



Energy Controls at the USGBC Headquarters, Washington D.C.

Photo Credit: Eric Laignel

Prepared by Dane Sanders, Clanton & Associates



CONVIA[®]
A HERMAN MILLER COMPANY



Lighting Control Capabilities:

- Daylight Dimming
- Occupancy Sensing
- Manual-On / Auto-Off (Daytime)
- Auto-On / Auto-Off (Nighttime)
- Time of Day Control
- Extended Night Views
- HVAC Occupancy Setback
- Intuitive Manual Dimming
- Preset Lighting Scenes
- Small Dimming Zones
- Energy Monitoring Dashboard
- Audio / Visual Interface
- Conference Room Partitioning
- Load Shed Priority Dimming
- Plug Load Control



GENERAL LIGHTING CONTROLS DESCRIPTION

As the leading organization in the green building movement, the U.S. Green Building Council set very high goals for their new office headquarters. Since lighting consumes approximately 40% of the energy in a typical office building, the lighting control system was instrumental in achieving USGBC's lofty goals. The target energy use was set at 50% below ASHRAE 90.1 2004. In addition to aggressive energy reduction, the lighting system must also provide comfortable, high quality lighting and manual lighting control for small groups and individuals. The lighting controls had to integrate automated energy saving strategies with intuitive, easy-to-use manual controls. The system had to be capable of displaying continual energy use data for educational and verification purposes, integrated control for HVAC set-backs and plug load shedding based on occupancy. Only a few lighting control systems were capable of meeting these demanding goals. Convia was chosen for their ability to meet all of the technical requirements, and for their responsiveness and dedicated service to the project.

LIGHTING CONTROL FOR A COMFORTABLE, HIGH-PERFORMANCE WORKPLACE

- **Layers of Light:** Multiple layers of light create a visually comfortable and stimulating office environment. Controlling ambient, task and accent lighting layers independently allows for variety and multiple lighting moods. Combining low-glare daylight with soft direct / indirect ambient lighting provides a bright and comfortable workplace. Task lights located at each desk allows individual control and adjustment of localized light. Accent lighting on graphics and walls adds vibrancy and balances brightness from the windows.
- **Personal Interaction:** Some people prefer bright lighting, while others prefer darker areas. Individual lighting control can improve employee satisfaction and may even reduce instances of migraine headaches.
- **Time of Day:** The cycle of daylight provides variation of brightness and color throughout the day. These changes in light provide visual signals that give people a sense of time and reset their biological circadian cycle. Daylight dimming that slowly and almost imperceptibly adjusts along with the daylight reinforces the natural rhythm of light.
- **Extended Night Views:** At night, most occupancy sensor controls would turn off all lighting, isolating an occupied office in an island of light surrounded by darkness and creating an uncomfortable atmosphere with limited view. With the Convia control system, at night occupancy sensors can illuminate an adjacent open office area and the interior walls, thereby extending views and creating an improved sense of security.



LIGHTING CONTROL FOR AGGRESSIVE ENERGY EFFICIENCY

- Occupancy Sensors:** In the Convia system, sensors can trigger multiple devices or events. Sharing occupancy data on the control network enables integration with HVAC and security systems and allows the occupancy response to change depending on time of day. When offices are unoccupied, lights turn off automatically and the thermostat set-point automatically changes to reduce heating and cooling energy. During the day the lighting responds with manual-on / auto-off operation to encourage users to keep lights off when there is enough daylight. At night, lighting in open office areas turns on automatically to provide an illuminated path when there is no daylight.
- Daylight Dimming:** Convia provides adjustable daylight dimming response to create a smooth dimming transition as daylight changes throughout the day which is essential to avoid distracting employees. An override for daylight dimming is programmed to give users ultimate control of their space.
- Lumen Maintenance Dimming:** Using the photo sensors at night to provide the target light level allows a new lighting system to be dimmed, and will automatically balance the light level throughout the lifetime of the lighting system.
- Load Shedding:** More and more utilities are providing, or are considering, Demand Side Management programs that offer rebates for shedding loads during peak demand events. With Convia, priorities can be assigned to dim lighting in low priority areas during peak load events. These Demand Side Management programs can result in significant reduction of energy bills, putting money back in the Owner's pocket.
- Energy Dashboard:** A graphical, interactive display in the lobby provides real-time energy use feedback for employees, visitors, and facility managers to learn how and where the energy is being used in the building. This will help educate the users on how they can play an active role in saving energy and will highlight areas that need improvement.
- Plug Load Control:** Each office space has one outlet that is controlled by an occupancy sensor for controlling personal plug loads, such as task lights, laptop computers, and other electronics with stand-by power or transformers with trickle power. The resulting energy reduction of this strategy at the USGBC Headquarters will be evaluated in a follow-up case study.

COMPARING ENERGY USE AT THE HEADQUARTERS VERSUS THE 90.1 ASHRAE BASELINE

	Open Offices	Private Offices	Conference Rooms	Reception & Lobby	Cafe & Kitchenettes
Baseline					
-10%					
-20%					
-30%				32%	
-40%		49%			
-50%	60%				
-60%					
-70%			71%		
-80%					80%
-90%					
-100%					

CONVIA® Lighting Controls: USGBC Headquarters



Phase 1 Case Study: Design & Preliminary Energy Evaluation

Accent Light

Translucent images of nature glow with backlight from the ambient lighting and daylight, providing brightness and visual interest with no additional lighting.



Task Light

LED task lights at each workstation provide individualized lighting control.

- 6 watts,
- 75 Footcandles
- Fully adjustable and dimmable.



Illuminating the bright white ceiling creates a bright workspace with soft, low-glare light. The direct, downward light provides brightness and clarity to the workstations.

- 25-30 Footcandles on desks
- 0.45 Watts/Sqft



Photo Credit: Eric Laignel

Ambient Light

Light colored carpet around the perimeter reflects sunlight to the ceiling, providing a soft brightness to the open offices. Mesh roller shades automatically adjust to shade sunlight from the workstations.



Daylight



Photo Credit: Eric Laignel

TASK LIGHT & CONTROLLED PLUG LOADS

- Each workstation has a controlled outlet and a non-controlled outlet. Task lights, lap-top computers, and other personal electronics can be plugged into the controlled outlet which will automatically turn off when the occupancy sensors time-out in each Open Office cluster. The task lights also have an on-board switch to allow local control for each workstation.

AMBIENT LIGHTING

- Daytime Operation (activated at 30 minutes after sunrise): During the day, Ambient Lighting must be turned on manually using the switch located on a nearby column. This manual operation is to encourage users to keep the ambient lighting turned off if there is enough daylight in the space. Each switch has two buttons, and each button has two functions.



Wall Switches

Click Once: Turns Lights On & Activates Daylight Dimming

Push & Hold: Brightens Lights & Disables Daylight Dimming

Click Once: Turns Lights Off

Push & Hold: Dims Lights & Disables Daylight Dimming



Occupancy Sensors

When an Open Office Area has been vacated for a certain time period, the lights will turn off automatically.

Day: Manual-On/Auto-Off

Night: Auto-On/Auto-Off



Daylight Dimming

When daylight dimming is activated, the dimmers respond to input from a photo sensor to maintain 25 foot candles on the desk tops.

▪ **Nighttime Operation: (Activated 30 minutes before sunset).** At night, the Ambient Lighting will automatically turn on when motion is sensed by the occupancy sensors. This automatic operation will allow users to walk through the space to their office without having to manually turn lights on. Once a person settles into their workspace, the occupancy sensors in their area will maintain a low level of lighting in an adjacent Open Office. This provides a more comfortable setting for working at night than localized occupancy sensors that would leave the surrounding areas dark.

LIGHTING ENERGY USE

- **ASHRAE 90.1 2004 Allows:** 1.10 W/SF
- **Installed Lighting Power Density:** 0.62 W/SF (44% Below ASHRAE)
- **Open Office Square-Footage:** 17,650 SF
- **Connected Lighting Load:** 10,950 Watts
- **Predicted Annual Lighting Energy:** (Both Baseline & Convia are based on installed lighting loads)
 - o **Baseline Controls:** 36,700 kWh/yr
(Assumes occupancy sensors with Auto-On/Auto-Off control)
 - o **Convia Controls:** 14,800 kWh/yr (60% below Baseline Controls)

CONVIA® Lighting Controls: USGBC Headquarters



Phase 1 Case Study: Design & Preliminary Energy Evaluation

OPEN OFFICES

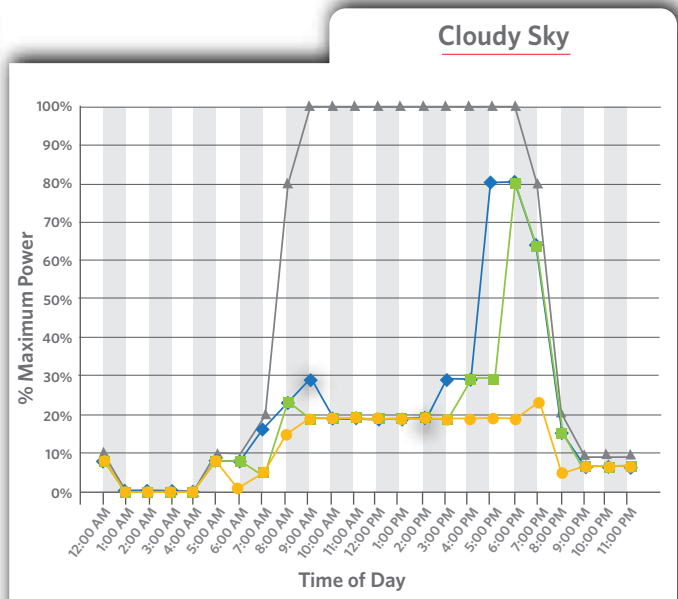
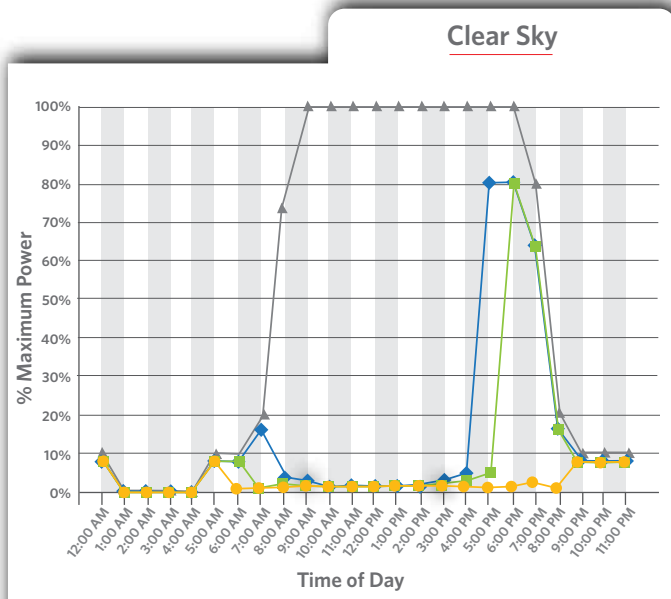


Photo Credit: Eric Laignel



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Photo Credit: Eric Laignel

TASK LIGHT & CONTROLLED PLUG LOADS

- Each Private Office has a controlled outlet and a non-controlled outlet. Task lights, laptop computers, and other personal electronics can be plugged into the controlled outlet that will automatically turn off when the occupancy sensors time-out in each Private Office. The task lights also have an on-board switch to allow local control for each work station.

AMBIENT LIGHTING

- Daytime Operation: (Activated at 30 minutes after sunrise). During the day, the Ambient Lighting must be turned on manually using the switch located on a nearby column. This manual operation is to encourage users to keep the ambient lighting turned off if there is enough daylight in the space. Each switch has two buttons, and each button has two functions.



Wall Switches

Click Once: Turns Lights On & Activates Daylight Dimming

Push & Hold: Brightens Lights & Disables Daylight Dimming

Click Once: Turns Lights Off

Push & Hold: Dims Lights & Disables Daylight Dimming



Occupancy Sensors

When an Open Office Area has been vacated for a certain time period, the lights will turn off automatically.

Day: Manual-On/Auto-Off

Night: Auto-On/Auto-Off



Daylight Dimming

When daylight dimming is activated, the dimmers respond to input from a photo sensor to maintain 25 foot candles on the desk tops.

- **Nighttime Operation:** (Activated at 30 minutes before sunset). At night, the Ambient Lighting in Private Offices is still turned on manually. Once a person settles into their Private Office, the occupancy sensors in their office will maintain a low level of lighting in an adjacent Open Office. This provides a more comfortable setting for working at night than localized occupancy sensors only that would leave the surrounding areas dark.

LIGHTING ENERGY USE

- **ASHRAE 90.1 2004 Allows:** 1.10 W/SF
- **Installed Lighting Power Density:** 0.53 W/SF
- **Private Office Square-Footage:** 12,200 SF
- **Connected Lighting Load:** 6,500 Watts
- **Predicted Annual Lighting Energy:** (Both Baseline & Convia are based on installed lighting loads)
 - o **Baseline Controls:** 14,700 kWh/yr
(Assumes occupancy sensors with Auto-On/Auto-Off control)
 - o **Convia Controls:** 7,600 kWh/yr (49% below Baseline Controls)

CONVIA® Lighting Controls: USGBC Headquarters



Phase 1 Case Study: Design & Preliminary Energy Evaluation

PRIVATE OFFICES

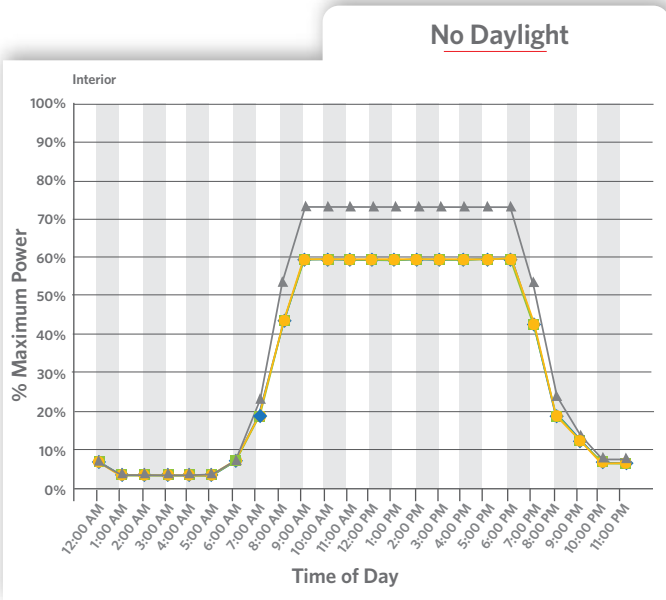
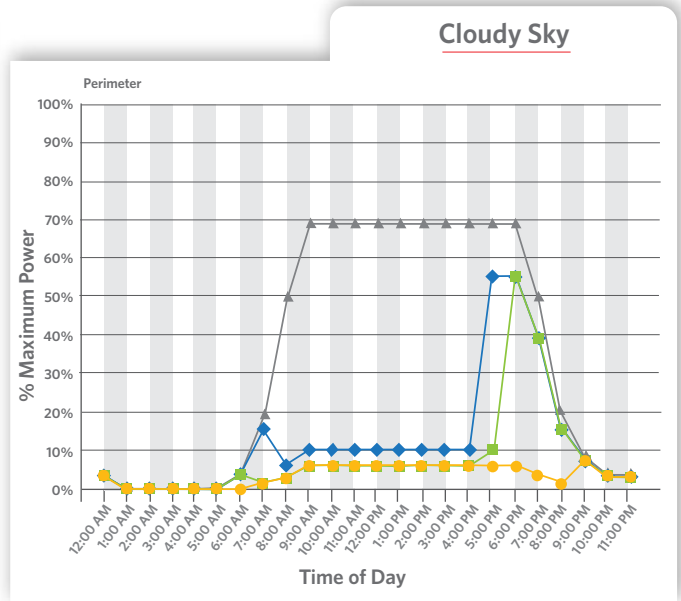
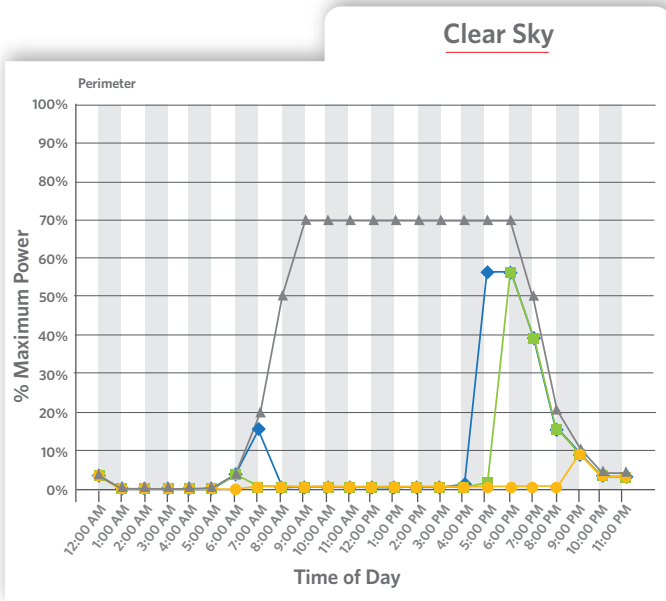


Photo Credit: Eric Laignel

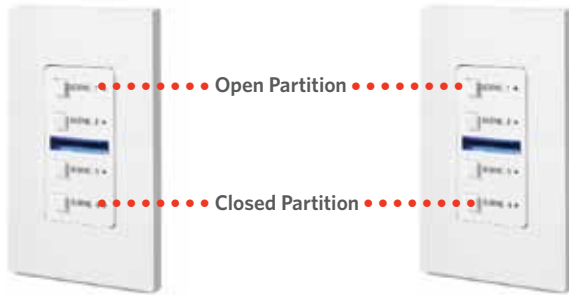


Photo Credit: Eric Laignel

CONFERENCE ROOMS

AMBIENT LIGHTING & WALL WASHING

- Lighting Scene Control: Each Conference Room has four lighting scenes to provide appropriate lighting levels for different types of interactive meetings and multi-media presentations.
- Lighting Control Partitioning: The large Conference Rooms have retractable partition walls to divide the space into two smaller conference rooms. Two scene controllers in each Conference Room offer 3-way lighting control when the partition wall is open, and divided lighting control when the partition wall is closed. The partitioning feature also links or divides occupancy sensors to adapt to an opened or closed partition wall.
- A/V Interface: Users can control the lighting from the Audio/Visual touch screen controller with a communication link to the lighting control system.
- Occupancy Sensors: When the Conference Room has been vacated for a certain time period, the lights will automatically turn off.
- Daylight Dimming: When daylight dimming is active, the dimmers respond to input from a photo sensor to maintain 25 footcandles on the table tops.



Lighting Scene Control with Room Partitioning

Four lighting presets in each conference room provide a variety of bright and dim lighting



A/V Interface

Lighting scenes can be activated from the A/V controller.



Occupancy Sensors

Manual-On/Auto-Off operation.



Daylight Dimming

Maintains 25 footcandles on table tops..

LIGHTING ENERGY USE

- **ASHRAE 90.1 2004 Allows:** 1.30 W/SF
- **Installed Lighting Power Density:** 0.51 W/SF
- **Conference Room Square-Footage:** 5,500 SF
- **Connected Lighting Load:** 2,800 Watts
- **Predicted Annual Lighting Energy:** (Both Baseline & Convia are based on installed lighting loads)
 - o **Baseline Controls:** 6,200 kWh/yr
(Assumes occupancy sensors with Auto-On/Auto-Off control)
 - o **Convia Controls:** 1,800 kWh/yr (71% below Baseline Controls)

CONVIA® Lighting Controls: USGBC Headquarters



Phase 1 Case Study: Design & Preliminary Energy Evaluation

CONFERENCE ROOMS

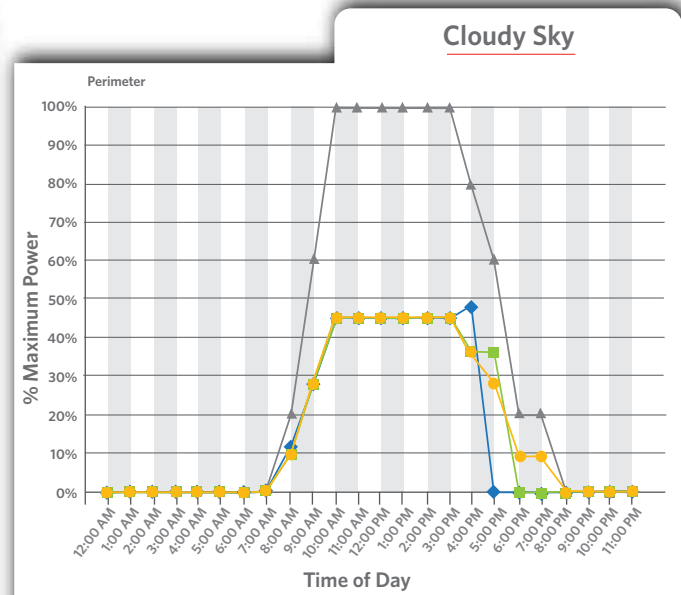
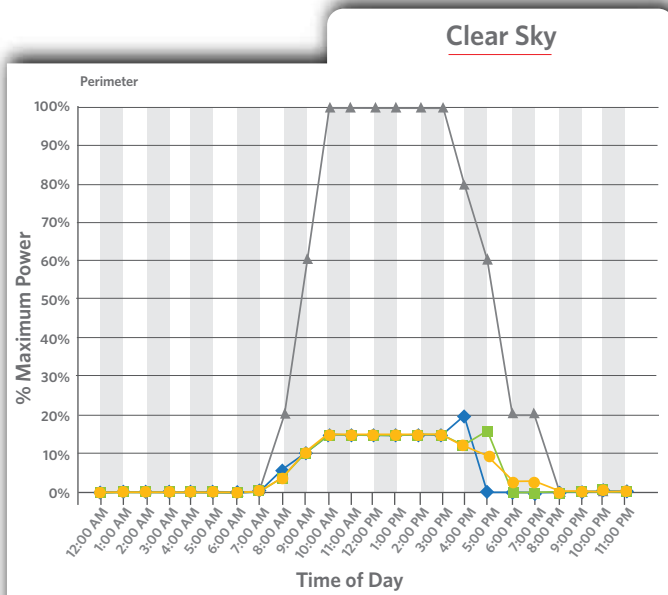


Photo Credit: Eric Laignel



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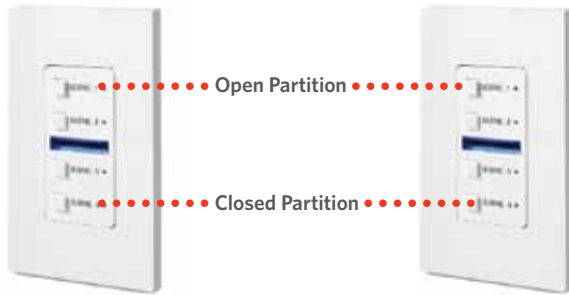
Photo Credit: Eric Laignel

AMBIENT LIGHTING & WALL WASHING

o Lighting Scene Control: A variety of lighting scenes provide options to the USGBC staff to set the right mood in the lobby for different events. A bright lighting scene enlivens people for morning meetings, and dim lighting scenes create a more intimate setting for evening events. For general daily activities, the lights are dimmed to save energy while also providing a bright environment.

o Kinetic Lighting Shows: For evening hospitality events, the touch of a button activates a calming kinetic rhythm of light and dim. Each luminaire is dimmed independently and two lighting shows can be activated from the scene control station. One show is a random pattern of lightening and dimming and the second show is a wave of light that travels across the lobby.

o Occupancy Sensors: Occupancy sensors are only activated at night to ensure that the lobby remains a light and inviting space during business hours.



Lighting Scene Control

Eight lighting presets in the Lobby provide a variety of bright and dim lighting scenes, and two kinetic lighting shows.



Occupancy Sensors

Day: Deactivated
Night: Auto-On/Auto-Off

LIGHTING ENERGY USE

- **ASHRAE 90.1 2004 Allows:** 1.30 W/SF
- **Installed Lighting Power Density:** 0.57 W/SF
- **Lobby Square-Footage:** 3,800 SF
- **Connected Lighting Load:** 2,150 Watts
- **Predicted Annual Lighting Energy:** (Both Baseline & Convia are based on installed lighting loads)
 - o **Baseline Controls:** 8,100 kWh/yr
(Assumes occupancy sensors with Auto-On/Auto-Off control)
 - o **Convia Controls:** 5,550 kWh/yr (32% below Baseline Controls)

CONVIA® Lighting Controls: USGBC Headquarters



Phase 1 Case Study: Design & Preliminary Energy Evaluation

RECEPTION & LOBBY

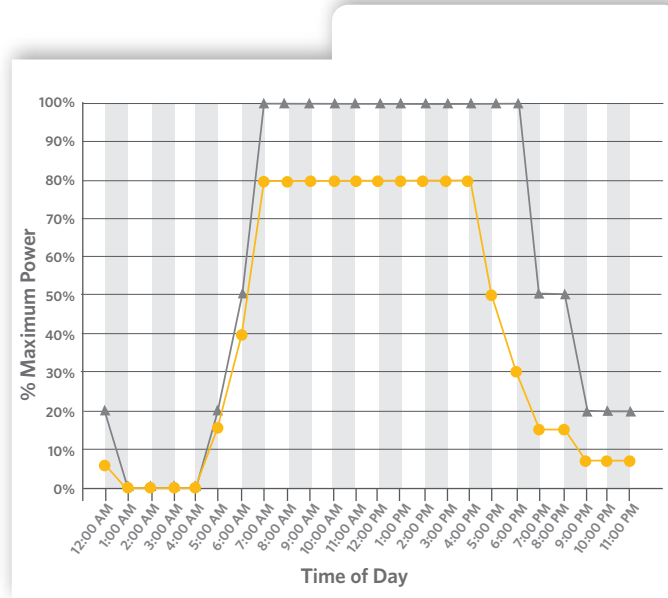


Photo Credit: Eric Laignel



Photo Credit: Eric Laignel



Photo Credit: Eric Laignel

CAFE & KITCHENETTES

AMBIENT LIGHTING & WALL WASHING

o Wall Switches: During the day, the wall switch must be turned on manually to encourage users to keep the lights turned off when there is enough daylight. Turning the lights on activates daylight dimming to provide the right amount of light. For those who might need more light, the daylight dimming can be overridden by pushing and holding the top button on the switch.

o Daylight Dimming: When daylight dimming is active, the dimmers respond to input from a photo sensor to maintain 25 footcandles in the Cafe.

o Occupancy Sensors: The occupancy sensors are programmed to respond differently at night than during the day. During daylight hours, the lights must be turned on manually to encourage more energy savings, yet turn off automatically after people leave the space. At night, the lights turn on automatically to illuminate the space.



Wall Switches

Click Once: Turns Lights On & Activates Daylight Dimming

Push & Hold: Brightens Lights & Disables Daylight Dimming

Click Once: Turns Lights Off

Push & Hold: Dims Lights & Disables Daylight Dimming



Occupancy Sensors

When a Kitchenette has been vacated for a certain time period, the lights will turn off automatically.

Day: Manual-On/Auto-Off

Night: Auto-On/Auto-Off



Daylight Dimming

When daylight dimming is activated, the dimmers respond to input from a photo sensor to maintain 25 footcandles on the in the Cafe.

LIGHTING ENERGY USE

- **ASHRAE 90.1 2004 Allows:** 0.9 W/SF
- **Installed Lighting Power Density:** 0.51 W/SF
- **Lobby Square-Footage:** 1,950 SF
- **Connected Lighting Load:** 1,000 Watts
- **Predicted Annual Lighting Energy:** (Both Baseline & Convia are based on installed lighting loads)
 - o Baseline Controls: 2,250 kWh/yr
(Assumes occupancy sensors with Auto-On/Auto-Off control)
 - o **Convia Controls:** 450 kWh/yr (80% below Baseline Controls)

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Phase 1 Case Study: Design & Preliminary Energy Evaluation

CAFE & KITCHENETTES

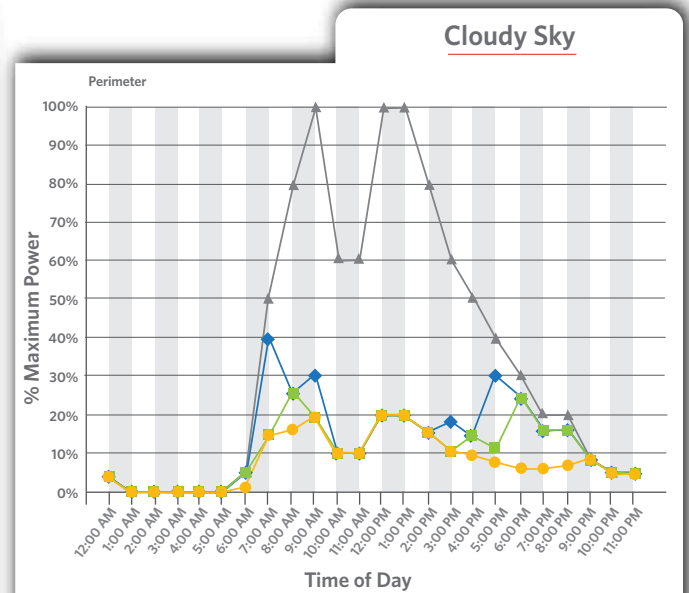
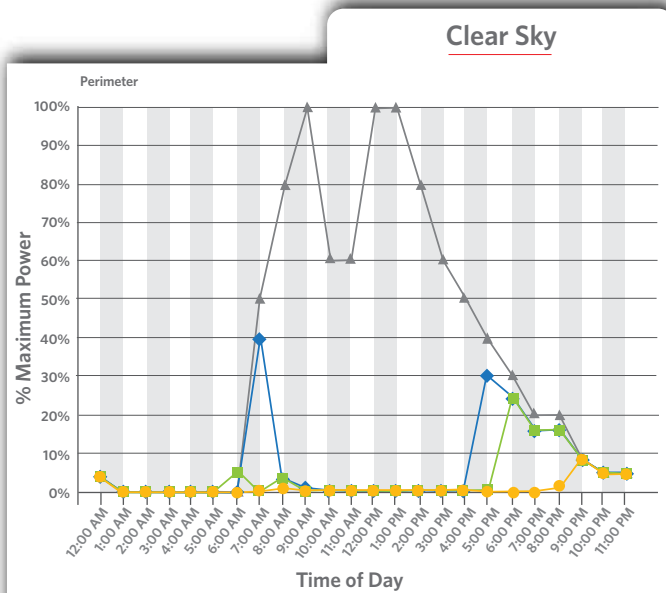


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