CHAPTER | 13

LEED Green Associate Exam

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Exam Overview

What you NEED to know

Everything you need to know about ***taking*** the exam is in the LEED v4 Green Associate Candidate Handbook, so there is little value in replicating the details here. If you haven't done so as yet, download the handbook from GBCI's website and read cover-to-cover (currently 15 pages).

LEED v4 Green Associate Candidate Handbook: *http://www.usgbc.org/resources/leed-v4-green-associate-candidate-handbook*

The most important reference materials listed in the candidate handbook is a free web version of the Reference Guide Introductory and Overview Sections. The document sections include: Preface; Getting Started; Credit Category Overviews; Minimum Program Requirements; Appendices; and Rating System Selection Guidance. ***Exam questions will be taken from this web document.***

Reference Guide Introductory and Overview Sections: *http://www.usgbc.org/guide/bdc*

What you SHOULD know

What we ***are*** going to do in this section is present a refresher course of sorts: a list of the credit categories and each prerequisite and credit within each category that has any referenced standards and terms that are the most important to learn. The Appendix section has ***all*** the referenced standards listed by credit category and the Acronyms & Glossary of Terms chapter has ***all*** the terms listed by credit category. There are a lot of data in each, so the shortened lists are here. Then, we'll close out this chapter with a few exam tips.

But first, read the ***Space Categorization*** section of the ***EQ Overview*** for information on space types and occupied vs. unoccupied spaces. Pay particular attention to the differences between regularly occupied spaces vs. nonregularly occupied spaces, and also individual occupant spaces vs. shared multioccupant spaces. Reference Guide Introductory and Overview Sections: *http://www.usgbc.org/guide/bdc#cc_overview*

Secondly, read the ***Maintaining Consistency in the Application*** section of the ***Getting Started*** part of the same document for ***Occupancy***, which explains the types of building occupants and Full Time Equivalents (FTEs). Reference Guide Introductory and Overview Sections: *http://www.usgbc.org/guide/bdc#getting_started*

Then here is a list of general codes and standards that you should, at a minimum, recognize.

General Codes

- USGBC's history of building codes: Greening the Codes: *http://www.usgbc.org/resources/greening-codes-building-codes-begin-broaden-their-charge-include-human-and-environmental-i*
- **Zoning**: zoning is commonly controlled by local governments (such as counties or municipalities). Zoning may include regulation of the kinds of activities which will be acceptable on particular lots (such as open space, residential, agricultural, commercial or industrial), the densities at which those activities can be performed (from low-density housing such as single family homes to high-density such as high-rise apartment buildings), the height of buildings, the amount of space structures may occupy, the location of a building on the lot (setbacks), the proportions of the types of space on a lot, such as how much landscaped space, impervious surface, traffic lanes, and whether or not parking is provided.

- **Ordinance**: an ordinance is typically a law or regulation made by local governments (such as counties or municipalities). A law enacted by local government about parking (such as no parking during snow emergencies) is an example of an ordinance.
- **ADA**: All commercial projects in the United States must comply with the accessibility guidelines of the Americans with Disabilities Act (ADA).
- **National Fire Protection Association (NFPA)**: NFPA is responsible for 300 codes and standards that are designed to minimize the risk and effects of fire by establishing criteria for building, processing, design, service, and installation in the United States, as well as many other countries.
- **National Electrical Code (NEC)**: NEC is a regionally adoptable standard for the safe installation of electrical wiring and equipment in the United States. It is part of the National Fire Codes series published by the National Fire Protection Association (NFPA).
- **International Code Council (ICC)**: ICC develops model codes and standards used in the design, build and compliance process to construct safe, sustainable, affordable and resilient structures. Most U.S. communities and many global markets choose the International Codes.
- **International Green Construction Code (IgCC)**: The IgCC is the first model code to include sustainability measures for the entire construction project and its site — from design through construction, certificate of occupancy and beyond.
- ASHRAE: commonly referenced in LEED prerequisites and credits:
  - ASHRAE Standard 90.1-2010: energy efficiency for commercial projects (minimum requirements; energy modeling)
  - ASHRAE Standard 62.1-2010: ventilation (minimum rates)
  - ASHRAE Standard 52.2–2007: ventilation (air filters)
  - ASHRAE Standard 55-2010: thermal comfort
  - ASHRAE Guideline 0–2005: commissioning
  - ASHRAE Guideline 1.1–2007: commissioning
  - Procedures for Commercial Building Energy Audits, 2nd ed.
  - (50%) Advanced Energy Design Guides
- I-Codes: The International Codes, or I-Codes, published by ICC, provide minimum safeguards for people at home, at school, and in the workplace. The I-Codes are a complete set of comprehensive, coordinated building safety and fire prevention codes. Building codes benefit public safety and support the industry's need for one set of codes without regional limitations.
- International Organization for Standardization (ISO)
  - ISO 14000 series: environmental management (life cycle assessment and EPDs)
- Energy Policy Act (EPAct) of 1992: water
- SCAQMD Rule 1113 (architectural coatings) and SCAQMD Rule 1168 (adhesives, sealants, and sealant primers)

IP Category

- ***Referenced Standards***
  - Integrative Process (IP) ANSI Consensus National Standard Guide© 2.0 for Design and Construction of Sustainable Buildings and Communities
- ***Terms***
  - basis of design (BOD)
  - charrette
  - iterative process
  - life cycle approach
  - life cycle assessment (LCA)
  - life cycle cost analysis (LCC)
  - owner's project requirements (OPR)
  - synergy
  - systems theory
  - systems thinking

LT Category

- ***Referenced Standards***
  - Sensitive Land Protection (credit)
    - U.S. Department of Agriculture, U.S. Code of Federal Regulations
    - FEMA Flood Zone Designations
    - U.S. Fish and Wildlife Service, List of Threatened and Endangered Species
    - NatureServe Heritage Program, GH, G1, and G2 species and ecological communities
  - Reduced Parking Footprint (*credit*)
    - Institute of Transportation Engineers, Transportation Planning Handbook
  - Green Vehicles (*credit*)
    - American Council for an Energy Efficient Economy (ACEEE) Green Book
- ***Terms***
  - bicycle network
  - bicycling distance
  - density
  - development footprint
  - diverse use
  - floor-area ratio (FAR)
  - full time equivalent building occupants (FTE)
  - functional entry
  - main entry

- master site
- site master plan
- smart growth
- vehicle miles traveled (VMT)
- walking distance

SS Category

- ***Referenced Standards***
  - Construction Activity Pollution Prevention (*prerequisite*)
    - 2003 EPA Construction General Permit
  - Environmental Site Assessment (Schools and Healthcare) (*prerequisite*)
    - ASTM E1527—05 Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process
    - ASTM E1903—11 Standard Practice for Environmental Site Assessments: Phase II Environmental Site Assessment Process
  - Site Assessment (*credit*)
    - ASTM E1527—05 Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process
    - ASTM E1903—11 Standard Practice for Environmental Site Assessments: Phase II Environmental Site Assessment Process
  - Heat Island Reduction (*credit*)
    - ASTM Standards E903 and E892
  - Light Pollution Reduction (*credit*)
    - Illuminating Engineering Society and International Dark Sky Association (IES/IDA) Model Lighting Ordinance
- ***Terms***
  - 95th percentile
  - backlight-uplight-glare (BUG) method
  - Green infrastructure (GI)
  - heat island effect
  - light pollution
  - light trespass
  - lighting zones
  - low-impact development (LID)
  - natural site hydrology
  - integrated pest management
  - site assessment

- solar reflectance (SR)
- solar reflectance index (SRI)
- sky glow

WE Category

- ***Referenced Standards***
- Indoor Water Use Reduction (*prerequisite* & *credit*)
  - Energy Policy Act (EPAct) of 1992
  - EPAct 2005
  - International Association of Plumbing and Mechanical Officials, Uniform Plumbing Code (UPC)
  - International Code Council, International Plumbing Code (IPC)
  - ENERGY STAR
  - IgCC/ASHRAE 189.1
- ***Terms***
  - alternative water source
  - baseline irrigation water use
  - baseline water consumption
  - blackwater
  - composting fixtures
  - dual flush toilets
  - gallons per flush (gpf)/liters per flush (lpf)
  - gallons per minute (gpm)/liters per minute (lpm)
  - graywater
  - low-flow fixtures
  - natural site hydrology
  - nonpotable water (a.k.a. gray water)
  - on-site wastewater treatment
  - potable water
  - process water
  - reclaimed water
  - tertiary treatment
  - wastewater
  - waterless fixtures
  - xeriscaping

EA Category

- ***Referenced Standards***
  - Fundamental Commissioning and Verification (*prerequisite*) & Enhanced Commissioning (*credit*)
    - ASHRAE Guideline 0–2005, The Commissioning Process
    - ASHRAE Guideline 1.1–2007 for HVAC&R Systems
  - Minimum Energy Performance (*prerequisite*) & Optimize energy performance (*credit*)
    - ASHRAE 90.1–2010
    - ASHRAE 50% Advanced Energy Design Guides
    - Advanced Buildings Core Performance Guide
    - COMNET Commercial Buildings Energy Modeling Guidelines
  - Renewable Energy Production (*credit*)
    - Center for Resource Solutions Green-e Program
    - Commercial Building Energy Consumption Survey (CBECS)
  - Green Power and Carbon Offsets (*credit*)
    - Green-e Energy and Green-e Climate
    - Commercial Building Energy Consumption Survey (CBECS)
- ***Terms***
  - baseline building performance
  - Building Automation Systems (BAS)
  - building envelope
  - carbon offset
  - chlorofluorocarbons (CFCs)
  - climate change
  - climate zone
  - commissioning (Cx)
  - commissioning authority (CxA)
  - district energy system (DES)
  - district heating and cooling (DHC)
  - energy simulation model (or energy model)
  - ENERGY STAR
  - ENERGY STAR Portfolio Manager
  - enhanced commissioning

- fundamental commissioning
- green power (a.k.a. renewable energy)
- green-e
- greenhouse effect
- greenhouse gases (GHG)
- halons
- hydrochloroflourocarbons (HCFCs)
- Montreal Protocol
- natural refrigerant
- net zero energy
- off-site renewable energy
- ongoing commissioning
- on-site renewable energy
- operations and maintenance (O&M) plan
- ozone
- ozone layer
- passive solar
- plug load (a.k.a. receptacle load)
- process energy
- process load (a.k.a. unregulated load)
- refrigerants
- regulated load
- renewable energy
- Renewable Energy Certificates (RECs)
- retrocommissioning
- simple box energy modeling analysis
- source energy
- waste-to-energy

MR Category

- ***Referenced Standards***
  - Building Product Disclosure and Optimization (*credits*)
    - Forest Stewardship Council
    - Sustainable Agriculture Network
    - The Rainforest Alliance
  - PBT Source Reduction (*prerequisite & credits*)
    - GreenSeal

- **MRc Building Product Disclosure and Optimization - Material Ingredients**
  - GreenScreen
  - Health Product Declaration
  - Cradle-to-Cradle Certified Products Program
- ***Terms***
  - alternative daily cover (ADC)
  - building reuse
  - certified wood
  - commingled waste
  - construction and demolition debris (C&D)
  - construction, demolition and land clearing debris (CDL)
  - construction waste management plan
  - cradle-to-cradle
  - cradle-to-grave
  - departmental gross area (DGA)
  - durable goods
  - embodied energy
  - environmental product declaration (EPD)
  - extended producer responsibility
  - Fairtrade
  - Forest Stewardship Council (FSC)
  - hazardous material
  - interior fit-out
  - interior nonstructural components reuse
  - ISO 14021
  - materials reuse
  - ongoing consumable
  - on-site salvaged materials
  - postconsumer recycled content
  - preconsumer recycled content
  - rapidly renewable material
  - raw material
  - recycled content
  - recycling
  - regenerative design
  - regionally harvested or extracted materials

- reuse
- salvaged material
- solid waste management policy
- source reduction
- sustainable purchasing policies
- waste diversion
- waste-to-energy
- wood

EQ Category

- ***Referenced Standards***
  - Minimum Indoor Air quality Performance (*prerequisite*) & Enhanced Indoor Air Quality Strategies (*credit*)
    - ASHRAE Standard 52.2–2007
    - ASHRAE Standard 62.1–2010
    - Chartered Institution of Building Services Engineers (CIBSE) Applications Manual AM10
    - Chartered Institution of Building Services Engineers (CIBSE) Applications Manual AM13
  - Low-Emitting Materials (*credit*)
    - South Coast Air Quality Management District (SCAQMD) Rule 1168
    - South Coast Air Quality Management District (SCAQMD) Rule 1113
- ***Terms***
  - carbon dioxide (CO2)
  - construction IAQ management plan
  - contaminant
  - daylighting
  - daylighting zone
  - direct line of sight to perimeter vision glazing
  - Environmental Tobacco Smoke (ETS)
  - exhaust air
  - flush out
  - glare
  - green cleaning
  - individual occupant space
  - indoor air quality (IAQ)
  - indoor air quality management plan
  - indoor environmental quality (EQ)
  - minimum efficiency reporting value (MERV)

- mixed (active and passive) mode ventilation
- natural (passive) ventilation
- non-regularly occupied space
- occupant control
- off-gassing
- particulates
- pollutant
- regularly occupied space
- reverberation
- shared multi-occupant space
- sick building syndrome (SBS)
- source reduction
- spatial daylight autonomy (sDA)
- thermal comfort
- unoccupied space
- volatile organic compounds (VOC)
- walk off mats

Exam Study Tips

How can you understand what your peers are talking about, or what a particular exam question is referring to, when you don't know the language? When you see the term ***wood*** listed in the MR chapter for related terms, you will likely think you know what wood is. Not so. At least in the world of LEED.

- **wood**: plant-based materials that are eligible for certification under the Forest Stewardship Council (FSC). Examples include bamboo and palm (monocots) as well as hardwoods (angiosperms) and softwoods (gymnosperms).

Many LEED APs weren't aware that FSC included both wood-based ***and*** plant-based products. But these exams are all about LEED, and this is why it's important to read Glossaries. Refer to the Acronyms and Glossary of Terms chapter for terms ***and*** refer to USGBC's website for a Glossary of additional definitions applicable to LEEDv4: *http://www.usgbc.org/glossary*

The sustainable community is replete with advice on how and what to study when preparing for these exams. Common traps to be wary of: 1) the secret to passing is to memorize everything, 2) what is the exact number of questions I need to answer correctly in order to pass the exam, and 3) the exams are loaded with trick questions. Let's debunk these before you begin studying.

- Trying to memorize everything is dangerous. Yes, there is a certain amount of data and calculations to remember. However, rest assured that when under stress, and these exams can be stressful, your memory will be the first to fail you. Learn and understand as much as possible, then memorization, when needed, becomes minimal.

- The minimum passing score is 170. Each question is weighted according to it's degree of difficulty. The questions are randomly selected from a pool of questions. You can take this exam every day for a week and you may never draw the same lot of questions. You may get lucky and draw an easy exam, or not so lucky and draw a difficult exam. Less difficult questions require a higher number of correct answers and, conversely, a more difficult exam will require fewer correct answers. Trying to get to the magic number of correct answers is a fool's errand, so don't waste your time.
- Trick questions. The 3 tenets promoted by this study guide are—*learn—understand—advocate*. We know that children, being as inquisitive as they are, have a voracious appetite for learning. We also know that only as they mature do they understand what they've learned. When you are properly prepared and understand what you've learned, there can be no trick questions—poorly worded questions perhaps. Remember that exam questions assess your knowledge at three levels:
  - **Recall questions** test your direct knowledge of concepts: define terms or concepts; recall facts; recognize steps or components in a process; group items into categories.
  - **Application questions** evaluate your knowledge of procedures and performance: demonstrate how things work; perform calculations; understand how processes function.
  - **Analysis questions** test your reasoning and problem solving abilities: understand how things work and subsequent causes and effects; troubleshoot problems; analyze problems and arrive at solutions.

Make certain your study materials, whether obtained from USGBC, GBCI or third party sources, are up-to-date. Be careful not to accumulate too many materials as you can quickly become overwhelmed and disoriented. Read the glossaries and learn the terminology.

Develop a study regime that fits into your lifestyle and schedule. Studying can quickly become a task if the process is forced. If your study schedule is erratic, you can lose quite a bit of what you learned.

All of the exam questions are multiple choice. Reduce the field by culling out the answers that are obviously incorrect. If you are uncertain about any answers, mark the questions and revisit them at the end of the original 100 question session. You will find that questions you encounter later can be helpful in selecting the correct answer for questions you previously marked.

There's an old adage in real estate: the first offer you receive is often the best offer you'll ever receive. At the end of the exam, if you are still uncertain about a few questions, go with your first "gut" reaction or instinct — surprising how effective this can be!

SUSTAINABLEIDEALS

There were reasoned criteria established for the creation of the Studio4 logo. First and foremost, what the design was never intended to represent was any signature that identified with the typical symbolism of green that saturates the environmental dialog today.

The stylization of primitive fish? My fascination with primitive fish art began during my first visit to the Caribbean. At some point, after bringing back trinkets of this art for many years, I became curious about these aggressive looking creatures, sensing something more than merely representing lives long expired. As I began to investigate my curiosities, I uncovered a few interesting facts that lead to this graphic creation for the Studio4 logo as, perhaps, the best symbolism of sustainability:

Hagfish have existed for over 300 million years, which means they were already old when dinosaurs took over the world.

The very voracious predator Lancetfish is found in all the oceans except in the Polar Regions.

The Arowana fish already existed in the Jurassic period.

The Frilled Shark, a deep sea predator and one of the most primitive sharks alive today, is a relic from the Cretaceous period, when dinosaurs ruled the Earth.

Sturgeons, another survivor from the age of dinosaurs, were around in the early Jurassic.

The Sawfish is another survivor from the Cretaceous period.

The Coelacanth is the most famous of all “living fossils” because it is the best example of a “Lazarus taxon”, this is, animals that were supposed to be long extinct and are unexpectedly found to be alive; Coelacanths were supposed to have become extinct in the Cretaceous period, along with the dinosaurs, but in 1938, a live specimen was caught in South Africa.

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