

“GETTING LIGHTER” PARKING STRUCTURE LIGHTING ANALYSIS

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“By 2020, advanced products and best practices will transform the California lighting market. This transformation will achieve a 60-80 percent reduction in statewide electrical lighting energy consumption by delivering advanced lighting systems to all buildings.””

California Public Utilities Commission

“The Office of the President (UCOP) aims to identify, qualify, and implement energy efficiency projects systemwide to meet the policy goal reducing energy use to 2000 by 2014, adjusted for growth, in a financially viable manner that results in long-term economic and environmental benefits.”

UC/CSU/IOU Energy Efficiency Partnership



CASE BACKGROUND: UC

- ▶ Challenge: Older buildings limit ability to make changes (i.e., new LEED developments)
- ▶ Focus: Upgrading/fixing piping, HVAC, new energy technology, with the goal of reducing carbon footprint
- ▶ UC initiated 400 projects to improve building energy efficiency
- ▶ UC system uses 250 megawatts of power a year
- ▶ To date, utility savings are \$21 million annually (UC wide)
- ▶ UC recognized for sustainability efforts including Millennium Award for LEED building practices
- ▶ Energy savings could positively impact UC budget which continues to be impacted by State of California budget reductions

LEGISLATION/GUIDING PRINCIPLES

- ▶ UC/CSU/IOU Energy Efficiency Partnership (2004)
 - ▶ Reduce energy use to 2000 levels by 2014
 - ▶ \$60 million in incentive grants for efficiency projects if UC meets targets
- ▶ Assembly Bill 32 (GHG Emission Standards)
 - ▶ Reduce energy use to 1990 levels by 2020
 - ▶ Fee penalty for higher emissions
- ▶ UC Sustainability Policy/Annual Sustainability Report
- ▶ UC/UCLA Strategic Energy Plans (2009)
- ▶ California Public Utilities Commission Energy Action Plan (2008)

CURRENT & PROPOSED ENVIRONMENT FOR PARKING STRUCTURE LIGHTING

- ▶ Current: High Pressure Sodium Lighting
 - ▶ Requires frequent bulb replacement (bulb + labor costs every 24,000 hours)
 - ▶ Energy usage (bulbs use 100-180 watts of energy)
- ▶ Proposed: Bi-Level (Dimmable) Induction Lighting
 - ▶ Occupancy sensors (allow for lights to dim when there is no activity)
 - ▶ Longer life expectancy (100,000+ hours)
 - ▶ Reduced energy usage (25W 20% of time and 85W 80% of time)
 - ▶ Improved lighting (provides brighter, whiter light)
 - ▶ Potential concerns with new technology:
 - ▶ Initial expense/cash outlay and return on investment
 - ▶ Perceived sense of safety/security or vandalism/crime target with dimmed lighting
 - ▶ Reliability of new technology
 - ▶ Cost of maintenance/bulb replacement

GIVEN INFORMATION

- ▶ Total number of fixtures = 8002
- ▶ Cost of electricity = \$0.010/kWh
- ▶ Lighting activity = 24/7 or 8,736 hours a year
- ▶ Electrician cost = \$50/hour
- ▶ Time to replace HPS unit with new technology = 1.5 hours x 2 electricians
- ▶ Replacement HPS/Dimmable Induction bulb = \$25
- ▶ Time to replace HPS bulb = .5 hours x 1 electrician
- ▶ Life expectancy for HPS 100W-180W = 24,000 hours
- ▶ Life expectancy for Dimmable Induction 85W = 100,000
- ▶ Energy usage for Dimmable Induction 85W = 70% (due to occupancy sensors)
- ▶ Price of Dimmable Induction 85W fixture = \$350
- ▶ Current lamp replacement schedule = 2-3 years
- ▶ New lamp replacement schedule = 10+ years

ORGANIZATIONAL STRATEGIC & OPERATIONAL NEEDS

- ▶ Energy Efficiencies Required to Meet Legal Mandates
- ▶ Energy Savings Needed to Meet Budget Constraints & Targets
- ▶ Environmental Responsibility – Greenhouse Gas Emission Goals & UC Systemwide Sustainability Goals
- ▶ Community Partnership & UCLA Brand/Reputation
- ▶ Improved Service to Customers & Other Stakeholders

OUTCOME ANALYSIS

Stakeholder	New Technology Features & Capabilities	Organizational Benefits
<p>Customers who park in/pass through the structure</p> <p>(permit holders, visitors, patients, departmental vehicle drivers, pay-by-space/pay-and-display customers, pedestrians, bicyclists, etc.)</p>	<p>Improved lighting – brighter, whiter light</p> <p>Motion sensor – instant brightening</p>	<p>Personal safety/security</p> <p>Reduced crime/vandalism</p> <p>Message of “caring”</p> <p>Visually pleasing</p>
<p>Maintenance Personnel/Tenants</p> <p>(Facilities, CSO/Police, Mail & Doc Svcs, Fleet & Transit, AMPCO, storage rooms, structure maintenance)</p>	<p>Improved lighting – brighter, whiter light</p> <p>Motion sensor – instant brightening</p>	<p>Greater productivity/accuracy due to improved visibility</p>
<p>UC partners in energy efficiency</p> <p>(UC/UCLA leadership, Higher Education Partnership, legislative authorities, campus community)</p>	<p>Reduced energy usage/cost</p> <p>More efficient technology – motion-sensor dimmable</p> <p>Reduced hazardous waste</p>	<p>Supporting UCLA brand & reliability/trust</p> <p>Monetary savings</p> <p>Environmental stewardship</p>

LIFE CYCLE COST ANALYSIS

Parking Structure	# of Light Fixtures	Light Fixture Wattage	Cost of New Fixture	Fixture Replacement - Labor	Electricity - New Fixture	Total by Structure
PS-1	1820	180	\$637,000	\$273,000	\$946,021	\$1,856,021
PS-2	672	180	\$235,200	\$100,800	\$349,300	\$685,300
PS-3	547	100	\$191,450	\$82,050	\$284,326	\$557,826
PS-4	908	180	\$317,800	\$136,200	\$471,971	\$925,971
PS-5	203	180	\$71,050	\$30,450	\$105,518	\$207,018
PS-6	219	180	\$76,650	\$32,850	\$113,834	\$223,334
PS-7	888	180	\$310,800	\$133,200	\$461,575	\$905,575
PS-8	712	180	\$249,200	\$106,800	\$370,092	\$726,092
PS-9	850	100	\$297,500	\$127,500	\$441,823	\$866,823
PS-32	236	180	\$82,600	\$35,400	\$122,671	\$240,671
PS-CHS-MC	543	180	\$190,050	\$81,450	\$282,247	\$553,747
PS-Dykstra	99	180	\$34,650	\$14,850	\$51,459	\$100,959
PS-RC	46	180	\$16,100	\$6,900	\$23,910	\$46,910
PS-SV	259	180	\$90,650	\$38,850	\$134,626	\$264,126
TOTAL	8002		\$2,800,700	\$1,200,300	\$4,159,376	\$8,160,376

TOTAL COST OF OWNERSHIP OVER 10 Years = \$8,160,376

PAYBACK ANALYSIS

Parking Structure	# of Light Fixtures	Light Fixture Wattage	10Yr Cost of New Fixtures (Fixture + Labor-Rebates)	Replacement - Old Bulbs (Labor + Bulb)	10Yr Electricity - Old Fixture	10Yr Electricity - New Fixture	10Yr Electricity Savings	# of Years to Achieve Payback
PS-1	1820	180	\$764,400	\$331,240	\$2,861,914	\$79,498	\$2,782,416	2.71
PS-2	672	180	\$282,240	\$122,304	\$1,056,707	\$29,353	\$1,027,354	2.71
PS-3	547	100	\$229,740	\$99,554	\$477,859	\$23,893	\$453,966	4.58
PS-4	908	180	\$381,360	\$165,256	\$1,427,812	\$39,662	\$1,388,150	2.71
PS-5	203	180	\$85,260	\$36,946	\$319,213	\$8,867	\$310,346	2.71
PS-6	219	180	\$91,980	\$39,858	\$344,373	\$9,566	\$334,807	2.71
PS-7	888	180	\$372,960	\$161,616	\$1,396,362	\$38,788	\$1,357,574	2.71
PS-8	712	180	\$299,040	\$129,584	\$1,119,606	\$31,100	\$1,088,506	2.71
PS-9	850	100	\$357,000	\$154,700	\$742,560	\$37,128	\$705,432	4.58
PS-32	236	180	\$99,120	\$42,952	\$371,105	\$10,309	\$360,797	2.71
PS-CHS-MC	543	180	\$228,060	\$98,826	\$853,857	\$23,718	\$830,138	2.71
PS-Dykstra	99	180	\$41,580	\$18,018	\$155,676	\$4,324	\$151,351	2.71
PS-RC	46	180	\$19,320	\$8,372	\$72,334	\$2,009	\$70,325	2.71
PS-SV	259	180	\$108,780	\$47,138	\$407,272	\$11,313	\$395,959	2.71
TOTAL	8002		\$3,360,840	\$1,456,364	\$11,606,650	\$349,528	\$11,257,121	2.91

10-Year Payback is \$6,439,917

IMPACT ASSESSMENT

- ▶ Internal Stakeholders – E&T Organization
 - ▶ Initial cash outlay
 - ▶ Project management resources (in-house)
 - ▶ Project team resources/partner capacity (Facilities, storage and coordination of materials)
 - ▶ Disposal of hazardous waste
- ▶ External Stakeholders – UCLA, UC, State of California
 - ▶ Meeting mandates, goals
 - ▶ Threat of fines/penalties
 - ▶ Shrinking state budget/funding resources
 - ▶ UC/UCLA image and brand – “good neighbor” perception

RECOMMENDATION & JUSTIFICATION

- ▶ Analyze potential cost savings to use outside vendors for fixture installation
- ▶ Assure that all available funding resources have been identified and are utilized
 - ▶ Utility Incentive Programs
 - ▶ UCOP Energy Efficiency Financing Program
 - ▶ US DOE/State Energy Program/Grants.gov
- ▶ Develop a marketing plan share the new technology features with customers and stakeholders
- ▶ Review plan to phase-in lighting replacement and prioritize areas with highest savings
- ▶ Plan for new technology integration with new construction projects
- ▶ Next Steps:
 - ▶ Develop plan for updating lighting in parking lots, top levels of structures & stairwells
 - ▶ Explore renewable energy such as photovoltaic
 - ▶ Research new technology such as wireless mesh network lighting controllers



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AC LEDs
14 Jan 2009

UC Davis' lighting center develops "smart" LED parking lot lights

The California Lighting Technology Center and industry partners have developed an energy-efficient LED parking lot light with a motion sensor triggering increased brightness.

Bright LED parking lot lights with motion sensors were unveiled January 12 at University of California Davis' California Lighting Technology Center. After two years of development and field testing, the college placed the fixtures in its South Entry Parking Structure.

The 50 LED light fixtures, developed by Ruud Lighting/BetaLED, feature activity-sensing technology, provide enhanced nighttime visibility, and reduce energy consumption by up to 80% compared with the metal-halide fixtures that were replaced, according to UC Davis.

UC Davis parking garage

Alpha's LED Technologies
Alpha's LED Materials
Reduce cost/lumen
The Preferred Choice of LED Producers



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Case Study: UC Davis Exterior Lighting Retrofit
Smart Bi-level Induction, North Entry Parking Structure

UC DAVIS
UNIVERSITY OF CALIFORNIA

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Statistics
Visitors: 1776596

UC DAVIS
60% INITIATIVE

INDUCTION FLUORESCENT

- 381 Everlast induction fixtures
- 100 W lamps
- 100,000 hour lamp life
- 5000K Correlated Color Temperature

RETROFIT BENEFITS

- 201,755 kWh saved annually
- Reduced maintenance
- Better visual environment
- Increased safety

ESTIMATED PAYBACK

- 10 years at \$0.10 kWh
- 7 years with maintenance savings included
- Equipment cost: \$200K plus labor

For more information on bi-level exterior lighting projects, visit pierpartnershipdemonstrations.com, cltc.ucdavis.edu, or facilities.ucdavis.edu

Presented by PIER State Partnerships for Energy Efficiency

“new, smart energy initiative ...installing energy efficient lighting to enhance safety, reduce energy consumption, and provide a better visual environment for motorists and pedestrians.”

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“where knowledge meets need...”

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August 14, 2012

UC DAVIS IS NATION'S 'COOLEST SCHOOL'

energy use

<http://cltc.ucdavis.edu/content/view/560/334/>

RESOURCES

- ▶ <http://workingsmarter.universityofcalifornia.edu>
- ▶ <http://sustain.ucla.edu/news/article.asp?parentid=11597>
- ▶ <http://www.uccsuioee.org>
- ▶ <http://www.universityofcalifornia.edu/news/article/24812>
- ▶ <http://uc-ciee.org/energy-use-in-buildings/monitoring-based-commissioning>
- ▶ <http://www.cpuc.ca.gov/NR/rdonlyres/6234FFE8-452F-45BC-A579-A527D07D7456/0/Lighting.pdf>
- ▶ <http://cltc.ucdavis.edu/content/view/560/334/>
- ▶ http://sustainability.universityofcalifornia.edu/documents/ucsep_ucla_mc.pdf