Mendocino Hall – Pilot LED Lighting Project with Advanced Controls by enlightened

California State University, Sacramento
June 28, 2017
Mendocino Hall
Mendocino Hall was built in 1990, with fluorescent T12 lamps.

A lighting retrofit occurred in 1997 with fluorescent T8 lamps, electronic ballast.
Where we were...

Existing lamp and fixture examples
Where we were...

Before project, 5\textsuperscript{th} floor hallway
Why we did it

- No means of controlling hallway or stairwell lighting
- We considered installing bi-level fluorescent T8 lamps in stairwells
- We considered installing occupancy sensors in hallways
- In the end, new LED fixtures with advanced controls were selected
## The Plan

<table>
<thead>
<tr>
<th>SYSTEM FEATURE</th>
<th>Enlighted</th>
<th>Daintree</th>
<th>Distech</th>
<th>Encelium</th>
</tr>
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<tbody>
<tr>
<td>Fixture integrated sensor</td>
<td>X</td>
<td>X</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>On/off, and dim luminaire scheduling</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Fixture integrated temperature sensor</td>
<td>X</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
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<tr>
<td>Occupancy sensing</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Daylight harvesting</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Task tuning and personal control</td>
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<td>X</td>
<td>NA</td>
<td>NA</td>
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<tr>
<td>BacNet</td>
<td>X</td>
<td>X</td>
<td>NA</td>
<td>X</td>
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<tr>
<td>Integrates with Demand Response</td>
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<td>X</td>
<td>NA</td>
<td>NA</td>
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<tr>
<td>Web-based user interface</td>
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<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>ZigBee mesh network</td>
<td>IEEE 802.15.4</td>
<td>X</td>
<td>NA</td>
<td>X</td>
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<tr>
<td>General eqpm controller</td>
<td>X</td>
<td>X</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>
# LUMINAIRE SCHEDULE

## NEW LUMINAIRES

<table>
<thead>
<tr>
<th>Label</th>
<th>Quantity</th>
<th>Catalog Number</th>
<th>Description</th>
<th>Lamp</th>
<th>Lumens Per Lamp</th>
<th>LIF</th>
<th>Wattage</th>
<th>Existing Luminaire Wattage</th>
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</thead>
<tbody>
<tr>
<td>A1</td>
<td>27</td>
<td>24CZ-LD4-50-UNV-L835-CD-1</td>
<td>METALUX ZX4 CRUZE FIXTURE</td>
<td>4100K LEDS</td>
<td>5000</td>
<td>0.95</td>
<td>44.5</td>
<td>92</td>
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<td>A2</td>
<td>30</td>
<td>24CZ-LD4-50-UNV-L835-CD-2</td>
<td>METALUX ZX4 CRUZE FIXTURE</td>
<td>4100K LEDS</td>
<td>5000</td>
<td>0.95</td>
<td>44.5</td>
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<td>C1</td>
<td>31</td>
<td>RZL-WL-1-L35-1-D-UNV-SU-JB-4-STD-W</td>
<td>COOPER CORELITE RZL SEMI-DIRECT LED</td>
<td>4100K LEDS</td>
<td>4290</td>
<td>0.95</td>
<td>42</td>
<td>54</td>
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<tr>
<td>D1</td>
<td>27</td>
<td>S124-DRP-2-35-GYP-X3XX-1-U-DD-W</td>
<td>NEO-RAY DEFINE SERIES PERIMETER COVE LIGHT</td>
<td>4100K LEDS</td>
<td>3765</td>
<td>0.95</td>
<td>43</td>
<td>54</td>
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<tr>
<td>F1</td>
<td>10</td>
<td>LD6ART-15-DIOTE-ERM6-15-8-35-6LMO-H</td>
<td>PORTFOLIO COMMERCIAL 6 INCH RECESSED RETROFIT LED DOWNLIGHT WITH SEMI SPECULAR CLEAR FINISH REFLECTOR</td>
<td>(1) HIGH LUMEN LED 80CRI/4100K CCT ABSOLUTE PHOTOMETRY IS BASED ON CALIBRATION FACTORS CREATED USING LAB LUMEN STANDARDS IN GONIOPHOTOMETER WITH TEST DISTANCE OF 28.75 FEET</td>
<td>1444.012</td>
<td>0.95</td>
<td>18.5</td>
<td>31</td>
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<tr>
<td>I1</td>
<td>34</td>
<td>P06-30-ED010-PDM6A-835-6IV-H</td>
<td>HALO RECESSED 6&quot; LED LENS DOWNLIGHT</td>
<td>4100K LEDS</td>
<td>3000</td>
<td>0.95</td>
<td>36.5</td>
<td>300</td>
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<tr>
<td>L2</td>
<td>48</td>
<td>22EN-LD1-19-UNV-L835-CD1-U-SK-22-WS</td>
<td>METALUX Z2X ENCOUNTER FIXTURE</td>
<td>4100K LEDS</td>
<td>1936.041</td>
<td>0.95</td>
<td>18.7</td>
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<td>L1</td>
<td>100</td>
<td>24EN-LD1-30-UNV-L835-CD1-U-SK-24-WS</td>
<td>METALUX Z2X ENCOUNTER FIXTURE</td>
<td>4100K LEDS</td>
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<td>14EN-LD1-38-UNV-L835-CD1-U-MS-SR-14</td>
<td>METALUX 1X4 ENCOUNTER</td>
<td>4100K LEDS</td>
<td>3873.715</td>
<td>0.95</td>
<td>40.8</td>
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</tbody>
</table>

*Light fixture shall have an integrated multi-functional sensor. Light fixture 40-00 or approved equal. Connect new fixtures to (E) Lighting Circuit.*
Summary of energy saving features of the advanced controls system:

- Web-based user interface
- Graphical on-screen floor plan provides complete control and monitoring of all controlled lighting fixtures
- Direct power metering at individual fixtures level
- Individual fixture occupancy/temperature sensor
- Dimming and on-off control
- Daylight harvesting
- The sensors can be configured in a grouping pattern to allow zone control
Project Features...

- Light level tuning and power monitoring
- Automatic Demand Response (ADR) capable, system will tie into the existing campus Tridium EMS to respond to a ADR signal from SMUD
- Project will be commissioned after installation
- All sensors provide occupancy, ambient light sensing, and temperature sensing with wireless communication

The project is expandable to use the temperature sensors on each fixture to connect to VAV boxes in the future for better occupancy control of HVAC system in the building with hi/lo cut off limits.
• Project cost = $367,000

• Est. Utility rebate = $50,000

• New system design is 49.9% better than 2013 T24

• Est. annual energy savings = 213,096 kWh/year

• Est. GHG emission reduction in CO2e = 46.65/year

• Est. project completion date end of June 2017
The Plan...

First floor Plan example
The Plan...

First floor plan example in program
What we did

Before

After
What we did

After pictures
Components:

- Smart Sensor
- Energy Manager
- Gate Way
Components:

The Enlighted System. How it Works

- Smart Sensor
- Gateway
- Energy Manager
- Real-time Data In The Cloud
Screen shot example

Energy Consumption Graph

View: Lighting | Unit: kWh | Period: D, W, M, Y | From: 06/22/2017 | To: 06/23/2017 | Apply

Period Savings:
- Task T/Ling: 89%
- Daylight Harvesting: 87%
- Occupancy: 473.4 kWh

Current Savings:
- Task T/Ling: 89%
- Daylight Harvesting: 87%
- Occupancy: 473.4 kWh

Load:
- Current: 2.7 kW
- Period Peak: 3.8 kW
- Current Baseline: 22.0 kW

Sacramento State Sustainability

California State University Sacramento > Sac-Man > Mendocino Hall
7 day energy usage and kW profile 2015
7 day energy usage and kW profile 2017
Energy usage profile
Problem examples
Problem examples

Pictures taken at 3/31/17 at noon
Lessons Learned

• We had numerous lighting fixture and sensor installation problems

• After the installation start-up, we had problem with egress/emergency lighting
• Critical element was to share product technology information with the campus IT department during the project planning process. This will insure IT’s approval and confirmation regarding technology compatibility.

• Select a General Contractor with lighting installation experience.
Thank you!

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