Advanced Lighting Control for High Building Performance

Better Buildings by Design

Kandice Castellino | February 2014 | Burlington, VT

Why Advanced Lighting Controls?

- Greater energy savings potential versus traditional lighting efficient techniques
- Incorporates all six lighting control strategies to work in concert
- Software based advanced lighting controls provide:
  - Complete snapshot of your building's lighting energy usage in a multi-floor view
  - Advanced energy reporting features to identify lighting inefficiencies and demonstrate energy savings
- Contributes up to 19 points toward LEED® certification
- Overall, improves comfort for building occupants, leading to an increase in satisfaction and work productivity

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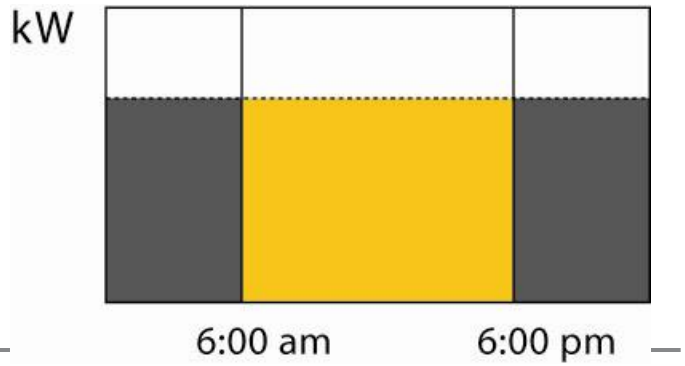
Six Control Strategies

64% average energy savings attaining through six strategies, synergies and deep commissioning

Energy Management Strategies

SMART TIME SCHEDULING

- Light scheduling configurable by floor, department, room, zone or even a light fixture
- Lighting schedules are automatically extended in the event that after hours occupancy is detected via the “virtual occupancy sensor” feature (detects PC activity)
- Office occupancy can override to keep hallways lit at night
- Easy to use drag & drop calendar
- Built on Microsoft Outlook platform
- Possible savings: 10-30%



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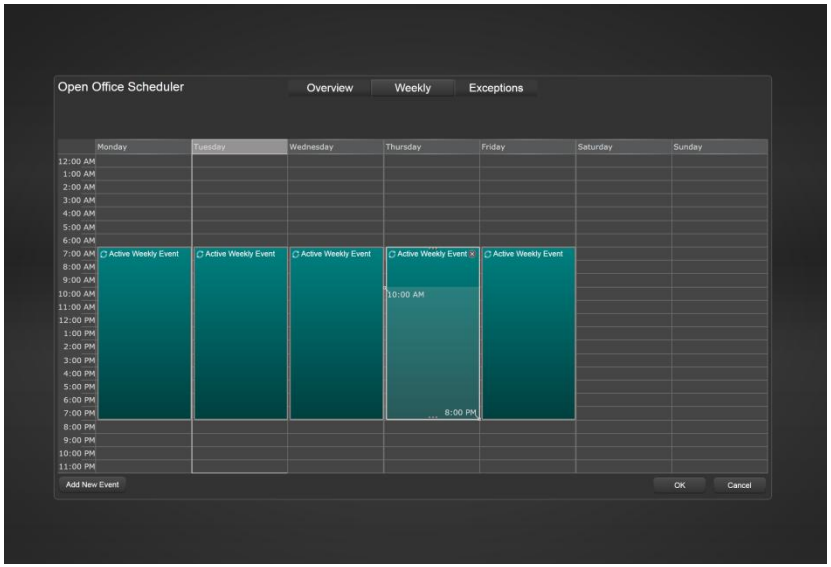
Software

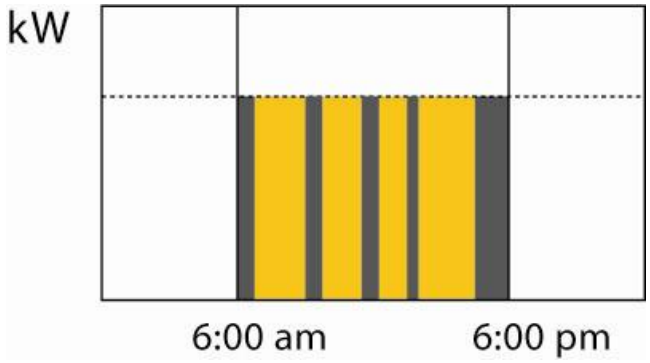
Time Scheduling



Energy Management Strategies

OCCUPANCY CONTROL

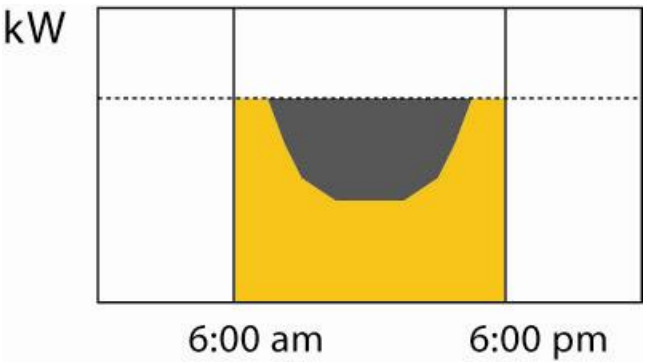
- Lights are automatically turned on or off based on occupancy detection (independent of electrical circuiting)
- Association of sensors to fixtures via software
  - Allows for overlapping and support zones
  - Reconfigure without rewiring
- Occupancy signal can switch or dim lights – bi-level for stairs and corridors
- Share real time occupancy data with HVAC systems
- Possible savings: 15-90%



Energy Management Strategies

DAYLIGHT HARVESTING

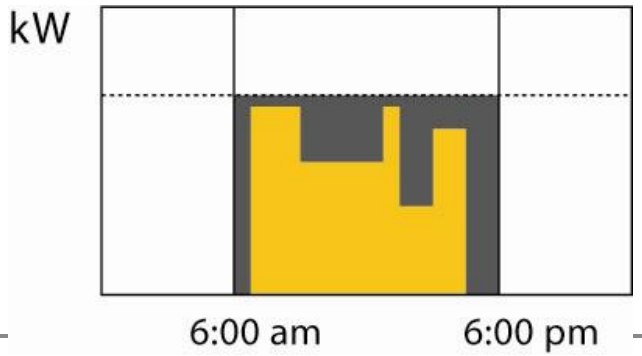
- Lighting levels are automatically adjusted to take into account ambient natural sunlight through windows or skylights
- Level of daylight harvesting varies based on proximity of fixture to window
- Association of sensors to fixtures via software
- Reconfigure without rewiring.
- Adjust aggressiveness with software
- Possible savings: 35-60%



Energy Management Strategies

PERSONAL CONTROL

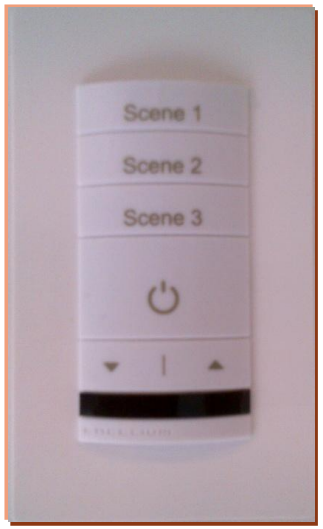
- Occupants can control light levels in their workspace from their PC, create personal presets for reading, computer work, meetings, etc.
- Each light fixture can be dimmed or turned off individually allowing users ultimate flexibility in setting preferred light levels
- PC is used as secondary form of occupancy sensor
- Significant contributor to energy savings as most users dim lights below default light levels
- Possible savings: 5-20%



Energy Management System Hardware

Three-Scene Dimming Control Wall Station

- Recall of three scenes per zone, ON/OFF functionality and manual dimming
- More scenes allowable with multi-scene configurations



Three-Zone Control Wall Station

- Manual switching lighting controller that provides local ON/OFF control over three lighting zones.

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Personal Control Software

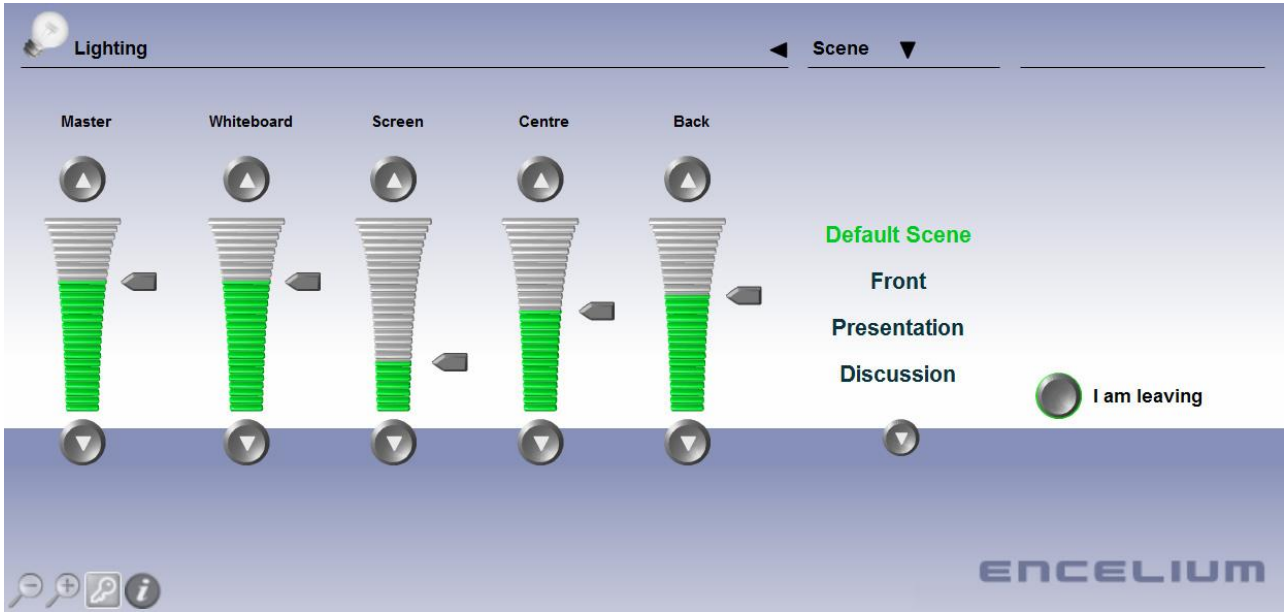
Personal Control Software

- Available to each occupant in a building to control lighting in their workspace
- Allows dimming, on/off control and pre-set scene selection
- Can be configured as PC based software application or via web browser interface
- Also can be used to control light levels in larger spaces, such as boardrooms, conference rooms or auditoriums

Personal Control Software

Personal Control Settings

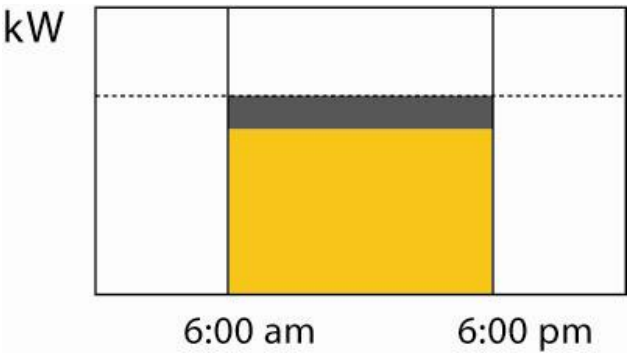
- Sampling of 36 private offices
- 7.61% Savings over 720 users
- Voluntary energy savings and greater employee comfort
- At $500 per sq ft, how much is it worth?



Energy Management Strategies

TASK TUNING

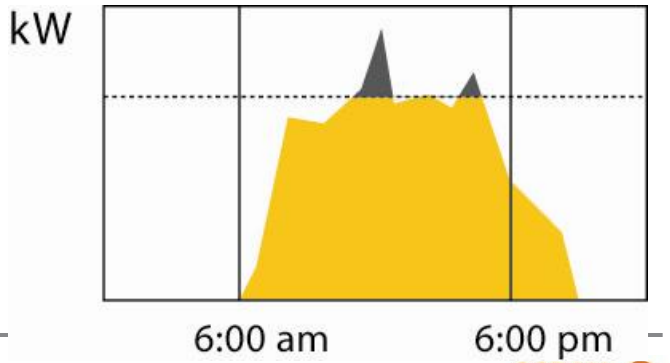
- Requires dimming AND advanced control system
- Without Task Tuning, lights are set at 100% light output 100% of the time
- Set light levels to suit the area or task to the “new 100%”
- Light levels are “tuned” by individual fixture throughout a facility (through dimming or addressable switching) to meet required light levels
- Save $ when the lights are ON
- Possible savings: 5-10%



Energy Management Strategies

VARIABLE LOAD SHEDDING

- Requires dimming AND advanced control system
- Your customers are paying big dollars in peak demand charges
- System automatically executes load shedding to reduce demand peaks or to meet specific demand response goals
- Lights are dimmed selectively by lowest priority areas first
- Sheds load in a manner that is transparent to occupants (i.e., configurable fade rate)
- Responds to a demand meter, a utility demand response signal, or a signal from building or energy management systems



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Energy Management System Overview

Six energy management strategies seamlessly integrated

Energy Management Strategies	Lighting energy savings due to Addressable Lighting Controls				Average Savings by Strategy *
	Multi-Tenant office bldg 300K ft^2	HQ of Fortune 100 firm 400K ft^2	Hospital Admin Building 175K ft^2	Major sports complex 1.3 M ft^2	
Smart Time scheduling	13.91%	8.91%	22.2%	24.01%	15 - 25%
Daylight Harvesting	0.60%	3.96%	8.15%	3.4%	20 - 50%
Task Tuning	9.0%	10.95%	13.24%	5.32%	10 - 25%
Occupancy Control	31.3%	24.94%	25.38%	37.21%	20 - 43%
Personal Control	6.12%	10.64%	1.8%	2.1%	7 - 23%
Variable Load Control	0.03%	4.65%	3.2%	5.1%	0 - 5%
Cumulative Savings due to Addressable Lighting Controls	60.96%	64.05%	73.97%	77.14%	

Consumption Savings & Demand Reduction

Analysis for 1st Encelium Place

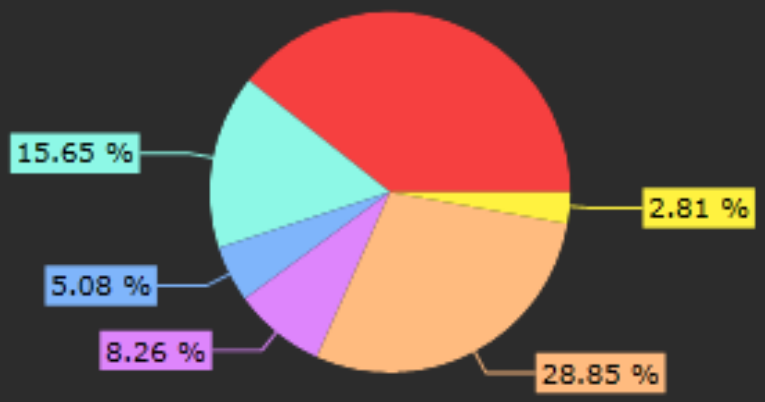
eptember, 2011 | October, 2011 | November, 2011 | December, 2011 | January, 2012 | February, 20

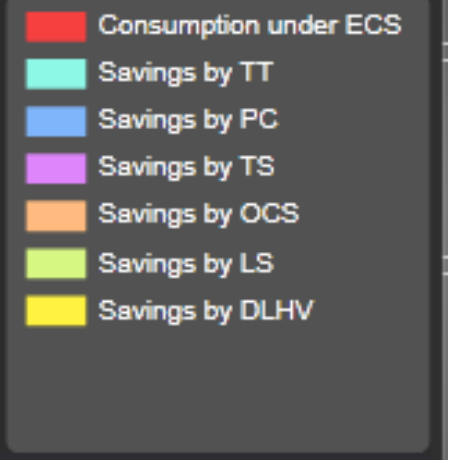
Quarter 4, 2011 | Quarter 1, 2012

Unit: % | Energy price: 0.25 $/kWh | Demand price: 4 $/kW | ✓ Split by strategy | Update Chart

Consumption Savings and Demand Reduction by strategy
compared to pre ECS installation, averaged over 2011-09-05 to 2012-02-19

Consumption Savings





Demand Reduction

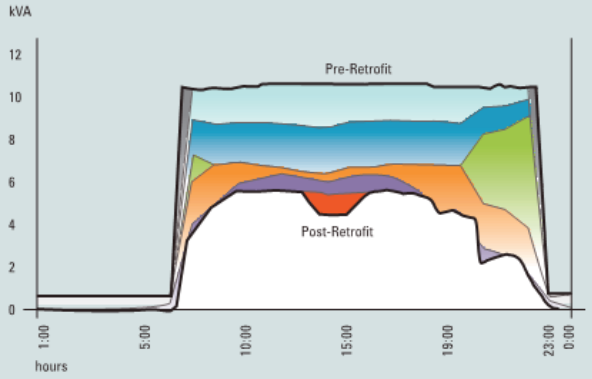
System Capabilities

- Look for systems that are capable of switching or dimming light loads
- Look for systems that are capable of individual fixture control or zone control to meet end user budget
- Look for systems that offer the ability to control any lighting load including traditional (fluorescent, HID, induction, etc) or SSL (LED)
- Energy reporting capability is critical!

CONTRIBUTION OF SIX STRATEGIES TO ENERGY SAVINGS

The graph on the right illustrates how each of these 6 strategies contribute to overall building energy savings and the combined impact on lighting energy consumption (actual results taken from an Encelium retrofit project – Toronto, Canada).

- TASK TUNING
- PERSONAL CONTROL
- SMART TIME SCHEDULING
- OCCUPANCY CONTROL
- DAYLIGHT HARVESTING
- VARIABLE LOAD SHEDDING



Colored areas between the respective load profiles (Pre-retrofit and Post-retrofit) represent typical energy savings from each strategy over a 24 hour period, averaged over 1 hour intervals.

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Traditional Lighting

Including Fluorescent and HID Lamps and Ballasts

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Solid State Lighting (LED)

LED Retrofits

TLED

LED Luminaires

LED Technology

LEDs will make up 70% of the global lighting market by 2020*

- Lower energy usage and larger life spans contribute to significantly lower operational costs
- LEDs may be able to replace all other types of light fixtures
- **LEDs are continuously becoming dimmable out-of-the-box**
  - Will decrease incremental costs of implementing lighting controls

**McKinsey & Company – Lighting the Way: perspectives on the global lighting market Second Edition/August 2012*

NEMA SSL 7A-2013:
LED Lamp and Dimmer Compatibility Standard

Standard for phase-cut dimming of LED lamps & light engines

Phase-cut is most popular type of dimmer

- Low cost to manufacture
- Low cost to install: uses the same wires for both power and control

Developed by NEMA and **published April 2013**
www.nema.org/Standards/Pages/Phase-Cut-Dimming-for-Solid-State-Lighting-Basic-Compatibility.aspx

Global: 50/60 Hz, 100/120/230/277 Vac

Forward-looking

- for new dimmers and lamps
- not intended for the installed base of incandescent dimmers, which are covered by NEMA SSL 6

7A covers basic compatibility and safety but *does not cover performance*

7B will address performance issues including flicker, noise, wide dimming range, etc.

Thank you for your attention.

For more information, contact:

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