

ENERGY AND ATMOSPHERE

LEED OVERVIEW

The LEED logo is positioned in the bottom left corner. It features the word "LEED" in a bold, black, sans-serif font. The text is overlaid on a photograph of vibrant green, elongated leaves, likely from a plant like a peace lily, which are slightly out of focus in the background.

LEED

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Optimize Energy Performance

Lighting Controls

Purpose:

- Achieve increasing levels of energy conservation beyond the prerequisite standard to reduce environmental impacts associated with excessive energy use.

Requirements:

- Install daylight responsive controls in all regularly occupied spaces within 15 feet of windows and under skylights.

Submittal:

- Provide documentation signed by the professional engineer stating that lighting controls were installed consistent with the requirements.
- Provide a narrative describing the lighting controls that have been incorporated in the tenant space design.
- Include plan of the lighting control zones showing each control device.
- Provide a schedule of lighting controls showing model, type, and other characteristics.



Optimize Energy Performance

Lighting Controls

- The objective of daylight-responsive controls is to reduce energy consumption.
- The use of daylight responsive controls is one element of an overall lighting strategy.
- This strategy optimizes natural daylight while minimizing artificial illumination, and offers appropriate task/ambient working conditions while offering occupant control.
 - Must establish the zones that are to be controlled
 - Perimeter areas within a radius of at least 15 feet from windows.
 - Areas beneath sky-lights.
- Daylight controls usually include a photosensor in the circuit.
- Good designs go further to anticipate the occupant activities and comfort, and to avoid drastic changes in lighting levels and minimizing glare.
- When possible, indicate the anticipates annual reduction in electrical consumption that the design should produce; this comparison will be used for interior lighting power density provided in Section 9 of Standard 90.1-2004.

Why choose daylight..?

- Daylight improves the indoor environment.
- When planned accordingly with heating and air conditioning requirements, the net cost of utilities can be reduced.



Optimize Energy Performance

HVAC

Purpose:

- Achieve energy consumption levels below the required standard to reduce environmental impacts attributed to excessive energy use

Requirement:

- **Option A** (implement one or both of the following)
 - ~Equipment Efficiency (1point)
 - install HVAC systems which comply with the efficiency requirements outlined in the new buildings institute publication "Advanced Buildings: Energy Benchmark for High Performance Buildings"
 - ~ Appropriate zoning and controls (1 point)
 - every solar exposure must have a separate control zone
 - interior spaces must be separately zoned
 - private offices and specialty occupancies must have active controls capable of sensing space use and modulating HVAC system in response to space demand
- **Option B**
 - ~ Reduce design energy cost compared to the energy cost budget for regulated energy components described in standard 90.1-2004
 - demonstrate that the HVAC performance criteria used for tenant space is 15% better than a system that is in min compliance with standard 90.1-2004 (1 point)
 - OR
 - demonstrate that the HVAC performance criteria used for tenant space is 15% better than a system that is in min compliance with standard 90.1-2004 (2 points)



Optimize Energy Performance

HVAC

Submittal:

- Option A
 - ~ Provide documentation stating that the strategy used meets the credit requirement
 - ~ Provide a narrative description of the building level system and HVAC system in use
 - ~ Plans and specifications should have an HVAC equipment schedule and plans showing the equipment within the space
 - ~ Demonstrate in the narrative and plans submitted that the installed HVAC systems comply with the requirements
- Option B
 - ~ Provide documentation stating that the HVAC system energy use is 15% or 30% lower than a budget or baseline case system as defined in standard 90.1-2004 section 11
 - ~ Provide completed copy of the energy cost budget compliance form
 - ~ Provide a narrative description of the building level system and HVAC system in use
 - ~ Plans and specifications should have an HVAC equipment schedule and plans showing the equipment within the space



Optimize Energy Performance

Equipment & Appliances

Purpose:

- Achieve increasing levels of energy conservation beyond the prerequisite standard to reduce environmental impacts associated with excessive energy use.

Requirements:

- For all ENERGY STAR eligible equipment and appliances installed in the project, including appliances, office equipment, electronics and commercial food service equipment (excluding HVAC, lighting and building envelope products).
 - 70%, by rated-power, of ENERGY STAR eligible equipment and appliances shall be ENERGY STAR rated (1 point)
 - 90%, by rated-power, of ENERGY STAR eligible equipment and appliances shall be ENERGY STAR rated (2 points)

Submittal:

- Provide documentation signed by the responsible party, declaring that ENERGY STAR eligible equipment and appliances are ENERGY STAR rated and yield the indicated percentage of the total, determined by rated power.
- Provide narrative of equipment and appliance to be installed including the types and quantity of equipment and appliances.



Optimize Energy Performance

Equipment & Appliances

- The calculation is based on power demand, instead of the number of appliances or equipment, to normalize the anticipated energy savings to the consumption of each item.
- The actual power varies significantly based in these factors:
 - Frequency of use
 - Number of simultaneous function
 - Screen resolution (for monitors)
 - Sleep mode
- According to the 1999 Energy Information Agency's (EIA) Commercial Building Energy Consumption Survey (CBECS), plug loads account for 21% of total commercial building energy consumption, and 29% of total electrical consumption.
- The percentage varies depending on the type of building.
 - The percentages range from 8% to 0% of the total building energy consumption.
 - Plug load refers to all equipment that is plugged into the electrical system, from office equipment to refrigerators.



Enhanced Commissioning

Purpose:

- Verify and ensure that the tenant space is designed, constructed and calibrated to operate as intended

Requirements:

- In addition to the Fundamental commissioning prerequisite, implement or have a contract in place to implement the following in additional commissioning process activities
 1. Designate an individual as the commissioning authority independent of the firms represented on the design and construction team to lead the commissioning design review activities prior to the end of design development
 2. Conduct a review of the tenant spaces's energy related systems contractor submittals
 3. Develop a single manual that contains the information required for the re-commissioning of the tenant space's energy related systems
 4. Verify that the requirements for training operating personnel and tenant space occupants are completed. Have a contract in place to review tenant space operation with O&M staff and occupants including a plan for resolution of outstanding commissioning related issues 8 - 10mo after final acceptance

Submittal:

- Provide documentation signed by the owner and independent commissioning authority confirming that the required enhanced commissioning process req 1 and 2 have been completed and that a contract for completing req 3 and 4 are in place



Energy Use

Measurement & Payment Accountability

Purpose:

- Provide for the ongoing accountability and optimization of tenant energy and water consumption performance over time.

Requirements:

- CASE A: For those projects with an area that constitute less than 75% of the total building area:
 - Install sub-metering equipment to measure and record energy uses within the tenant space (1 point)
 - Negotiate a lease where energy costs are paid by the tenant and not included in the base rent (1 point)
- CASE B: For those projects with an area that constitutes 75% or more of the total building area (2 points)
 - Install continuous metering equipment for the following end-uses:
 - Lighting systems and controls
 - Constant and variable motor loads
 - Variable frequency drive (VFD) operation
 - Chiller efficiency at variable loads (kW/Ton)
 - Cooling load
 - Air and water economizer and heat recovery cycles
 - Air distribution static pressures and ventilation air volumes
 - Boiler efficiencies
 - Building-related process energy systems and equipment
 - Indoor water meter and outdoor irrigation systems

Submittals:

- For projects that constitutes 75% of the total building area, provide documentation signed by licensed engineer describing the metered equipment installed and indicating that energy costs are paid by tenant and not included in base rent.
- For projects that constitutes 75% or more of the total building area, provide documentation signed by licensed engineer indicating that metering equipment has been installed for each end-use.



Energy Use

Measurement & Payment Accountability

- **Projects Less Than 75% of the Total Building Area:**
 - The objective of the requirements is to encourage efficient operation of leased spaces through measurement and the accountability associates with paying for what is used.
 - Sub-metering is simply metering a utility for a designated portion of a building.
 - To satisfy the credit requirements, the sub-metering need only be by energy source, or utility.
 - These are the forms of energy, fuels, and other utilities that are to be considered:
 - Electricity
 - Natural gas
 - Fuel oil
 - District or Distributed Energy Sources
 - Steam
 - Chilled water
 - Other fuels
 - Process water
- **Projects with Areas 75% or Greater to the Total Building Area:**
 - The LEED measurement & Verification (M&V) credit provides an extension of this quality assurance effort by ensuring that the predicted performance of the functioning building is actually producing savings to the owner.
 - Elements of the M&V Plan that are required to comply with the requirements of this credit are listed below.
 - The IPMVP standard language and terminology should be employed.
 - State which option and method from the document will be used.
 - Indicate who will conduct the M&V.
 - State key assumptions about significant variables or unknowns.
 - Create an accurate baseline using techniques appropriate to the project.
 - Describe the method of ensuring accurate energy savings determination.
 - Define a post-installation inspection plan.
 - Specify criteria for equipment metering, calibration, measurement period.
 - Define the level of accuracy to be achieved for all key components.
 - Indicate quality assurance measures.
 - Describe the contents of reports to be prepared, along with a schedule.



Green Power

Purpose:

- Encourage the development and use of grid-source renewable energy technologies on a net zero pollution basis.

Requirement:

- Provide at least 50% of tenant's electricity from renewable sources by engaging in at least a two-year renewable energy contract.
- The power may be supplied from Green-e marketer, a Green-e accredited utility program, through Green-e tradable Renewable Certificates, or from a supply that meets the Green-e Renewable Power definition.

Submittals:

- Provide documentation signed by responsible party stating that all requirements have been met.
- Provide a copy of a two-year electric utility contract for power generated from renewable resources.



Chapter Overview

- In this chapter, LEED focuses on the individual aspects of energy efficiency, lighting, HVAC, appliances and equipment.
- Each element has individual requirements for points.
- According to usgbc.org buildings consume 72% of electricity produced in the United States and 39% of the nation's energy use.
- The various ways that energy is produced can impact the environment in dramatic ways or barely at all.
- Green buildings address these issues in two primary ways:
 - By reducing the amount of energy required.
 - By using more efficient forms of energy.
- LEED also offers incentives to purchase green power.



Green Power

Green-e Program

- This is a voluntary certification and verification program for green electricity products.
- Anything labeled with the green-e logo are greener and cleaner than the average retail electricity company
- In order to receive the green-e logo the power must be generated from renewable sources as well as meeting other criteria
- Criteria can vary widely from state to state
- Nuclear power is not considered for the green-e logo and hydro-electric facilities must be certified low impact in order to receive the logo

More information about the Green-e program can be found at www.green-e.org



Fundamental Commissioning

Fundamental commissioning is getting all aspects of the energy related systems accounted for into a plan.

Purpose:

- To verify the project's energy-related systems are installed, calibrated and perform as intended.

Requirements:

- A designated individual over see that requirements are met. This person is not the same individual who is responsible for the project design or construction management.
- Document the client's needs for all energy related systems that are included in the project.
- Construction documents should include the requirements the systems installed.
- Verify that the installation and performance of the energy systems meet the owner's needs and LEED requirements.

Commission Systems:

- The systems that must be outlined in the plan include:
 - Heating, ventilating air condition and refrigeration (HVAC&R) systems (mechanical and passive) and associated controls
 - Lighting controls, including day lighting
 - Domestic hot water systems
 - Renewable energy systems (PV, wind solar, etc.)

Submittals:

- The previously designated individual shall submit a letter confirming that the commissioning requirements for the projects energy related systems have been successfully executed or will be provided under existing contracts).



Minimum Energy Performance

Purpose:

- Establish min. level of energy efficiency for the structure

Requirements:

- Building must comply with ANSI/ASHRAE/INESNA Standard 90.1-2004 OR the local energy code, which ever is more stringent

Submittal:

- Provide documentation stating the project complies with standard 90.1-2004 or local energy code.
- If local energy code is used document how it is more stringent than standard 90.1-2004
- If California title 24 2001 is applied no further documentation is required because it has shown to be more stringent than 90.1-2004



Minimum Energy Performance

Standard 90.1-2004 establishes min requirements for the energy-efficient design of buildings

~ The standard provides criteria for the following mandatory categories

building envelope (section 5)

HVAC (section 6)

Service Water Heating (section 7)

Power (section 8)

Lighting (section 9)

Other Equipment (section 10)

~ This standard does not apply to single family houses, multi-family structures of three habitable stories or fewer above grade, manufactured houses, buildings that do not use either electricity or fossil fuel

~ You can read standard 90.1-2004 at this address

<http://www.realread.com/prst/pageview/browse.cgi?book=1931862664>



CFC Reduction in HVAC&R Equipment

Purpose:

- Reduce ozone depletion.

Requirements:

- Zero use of CFC-based refrigerants in new tenant HVAC&R systems when within scope of work.

Submittal:

- Provide documentation signed by a professional engineer, declaring that there are no CFCs in HVAC&R systems that have been installed or renovated within the project scope.



CFC Reduction in HVAC&R Equipment

- Refrigerants have varying applications, lifetimes, ozone-depleting potentials (ODPs) and global-warming potentials (GWPs).
- Those who demonstrate they have eliminated the use of ozone-depleting materials or materials with global-warming potential from their project may qualify for an ID point.
- Older refrigeration equipment uses chlorofluorocarbons (CFCs), which are the root cause of serious environmental and health problems.
 - The reaction between a CFC and an ozone molecule in the earth's stratosphere, destroys the ozone and reduces the stratosphere's ability to absorb a portion of the sun's UV radiation.
 - CFC fall into a larger category of ozone depleting substances (ODS).
 - The United States is one of the world's largest emitters of ODS's.

REFRIGERANT	LIFETIME (YRS)	ODP	GWP
CFC-11	45	1	4,000
CFC-12	100	1	8,500
CFC-13	640	1	11,700
CFC-113	85	1	5,000
CFC-114	300	1	9,300
CFC-115	1,700	1	9,500

Optimize Energy Performance

Lighting Power

Purpose:

- Achieve energy consumption levels below the required standard to reduce environmental impacts attributed to excessive energy use

Requirements:

- Reduce connected lighting power density below what is allowed in standard 90.1-2004 by either 15%, 25%, or 35% below the standard (points awarded accordingly)

Submittal:

- Provide documentation stating that the lighting power density is reduced below standard 90.1-2004 to the level of credit being sought
- Complete the lighting compliance documentation provided in the standard 90.1-2004 user manual
- Provide separate calculations showing the percentage reduced.



Optimize Energy Performance

Lighting Power

One of the best ways to reduce energy consumption (especially in commercial building) is the reduction of interior lighting. When highly efficient luminaires are combined with proper control systems and daylighting the result will be lower operating cost (increasing profit) , lower AC loads and improved occupant wellbeing

Terms to understand

- Interior Lighting Power Allowance
 - ~ the maximum light power (in watts) allowed for the interior of a building
- Lighting Power Density (LPD)
 - ~ the maximum lighting power, per unit area, of a building classification of space function
- Luminaire
 - ~ a complete lighting unit consisting of a lamp or lamps together with the housing designed to distribute the light, position and protect the lamps and connect the lamps to the power supply

