

Light Control and LEED

How light control helps achieve LEED certification in new construction and major renovations of commercial buildings



AIA Program Number LCAL10
1.0 Learning Unit
HSW/SD



Approved by USGBC for
1.0 GBCI CE Hours



Light control and LEED

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Learning Objectives

- By reviewing the credit categories of Leadership in Energy and Environmental Design (LEED), the participant will be able to describe the LEED green building rating system for commercial buildings.
- By comparing the previous version of LEED (LEED 2.2) with the most recent one (LEED 2009), the participant will be able to identify the key changes in LEED 2009 that affect the design and construction, or major renovation, of commercial buildings.
- Using the LEED green building rating system, the participant will be able to determine how light controls and their manufacturer can effectively contribute to LEED certification in new construction and major renovation projects.
- Through examination of the provided case study, the participant will be able to describe how the Plaza at PPL Center used lighting controls to meet LEED certification objectives.


What is LEED?

- LEED—Leadership in Energy and Environmental Design
- A leading-edge system for certifying the greenest performing buildings in the world
- Started in 1998 and administered by the United States Green Building Council (USGBC).
- Current version is LEED v3.0

LEED® Facts	
[Your Project Here] [City, State, County]	
LEED for New Construction	
Platinum	110*
 Sustainable Sites	26
 Water Efficiency	10
 Energy & Atmosphere	35
 Materials & Resources	14
 Indoor Environmental Quality	15
<i>*Out of a possible 100 points + 10 bonus points</i>	
 Innovation & Design	6
 Regional Priority	4

LEED Credit Categories

- Sustainable Sites (SS)
- Water Efficiency (WE)
- Energy and Atmosphere (EA)
- Materials and Resources (MR)
- Indoor Environmental Quality (IEQ)
- Innovation in Design (ID)
- Regional Priority (RP)

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What is LEED v3.0?

- New LEED 2009 rating system (point-based green building rating system) +
- New LEED AP exams (exams for people to become LEED Accredited Professionals) +
- New LEED online (primary resource for managing the LEED documentation process; www.leedonline.com)

Light control and LEED



LEED-NC[®]

Green Building Rating System
For New Construction & Major Renovations

Version 2009

3 Key Changes in LEED 2009

1. Credit weighting:

- More emphasis on Energy and Atmosphere.

2. Updated credits:

- Additional innovation and design point
- ASHRAE 90.1 2007 is now the baseline
- 10% minimum energy performance improvement

3. Regional Priority Credits (RPCs):

- Bonus points for achieving the credits that are deemed to be a priority for a particular region

LEED NC 2009 vs. LEED NC 2.2

Previous version

Current version

LEED Point Structure Comparison

Description	LEED NC 2.2		LEED NC 2009		Difference in %
	Possible Pts	% of Total Pts	Possible Pts	% of Total Pts	
Sustainable Sites (SS)	14	20.29	26	23.64	3.35
Water Efficiency (WE)	5	7.25	10	9.09	1.84
Energy and Atmosphere (EA)	17	24.64	35	31.82	7.18
Material & Resources (MR)	13	18.84	14	12.73	-6.11
Indoor Environmental Quality (IEQ)	15	21.74	15	13.64	-8.10
Bonus Points					
Innovative Design (ID)	5	7.25	6	5.45	-1.79
Regional Priority (RP)	0	0	4	3.64	3.64
Totals	69	100	110	100	

LEED NC Certification Point Requirements

LEED NC 2.2

LEED NC 2009

Level	Lower Limit	Upper Limit	Lower Limit	Upper Limit
Certified	26	32	40	49
Silver	33	38	50	59
Gold	39	51	60	79
Platinum	52	69	80	110



Light Control Impacts these LEED® Categories and Credits

Category	Credit
Sustainable Sites	<ul style="list-style-type: none">• Light Pollution Reduction
Energy & Atmosphere	<ul style="list-style-type: none">• Commissioning• Energy Performance• Measurement and Verification
Materials & Resources	<ul style="list-style-type: none">• Recycled Content
Indoor Environmental Quality	<ul style="list-style-type: none">• Controllability of Systems• Daylight & Views
Innovation in Design	<ul style="list-style-type: none">• Innovation in Design and LEED AP
Regional Priority	<ul style="list-style-type: none">• Varies by zip code

Sustainable Sites

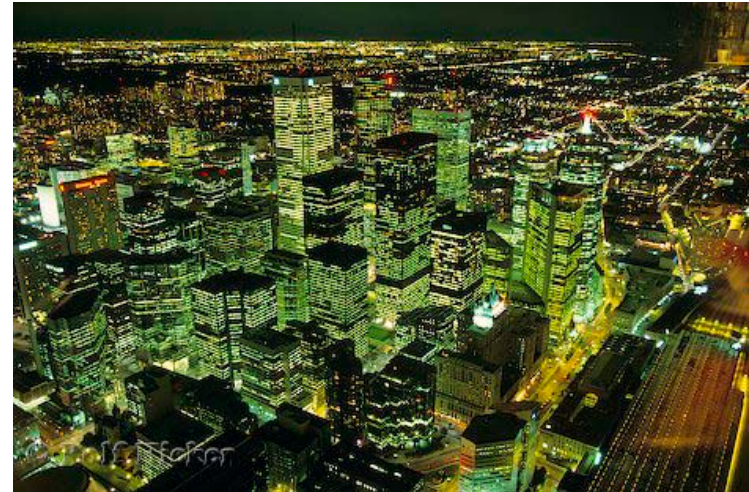
Credit 8: Light Pollution Reduction (1 point)

Intent:

- Minimize light trespass

Requirements:

- Interior lighting—No light shining out windows OR all non-emergency interior lighting power reduced by at least 50% during non-business hours
- Exterior lighting—Must comply with ASHRAE 90.1 2007 Lighting Power Densities and lighting zone requirements in IESNA RP 33.



Sustainable Sites

Credit 8: Light Pollution Reduction (1 point)

Light control solutions:

- Controllable window shades to prevent light from escaping on the windows
- Occupancy sensors turn lights off when spaces are vacant
- Timeclock scheduling can be used to provide a building lighting sweep at night so that lights are off or set to a low dimmed level at certain times



Energy and Atmosphere

Prereq 1 and Credit 3: Commissioning (2 points)

Intent:

- Verify that building operates as intended (Prereq 1)
- Begin commissioning early and execute additional activities (Credit 3)



Requirements:

- Develop and implement commissioning plan
- Develop a systems manual
- Verify that the training requirements for operating personal are in place
- Review building performance within 10 months of substantial completion

Energy and Atmosphere

Prereq 1 and Credit 3: Commissioning (2 points)

Light control solutions (manufacturer services):

- Commissioning and calibration
- Operations manual
- Customer training
- Service contracts over life of building
- Lighting energy audits and system optimization



Energy and Atmosphere

Prereq 2: Minimum Energy Performance

Intent:

- Establish minimum level of energy efficiency

Requirement:

- Comply with mandatory lighting control requirements in section 9.4 of ASHRAE 90.1 2007.
- Demonstrate a 10% minimum energy reduction compared to an ASHRAE 90.1 2007 (or CA Title 24 2005) compliant building.



Energy and Atmosphere

Prereq 2: Min Energy Performance

ASHRAE 90.1 2007 section 9.4 requirements:

- Automatic lighting shut-off
- Space control

Light control solutions:

- Switching system with time clocks
- Local wallbox override controls
- Occupancy sensors



Energy and Atmosphere

Prereq 2: Minimum Energy Performance --
beating ASHRAE 90.1 2007 baseline building by
at least 10% (5% for existing buildings)

Light control solutions:

- Occupancy sensing
- Scheduling
- Daylight harvesting
- Dimming/personal light control
- Light level tuning
- High-end trim
- Automated shading



Energy and Atmosphere

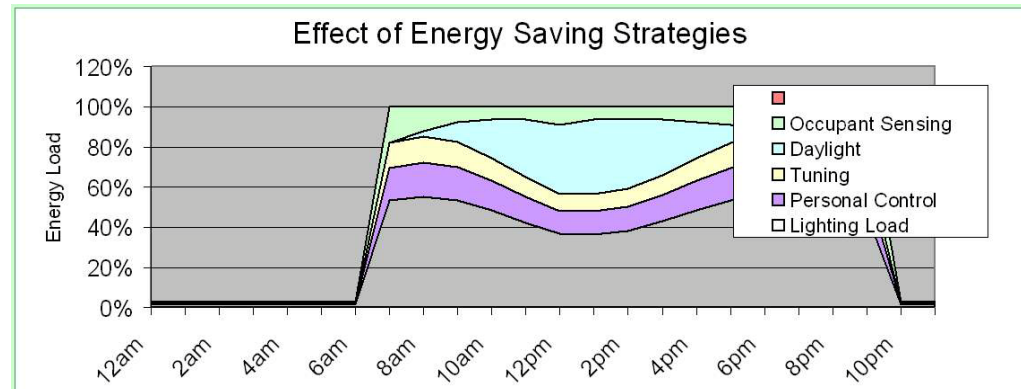
Credit 1: Optimize Energy Performance (1 to 19 points)

Intent:

- Further reduce energy use below the ASHRAE 90.1 baseline

Requirements:

- Option 1 - Whole Building Energy Simulation (1-19 points)
- Option 2 – Prescriptive path -ASHRAE Advanced Energy Design Guides (1 point)
- Option 3 – Prescriptive path -Advanced Buildings Core Performance Guide (1-3 points)

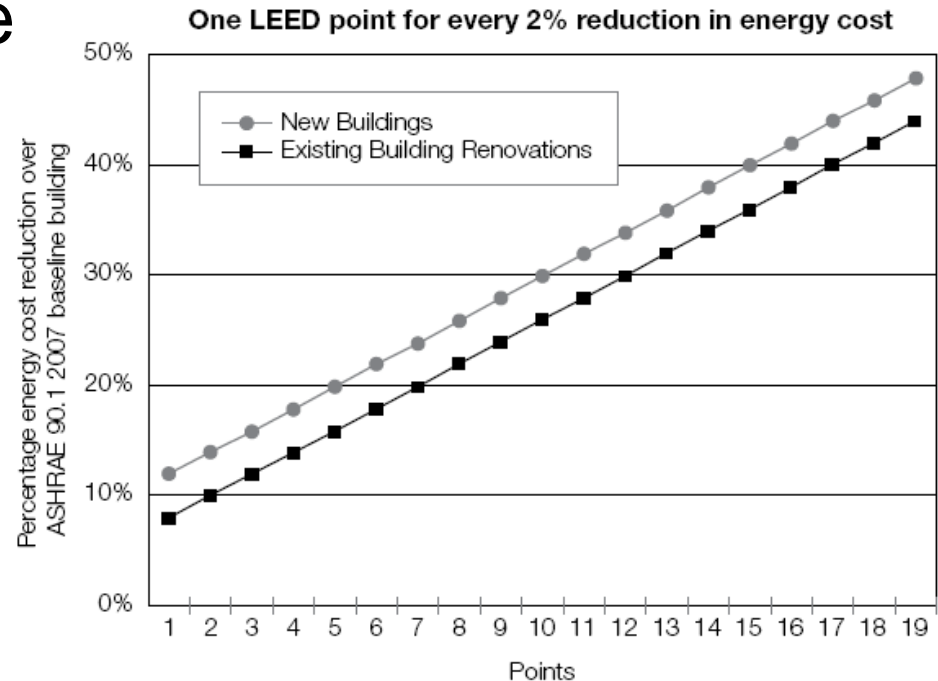


Energy and Atmosphere

Credit 1: Optimize Energy Performance (1 to 19 points)

Requirements:

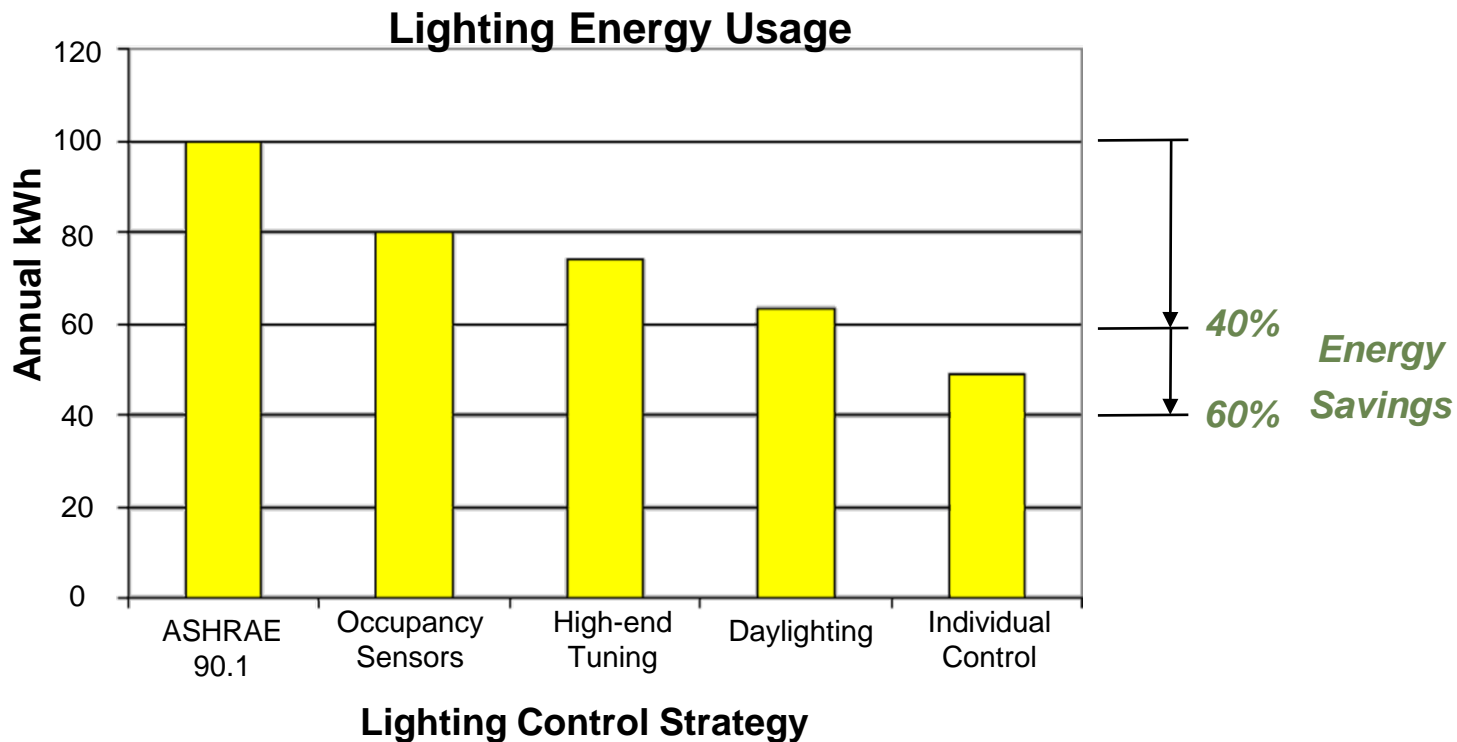
- Whole Building Energy Simulation - demonstrate energy performance better than ASHRAE 90.1
- One point for every 2% reduction in energy cost (see graph)



Energy and Atmosphere

Credit 1: Optimize Energy Performance

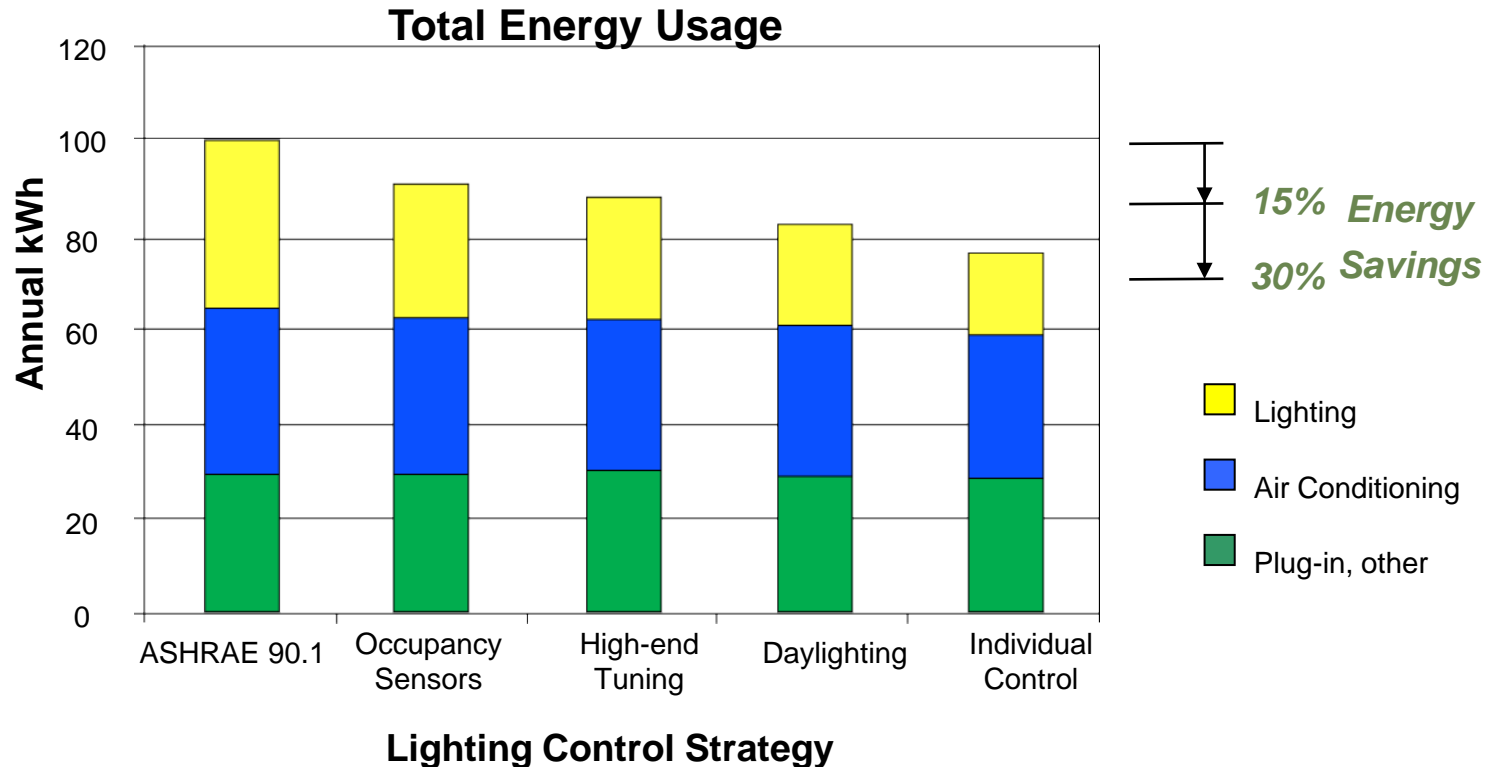
Light control solutions:



Energy and Atmosphere

Credit 1: Optimize Energy Performance

Light control solutions:



Energy and Atmosphere

Credit 5: Measurement and verification (3 points)

Intent:

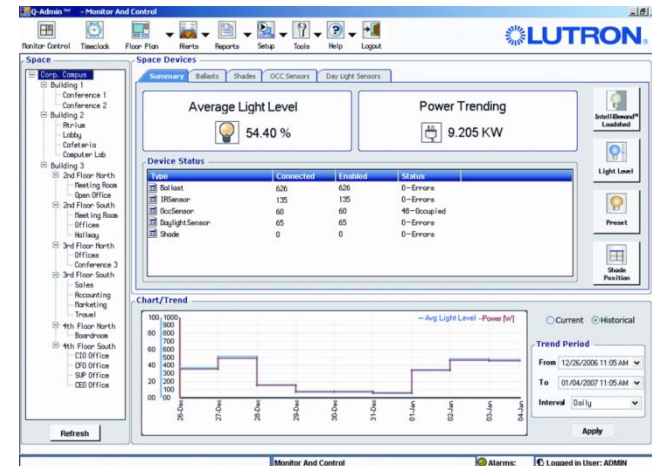
- Provide ongoing accountability and optimization of energy consumption over time

Requirements:

- Measure and track actual energy performance
- Provide corrective action if desired savings are not achieved

Light control solution:

- Centralized lighting control system with monitoring capability
- Integration with Building Management System



Material & Resources

Credit 4: Recycled Content (1-2 points)

Intent:

- Increase demand for building products that incorporate recycled materials.

Requirements:

- Use materials such that the sum of the recycled content constitutes at least 10% or 20%, based on cost, of the total value of the materials cost in the project.

Light control solution:

- Controllable windows shades with recycled fabric



Indoor Environmental Quality

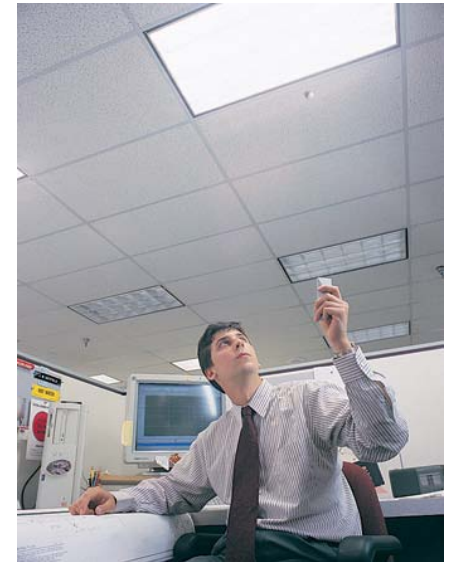
Credit 6.1: Controllability of Systems, Lighting (1 point)

Intent:

- Provide lighting system control by individual occupants or groups to promote productivity, comfort and well-being

Requirements:

- Individual controls for 90% of occupants
- Lighting controls in shared, multi-occupant spaces
- Enable lighting adjustment to meet needs and preferences



Indoor Environmental Quality

Credit 6.1: Controllability of Systems, Lighting (1 point)

Light Control Solutions:

- Task lighting
- Local wall box controls
- Handheld remotes
- PC integrated control
- Architectural lighting controls
- Remote and/or AV integrated controls



Indoor Environmental Quality

Credit 8.1 & 8.2: Daylight and Views (1 point each)

Intent:

- Introduce daylight and views into occupied areas to provide a connection to the outdoors

Requirements:

- 75% of occupied spaces daylight illuminated with a minimum of 25 foot-candles
- Direct line-of-site to the outdoors, 90% of occupants
- Provide glare control

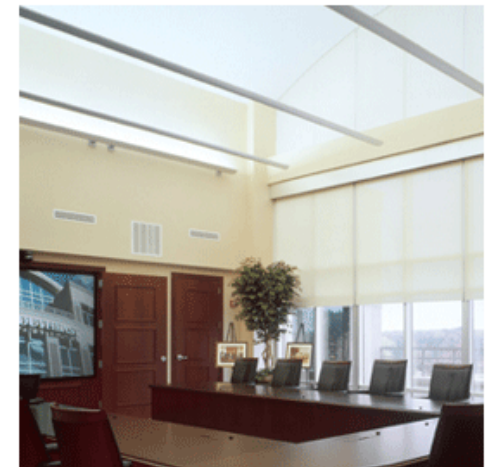


Indoor Environmental Quality

Credit 8.1 & 8.2: Daylight and Views (1 point each)

Light control solutions:

- Passive control, structural design
- Automated window treatments



Innovation in Design

Credits 1: Innovation in Design (1-5 points)

Intent:

- Award points for exceptional or innovative performance above requirements

Requirements:

- Exemplary performance OR
- Innovative design

Opportunities:

- Individual control and energy performance
- Daylight and views
- Green education

Innovation in Design

Credits:

- Optimizing Energy Performance
- Controllability of Lighting System

Light Control Solution:

- Personal lighting control of overhead ambient light



Innovation in Design

Credits:

- Indoor Environmental Quality -- Daylight and Views

Light Control Solution:

- Solar-adaptive shading -- automatically adjust to block sun glare while preserving the view

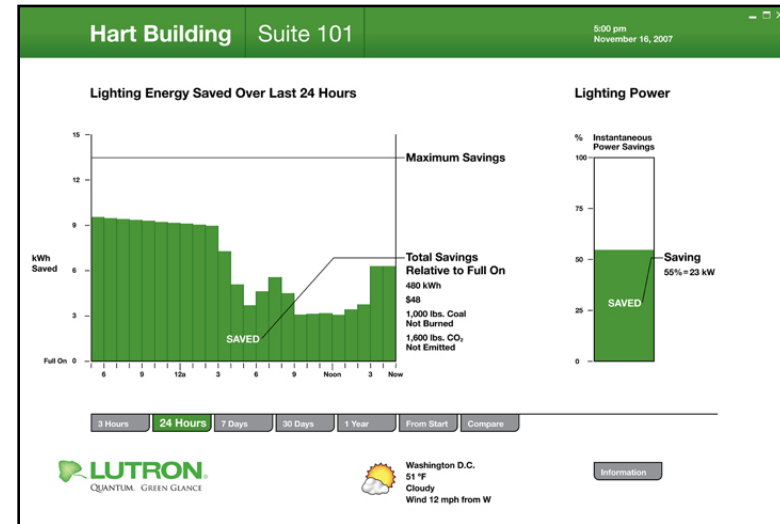


Innovation in Design

Green education

Light control solution:

- Public display of energy savings and other green features of the building
- For entire building and individual spaces
- Also need:
 - Distributed project case study
 - Building tours



Innovation in Design

Credits 2: LEED Accredited Professional
(1 point)

Intent:

- Support and encourage the design integration required by LEED to streamline the application and certification process

Requirements:

- At least 1 principal participant of the project team must be a LEED AP

Light control solution:

- Use LEED APs on staff with the light control manufacturer to help with the LEED rating system

The Plaza at PPL Center

Overview:

- Allentown, PA
- 280,000 ft²
- Corporate headquarters
- LEED® Gold certification
- Green drivers:
 - LEED rating for marketing and public image
 - Reduced energy consumption; return on investment



Architect: Robert A. M. Stern

Consulting Environmental Designers and
Engineers: Atelier Ten, NY, NY

The Plaza at PPL Center

Low Energy Design Features:

- South Façade sun screening
 - 3' deep louvers at every level
 - High performance solar control glass
- Thermal control glass on north facades
- Heat recovery ventilation
- Optimized HVAC systems with variable speed drives
- Occupant and daylight responsive lighting controls
- 30% improvement over ASHRAE 90.1



The Plaza at PPL Center

Advanced lighting controls:

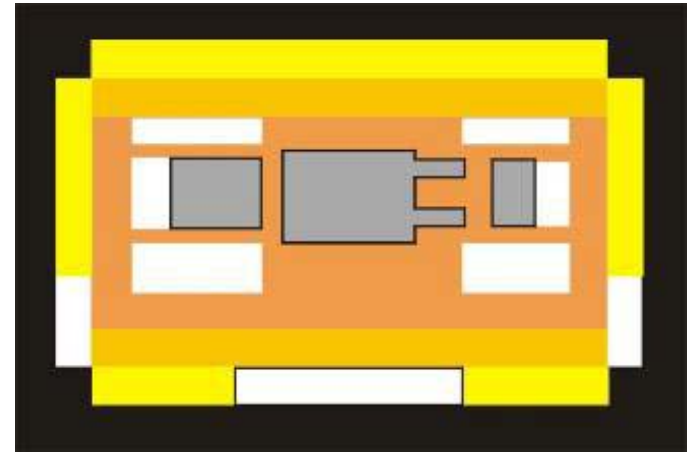
- Open plan office areas
 - South & North open office areas divided into three control zones:
 - Perimeter (15' from façade)
 - Middle (15-30' from façade)
 - Interior (30' to core)



Perimeter and Middle zones have dedicated daylighting controls to set electric light levels based on available daylight.



Interior zone has only central on/off time clock control.

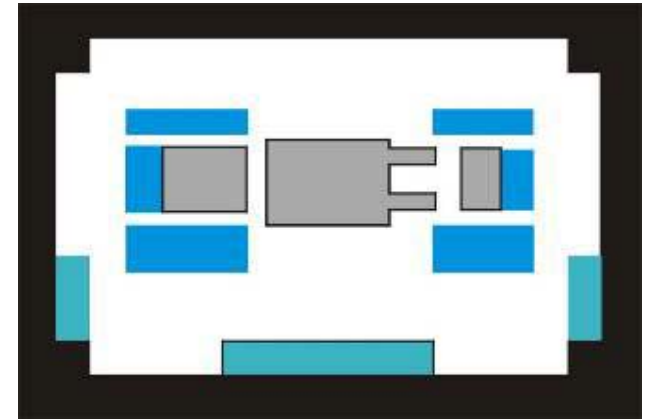


The Plaza at PPL Center

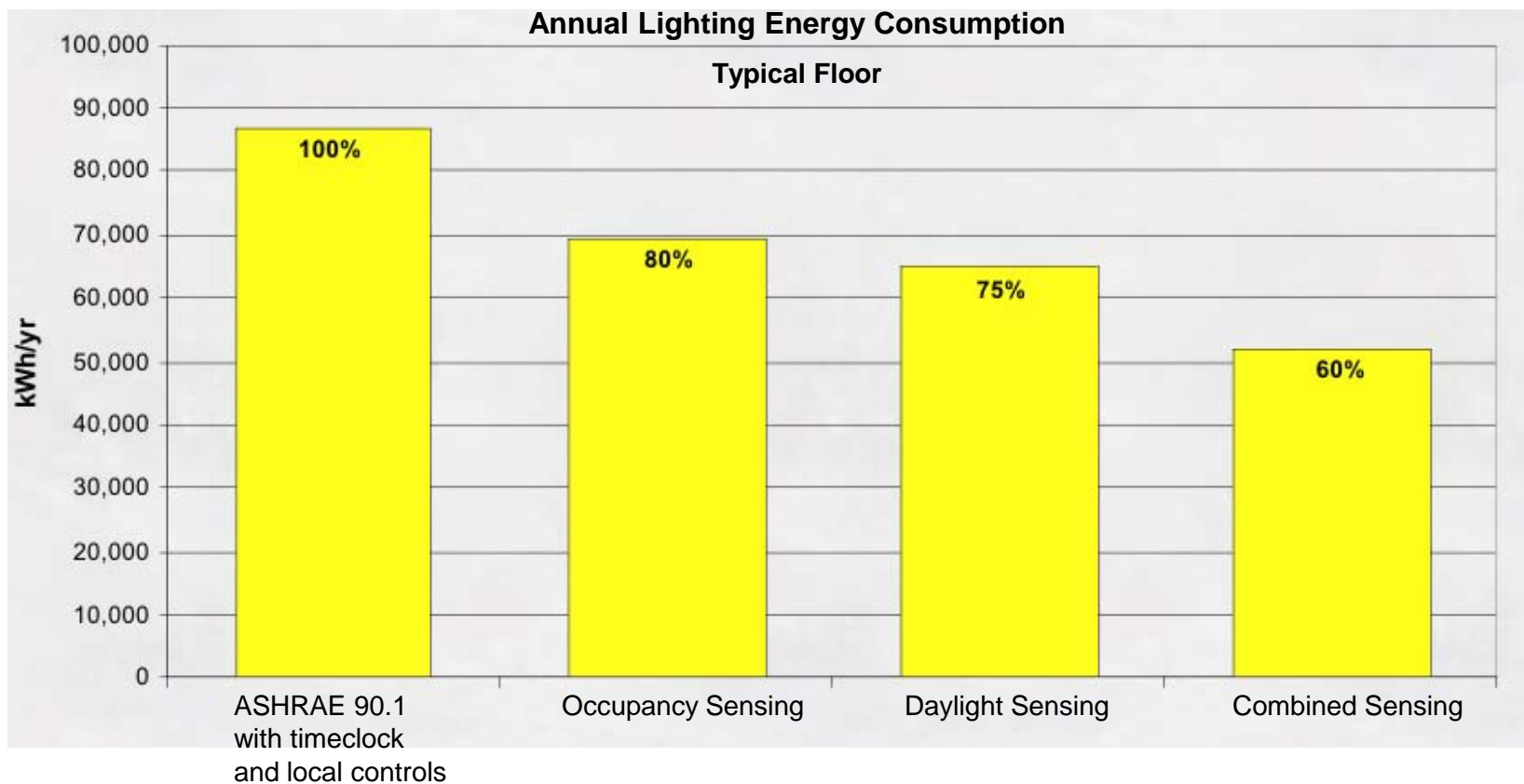
Advanced lighting controls:

- Perimeter offices, conference rooms
 - Vacancy switches/sensors to switch lights on/off
 - Daylight sensor to set electric light levels based on available daylight

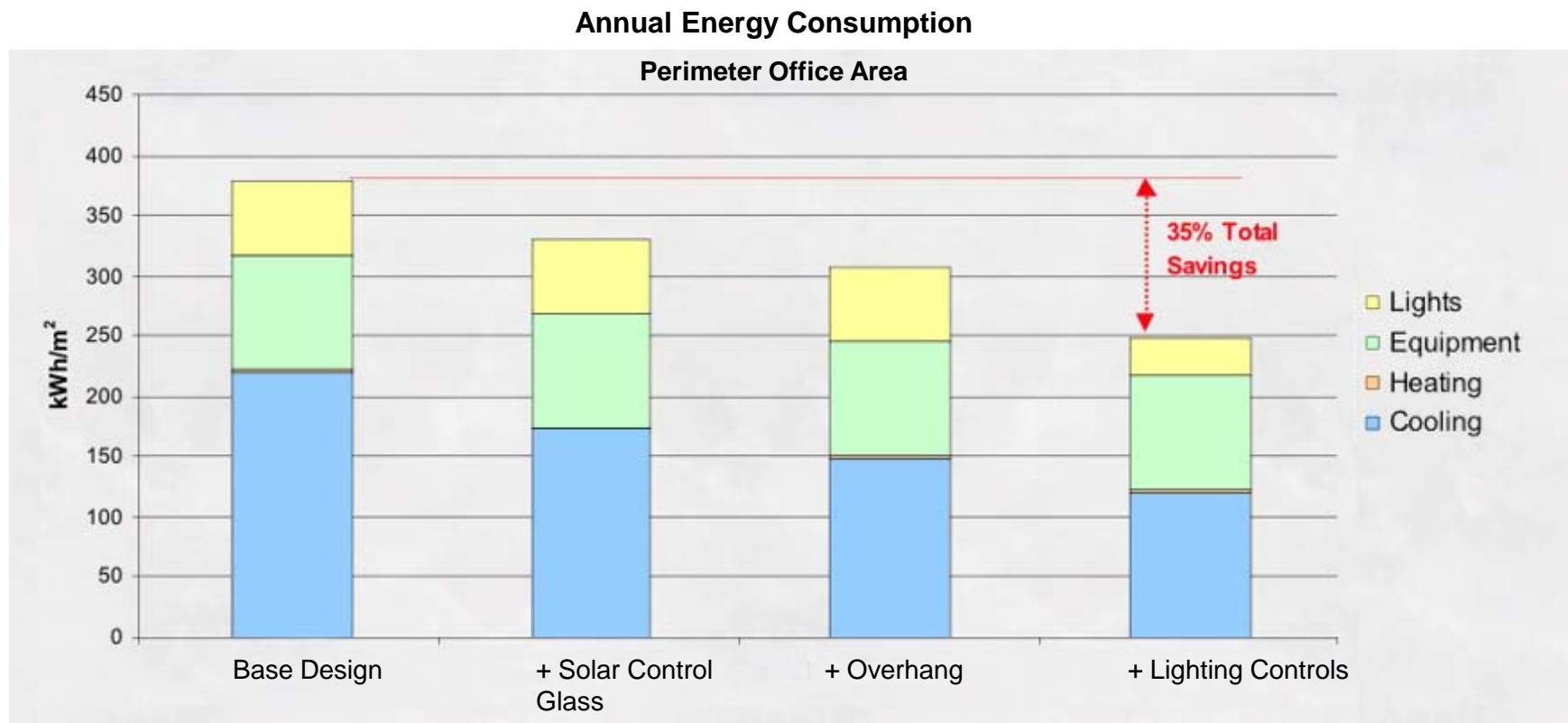
- Interior offices, copy rooms, restrooms
 - Vacancy switches/sensors to switch lights on/off



Lighting Energy Savings



Total Energy Savings



Summary

Light control and their manufacturer's services provide solutions that contribute to 40 of the 110 possible points in LEED NC.

- Reducing light pollution (1 point)
- Commissioning (2 points)
- Optimizing energy performance (1-19 points)
- Enhancing measurement and verification (3 points)
- Recycled content (1-2 points)
- Increasing controllability of systems (1 point)
- Accommodating daylight design and views (2 points)
- Providing innovation in design (Up to 5 points)
- Using a LEED AP on the project (1 point)
- Regional priority points (1-4 points)