

The logo for GreenSense, featuring the word "GreenSense" in a bold, dark green sans-serif font, with a trademark symbol (TM) to the upper right of the "e".

GreenSense™

SENSIBLE SOLUTIONS
FOR SUSTAINABILITY

The logo for WattStopper, featuring a stylized black icon of a hand plugging a two-prong electrical plug into a wall outlet, followed by the text "WattStopper" in a bold, black, sans-serif font.

 **WattStopper**

The logo for Legrand, featuring a small black square icon with a white stylized 'L' shape inside, followed by the word "legrand" in a bold, black, sans-serif font, with a registered trademark symbol (®) to the upper right.

 **legrand®**

GreenSense is common sense

Sustainable building practices are rapidly gaining mainstream acceptance as more and more people recognize that “green” sense is simply common sense.

Building owners and operators benefit from a more valuable, efficient facility, and may be eligible for significant tax advantages under the federal EAct of 2005. Occupants appreciate the enhanced work environment. The environment benefits from fewer construction-related impacts and the decreased ongoing demand for natural resources.

With green building initiatives, such as the LEED program (Leadership in Energy and Environmental Design), increasing in

Lighting Control for Green Buildings

popularity, building owners are seeking ways to enhance the efficiency of building systems. Since lighting consumes such a significant percentage of a facility’s energy usage (up to 40%), the lighting control strategies outlined in this brochure are simply a matter of green sense.





Lighting Control and LEED 2.2

A voluntary program administered by the U.S. Green Building Council, LEED provides a rating and certification system for sustainable building practices. Projects achieve Certified, Silver, Gold, or Platinum ratings by satisfying standard prerequisites and going beyond this threshold to earn points in specific categories.

Lighting controls can help you reach your LEED goals. They enable energy code compliance, a major LEED prerequisite. Devices such as daylighting controls complement LEED's strong emphasis on architectural daylighting design. What's more, controls boost building energy performance through layering control or other innovative strategies.

LEED Categories*	Points Possible
• Sustainable Sites	14
• Water Efficiency	5
• Energy and Atmosphere	17
• Materials and Resources	13
• Indoor Environmental Quality	15
• Innovation and Design Process	5

*Refers to LEED-NC version 2.2.

LEED-NC 2.2 At a Glance

LEED Category related to Lighting Control	Prerequisites	Credit 1	Credit 2	Credit 2
Energy & Atmosphere (17 pts)	Fundamental building commissioning Minimum energy performance CFC reduction	Optimize energy performance (1-10 pts)	Renewable energy (1-3 pts)	Additional commissioning (1 pt)
Indoor Environmental Quality (15 pts)	Minimum IAQ performance Environmental tobacco smoke control			
Innovation & Design Process (5 pts)		Innovation in Design (1-4 pts)	LEED accredited professional (1 pt)	
Other LEED Categories				
Sustainable Sites (14 pts)	Erosion and Sedimentation Control	Site selection (1 pt)	Urban redevelopment (1 pt)	Brownfield redevelopment (1 pt)
Water Efficiency (5 pts)		Water efficient landscaping (1-2 pts)	Wastewater technologies (1 pt)	Water use reduction (1-2 pts)
Materials & Resources (13 pts)	Storage & collection of recyclables	Building reuse (1-3 pts)	Construction waste management (1-2 pts)	Resource reuse (1-2 pts)



LEED Category related to Lighting Control	Credit 4	Credit 5	Credit 6	Credit 7	Credit 8
Energy & Atmosphere (17 pts)	Ozone depletion (1 pt)	Measurement & verification (1 pt)	Green power (1 pt)		
Indoor Environmental Quality (15 pts)	Low-emitting materials (1-4 pts)	Indoor chemical & pollution control (1 pt)	Controllability of systems (1-2 pts)	Thermal comfort (1-2 pts)	Daylight & views (1-2 pts)
Innovation & Design Process (5 pts)					
Other LEED Categories					
Sustainable Sites (14 pts)	Alternative transportation (1-4 pts)	Reduced site disturbance (1 pt)	Stormwater management (1-2 pts)	Heat island effect (1-2 pts)	Light pollution reduction (1 pt)
Water Efficiency (5 pts)					
Materials & Resources (13 pts)	Recycled content (1-2 pts)	Local/Regional materials (1-2 pts)	Rapidly renewable materials (1 pt)	Certified wood (1 pt)	

Bolded blue text indicates prerequisites and credits that either require lighting controls or benefit from their use.

Establishing a Foundation: Meeting LEED Prerequisites

ASHRAE.IESNA 90.1-2004 Compliance

Sustainable building practices start with energy code compliance. In LEED-NC 2.2 projects, ASHRAE 90.1-2004 code compliance is a stated minimum prerequisite in the Energy and Atmosphere (E&A) category. This is a change from LEED-NC 2.1 which required ASHRAE 90.1-1999 compliance. ASHRAE User's Manual worksheets may be used to demonstrate compliance.

For lighting control, the building blocks of energy code compliance include:

- automatic shutoff
- individual space controls
- exterior lighting control

Common strategies for achieving automatic shutoff include scheduled control using a lighting control panel and timeclock, or occupancy sensors. For complying with ASHRAE individual space control requirements, use manual

switches or occupancy sensors in spaces bounded by full height partitions. Certain applications require the use of occupancy sensors, including classrooms, conference rooms, lunch rooms, and break rooms. Provide automatic shutoff of exterior lighting with either a photosensor or astronomical timeclock.

Watt Stopper/Legrand offers a range of products in its lighting control panel and occupancy sensor lines that can provide a code-compliant baseline to any LEED project. We also offer expertise and guidance for code-compliant lighting control solutions in our CodeSmart initiative.

ASHRAE/IESNA 90.1-2004 Lighting Compliance Form

Lighting Compliance Documentation

Page 1

Project Name:	
Project Address:	Date:
Designer of Record:	Telephone:
Contact Person:	Telephone:
City:	

Mandatory Provisions Checklist

- Automatic lighting shutoff controls are provided based on either a scheduling device or an occupant sensor.
 - Exception: Space is intended for 24-hour operation.
 - Exception: Space is smaller than 5,000 ft².
- Each space enclosed by ceiling-height partitions has an independent, accessible control that operates general lighting in the space.
 - Exception: The control is located in a remote location for safety or security reasons.
- For spaces less than or equal to 10,000 ft², a separate space control is provided for each 2,500 ft² of area.
- For spaces more than 10,000 ft², a separate space control is provided for each 10,000 ft² of area.
- Either a photosensor or an astronomical time switch controls exterior lighting applications.
 - Exception: Lights must remain on for safety, security or eye adaptation reasons.
- Two-lamp tandem-wired ballasts.
- Display lighting has a separate control.
- Case lighting has a separate control.
- Hotel/motel guest rooms have a master switch at the main entry.
- Task lighting has a separate control.
- Nonvisual lighting has a separate control.
- Demonstration lighting has a separate control.
- Exit signs larger than 20 W have an efficacy greater than or equal to 35 lumens/W.
- Exterior luminaires greater than 100 W have lamps with minimum efficacy of 60 lumens/W.
 - Exception: Luminaire is activated with a motion sensor.

Interior Lighting Power Allowance (Building Area Method)

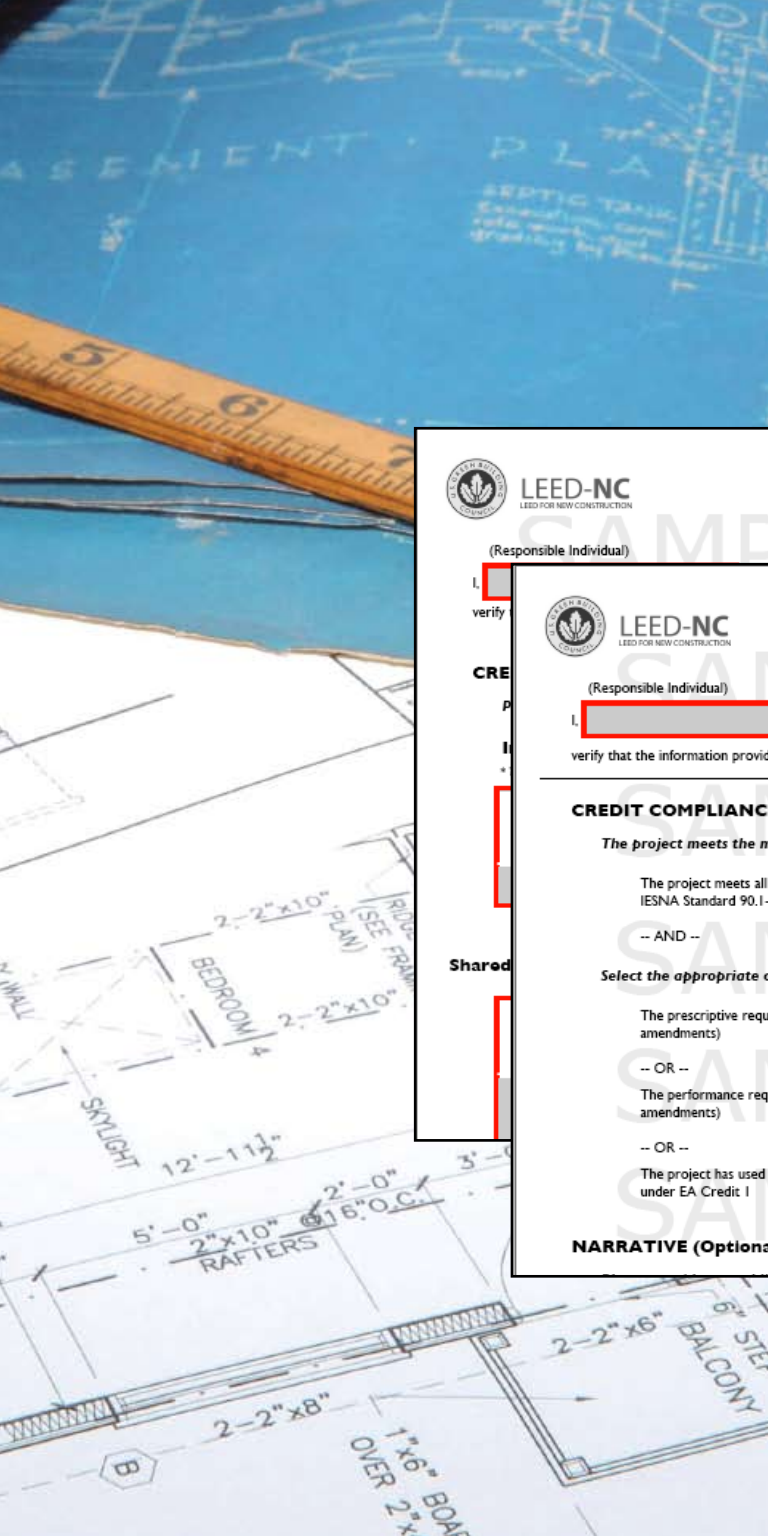
Building	Lighting Power Density	Building Area	Lighting Power Allowance
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Establishing a Foundation: Meeting LEED Prerequisites

Fundamental Building Commissioning

LEED-NC v2.2 expands the prerequisite of building commissioning. This is intended to verify that the building's energy related systems are installed, calibrated and performing according to the owner's project requirements, basis of design, and construction documents. To achieve compliance with this prerequisite, a project must complete documentation of procedures and settings for all energy-related systems, including lighting and daylighting controls. In addition, a project must engage in a comprehensive commissioning process that spans the life of the project itself. The commissioning process must be led by a Commissioning Authority who is independent of the project's design and construction team. This authority reports its results, findings and recommendations directly to the project owner.





LEED-NC
LEED FOR NEW CONSTRUCTION

LEED
EQ Credit 6.1: Control

(Responsible Individual) (Company Name)

I, [redacted] verify that the information provided below is accurate, to the best of my knowledge.

LEED-NC
LEED FOR NEW CONSTRUCTION

LEED-NC 2.2 Subm
EA Prerequisite 2: Minimum Energy

(Responsible Individual) (Company Name)

I, [redacted] from [redacted] verify that the information provided below is accurate, to the best of my knowledge.

CREDIT COMPLIANCE

The project meets the minimum energy efficiency requirements.

The project meets all the mandatory provisions (Sections 5.4, 6.4, 7.4, 8.4, 9.4, and IESNA Standard 90.1-2004 (without amendments).

-- AND --

Select the appropriate compliance path:

The prescriptive requirements (Sections 5.5, 6.5, 7.5, and 9.5) of ASHRAE 90.1-2004 (without amendments)

-- OR --

The performance requirements (Section 11) of ASHRAE/IESNA Standard 90.1-2004 (without amendments)

-- OR --

The project has used a computer simulation model to document improved building performance under EA Credit 1

NARRATIVE (Optional)

The commissioning process includes:

- Documentation of Owner's Project Requirements
- Development of Basis of Design documentation by design team
- Review of planning documents by commissioning authority
- Develop and incorporate commissioning requirements into the construction documents (CD's)
- Develop and implement a commissioning plan
- Verify the installation and performance of the systems to be commissioned
- Complete a summary commissioning report

LEED v2.2 offers online compliance via electronic forms and filing. These forms, shown as samples here, are available in fully interactive form to registered project members.

Building Sustainability: Optimizing Energy Performance

One of the greatest opportunities in a LEED project comes with Optimizing Energy Performance (OEP), Credit 1 in the Energy & Atmosphere category. By optimizing a building's energy performance, a LEED team can earn up to 17 points toward Certified, Silver, Gold and Platinum.

Watt Stopper/Legrand's lighting controls are key to optimizing energy performance:

- Automatic daylighting control
- Occupancy-based control with occupancy sensors
- Integrating lighting control with other building controls
- Include strategy for controlling unregulated plug loads



Three compliance paths available:

Whole Building Energy Simulation Path (1 - 10 Points)

- Demonstrate percentage improvement over 90.1 baseline performance
- All energy costs include regulated and unregulated loads (plug loads, parking garage, exterior lighting)

Prescriptive Compliance Path (4 Points)

- Earn 4 points by complying with ASHRAE Advanced Energy Design Guide for Small Office Buildings 2004.
- Applies to buildings up to 20,000 ft²

Prescriptive Compliance Path (1 Point)

- Earn 1 point by complying with Advanced Buildings Benchmark Version 1.1



EXIT

Building Sustainability: Optimizing Energy Performance with Daylighting

LEED actively encourages the use of architectural daylighting building design through the availability of the daylight and views credit (IEQ Credit 8). Daylighting controls leverage the natural light in interior spaces by reducing electric light levels in response. This significantly improves a building's energy performance.

In fact, using daylighting controls can boost energy savings by as much as 40%.

Boost energy savings by as much as 40%

In addition to reducing lighting usage, daylighting controls can reduce the cooling load significantly and provide peak demand reduction.

Leverage the application of architectural daylighting elements, such as clerestories and skylights, by implementing controls to reduce electric lighting automatically when adequate daylight exists.

Watt Stopper/Legrand offers both automatic dimming and ON/OFF switching controls. Use dimming controls in applications such as offices, conference rooms, and classrooms, where occupants often focus on desktop activities. ON/OFF switching controls are ideal for settings like hallways, lobbies, and warehouses, where occupancy is more transient. Implement a bi-level control strategy for uniform light level reduction.



In this classroom, the LEED prerequisite requiring energy code compliance is provided via occupancy sensor. Adding automatic dimming photosensors to control electric lighting in response to the daylight contribution from the skylights improves the energy performance of the space.



Building Sustainability: Optimizing Energy Performance with Integrated Building Controls

Linking lighting controls such as occupancy sensors with mechanical systems for coordinated control reaps significant energy efficiency rewards — and earns LEED points.

For instance, when an occupancy sensor is linked with an HVAC system, the sensor sends a status signal to the mechanical system, which controls the space air flow and temperature based upon occupancy. When the space is unoccupied, lighting turns off; HVAC systems can revert to a setback temperature. When the space is occupied, lighting turns on while the mechanical system maintains comfortable environmental conditions. Another approach is to utilize Watt Stopper's

programmable thermostat module with a Lighting Integrator lighting control panel.

Coordinating control boosts total energy savings by layering mechanical system savings on top of lighting energy savings. It's an ideal strategy for intermittently occupied spaces such as conference

rooms, restrooms, multi-purpose rooms, cafeterias, and private offices.

**Integrate
lighting and
mechanical
system control**



Using lighting control panels with programmable thermostats to automate lighting and HVAC systems in this cafeteria enables coordination of temperature setback with lighting shutoff.



Building Sustainability:

Optimizing Energy Performance

Controlling Unregulated Plug Loads

Under LEED-NC v.2.2, the energy usage of unregulated plug loads must be taken into account for projects using the whole building energy simulation compliance path and seeking points under OEP Credit 1 (see page 10). This usage includes task lights and other desktop appliances such as fans and computer monitors, as well as fax machines, copiers, shredders and other general office equipment.

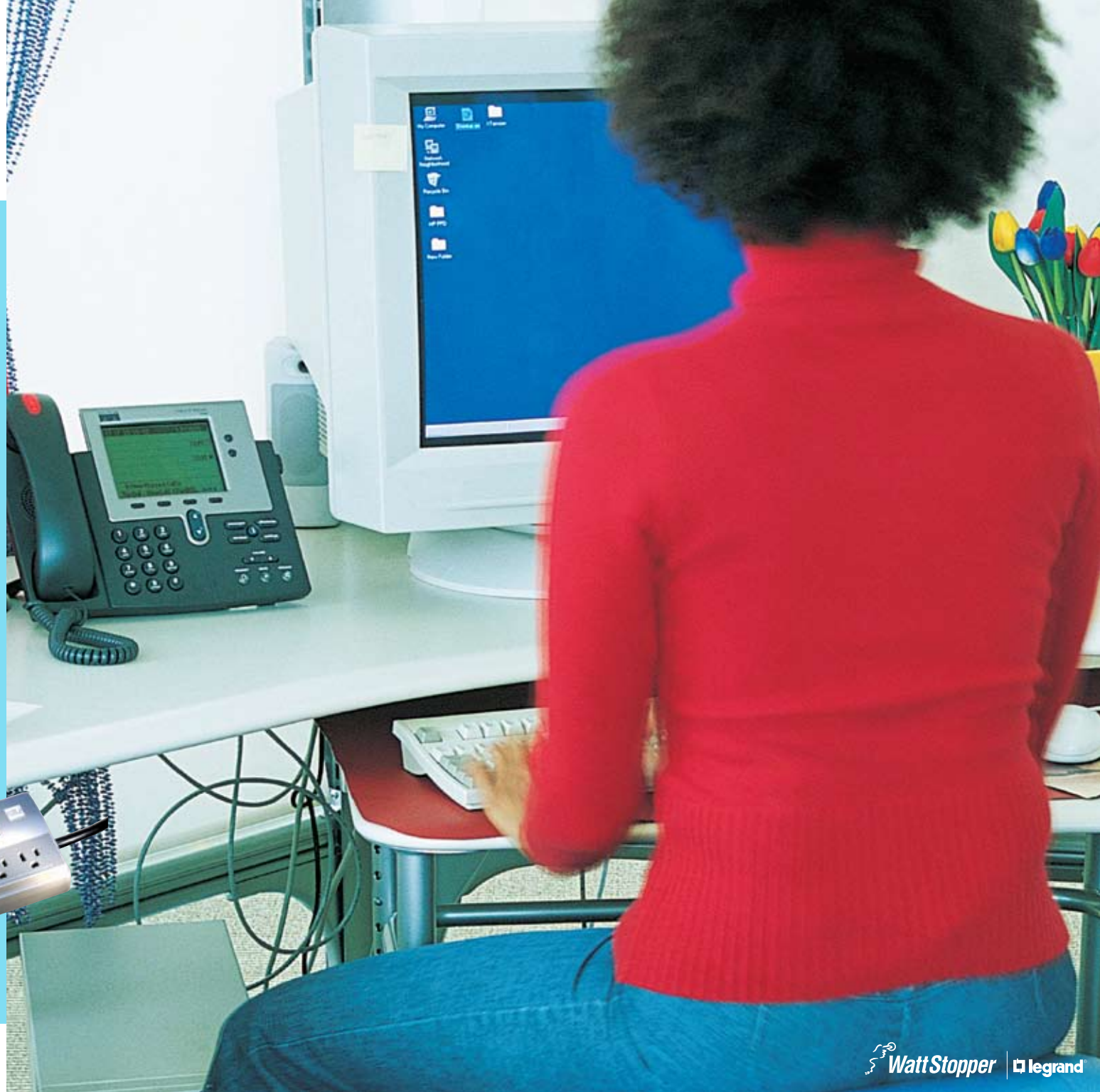
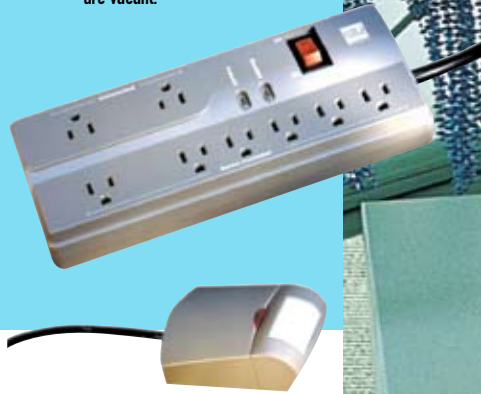
The LEED criteria require that energy usage from these loads be included in the total energy usage of the project, which in turn must be modeled to determine total building performance and energy usage reductions. Using plug load controls reduces plug load energy usage without impacting energy usage reductions due to other controls.

LEED 2.2 includes unregulated plug loads in whole building energy usage

Plug load controls may also work toward obtaining credits under the Innovation in Design category, when the registered project is using either of the other prescriptive compliance paths for obtaining points in OEP Credit 1 (see table on page 10).

Plug load controls, such as Watt Stopper/Legrand's Isolé, provide occupancy-based control of specific loads. Users simply plug the loads they wish to turn off into the controllable outlets on the power strip. Devices such as computer hard drives or fax machines are plugged into uncontrolled outlets. When the personal sensor detects occupancy, it turns on controlled loads. When the space becomes vacant, the sensor turns controlled loads off, while uncontrolled loads continue to operate.

Plug load controls provide automatic shutoff of task lighting and other desktop equipment when work spaces like this office cubicle are vacant.



Controllability of Systems

Earning points under Credit 6.1 in the Indoor Environmental Quality (IEQ) category requires providing a high level of lighting system control by individual occupants or by specific groups in multi-occupant spaces to promote the productivity, comfort and well-being of building occupants.

Requirements for earning one point under Credit 6.1:

- Individual lighting controls for a minimum of 90% of the space occupants to enable adjustments to suit individual task needs and preferences
- Lighting controls must be supplied for all shared multi-occupant spaces so that groups can tailor lighting to their needs

In open office areas like this, individual lighting controls such as separately switched task lighting or manual override switches provide occupant adjustability.



Innovation and Design

Lighting controls also offer the potential for earning LEED points under Credits 1.1-1.4 in the Innovation and Design Category. Rather than setting forth specific criteria for performance, as the other LEED categories do, the Innovation and Design category intends to embrace sustainable design practices not specifically identified in any other part of the LEED system.

Under this category, projects may be awarded points for exceptional performance above the base LEED requirements, and/or for implementing design strategies not specifically addressed in the LEED rating system. For instance, one certified LEED project received Innovation and Design points for the use of DALI dimming controls.

Requirements:

- In writing, identify intent of proposed innovation credit, requirements for compliance, submittals to demonstrate compliance, and the design approach that might be used to meet the requirements
- Provide proposal(s) with LEED Letter Template and relevant evidence of performance achieved

Other LEED Rating Systems

LEED-NC: LEED for New Construction

LEED-NC is a green building rating system designed to guide and distinguish high-performance commercial and institutional projects, with a focus on office buildings. The system has also been applied to projects as diverse as K-12 schools, multi-unit residential buildings, manufacturing plants, and laboratories.

LEED-EB: LEED for Existing Buildings

LEED-EB maximizes operational efficiency while minimizing environmental impacts. It provides a recognized, performance-based benchmark for building owners and operators to measure operations, improvements and maintenance on a consistent scale.

LEED-CI: LEED for Commercial Interiors

LEED-CI is the green benchmark for the tenant improvement market. LEED-CI gives the power to make sustainable choices to tenants and designers, who do not always have control over whole building operations. LEED-CI is a standard for certifying high-performance green interiors that are healthy, productive places to work, are less costly to operate and maintain, and reduce environmental footprint.

LEED-CS: LEED for Core and Shell Development

LEED-CS is for designers, builders, developers and new building owners who address sustainable design for new core and shell construction. Broadly defined, core and shell construction covers base building elements, such as the structure, envelope and building-level systems, such as central HVAC, etc. The CS product recognizes that the division between owner and tenant responsibility for certain elements of the building varies between markets.

LEED-H: LEED for Homes

LEED-H is being developed by the USGBC with input from local and national stakeholder groups. Like the other LEED programs, it is a voluntary initiative that encourages the transformation of the home building industry towards more sustainable practices. It will provide a tool for homebuilders, homeowners, and local governments for building environmentally sound, healthy, and resource-efficient places to live.

LEED-ND: LEED for Neighborhood Development

USGBC, the Congress for the New Urbanism, and the Natural Resources Defense Council are working together to develop a national standard for neighborhood design that incorporates the principles of smart growth, urbanism, and green building. It will include compact design, proximity to transit, mixed use, mixed housing type, and pedestrian- and bicycle- friendly design.



Other High Performance Building Design Guides

While the LEED system is perhaps the most recognized green building program in use today, numerous other sustainable building practice systems exist. Most, like LEED, are voluntary programs developed by consensus among multiple stakeholders.

Green Guide for Health Care™ (www.gghc.org)

Modeled on the LEED organizational structure (borrowed by agreement from the U.S. Green Building Council), the Green Guide for Health Care is the health care sector's first quantifiable sustainable design toolkit that designers, owners, and operators can use to guide and evaluate their progress towards high performance healing environments. It integrates enhanced environmental and health principles and practices into the planning, design, construction, operations and maintenance of their facilities.



Whole Building Design Guide (WBDG) (www.wbdg.org)

The WBDG is a web-based resource providing government and industry practitioners with one-stop access to up-to-date information on a wide range of building-related guidance, criteria and technology from a 'whole buildings' perspective. Development of the WBDG is a collaborative effort among federal agencies, private sector companies, non-profit organizations and educational institutions.

Online GreenSense Resources from Watt Stopper/Legrand

Our **GreenSense** initiative offers up-to-date information on how the use of lighting controls can enhance sustainable building practices, including current information on sustainability initiatives.

www.wattstopper.com/greensense.html

Turn to **CodeSmart** online for the latest information on state code adoptions, technical bulletins about specific code provisions, code compliant application highlights, and more!

www.wattstopper.com/codesmart.html

Study **Best Practice Design Guides**

for detailed information on using lighting controls in sustainable or high-performance building projects. These include insight on product selection and implementation, layout examples, wiring and installation tips, and equipment schedules.

www.wattstopper.com/DesignLibrary.html

Take advantage of our electronic **CAD Resource Center** for wiring diagrams, coverage patterns, photocell placement, and more. Files are available in PDF and CAD formats.

www.wattstopper.com/products/cad-resource.html



% of LPD reduction	25%	26%	27%	28%	29%	30%	31%	32%
Amount of tax deduction	\$0.30	\$0.32	\$0.34	\$0.36	\$0.38	\$0.40	\$0.42	\$0.44



Sustainability and EPAAct 2005



Under the Energy Policy Act of 2005 (EPAAct), sustainable building practices can be leveraged to take advantage of tax incentives. EPAAct 2005 enables commercial building owners to invest in energy efficiency, with a Commercial Building Tax Deduction (CBTD) for capital investments in energy efficiency equipment, including lighting controls.

Lighting Tax Deduction Provisions

LEED projects may qualify for either a complete or partial deduction, up to \$1.80/ft² or \$.60/ft² respectively. To do so, projects qualify in one of three ways:

1. a total building approach in which energy efficient lighting, HVAC/hot water and building envelope systems are installed, and which achieve a 50% savings in total annual energy and power costs as compared to the reference building (compliant with ASHRAE 90.1-2001). The owner may deduct the full cost of the efficient systems up to \$1.80/ft².

2. a lighting system upgrade that reduces LPD between 25 and 40% (see table below for corresponding tax deduction amounts), complies with 90.1-2001 controls requirements, provides bi-level switching, and satisfies minimum requirements for calculated lighting levels according to IESNA Lighting Handbook, 9th Ed.

3. a lighting system upgrade that results in a total building energy and power cost savings of 16 2/3% compared to the reference building (compliant with 90.1-2001) under the permanent EPAAct rules (IRS Notice 2006-52).

To qualify for this new Commercial Building Tax Deduction (CBTD), building owners must act quickly. The deduction will be available only for buildings placed in service between January 1, 2006 and December 31, 2007.

Visit www.wattstopper.com/epact for more information.

33%	34%	35%	36%	37%	38%	39%	40%	more than 40%
\$0.46	\$0.48	\$0.50	\$0.52	\$0.54	\$0.56	\$0.58	\$0.60	\$0.60

Table reprinted from "Energy Policy Act of 2005 Encourages Energy-Efficient Lighting with Tax Deduction," Craig DiLouie, Lighting Controls Association, www.aboutlightingcontrols.org/education/papers/tax_deduction_2005.shtml.



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