 per CIR
     - Technical Advisory Group (TAG) Reviews them

Or submit a suggested approach and the LEED Reviewer will accept/reject it at their discretion

---

**Additional Terms**

1. ADA - Americans with Disabilities Act
2. AIA - American Institute of Architects
3. LEED Alternative Compliance Paths (ACPs)
4. Credit Harmonization
5. LEED Interpretation
   - Precedent Setting
6. LEED Addenda — Account for corrections, interpretations and ACPs
7. Technical Advisory Groups (TAGs)
   - Credit Interpretation Request (CIR) rulings

---

**THE EXAM**

- 2 hours
- 100 Questions
- Multiple Choice (Choose 2 of 5 → no part points)
- Pass: 170/200 not = to 85%
  - Unknown marking scheme
    - Generally multiple answers are worth more
      - 125 = 0 = Lowest score

---

**TAking THE EXAM**

- Multiple Choice Rule of Thumb Applies
  - Read the question carefully
    - Know how many answers they want + TAKE YOUR TIME
  - Choose “BEST” answer
    - Many times they do not put the most obvious choice
- Mandatory on Computer = differences
  - 10 minute introduction
  - Ability to mark unknown questions and come back later
- Study Time
THE EXAM – 9 sections of the exam

1. LEED Process (16 Questions)
2. Integrative Strategies (8 Questions)
3. Location and Transportation (7 Questions)
4. Sustainable Sites (7 Questions)
5. Water Efficiency (9 Questions)
6. Energy and Atmosphere (10 Questions)
7. Materials and Resources (9 Questions)
8. Indoor Environmental Quality (8 Questions)
9. Project Surroundings and Public Outreach (11 Questions)
   • The exam contains 15 pretest (pilot) questions

LEED AP BD+C or O+M EXAM PREP + EXPERIENCE

When: ONLINE
Where: ONLINE

What’s Included:
1. 12+ hours of in-class instruction
2. An introduction to the LEED AP and an in-depth credit by credit description of their intents, requirements, submittals, documentation and real life examples
3. 4 Mock Exams (400 Questions) with in-depth question answers and explanations
4. LEED reference guide summary charts
5. Access to project CAD files, energy models, LEED letter templates and spreadsheet

Cost: $400 per participant

TAKING THE EXAM TOGETHER SAVES TIME AND MONEY

NEXT STEPS

1. Go to www.leadinggreen.ca
2. Sign in
   a) Username –
   b) Password –
3. Go to http://leadinggreen.ca/leed-ga-paid/
4. Read the study guide
5. Re-watch the recordings
6. Achieve 80%+ consistently on all mock exams
7. Register with USGBC.org
8. Pay for the exam
9. Schedule the exam on prometric
10. Pass!