SmartLighting™

September 8, 2011
Chris Covell

LED + Controls
Case Study:

United States Cold Storage

SmartLighting™

Right Light
Right Place
Right Time
Lighting Terms

• Fixture Efficiency = Total Design Lumens of Fixture / Total Lumen Output

• Fixture Optics = The distribution of lumens of each lighting fixture. Fixture optics is often defined as spacing criteria.
  - Example - 1.2 SC at the 180 degree and 1.0 SC at the 90 degree.

• Lumens per Watt = Total Lumens / Total Wattage

• CRI = Color Rendering Index = 100% = Sun’s Light

• Foot-Candle = Measurement of Light

SmartLighting™

What is the “right light” technology for cold storage applications?

HID

• Most popular lighting in cold storage
• Power intensive
• Long start up time of fixtures – no cycling
• Metal Halide has poor lumen maintenance
• High Pressure Sodium has poor color rendering
• Poor optical control
• 10,000 to 24,000 L70 life
• Lamps contain mercury
• Lamp breakage concern
• New electronic metal halide fixtures offer attractive efficiency and better lumen maintenance.
• Dimming of fixtures possible

Fluorescent

• Long warm up period in cold environments, cycling in cold storage difficult
• Lumen output is poor in below freezing temperatures
• Better fixture optics than HID
• Contains mercury
• Lamp breakage concern
• Economical fixture cost
• In temperatures above 40°F Fluorescent offers most attractive ROI
• Long lamp life of 50,000 hours
• Large incentives from utility rebates

LED

• Instant on/off capability, even in below 0 environments
• Best fixture optics
• Maximum energy savings
• Decreased maintenance costs - L70 life of over 70,000 hours.
• Cold temperatures increase life of LED’s
• Increased lumen performance in cold environments
• No mercury
• No Glass
• Large incentives from utility rebates
**Comparable Operational Cost**

What is the true cost of each Lighting System within a typical 350,000 square foot cold storage warehouse?

<table>
<thead>
<tr>
<th># of Fixtures</th>
<th>Lighting System</th>
<th>*Annual Operating Hours</th>
<th>Annual kWh</th>
<th>**Annual Energy $</th>
<th>*** Annual Maint. $</th>
<th>Annual Lighting Operating $</th>
</tr>
</thead>
<tbody>
<tr>
<td>300</td>
<td>4 lamp T-5 HO</td>
<td>8,760</td>
<td>620,208</td>
<td>$74,425</td>
<td>$7,500</td>
<td>$81,925</td>
</tr>
<tr>
<td>300</td>
<td>320 w PS MH</td>
<td>8,760</td>
<td>917,172</td>
<td>$110,061</td>
<td>$7,500</td>
<td>$117,561</td>
</tr>
<tr>
<td>250</td>
<td>163w LED w/ Control Systems</td>
<td>1,752</td>
<td>71,394</td>
<td>$8,567</td>
<td>$0</td>
<td>$8,567</td>
</tr>
</tbody>
</table>

*Assumes 20% occupancy rate.  
**Does not include thermal related energy cost and assumes $.12 per kWh  
*** Assumes 10 year annual average.
10 – Yr. Comparable Total System Cost

<table>
<thead>
<tr>
<th># of Fixtures</th>
<th>Fixture Type</th>
<th>Installed Cost (before rebates)</th>
<th>Annual Operational $</th>
<th>10 Year Total System $</th>
</tr>
</thead>
<tbody>
<tr>
<td>300</td>
<td>4 lamp T-5 HO</td>
<td>$105,000</td>
<td>$81,925</td>
<td>$924,250</td>
</tr>
<tr>
<td>300</td>
<td>320 w PS MH</td>
<td>$105,000</td>
<td>$117,561</td>
<td>$1,280,606</td>
</tr>
<tr>
<td>250</td>
<td>163w LED</td>
<td>$275,000</td>
<td>$8,567</td>
<td>$360,673</td>
</tr>
</tbody>
</table>

LED Purchasing Criteria

When Deciding which LED fixtures to use, below is some basic criteria to examine:

- Analyze LED pricing on a cost per Lumen basis.
- Color Selection of LED’s
- Look for fixtures that offer incremental control options.
- Look for fixtures that have multiple optics options.
- Look for fixtures that have a variety of Wattage and Lumen output options.
- Make sure provider develops lighting layouts showing point by point projections of new lighting system.
- Make sure fixture has LM79 testing and the LED has LM80 testing data.
- Make sure fixture is DLC approved.
The “right light” & the “right place”?  

“Fixture Selection”

Benefits of Using Less LED’s

Fewer LED’s Equals:

• Lower Project Cost
• More Energy Savings
  • More Energy Savings = Higher Rebate for many utilities
  • Fewer Fixtures to Maintain
SmartLighting™

Lusio 2.0 120W LED High Bay Aisle Lighter
by Lusio Solid State Lighting
SmartLighting™

Proteon 147W LED High Bay w/focused lens
by Lithonia Lighting

SmartLighting™

3-Bar 163W LED High Bay w/10 degree lens
by Albeo Technologies
SmartLighting™

Lusio Solid State Lighting

Albeo Technologies

Lithonia Lighting

SmartLighting™

Dial Light LED High bay

Lithonia Proteon

Albeo C-Series
SmartLighting™

The “right time” for lighting in cold storage applications?
Benefits of Turning Lights Off:

• Save more energy - including reduction in cooling load

• More energy savings relates into additional Utility Rebate

• Control systems make project eligible for EPAct tax savings

• Fixtures will operate less therefore significantly increasing their useful life – looking at fixtures that can operate for 30+ years
What to Look For In Control Systems:

• For cold storage application, wireless system eliminate the need to use expensive cold temp rated Ethernet cable.

• Look for a system that can be incrementally added to your system. If you need it, buy it...

• Look for a system that can be added to your entire facilities lighting system. The control system should easily incorporate your office fixtures, outdoor lighting, warehouse, etc.

• Look for system that has multi site functionality.

CASE STUDY

United States Cold Storage

Scope:
• Achieve 18FC average in warehouse aisles
• Replace 400w HPS
• Combine motion controls with advanced web based control
• Complete full building lighting retrofit – offices, docks, maintenance, etc.

SmartLighting™ Solution

Tracy, CA
Bakersfield, CA
CASE STUDY
US Cold Storage · Bakersfield, CA

SmartLighting™ Decision Matrix

More Savings

New Option D:
LED with Advanced Controls

New Option C:
LED with Simple Controls

New Option B:
New Fluorescent

New Option A:
Add Bi-Level Control to HID’s

Lower Project Cost

Higher Project Cost

Less Savings

US Cold Storage · Bakersfield, CA

CASE STUDY

US Cold Storage
Bakersfield, CA

Lighting Energy Savings: $41,838
Energy Cooling Savings: $14,267
Maintenance Savings: $5,841
Total Savings: $61,946

Annual Savings from Project
CASE STUDY

US Cold Storage
Bakersfield, CA

Simple Payback Period: 3.75 years
Internal Rate of Return (IRR): 22.3%
Reduction in Lighting Energy Usage: 90.0%

CASE STUDY

US Cold Storage
Tracy, CA

Savings from Retrofit $84,263
Coincidence Cooling Savings $28,734
Maintenance Savings $14,337
Total Savings $127,334

Annual Savings from Project
CASE STUDY

US Cold Storage
Tracy, CA · LED Fixtures + Motion Control System

Simple Payback Period: 1.61 years
Internal Rate of Return (IRR): 35.2%
Reduction in Lighting Energy Usage: 90.0%

Lighting Improvements

United States Cold Storage Lighting Results
• Improved Color Rendering Index from 26 to 75
• Increased Foot-candles
• Increased the uniformity of the foot-candles – standardized lighting levels between buildings
• Replaced old HID dimming system that caused maintenance problems
• Control system makes it easy for plant operators to curtail lighting load during peak events.
TESTIMONIALS

“As part of our company-wide sustainability program, we conducted IRR analysis of various supply-side energy savings options—wind, solar, etc.—and none of them made financial sense. The paybacks were just too long. In comparison, our SmartLighting solutions have come with IRRs of 35.2% and 22.3%.”

-Dan Dietrich, US Cold Storage Project Engineer

“The ability to reduce costs and reduce greenhouse emissions is a key reason we chose SmartWatt Energy for multiple facilities nationwide.”

-Fred Walker, Americold Vice President of Engineering

Comprehensive Solutions

Variable Frequency Drives (VFDs)
Applications:
• Compressors
• Pumps
• Evaporator Fans
• Condenser Units
• Demand Ventilation

HVAC Upgrades
Motor Replacements
SmartProfitProgram

Sample Project Cash Flow with SmartProfitProgram

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Investment:</td>
<td>$261,755</td>
</tr>
<tr>
<td>Utility Incentive:</td>
<td>-$ 56,586</td>
</tr>
<tr>
<td>Total Investment:</td>
<td>$205,169</td>
</tr>
<tr>
<td>Monthly Savings:</td>
<td>$10,611</td>
</tr>
<tr>
<td>Monthly Repayment:</td>
<td>$ 4,062</td>
</tr>
<tr>
<td>Monthly Profit:</td>
<td>$ 6,548</td>
</tr>
<tr>
<td>Annual Profit:</td>
<td>$78,583</td>
</tr>
</tbody>
</table>

Cash in your pocket. Energy savings for your facility.

LOCATIONS

Sacramento, CA
San Diego, CA
Chicago, IL
Rochester, NY
Syracuse, NY
NYC Metro
Wilkes-Barre, PA
Albany, NY
energy savings for **cold storage**

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