OVERVIEW

A government building in Texas was retrofitted as part of an initiative to increase energy efficiency and cost savings while reducing the green house gas emissions of public sector buildings and other statewide facilities.

The building was ten-stories and constructed in 1940 from concrete and steel. The project was an in-ceiling retrofit of existing fixtures in all floor spaces.

Stairwells and associated restrooms were not retrofitted. The fixture locations were not changed. All light levels were set to 50% or less, with the exception of a few special users. Occupancy sensing controlled 90% of retrofitted lamps. Some offices were left on light switch control.

The facility is now remotely controlled by building manager software residing in a separate Texas state facility.

PROJECT DESCRIPTION

LOCATION
Austin, Texas

GROSS AREA
48,000 ft² controlled

TIMEFRAME
Installation completed May 2010

ENERGY SAVINGS
Post-commissioning savings: 8,805 kWh/Mo.
SOLUTION

The customer wanted to have reduced energy use of the linear fixtures on all floors. The use of individual light levels in offices and open areas was required. Individual scene control was needed in several conference rooms. Daylight harvesting where appropriate was used in conjunction with scene controllers and occupancy and daylight sensors to achieve the client needs.

This facility showcases the versatility of the solution. The building manager resides in a separate facility, remotely controlling the building through a high speed connection. The system is fault tolerant with automatic local and remote server backup capability in the event of network failure, ensuring the integrity of system operation and energy usage data.

RESULTS

Lamps were retrofitted with the intelligent ballast. The controls were installed and commissioned using default settings for office buildings. The usage in post commissioning saved 8805KWh/Mo. Energy usage can be closely monitored with reporting, as seen in occupancy sensing and scheduling at work.

In addition to dramatic energy savings, the system provided these benefits:

- Adaptable lighting control capabilities, including integrated daylight harvesting, occupancy sensing, task tuning, scheduling and personal control.
- Superior energy savings and increased comfort.
- Real-time monitoring, reporting, and optimization.
- Standards-based, open architecture with BMS (Building Management System) integration.
OVERVIEW

This retrofit was performed by a major fixture manufacturer and was as part of an initiative toward energy savings, greenhouse gas emission reductions and improvements in occupant productivity in government-owned work spaces.

The retrofit consisted of two courthouse buildings, one in San Francisco, CA (21-floors, 1.4M sq. ft.), and the other in Oakland, CA (18-floors, 1.1M sq. ft.). The buildings utilized an advanced lighting solution, combining dimming ballasts and digital networked control systems. The client specified a number of features:

- Real-time monitoring and reporting
- Fine-tuning lighting levels with smooth dimming
- 2-way communication with individual addressability
- Standards-based, open architecture with BMS (building management system) integration
- Lighting control strategies for daylight harvesting, occupancy sensing, task tuning, scheduling and personal control
- Automated load shedding for demand response

PROJECT DESCRIPTION

LOCATION
San Francisco, CA
Oakland, CA

GROSS AREA
82,000 ft² (Pilot program)
>2 Million sq ft

TIMEFRAME
Installation completed in 2011

ORIGINAL LIGHTING POWER DENSITY - CONTROLS
1.4 W/sq ft

NEW LIGHTING POWER DENSITY - CONTROLS
~0.5 W/sq ft

ENERGY SAVINGS
Reduced energy use 66% over national average
PILOT PROGRAM

The specifications for this project were designed to ensure energy-efficient, high performance, dynamically responsive, intelligent buildings.

Since installation of the lighting control solution, collected results demonstrate that the HorseSense™ solution significantly decreased lighting electricity usage to 66% percent below the national average. Additional valuable data is being collected regarding energy and demand savings, greater occupant comfort levels, enhanced customer satisfaction and effective facility management.

Lighting is the biggest single use of electricity in office buildings, comprising approximately 34 percent of annual energy consumption. This government client is leading by example with smart energy management by using our advanced lighting solutions.

RESULTS

Workstation-specific luminaire energy use was reduced 37% below the already energy-efficient base energy usage that the client had previously achieved. Additionally, workstation-specific luminaire energy was reduced 66% below the U.S. National Average for large and small offices. There are no other lighting systems or light sources commercially available today that offer this degree of energy savings using hardware and software.

Daily lighting energy, estimated annual lighting energy use intensity (EUI) and relative energy savings with workstation-specific luminaries is calculated and compared to the GSA base use, California Title 24 (2004), and the U.S. National Average in following table:

### Daily and Annual Energy Density and Percent Savings

<table>
<thead>
<tr>
<th></th>
<th>Daily lighting Energy (watt-Hour/ft²/day)</th>
<th>Estimated Annual EUI (kWh/ft²/yr)</th>
<th>Annual Energy Savings % with WS Luminaires</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workstation-specific Luminaires</td>
<td>7.92 (±0.5)</td>
<td>2.18</td>
<td>n/a</td>
</tr>
<tr>
<td>GSA Base Case</td>
<td>13.2 (±0.8)</td>
<td>3.44</td>
<td>37%</td>
</tr>
<tr>
<td>CA Title 24</td>
<td></td>
<td>3.9</td>
<td>44%</td>
</tr>
<tr>
<td>US National Average for Offices</td>
<td>24.8 (±1)</td>
<td>6.45</td>
<td>66%</td>
</tr>
</tbody>
</table>
Estimated Lighting Power Density (LPD) over the 32 days studied is presented in the graph below. Even though the installed LPD is 1.23W/ft² and the default is 0.97W/ft², the actual LPD is much lower throughout the day. The average LPD peaks at approximately 0.66 W/ft², peak LPD averages 0.72W/ft², and the average LPD during working hours (6am-6pm) is 0.52W/ft². Security and custodial rounds cause power density spikes in the evenings. The average daily lighting energy density is 7.92W-h/ft-²/day, which corresponds to 40% savings compared to the base case.

SEQUENCE OF OPERATIONS

The project involved three space types: open office cubicle areas, perimeter offices and conference rooms. Luminance requirements for open office including luminaires set to full light output and exclusive of additional task or under cabinet lighting is:

- 320 lux (30 Footcandles) maintained over 80% of secondary task area (yellow areas in Figure 1), and
- 550 lux (50 Footcandles) maintained over 90% of primary task areas (red areas in Figure 1).
**SOLUTION**

**Workstation-Specific Lighting—Example 1**

Workstation-specific luminaires have the following features:

- **Form Factor:** Indirect/direct, pendant-hung luminaire.
- **Separable “ambient” and “task” lighting component control.** Usually one dimmable lamp provides “ambient” or uplighting component, while another two (dimmable) lamps provide baffled task light for occupant.
- **Occupancy sensors and photocells** built directly into the fixture body as well as all associated control circuitry required to commission and operate the system.
- **Networked together using a microcontroller that implements a controls communication protocol** to all luminaires over the physical cabling (typically DALI (Digital Addressable Lighting Interface)).
- **PC or server runs application-specific control software and collects energy data.**

**Existing Conditions**

- The existing lighting system was mainly comprised of 2x4, recessed, 18-cell parabolic electronic ballasts.
- The nominal lighting power density (LPD) is 1.4 W/sf; some areas were de-lamped to 0.9 W/sf.

**Figure 1:**
Two types of cubicle layout showing partitions, desk area, and location of storage cabinets

- 80% of secondary task area = 30 fc
- 90% of the primary task area = 50 fc (without additional under cabinet lighting)