



## Green Building Operations & Maintenance Curriculum Toolkit

### Introduction

Integrating sustainability across the curriculum prepares this generation to be both global citizens and champions in addressing some of the biggest challenges we face. The workplace is rapidly changing as are employer expectations. Sustainability is now being driven into core businesses and is the lens through which companies assess their operations. During this century, more than 60 percent of new jobs will require a background in STEM, according to the [National Commission on Mathematics and Science for the Twenty-first Century](#). Additionally, the [National Environmental Education Foundation: Business & Environment Program](#) says that 65% of businesses value environmental and sustainability knowledge in job candidates and 78% said this knowledge would grow in importance as a hiring factor in the next five years.

The purpose of these resources is to prepare students for 21<sup>st</sup> century careers using sustainability as a solutions driver. This toolkit provides higher education faculty curated access to resources and processes, organized to aid in teaching about and engaging students in the concepts of sustainability, green building and LEED with a focus on the operations and maintenance phase of a building’s life cycle. The materials can be adapted and scaled to fit a variety of class topics, degree programs, and student learning levels and provide content for experiential learning helping to prepare students for the needs of 21<sup>st</sup> century industry

These materials do not provide a prescriptive path or set curriculum, rather we encourage you to select resources that are right for your courses. These can be applied as teaching material, student assignments or as supplemental resources to share with the class. The materials are designed to support hands-on learning to address employers’ desire for stronger skills in critical thinking, complex problem solving, written and oral communication, and applied knowledge in real-world settings. (Source: [AACU 2013 Employer Survey](#)).

USGBC is here to help you apply these resources to your courses. Please contact us at [education@usgbc.org](mailto:education@usgbc.org) to let us know how you’ve customized use of these resources to meet your course needs. Also, please let us know if there are additional resources that will further support your efforts. We look forward to hearing stories about your green building and sustainability courses.

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## USGBC and LEED Resources for Curriculum Development

Are you building a curriculum addressing introductory concepts in sustainability, green building, or LEED? We encourage you to use these pages to ensure your lectures and activities include the most up to date information.

### *LEED Resources:*

- [LEED website](#). Overview of the LEED rating system.
- [LEED rating systems](#). Overview of the specific rating systems and what project types are best suited for each one.
- [LEED Credit Library](#). An online directory of all LEED credits categorized by rating system, adaptations, and versions.
- [Sample LEED credit forms](#). Includes links to associated credit calculators.
- [LEED regional priority credits](#). Online database to search for a project's selected regional priority credits based on their area.
- [LEED pilot credit library](#). Online database of new innovative credits available for testing by LEED projects.
- [USGBC Glossary](#). Online glossary of terms applicable to LEEDv4: BD+C (except Homes and Multifamily Midrise), ID+C, and O+M.
- [LEED Rating System Selection Guidance](#). Use the guidance to identify an appropriate rating system and determine the best adaptation. Or use the [Discover LEED](#) online tool to determine which rating system is the best fit for a project.
- [Guide to LEED Certification: Commercial](#). Information regarding the LEED certification program including the current policies, procedures and pricing.
- [LEED Campus Guidance](#). This document is for projects that are on a shared site under the control of a single entity; for example, a corporate or educational campus, government installation or commercial development.
- [LEED project tools](#). Project tools and supplemental materials to apply LEED strategies to a project. Includes information and link to LEED Online, sample LEED forms, and more.

### *LEED v4 resources:*

- [LEED v4 website](#). General information and links for the current version of LEED
- [LEED v4 User Guide](#). Highlights and requirements of LEED v4. Includes outlines differences between LEED 2009 to LEED v4.
- [LEED v4 Glossary of Terms with Translations](#). The LEED v4 glossary of terms and definitions, translated into eight major languages.
- [LEED v4 Impact Category and Point Allocation Process Overview](#). Discusses the weighting structure and development process for LEED v4.
- [LEED v4 Innovation Catalog](#). Online directory of innovation credits and strategies.

### *LEED Building Operations + Maintenance (O+M) rating system resources:*

- LEED v4. Projects pursuing this version must comply with all prerequisites and earn a minimum of 40 points through optional credits.
  - o [LEED v4 for Building Operations and Maintenance Rating System](#). A PDF document of the rating system's credits, intents, and requirements.



- [Introductory and Overview section of the LEED v4 Reference Guide for Building Operations + Maintenance](#). A PDF version of this material is available [here](#).
- [LEED v4 O+M Checklist](#). List of all credits to track a project's goals and progress.
- Online credit library: [LEED v4 O+M: Existing Buildings](#). A web-based LEED v4 Reference Guide. Free access to view each credit's intent, requirements and additional resources.
- [Guide to LEED Certification: Commercial](#)
- Publication: [LEED Reference Guide for Building Operations and Maintenance](#). Available as PDF, ebook, or web-based guide.
- LEED v4.1. Projects must submit data across five categories to earn a performance score. To achieve certification, a project must have a minimum performance score of 40 and comply with select LEED O+M prerequisites. Additional points can be earned through some optional select credits. (Currently in beta version).
  - [LEED v4.1 website](#). Overview of this newest version of LEED and links to materials
  - [LEED v4.1: O+M: Existing Buildings](#) credit library
  - [LEED v4.1 O+M: Interiors](#) credit library
  - [LEED v4.1 O+M beta guide](#)

### LEED Lab

A project-based course to support campus greening efforts! This multidisciplinary immersion course utilizes the built environment to educate and prepare students to become green building leaders and sustainability-focused citizens. In the course students assess the performance of existing facilities on campus and choose one building where they will facilitate the LEED for Building Operations and Maintenance (LEED O+M) process with the goal of certifying the facility.

USGBC recommends this as the next step to offering an experiential learning course that supports your campus' greening and sustainability efforts. Check out the [LEED Lab page](#) for more information.

### Locating LEED Projects

Exploring real LEED projects is a great way to make green building and sustainability concepts tangible for your students. The case studies listed here provide a snapshot of challenges faced and overcome by the project team, providing insight into the problem solving skills required by green building professionals. Want to take the learning experience even farther? Have your students develop their own case studies about LEED projects on your campus or in your community.

- [LEED Project Directory](#). A searchable online directory of publicly registered and certified LEED projects.
- Some of the profiles include information on goals, outcomes, and lessons learned. Examples of LEED O+M projects:
  - [Adlai E Stevenson High School](#)
  - [Boys & Girls Club of SF - Mission Clubhouse](#)
  - [City Tower](#)
  - [Dubai Chamber of Commerce and Industry](#)
  - [Office Building 22 Gubel Street](#)
  - [One Bush Street](#)
  - [One Sansome Street](#)



## Education @USGBC Resource

- [Park Central 8](#)
- [The Richard J Daley Center](#)
- [Thurgood Marshall Elementary School](#)
- Reach out to your local USGBC community and connect directly with LEED projects and teams in your area. Search the [USGBC Regions Database](#) by region to connect with USGBC near you.

### Suggested Lecture Topics

- Walk through LEED credit intents and requirements.
- Look up [regional priority credits](#) applicable to your location. Discuss why these are environmental priorities in that area. Identify ways that projects in this area can address these issues and achieve the LEED credits. Compare/contrast the regional priority credits in different states/regions/countries)
- Present concepts from the [innovation catalog](#).
- Compare LEED to other green building and sustainability rating systems.
- Use a [LEED v4 O+M checklist](#) and the [Introductory and Overview sections](#) from the reference guide to indicate how the credits address the overall goals and intents of the LEED credit categories. Discuss how credit weightings (assigned point values) reflect the [LEED impact categories](#).
- Discuss synergies in concepts, goals, and credits within LEED. Identify where a strategy implemented for one credit category contributes to the success in another. Identify where tradeoffs needs to be managed on a project.

### Content Resources

We encourage you to consider the wide range of USGBC public resources that can be incorporated into your teaching materials. Contact [education@usgbc.org](mailto:education@usgbc.org) to talk about how you can be creating innovative curriculum by accessing best-in-class content & resources for 21st century learning.

- [Education @USGBC](#)
  - Utilize this resource by accessing free content that includes:
    - [Introduction to LEED v4](#)
    - [Green Building for Everyone](#) (available [in Spanish](#) too)
    - [Think Like a Reviewer: Best practices for LEED projects](#)
    - [LEED 101: Green Building Basics and LEED v4](#) (Free to USGBC members and users with accounts using email addresses ending in .edu; Students and instructors who are not using an .edu address can request access by contacting [education@usgbc.org](mailto:education@usgbc.org).)
  - Access content in the [Education @USGBC Subscription](#). Options include:
    - Purchase an individual subscription which gives you access to all the content plus the LEED v4 web-based reference guide, and hundreds of courses that can be used for your own professional development.
    - Require your students to purchase a subscription as part of their required course materials. USGBC offers exclusive student pricing allowing your students to gain access to content that supports their sustainability journey.



- Speak with USGBC about a full access subscription for your institution which would benefit all instructors, staff and students. An annual subscription to Education @USGBC includes:
  - Ability to learn anytime from anywhere in the world, through online and offline access
  - Regularly refreshed content produced by USGBC and its Education Partners
  - The LEED v4 web-based reference guide and online credit tutorials
  - Ability to fulfill continuing education requirements for all LEED credentials
  - Streamlined CE reporting experience with automated CE hour reporting to GBCI and AIA
  - Ability to earn Knowledge-Based Badges: [Energy Efficiency](#); [Indoor Air Quality](#); [Building Data Analytics](#); [Site Assessment](#); [Water Efficiency](#); [Material Selection](#); and [Location and Transportation](#).
  - Explore curated playlists such as [Key concepts for facility professionals](#)
- [USGBC Articles](#). Search by topics or sort by channels. Sign up for [email subscriptions](#) to receive new articles directly; specific articles that may be interesting and useful:
  - [Green Building 101: What is LEED](#)
  - [What is Green Building?](#)
  - [Benefits of Green Buildings](#)
  - [Live. Learn. Work. Play. LEED. \(with video\)](#)
  - [Introducing the Case for LEED \(with video\)](#)
  - [World Green Building Council Showcases Cost-Effective Green Building Benefits Throughout the World](#)
  - [Green Building 101: What makes a site sustainable](#)
  - [Green Building 101: How does water efficiency impact a building?](#)
  - [Green Building 101: Why is energy efficiency important?](#)
  - [Green Building 101: Sustainable materials and resources](#)
  - [Green Building 101: What is indoor environmental quality?](#)
- [USGBC's YouTube Channel](#).
  - Playlist: [Big Ideas at USGBC](#)
  - Video interviews with [climate leaders](#)
- ["Why LEED for your clients"](#) – Free slide deck presentation on the value of LEED. Includes predesigned slides, some customizable slides for you to tailor to your presentation, and speaker notes.
- [USGBC+](#). USGBC's bi-monthly magazine with stories and strategies behind the world's greenest buildings. The current and archived issues are available [online here](#). Information on print copies is [here](#).
- [LEED in Motion Reports](#). These reports share data on LEED certification in various industry sectors, as well as geographical locations.
- Certificate of Completion Template. To provide students with formal recognition. (Included in the [Green Building Operations and Maintenance Curriculum Toolkit](#))



## Locating Subject Matter Experts and Guest Speakers

Invite local green building and sustainability professionals to join your course as guest lecturers, jurors, or participants in mock charrettes.

### *Resources for locating professionals*

- [USGBC Member Directory](#) links to USGBC member companies and their employees.
- [USGBC & GBCI Speaker Request Form](#) facilitates connections between USGBC representatives and your class.
- [USGBC Faculty Directory](#) presents a global network of credible, qualified instructors, teachers and facilitators. USGBC Faculty members are go-to experts in sustainability across sectors, cultures and geographies. Many USGBC Faculty also support LEED projects and can help to facilitate working with a project team for teaching purposes. Learn more about the [USGBC Faculty Program](#).
- Reach out to your local [USGBC community](#) and connect directly with LEED projects and teams in your area. Search the USGBC Organizations Database by region to connect with USGBC near you.

## Student Activity Ideas

The research shows the need for students to gain critical thinking and problem solving skills through hands-on learning. Nearly all employers (91%) agree that for career success, “a candidate’s demonstrated capacity to think critically, communicate clearly, and solve complex problems is more important than his or her undergraduate major.” And 96% of the employers agree that “all college students should have experiences that teach them how to solve problems with people whose views are different from their own.” (Source: [2015 AACU Survey](#))

Consider these activities to support hands-on learning of green building and LEED concepts.

### *Activities to generally introduce green building:*

- Create a mind map. Facilitate a mind mapping activity around the concept of “green building.” Students collaborate by adding ideas and associations that build off other’s ideas. Facilitate a discussion about how these ideas relate to others. What did others add that they would not have thought of? What diverse ideas or concepts emerged, and how might they be integrated?
- Explore career pathways. Research and identify job opportunities in green building, especially for LEED Green Associates or LEED Accredited Professionals. Use online search engines and job posting sites.
- Research your local community. Students explore opportunities that exist to support their work or interest in green building. Students share their discoveries about events they can attend, student or emerging professional networks to join, and other ways USGBC supports green building in their community.

### *Activities related to the LEED rating system:*

- Analyze existing LEED buildings on your campus. Divide class up into groups and assign a building; within each group assign one student to each LEED category. That student presents the credits in that category and how assigned project did or did not meet the criteria. Additional outcome is to research strategies for meeting credits not originally achieved.
- Apply the intents of a LEED credit category to a building site. Consider a site in your community. (e.g., on campus, home, work, place of worship, or community building). For a LEED credit



- category, identify the advantages and disadvantages of this site in addressing the intents of that category. Identify what it would take to address the disadvantages in order to meet the intents.
- Compare different LEED certified buildings. Compare/contrast the different criteria and elements based on project type, location, size, etc.
  - Conduct a mock charrette. Model the integrative design process to identify sustainable goals and strategies for a LEED project.
  - Contact manufacturers of building products. Request copies of spec sheets, environmental product declarations, or other transparency documentation. Evaluate sustainability of the materials.
  - Explore the existing [LEED pilot credits](#). Identify ones relevant to a project and suggest ways to achieve it.
  - Research local zoning laws and building codes. Identify how they may affect a project.
  - Research other green building rating systems. Evaluate how they compare to and/or complement LEED (e.g., [WELL](#), [Zero Waste](#), [Parksmart](#), [BREEAM](#)).
  - Research your school's commitment to sustainability practices. Propose additional strategies and how LEED can support these efforts and plan to present these ideas to the institution's leaders.
  - Visit a LEED certified building. Identify features and compare to scorecard; interview facilities management, occupants, etc.
  - Work with a LEED project team. Identify a LEED registered project on campus or in the community interested in sharing their work. Attend project planning meetings and work with project team to learn about planned LEED goals and strategies.

### *Suggested student deliverables:*

- Complete the Green Building Operations and Maintenance Assessment Activity. Materials to support this are provided as part of the [Green Building Operations and Maintenance Curriculum Toolkit](#). Present findings and recommendations to relevant campus staff.
- Create a comprehensive public project profile with photos, videos, and project stories. Work with a certified LEED project to highlight their green building features and tell their story via the [LEED Project Directory](#) or a brochure, presentation, or live/ virtual tour. Refer to the "LEED Project Profile Development Guide" available as part of the [Green Building Operations and Maintenance Curriculum Toolkit](#).
- Create a brochure or informational signage for a LEED project. Create visually interesting, colorful graphics signage that informs visitors about that LEED project.
- Create education or a video to train occupants or stakeholders on how to use their new LEED building.
- Create an occupant guide on maximizing the sustainability features of a green building. Consider opportunities to make this guide interactive by posting information around the components of the building, instead of just a single document.
- Create a presentation to share with campus sustainability staff or groups.
- Design a building tour (in person or virtual) for a green building.
- Present on how a current registered LEED project could achieve higher level of certification (i.e., if going for Silver, what would it take to earn Gold)
- Identify what credits a building previously certified under LEED v2009 or earlier version, would earn in LEED v4. Propose potential strategies for achieving additional LEED v4 credits.
- Research and identify how a building currently pursuing LEED v4 could earn additional points and higher certification level. Present findings via a report or a slide show.



- Deliver a presentation at a local industry conference or event. (e.g., [USGBC communities](#), [Association for the Advancement of Sustainability in Higher Education \(AASHE\)](#); [International Facility Management Association \(IFMA\)](#), or [Building Owners and Managers Association International \(BOMA\)](#))
- Propose a new [LEED pilot credit](#).

### LEED Green Associate Credential Resources

Prepare students to earn the LEED Green Associate Credential. LEED Green Associates have a documented, up-to-date understanding of the most current green building principles and practices, and are committed to their professional future. GBCI research shows that 71% of hiring decision makers maintain that being credentialed increases competitiveness and 85% of its credentialed professionals believe that their credential gives them a competitive edge in the job market.

#### Online resources:

- [LEED Green Associate exam: Two week study plan](#) – The syllabus could be adapted for a full academic term.
- [LEED Green Associate Candidate Handbook](#) - The task and knowledge domains in the candidate handbook may be used as a resource for developing student learning outcomes for courses.
- LEED Green Associate credential [frequently asked questions](#).
- [Learn LEED: How-to Guide for Planning and Conducting LEED Study Groups](#).
- [Exam Prep materials on Education @USGBC](#) (available for a fee).
- [LEED credential maintenance 101](#) - Information, video and link to Credential Maintenance Guide

#### Additional Resources:

- [LEED Core Concepts Guide v3](#). Available in multiple languages.
- [Study Bundle: LEED Green Associate Exam Preparation Guide, LEED v4 Edition and LEED Core Concepts Guide](#)
- [LEED in Your Future](#) study app (available for a fee)

### LEED Accredited Professional O+M Credential Resources

As stated above, GBCI research shows that employers value credentials for current and future employees. Instructors teaching LEED Lab programs are also encouraged to study and earn the LEED AP O+M credential as well.

#### Online resources:

- [LEED AP O+M exam: Four week study plan](#) – The syllabus could be adapted for a full academic term.
- [LEED AP O+M Candidate Handbook](#) - The task and knowledge domains in the candidate handbook may be used as a resource for developing student learning outcomes for courses.
- LEED AP O+M credential [frequently asked questions](#).
- [Learn LEED: How-to Guide for Planning and Conducting LEED Study Groups](#).
- [Exam Prep materials on Education @USGBC](#) (available for a fee).

#### Publications:

- [LEED Reference Guide for Building Operations and Maintenance](#). Available as PDF, ebook, or web-based guide.





## Additional USGBC Resources and Opportunities

- General USGBC resources:
  - o [USGBC Higher Education](#). Go to place to receive the latest information on the resources and products to support higher education sustainability efforts on campus.
  - o [USGBC Contact Us](#). Submit outstanding questions about LEED or other USGBC programs.
  - o [USGBC website](#). Information the U.S. Green Building Council and its programs.
  - o [GBCI website](#). Information about Green Business Certification Inc., the administration of LEED project certifications, professional credentials and certificates.
  - o [Arc](#). This state of the art platform allows you to collect, manage and benchmark your data so you can improve sustainability performance.
  - o [USGBC Student page](#). Encourage students to sign up for free usgbc.org user account and check off the “I am a student” box to receive discounts and access to additional resources. Encourage them to create a profile in the [USGBC Student Directory](#).
- Online materials
  - o [USGBC email subscriptions](#). Sign up to stay informed on LEED and other USGBC activities. Set emails based on your preferences. (Requires a free usgbc.org user account if not a member).
  - o [USGBC’s Trademark Policy and Branding Guidelines](#). For guidance on correct use of and USGBC trademarked materials.
  - o [USGBC Career Center](#). Searchable database of green building job openings
- Both USGBC members and nonmembers may create a [free usgbc.org user account](#) and create a public profile for the [USGBC Directory](#)
- Become a [USGBC Faculty](#) for up-to-date instructional resources, exclusive training opportunities to maintain your competitive edge in the market, and gain visibility across USGBC’s digital platforms. Benefits include a complimentary [Education @USGBC subscription](#) and a complimentary GBCI CE course review.

## Discounts for Institutions and Students

Currently, USGBC offers [student discounts](#) to individuals who indicate they are a student in their [USGBC account](#). This includes discounts on USGBC products including the [LEED v4 web-based reference guide](#) (\$50), [Education @USGBC subscription](#) (\$99), [publications](#) (USGBC member price) and the [LEED Green Associate exam](#) (\$100).

Looking for resources to teach about the *design and construction phases* of a green building? Check out the [Green Building Design and Construction Curriculum Toolkit](#) for resources and processes to aid in teaching about and engaging students in the concepts of sustainable design and construction and LEED.

For additional Higher Education curriculum support or to provide feedback on these resources, please contact [education@usgbc.org](mailto:education@usgbc.org).