

LEED within Higher Education Systems

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California has 128 Universities spread throughout the state. Out of these schools, many are LEED certified. LEED stands for Leadership in Energy & Environmental Design. (U.S. Green Building Council). In other words, LEED refers to green building techniques and has many benefits. Green building is transforming the way we think about how building communities are designed, constructed, maintained, and operated across the globe (U.S. Green Building Council). Buildings that are LEED certified have a better outlook on the future. Before going into the details of what school buildings are LEED certified, this paper will address how to earn different LEED credits and levels of certification. The practices of Green Building increase the efficiency of resources such as energy water and materials. In order to receive LEED certification, projects have to satisfy prerequisites and a certain amount of points to reach the different levels of certification; Certified, Silver, Gold, and Platinum. LEED is a third-party certification program developed by the United States Green Building Council in 2000, that is the nationally accepted benchmark for design, construction, and operation of high performance green buildings (LEED/ Green Building Initiatives).

LEED certified buildings save money and resources, as well as have a positive impact on the health of personnel who occupy the building while promoting renewable, clean energy, during the building's life-cycle through better siting, design, construction, operation, maintenance, and removal. There are six categories and projects earn LEED points for satisfying specific green building criteria. The categories follow: Sustainable

Sites, Water Efficiency, Energy and Atmosphere, Materials and Resources, Indoor Environmental Quality, and Innovation in Design.



Figure 1

Each of the categories comes with an icon as well.

These icons are available for public use to illustrate the credits a project has received. Sustainable sites credits encourage strategies that minimize the impact on ecosystems and water resources. The icon follows a branch with two leaves pointing out as shown in Figure 1. Figure 2 shows the label for Water Efficiency which



Figure 2

credit promotes effective use of water, inside and out to reduce potable water consumption. Potable water is drinking water that is safe enough for humans to drink. Energy and atmosphere credits promote better building energy performance through innovative

strategies. For example, lighting occupant sensor controls or variable speed drives on fans will earn the icon in LEED



Figure 3

certified buildings as shown in Figure 3. Figure 4 illustrates the icon for Materials and Resources. This credit encourages using sustainable building materials and reducing waste. The intent of

building reuse is to extend the life cycle of existing building stock, conserve resources, retain cultural resources, reduce waste and reduce environmental impacts of new buildings as they relate to materials manufacturing and transport. Indoor Environmental Quality credit encourage better indoor air quality and access to daylight and views. For example,



Figure 4

providing specific paints or adhesives that do not contain volatile organic compounds will improve the indoor air quality. Eliminating poisons and using non-chemical methods of pest controls will also fall in the Indoor Environmental Quality credit as shown by the icon in Figure 5. Innovation credits address sustainable building



Figure 5

expertise as well as design measure not covered under the five LEED credit categories. These credits are evaluated for each project so a strategy for one project may not be



Figure 6

applicable in a future project. The project team must sufficiently document the achievement using the LEED equivalence process.

The process includes identifying the proposed innovation credit intent, the proposed requirements for compliance, the proposed submittals to demonstrate compliance, and a summary of potential design approaches that may be used to meet the requirements. Figure

6 illustrates the icon used for Innovation in Design credits. Sustainable design strategies and measures are constantly evolving and improving. New technologies are continually introduced to the marketplace, and up-to-date scientific research influences building design strategies. The purpose of this LEED category is to recognize projects for innovative building features and sustainable building practices and strategies. Figure 7 shows

the icon for Regional Priority. This credit provides an incentive for the achievement of credits that address geographically specific environmental, social equity, and public health priorities.



Figure 7

One point is awarded for each Regional Priority credit achieved reaching up to a

maximum of four. Participants were asked to determine which environmental issues were most salient in their chapter area or country and then to focus on those to earn points.

In addition to the above categories, LEED for Neighborhood Development has three other categories. The first one is Smart location and linkage. This credit promotes walkable neighborhoods with efficient transportation option and open space. The second category is neighborhood pattern and design. This credit emphasizes compact walkable mixed-use neighborhoods with good connections to nearby communities. The last additional credit is green infrastructure buildings. This credit is awarded when environmental consequences of the construction and operation of buildings and infrastructure are reduced.

Colleges and universities are prime candidates for many of the LEED rating systems. Stable institutions do well to plan for the long term. This involves making decisions about not only what makes the most sense today but what will make the most sense in the future. This kind of forward thinking is perfectly suited to the concept of sustainability. For an academic institution, this hits close to home because it is precisely future generations of students who will be impacted by the decisions made today. As centers of education and research, higher education institutions have been early and strong proponents of sustainable design and many have efforts underway to enact green policies and practices. Colleges and universities often have the unique opportunity to control planning and construction decisions at various levels and set comprehensive, far-reaching objectives for future development.

The University or any other building just not automatically get certified just because they are using good practices. First you have to choose which LEED rating system best suits your project. The options are building and design construction, interior design construction, building operations and maintenance, neighborhood development and homes. When that choice has been made, the next step is to register your project to begin the LEED certification process. You can do this through the U.S. Green Building Council website. Now, you are ready to begin the application process. You must collect information and prepare documentation to include with an application for certification. Completed materials can be uploaded directly into LEED Online. Double-check each credit to confirm details have been entered accurately and consistently. The next step is to submit your application. Building Design and Construction, as well as Interior Design and Construction receive a split review. This allows the teams to submit their application in two parts. One for design credits and the other for construction credits. To do this, the owner will submit part of the application at the conclusion of your project's design phase (design credits and prerequisites), and the rest at the conclusion of construction (construction credits and prerequisites), completing two rounds of reviews. The split review is designed to help your team determine if your project is on track to achieve LEED certification at its preferred level. The regular non-split review comes with two mandatory reviews and two optional reviews. The preliminary design review and preliminary construction review are mandatory and the final design review and final construction review are optional.

In the preliminary review, Green Building Council Institute will check your application for completeness and compliance with the selected rating system and

attempted credits. They will respond with its preliminary review within 20-25 business days, indicating which prerequisites and credits are anticipated to be awarded during final review, pending further information or denied. Your team can then either accept the preliminary review results as final, submit new or revised documentation, or attempt additional credits before submitting for final review. If choosing to appeal the review, additional information is required. The appeal review stage provides one additional round of review and allows you to submit supplementary information, amend the application or add new credits not previously attempted. Green Building Council Institute will review the pending or newly submitted prerequisites and credits, and reconsider any anticipated credits or prerequisites for which information has changed since the return of the final review. The fee associated with appeals varies depending on the level of complexity of the credits or prerequisites involved in the appeal. Then again, GBCI (Green Building Council Institute) will respond in 20-25 business days, marking prerequisites and attempted credits as either awarded or denied. Like the final review, you can either accept the appeal review results as final, or submit a further appeal. There is no cap on the number of appeals you may submit.

Certification is the final step in the review process. This is when the building is given a certified, silver, gold, or platinum certification. Certified is 40-49 points, silver is 50-59 points, gold is 60-79 points and platinum is 80+ points. Each version of the rating system is open and available for 10 years after the rating system launch date. We require projects to register and complete the LEED certification process (accept the

certification decision) within that 10-year period. The certification comes with a fee as

Building Design and Construction Fees	ORGANIZATIONAL LEVEL OR NON-MEMBERS	SILVER, GOLD AND PLATINUM LEVEL MEMBERS	MEMBER SAVINGS
Registration	\$1,200	\$900	\$300
Certification Fees	Starting at \$2,750	Starting at \$2,250	\$500+

<http://www.usgbc.org/certification>

well as shown in the

picture below.

To break it down the steps are noted below:

1. Register your project to begin the LEED certification process
2. Prepare your application
3. Submit your application
4. Certification

In order to even attain certification by the end, your project team must work together and fill certain roles throughout the LEED certification process. The members include the owner, agent, and project administrator. The owner of the project is the person or entity who has the authority to hold and control the real and personal property associated with your project, and accepts (or authorizes the acceptance of) the certification agreement. In the case where there are multiple owner for a single project, one person will be asked to be the administrator of the certification process. What most people are unaware of is that the owner has ultimate control over the LEED certification application. With this being said, the Green Building Certification Institute will respond to

the owner regarding the administration of the project over any other member of the team. For example, in the case of higher education, the owner would be the government or people who run the U.C. system for University of California schools.

The next team member is the agent who is granted actual authority by the owner to register the project and accept the certification agreement. In order to use this member to register the project, a Confirmation of Agent's Authority form must be signed and the paper can be found on www.usgbc.gov. The last member who is the project administrator acts as the project manager. He or she is the one overseeing LEED project as well as which project team members are responsible for certain tasks, credits or prerequisites. The project administrator plays a key quality role by checking that the LEED submission is complete and accurate before submitting the project to GBCI for review, and accepting the review results once the review is complete. The individual who initially registers the project will automatically be granted the role of the project administrator, but the owner may transfer this role to another team member at any time (U.S. Green Building Council).

LEED does have some additional important considerations for campus projects. Since most higher education buildings have more than one LEED certified buildings on a single shared site and controlled by the same entity, the project may be registered as a campus or group project to streamline the documentation needed to be submitted for a review. The campus credit approach enables you to streamline the amount of documentation by earning "campus credits" – prerequisites and credits that can be applied to all LEED projects on the master site. You will need to register a "master site," which includes a general narrative of the overall campus projects and a schematic site

plan, in addition to registering each individual project on the site. the campus group project approach takes the route of registering the group of jets on the site as a single LEED project that will then receive a single LEED rating and certification. To be eligible for this approach, LEED Building Design and Construction and LEED Interior Design and Construction projects must be under the same construction contract and be constructed at the same time, and LEED Operations and Maintenance projects must be under the same ownership and management, share the same performance period and have substantially similar space types. For this approach, your team’s campus project documentation must demonstrate that the group of projects collectively meets the credit requirements using a “group credit.” You may use a campus group project certification independently or in combination with campus credits documented under a master site review, through the campus credit approach mentioned above. To sum it all up, campus projects can be built with two approaches as shown in Figure 8.

1. Campus credit approach
2. Campus group project approach



Figure 8- <http://www.usgbc.org/cert-guide/commercial>

LEED for Neighborhood Development can be a useful tool for certain types of campus development. Whether used for certification, for visioning exercises or to help evaluate current campus performance, LEED for Neighborhood Development can serve as a valuable tool for colleges and universities in developing a blueprint toward sustainability. The LEED for Neighborhood Development Rating System integrates the principles of smart growth, new urbanism and green building into the first national system for neighborhood design. Areas of focus include smart locations featuring transportation alternatives, and preservation of sensitive lands while also discouraging sprawl; a neighborhood design that emphasizes vibrant, equitable communities that are healthy, walkable, and mixed-use; and the design and construction of buildings and infrastructure that reduce energy and water use. LEED for Neighborhood Development is the product of collaboration between the U.S. Green Building Council, the Congress for the New Urbanism, and the Natural Resources Defense Council.

Unlike the other LEED programs, LEED for Neighborhood Development is not designed to rate individual buildings. Rather, it takes into account the connections between buildings and their context as well as the natural environment. The prerequisites and credits are divided into three categories: Smart Location and Linkage, Neighborhood Pattern and Design, and Green Infrastructure and Buildings. All three have prerequisites that are required of all projects and credits that reward performance. Beyond that, there also are ten additional points for Innovation and Design Process (exemplary performance and innovative performance) and Regional Priority Credits.

In order for the campus to get a Neighborhood Development credit, three stages of certification which relate to the real estate process must be completed. The stages include the following in Figure 9.

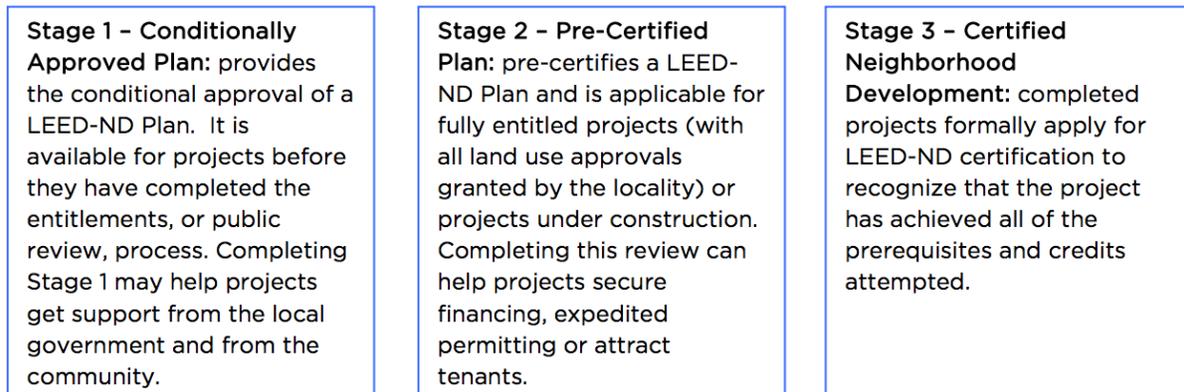


Figure 9- <http://www.usgbc.org/Docs/Archive/General/>

The main benefit for a university project to pursue LEED-Neighborhood Development certification for appropriate projects is to distinguish the project and to market its sustainability leadership. Typically, a higher education project seeking certification will register as Stage 2 because universities are generally exempt from local land use review processes but it is important to check the local regulations. While not specifically designed for universities, LEED for Neighborhood Development can be a useful tool for creating sustainable campuses and there are a variety of ways in which this rating system can be used to facilitate campus development. The program is best suited to colleges and universities that are in the process of expansion, major development, or redevelopment. As a design and construction program, LEED for Neighborhood Development is not intended to rate existing campuses without major development or renovation planned. Whether the goal is to create a new campus, expand an existing one, or develop a nearby area for students with partner

organizations, LEED for Neighborhood Development is a resource that can help to further these goals.

LEED-Neighborhood Development can be a valuable tool for existing campuses that are expanding or building new within their boundary. Many of the credits in the rating system can be used as criteria for overhauling a campus-wide master plan or deciding the best way to renovate part of an existing campus. Although it was designed as a certification tool, LEED-Neighborhood Development can be useful for evaluating future development and shaping the master planning policy of a college or university. In some cases the entire system might be considered but in others, specific metrics can be pulled out to influence focused planning. Since long-term planning is very important for large institutions with a vested interest in the future, it has become commonplace to include sustainability planning as a part of this. Established campuses with major renovations planned may also do well to consider at least some elements of the LEED-Neighborhood Development rating system even if the project is not conducive to certification due to the scope of the alteration. By considering elements of the rating system like walkability, access to alternative transit, water management, and energy efficiency, universities can use smaller projects to shape the direction of future development. These features help to develop a sustainable campus and may lay the groundwork for eventual certification.

The sensitive land protection requirements will earn a University up to two points. The requirements are that the land development footprint are located on prime farmland according to the U.S. Code of Federal Regulation, Title 7, Volume 6, Parts 400 to 699, Section 657.5 (or local equivalent for projects outside the U.S.) and identified in a state

Natural Resources Conservation Service soil survey (or local equivalent for projects outside the U.S.). Flood hazard areas must also be shown on a legally adopted flood hazard map or otherwise legally designated by the local jurisdiction or the state. Bicycle and pedestrian pathways no more than 12 feet wide (3.5 meters), of which no more than 8 feet (2.5 meters) may be impervious. Grade changes must also be made to ensure public access.

Another item Universities search for are Energy-Related Systems. Site conditions are accounted for assessing shading, exterior lighting, hardscape, landscaping, and adjacent site conditions. Massing and orientation affect the HVAC sizing, energy consumption, lighting, and renewable energy opportunities. Basic envelope attributes assess insulation values, window to wall ratios, glazing characteristics, shading, and window operability. Lighting levels assess interior surface reflectance values as well as lighting levels in occupied spaces. Thermal comfort ranges assess thermal comfort range options. plug and process load needs are used in reducing the loads through programmatic solutions such as equipment and purchasing policies, layout options etc. The final energy related system is the programmatic and operation parameters that assess multi-functioning spaces, operating schedules, space allotment per person, teleworking, reduction of building area, and anticipated operations and maintenance.

The University of California has a minimum requirement that all new buildings, except for acute care facilities, meet standards equivalent to the U.S. Green Building Council's LEED (Leadership in Energy and Environmental Design) certified to the Silver level, and that campuses strive to meet LEED Gold certification standards whenever possible. New buildings are also required to exceed by at least 20 percent the energy

savings required by California code (exceptions for acute care facilities). The U.C. Davis campus has set its own bar much higher. They believe new buildings should exceed California's energy code by at least 25 percent. In existing buildings, the U.S. Green Building Council's rating system for existing buildings is called LEED for Existing Buildings: Operations and Maintenance. The system evaluates ongoing building operations, including water and energy use, waste stream management, and ongoing indoor environmental quality.

U.C. Davis has a team of staff, students and volunteers that work together on a comprehensive LEED for Existing Buildings: O&M program. The team is a partnership between Design and Construction Management, Environmental Stewardship and Sustainability, and the Facilities Management Energy Conservation Office. The team is led by Amy Burns, Green Building Coordinator, Energy Outreach and LEED for Existing Buildings: O&M; Michael Huang, Green Building Analyst, Energy Data; and Diane Wu, Green Building Analyst, Outreach.

An important component to an eco-friendly building is addressing its future energy needs — especially for lighting and temperature control — with smart infrastructure. For example, at Gladys Valley Hall a building on the U.C. Davis campus had a goal to optimize daylight inside the building with ceiling, exterior shading and window designs that bring in light but not necessarily heat indoors. The building also has natural ventilation maximized by sensor-controlled louvers and uses evaporative cooling in some rooms.

U.C. Davis also put a lot of focus on water efficiency in new buildings. In their student residence halls in Tereco, water efficient plumbing is becoming standard,

including low-flow toilets and shower heads. At the brewery, winery and food processing plant, rainwater will be captured and stored in tanks to use for flushing toilets and irrigating landscape. With this capture, there is an anticipated savings of 300,000 gallons annually. Water efficiency also includes drought-tolerant plant choices; at Gallagher Hall, for instance, UC Verde buffalograss and Arboretum All-star plants reduce potable water use by 57 percent. Pervious concrete will also allow storm water to seep into soil, reducing run-off.

Gallagher Hall and the Conference Center on Davis's campus are both certified Platinum, the highest certification possible. The buildings use a ground-source heat pump for radiant heating and cooling, and have an innovative rain screen design that helps mitigate solar heat gain. Natural daylight is passively controlled by the buildings' orientation, clerestory windows and a large light well, which save energy used for artificial lighting.

Gladys Valley Hall, a veterinary instructional facility, was honored as the Best Overall Sustainable Design in 2005 in the statewide Best Practices Competition. Natural ventilation cools the building's common spaces, with thermal and humidity sensors that control ventilation louvers. The building uses a night-flush strategy to release heat absorbed during the day with circulated night air that pre-cools the structure, to help moderate indoor air temperatures for the following day. Some of the key project achievements include the use of a previously developed site including no prime farmland or wetland, pedestrian access within a half mile to numerous services, and limited light trespass to increase night sky visibility and reduce impact on nocturnal environments. Other achievements include 250 bike parking spaces, no added

occupant parking, native and adapted plants in landscape, and minimization of urban “heat islands” which occur when development replaces vegetation, by providing trees, shading devices, pervious pavers, and reflective roof materials.

The water efficiency on Gladys Valley Hall include highly water-efficient plumbing fixtures leading to 31% reduction in potable water use as well as real-time, weather based irrigation control, efficient watering devices and drought tolerant plant species for a water efficient landscape resulting in reduction of 56% water use from the calculated baseline. In addition, Water piping for toilets is separate from other domestic water piping to allow for future connection to reclaimed water service when it becomes available (Sustainability at U.C. Davis). Another step in this building earning their Platinum certification was the credits they received in materials and resources. They did a lot of recycling and 96% of construction waste sorted on site and diverted from landfill. They used recycled content materials throughout steel, insulation, windows, concrete and more. Used materials were also manufactured within 500 miles of the project to reduce the transportation impacts of long distance shipping.

Another LEED certified building is the Segundo Services Center located on U.C. Davis as well. The Segundo Services Center has a green roof with seating area and rooftop solar photovoltaic cells. The center also uses a "chilled beam" system for efficient indoor temperature control. Additional building features include: Solar light tubes installed at the maintenance workshop supply sufficient natural light so that artificial lighting is not required on most days; operable windows provide natural ventilation throughout the building; Water efficient landscape choices include “smart”

irrigation controllers with rain sensors and pressure-regulating sprinkler heads; and the building has a green cleaning and educational program.

An interesting fact about the U.C. Davis facility certifications is that they have the first brewery, winery or food processing facility in the world to be LEED Platinum certified. The two-wing building houses teaching and research activities in the August A. Busch III Brewing and Food Science Laboratory and the Teaching and Research Winery. The facilities will serve as a model for sustainability in each industry, with a focus on water and energy efficiency in the building's design. This facility has a large-scale water capture system used for irrigation and toilets that saves about 300,000 gallons of water annually. Photovoltaic panels on the building's roof are estimated to produce more energy than the building currently uses. The building also has a capture system for the carbon dioxide from the fermentation process, with future plans to sequester the carbon dioxide instead of releasing it into the atmosphere. Real-time data from the facility's water and electrical metering displays for visitors in the lobby, to help showcase the building's sustainable features.

One level under the Platinum certification is Gold. The Student Health and Wellness Center located on Davis's campus is LEED certified Gold. The Student Health and Wellness Center is 42 percent more energy efficient than a typical medical office building, which is largely due to the energy efficient heating & cooling system (Sustainability at U.C. Davis). Heat and cool air are delivered to the building through chilled beams—fixtures which are essentially one-foot wide by 4-, 5- or 6-feet long and hang from the ceiling to deliver cooling and heating with low airflow and virtually no noise. Other sustainable aspects of the building are its highly reflective roof and its

small green roof that both serve to minimize the building's heat-island effect on the surrounding microclimate. The Health and Wellness Center also offers a wellness garden for a quiet, reflective place to rest, exercise or reflect.

In conclusion, buildings are becoming a lot more sustainable as the future progresses. Most campuses have LEED requirements for the addition of new buildings and existing infrastructure improvements. Soon enough, hopefully all schools will have the same requirements across the country. To earn a LEED certification, you must meet prerequisites and requirements. The rating system will help earn points in multiple categories. There are so many little things that can be done to make a building more “green.” Whether its something as small as low-flow toilets, or large as installing a full roof of solar panels, the small upfront cost will be paid back in the long run. A small improvement can lead up to years full of savings. Higher education systems like U.C. Davis have gone above and beyond to make their campus improvements LEED Certified and they are leading a great example for other schools as well.

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