

# PIER Best Practice - 50%+ Emerging Technologies Solutions

30th Annual Utility Energy Forum

May 7, 2010

Karl F. Johnson, CIEE



# CIEE: KARL JOHNSON

## California Institute for Energy and the Environment

An innovative University of California partnership of energy agencies, utilities, building industry, non-profits, and research entities designed to advance energy efficiency science and technology for the benefit of California and other energy consumers and the environment. CIEE is a branch of the University of California Energy Institute.



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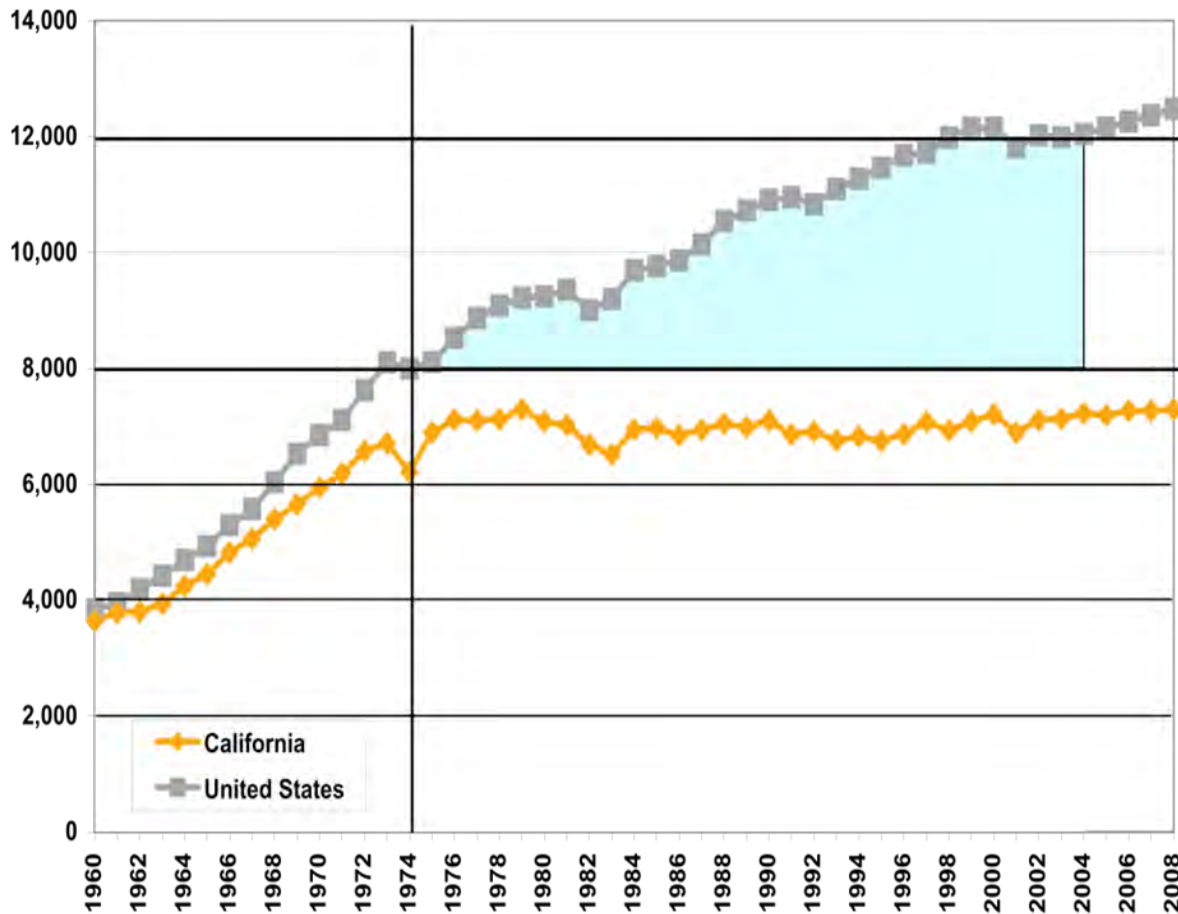
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# California Energy Use



# ENERGY USE PER CAPITA



## NATIONWIDE

- Steady increase
- Regulations
  - State preemptions
  - EnergyStar

## IN CALIFORNIA

- Stable for over 30 yrs
- Regulations
  - Appliances T20
  - Buildings T24
- Research

## CHALLENGES

- Expected growth
- Climate change
- Energy independence (efficiency ramp-up)



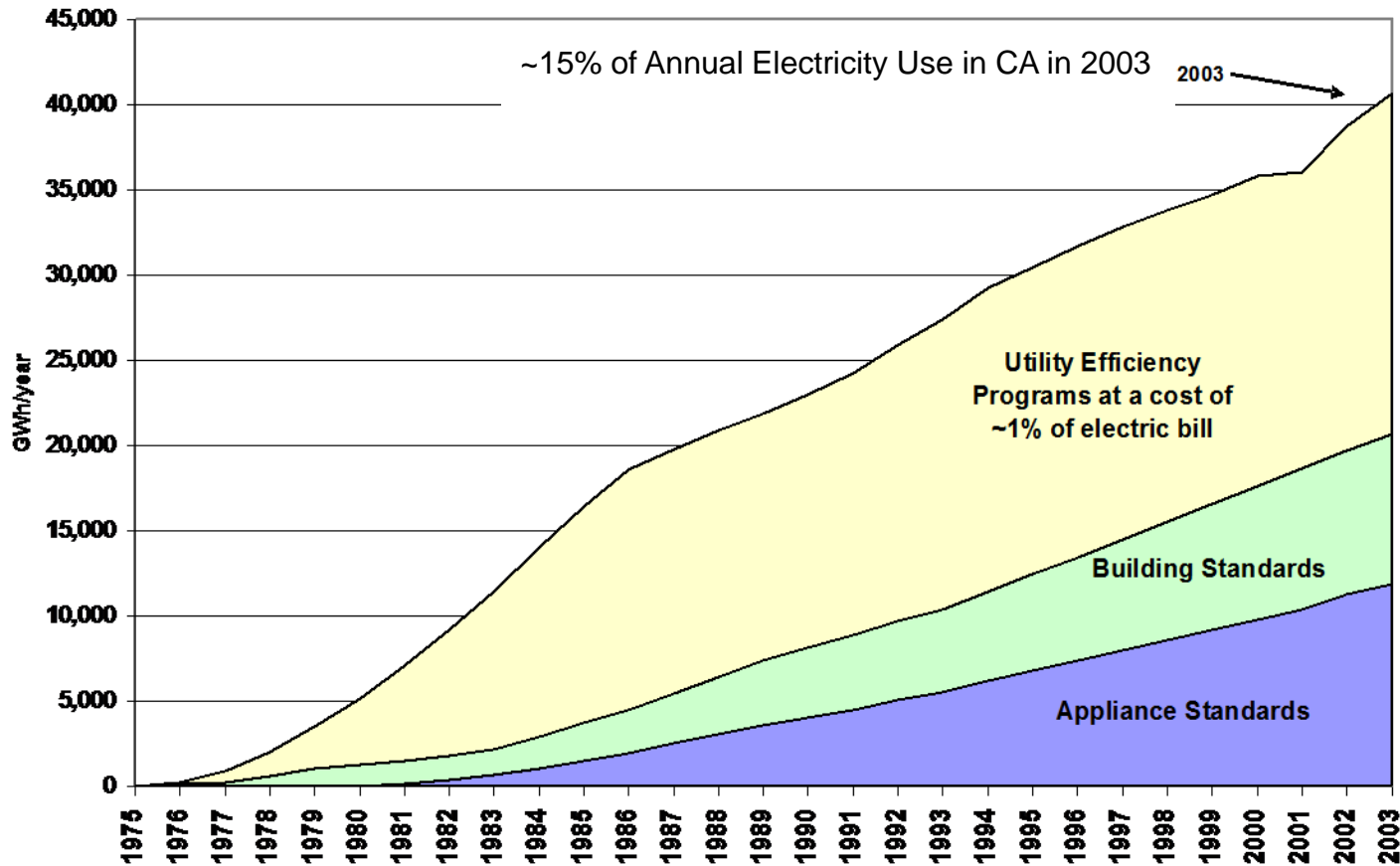
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# EFFICIENCY FIRST IN THE LOADING ORDER

## ANNUAL CA ENERGY SAVINGS FROM EFFICIENCY PROGRAMS AND STANDARDS



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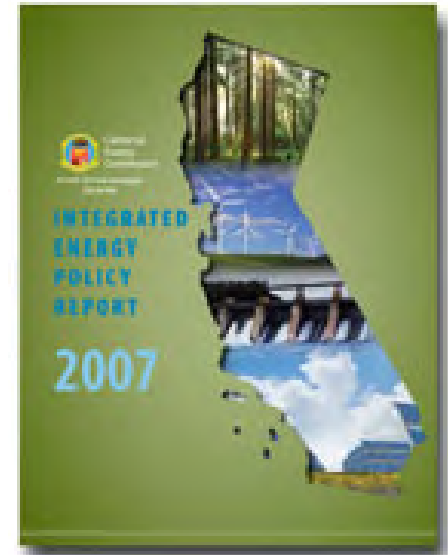
# RESEARCH AT THE CALIFORNIA ENERGY COMMISSION

## CEC PIER

The California Energy Commission was created in 1974 as the state's principal energy planning organization. It sets state policy by: forecasting state energy needs, licensing power plants, promoting energy conservation and efficiency, developing renewable energy resources and alternative energy technologies, RD&D, and planning/implementing state response to energy emergencies.

CEC is funded through utility bill surcharges (about 12 to 14 cents per month on an average bill).

PIER is the research arm of the Energy Commission. PIER receives about \$83M from the public goods charge each year, of which \$12-\$15M goes for buildings end-use energy research.



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# ROLE OF ENERGY EFFICIENCY RESEARCH



## APPLIED RESEARCH

- Brings innovative products to light
- Tests products in real-world settings
- Engages collaborators
- Provides a steady stream of solutions

## RESEARCH RESULTS

- Inspire early adapters
- Inform building owners, design professionals, trades
- Empower utility emerging technology programs
- Spread risk burdens of innovation
- Attract investors
- Guide codes and standards processes



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# RESEARCH FOCUS

## Sustainable Design

- Building Envelope
- HVAC
- Daylighting & Electric Lighting
- Appliances & Equipment

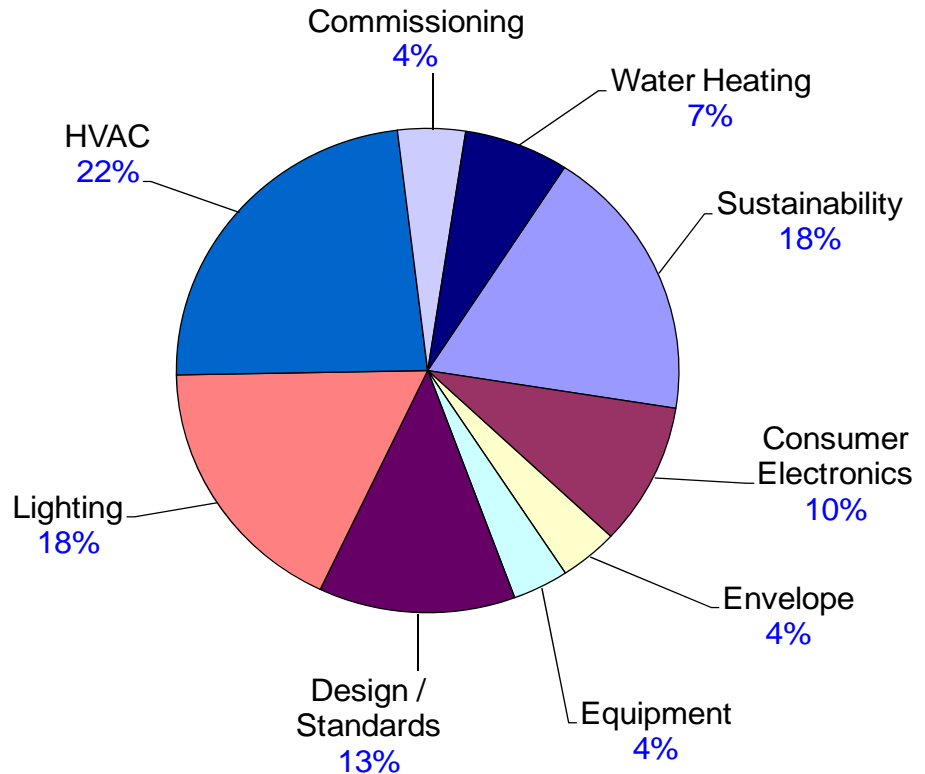
## Systems Integration

- Whole Buildings
- Commissioning

## Operations

- Diagnostics
- Performance Monitoring
- Demand Responsiveness

## Campuses Communities





# PIER PROGRAM RESEARCH AND DEVELOPMENT SYSTEM

FINDING MARKET-BASED SOLUTIONS WITH MANUFACTURERS • BUILDING PARTNERSHIPS FOR DEMONSTRATIONS  
INTEGRATING FEEDBACK FOR PRODUCT IMPROVEMENT • CREATING A RAPID, ECONOMIC PATH TO MARKET

## RESEARCH

- Assesses project objectives
- Tests and evaluates energy efficient technologies
- Partners with manufacturers
- Builds solutions for the public

## DEMONSTRATION

- Provides initial installations
- Validates onsite performance
- Creates confidence and receives feedback
- Broadens technology use

## MARKETPLACE

- Provides emerging technologies and incentives for utilities
- Creates early adoption momentum for other businesses and market success
- Stimulates suppliers to provide additional distribution of technology
- Increases technology adoption and public benefits

RESEARCH POWERS THE FUTURE OF ENERGY EFFICIENCY



ENERGY.CA.GOV

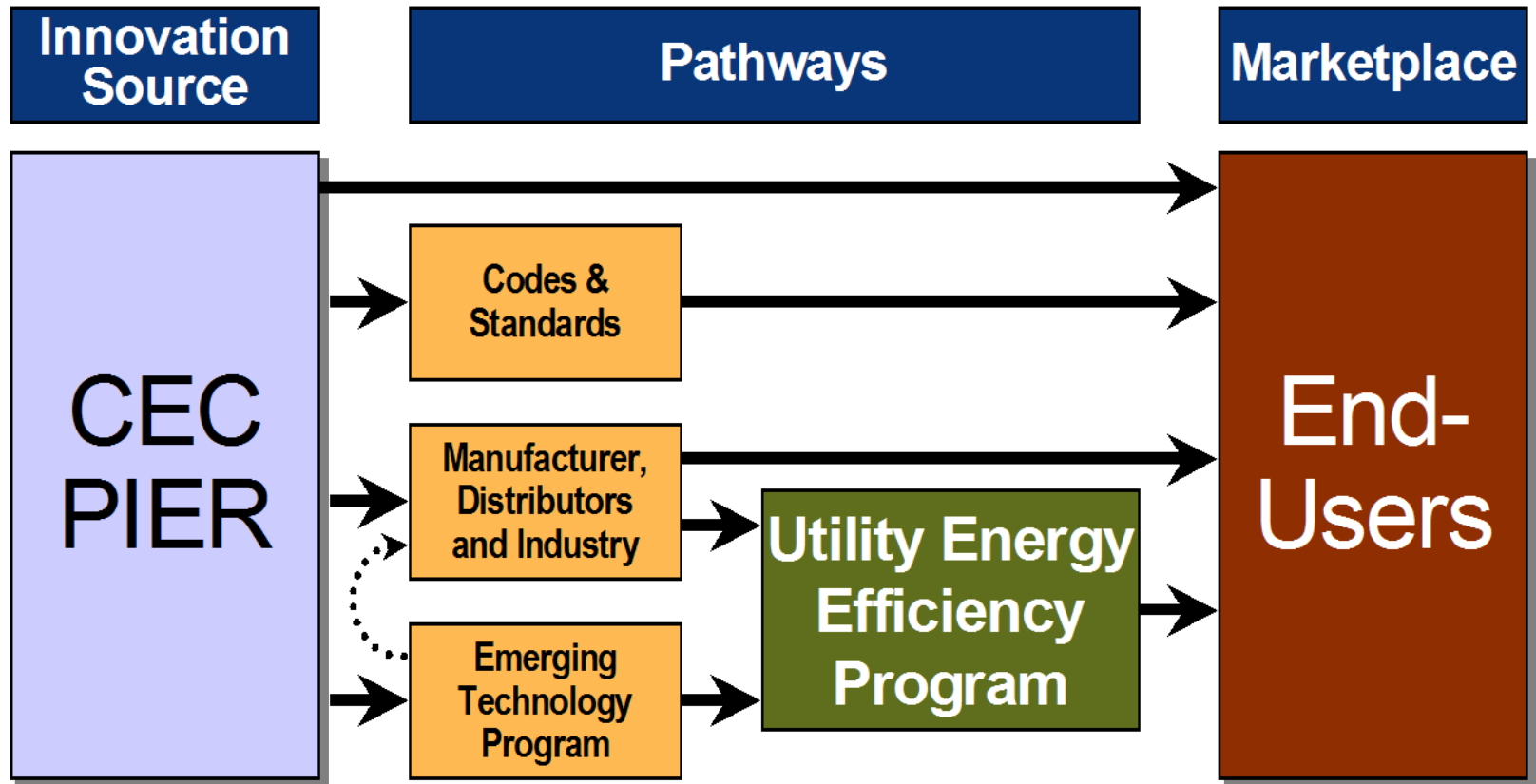


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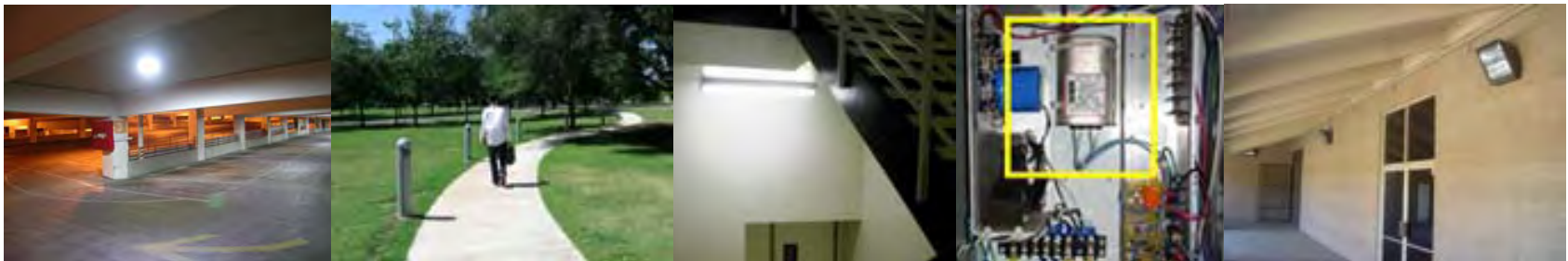
# MARKET CONNECTIVITY



# PIER STATE PARTNERSHIP IN ENERGY EFFICIENT DEMONSTRATIONS: OUR GOALS

- Demonstrations of PIER funded technologies, validate performance in actual building applications
- Large-scale demonstrations of pre-commercial products for cost-effectiveness and market acceptance
- Stimulate other manufacturers to make competitive products
- Provide products and field data for utility Emerging Technology Programs
- Provide data for CA energy efficiency code change proposals
- Improve the energy-efficiency of California's existing buildings
- Educate the public on available PIER funded technologies

[pierpartnershipdemonstrations.com/](http://pierpartnershipdemonstrations.com/)



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# PIER'S IMPACT AT JUST ONE CAMPUS: CAL POLY



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# POTENTIAL IMPACTS (JUST FOR 33 CALIFORNIA UNIVERSITY CAMPUSES)

For only seven of the PIER innovations:

Atmospheric carbon reductions = **2,250 cars removed/yr**

Energy savings of nearly = **50 million kW/yr**

Life cycle savings:

- ✓ 330,000 MWh or electricity use
- ✓ 266,000,000 pounds of CO<sub>2</sub>
- ✓ \$36,000,000 energy costs



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# INTERACTIVE GUIDE TO STATEWIDE PIER TECHNOLOGY SAVINGS

Take a Virtual Tour of each of these demonstration sites:

**[pierpartnershipdemonstrations.com](http://pierpartnershipdemonstrations.com)**

Dynamic map of PIER Lighting and HVAC installations  
throughout the state

## Features:

- Site Photos
- Energy and Environmental Savings
- Case Study Links
- Product Specification Links
- LEED Guide Links



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# PARTICIPATING PARTNERS

- University of California, California State University, and California Community Colleges
- Ca Department of General Services
- Ca State Agencies
- Ca cities and municipalities
- Select private sector partners



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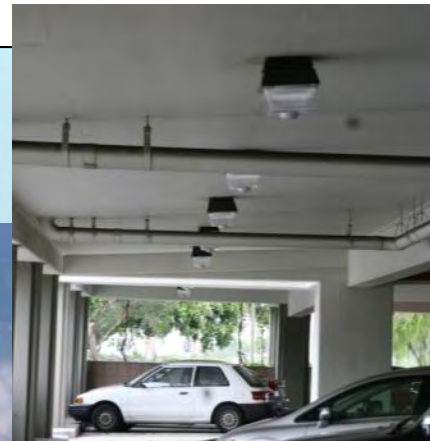
# PIER Lighting Demonstrations





# 50% Energy Savings Solutions: PIER Lighting Technology Portfolio

- Bi-level Smart Exterior Lighting
- Wireless controls for retrofit applications
- Integrated Office Lighting Systems
- Interior Lighting Controls
- Interior LED Lighting



# BI-LEVEL INDUCTION LUMINAIRES WITH WIRELESS DAYLIGHTING CONTROLS

- Controls are key: reduce energy use by 30–40%
- Bi-level occupancy controls, wireless RF daylighting controls
- Broad spectrum source, high CRI and CCT
- 80W high mode, 40W low mode
- Induction lamps can last up to 100,000 hours
- Demonstrated energy savings: 65%



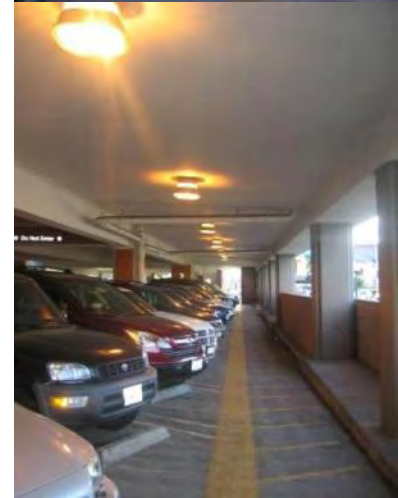
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# BEFORE

- 150W HPS lamps, 170W system
- Continuous operation, 24 hours per day
- Poor lighting quality, CRI ~22, CCT ~2100
- Average maintained illuminance at grade: 8.5 fc
- Annual energy consumption: 268,000 kWh
- Annual electricity cost: \$34,300



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# AFTER

- 70W induction lamp, 80W system
- Wireless daylighting controls reduce operating hours by half
- CRI ~82
- Average maintained illuminance at grade: 4.9 fc
- Estimated **annual energy savings** for full facility retrofit: 174,000 kWh
- Estimated **electricity cost savings** for full facility retrofit: \$22,700
- Estimated project cost after partnership incentive: \$108,000
- Simple payback on capital investment: 4.75 years



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# INDUCTION HIGH BAYS WITH ADVANCED CONTROLS

- Robust luminaires, with minimal components
- Long life lamps = reduced maintenance
- Improved lighting quality
- Demonstrated energy savings up to 60%



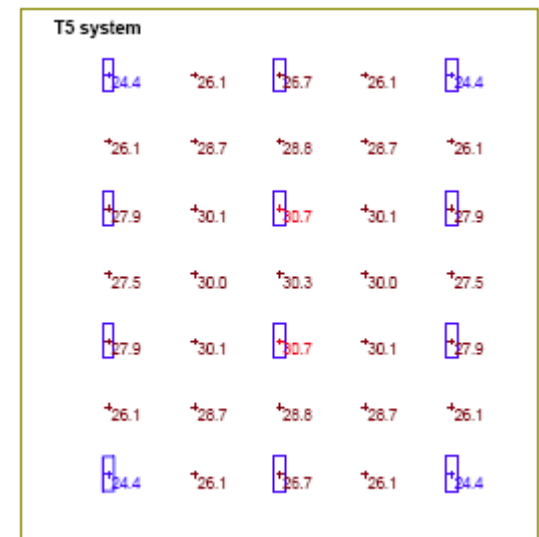
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# BEFORE

- Suspended fluorescent high bay luminaires with T5HO lamps
- 12 luminaires – 6 lamps per fixture
- Power density 0.7 W/ft<sup>2</sup>
- Average horizontal illuminance: 27 fc
- Lamp life 25,000 – 30,000 hours
- No daylighting or occupancy controls
- Estimated lifecycle cost: \$34,000



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# AFTER

- Suspended induction fluorescent high bay luminaires
- 12 luminaires – 1 lamp per fixture
- Power density 0.7 W/ft<sup>2</sup>
- Average horizontal illuminance: 27 fc
- Lamp life 100,000 hours
- Bi-level lighting zones with daylighting and occupancy controls
- Estimated lifecycle cost: \$13,500
- Total Lifecycle savings: \$20,500



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# PIER GROUP PURCHASING PLAN

- Web based portal for PIER technologies offered at volume pricing
- Designed for key demonstration partners such as UC, CSU, and CCC campuses
- Links to PIER technology manufacturers, information on PIER technology solutions
- Access on-line at <http://lightingportal.com/gpp/>

## Bi-level Exterior

Exterior Lighting, including parking lots, area lighting and security lighting represents 3,067 Gwh and 1.4% of California's energy usage annually. A significant portion of the energy used in exterior applications occurs during periods of limited occupancy in the area of illumination. Bi-level controls, which switch lighting between a high level and a low level rather than between on and off, offer a method to address the energy savings potential of these unoccupied exterior applications. While completely turning off the lighting is often not acceptable, switching to a low level provides enough light for security and for way finding. This opens opportunities for bi-level lighting systems that lower lighting levels during unoccupied periods.



**Everlast 100W Parking Garage Fixture**

Full Spectrum Solutions, Inc.

List Price: \$590 Our Price: \$388



**Everlast 100W Parking Lot Cobra Fixture**

Full Spectrum Solutions Inc.

List Price: \$570 Our Price: \$363



**Everlast 150W Cobra Roadway Fixture**

Full Spectrum Solutions Inc.

List Price: \$465 Our Price: \$319



**Everlast 100W Parking Lot Shoe Box Fixture**

Full Spectrum Solutions Inc.

List Price: \$570 Our Price: \$373



**Everlast 70W Wall Pack Fixture**

Full Spectrum Solutions Inc.

List Price: \$560 Our Price: \$353



**PIER PARTNERSHIP  
GROUP PURCHASING PROGRAM**



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# PIER HVAC TECHNOLOGIES



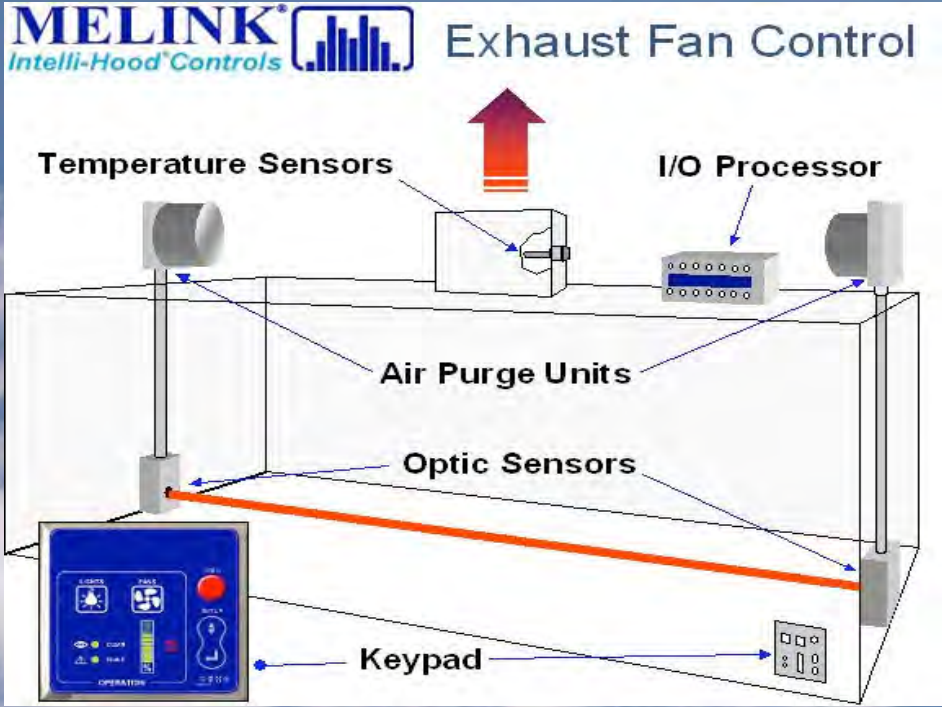
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# Demand Ventilation Control in Commercial Kitchens

- Reduces fan speeds in response to lower cooking loads
- Typical fan energy reductions – 40-75%
- Typical make-up heating and cooling reductions – 15-40%



# AEROSEAL FOR CENTRAL EXHAUST

- Low cost non-invasive leak sealing in central exhaust systems technology that can have three year payback given proper circumstances
- Demonstration in 3 similar UC Davis Residence Hall anticipates 50% fan energy savings, 20% thermal energy savings and improved ventilation
- Be prepared to address design flaws and major failures



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# AIRCARE PLUS

- Enhanced HVAC maintenance
  - Charge
  - Airflow
  - Economizer
  - Programmable thermostats
- Demonstration will service all packaged and split equipment at UC Davis
- Pre-post monitoring study over 2010 cooling season
  - 14 rooftop package units, 6 split systems, all 2-10 tons all at UC Davis
  - Monitoring capacity and energy consumption to evaluate COP improvements



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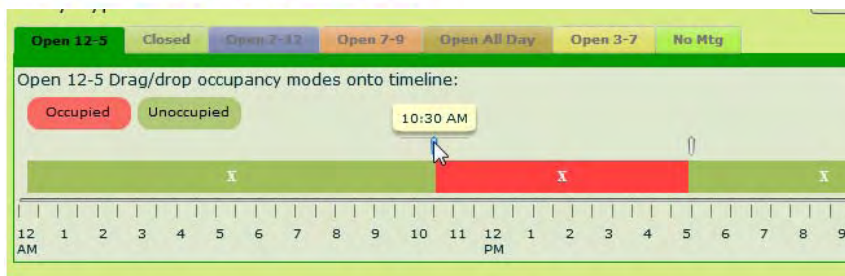
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# AIRCARE PLUS

- PowerMand DreamWatts
  - a web-enabled FDD, monitoring and control tool
    - Record info about user behavior
    - Allow simple control of facility-wide set points
    - Monitor equipment performance
- Monitoring in place for longer term study

DreamWatts®



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# COOLERADO H80

- First commercialized Western Cooling Challenge entry
- 80% energy savings, 60% demand reduction
- Demonstrations at UC Davis and LACCD
  - Pre-post monitoring at UC Davis
  - Side-by-side comparison at Los Angeles Community College



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# Other PIER TECHNOLOGIES



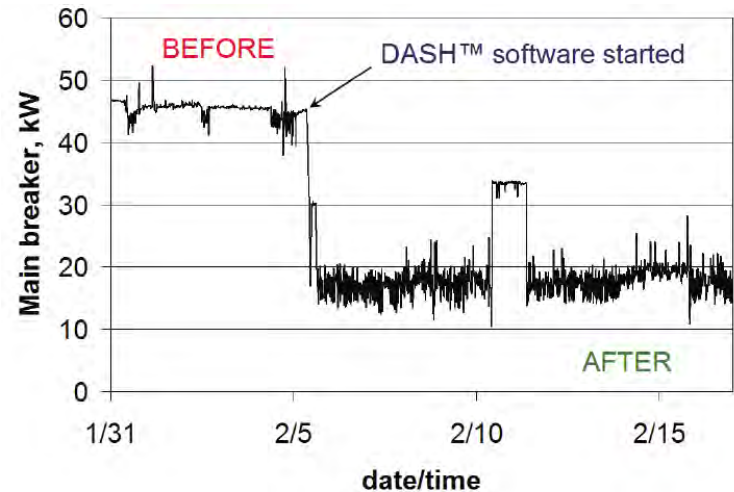
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# DATA CENTER SOFTWARE & HARDWARE (DASH™)

- System uses state-of-the-art wireless sensor network technology
- Battery-powered wireless temperature sensors installed on data center racks and cooling units
- Sensors measure server inlet air temperatures throughout the data center. Software integrates with the existing cooling infrastructure
- Automatically determines which cooling resources to run, optimal fan speeds, temperature setpoints, and humidity setpoints.



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# DEMONSTRATION SUMMARY

- Demonstrated PIER technologies save energy and money
- Demonstration program provides method for partners to test drive new lighting technologies
- Group purchasing program provides avenue for volume pricing on selected PIER lighting technologies
- Please visit : [www.pierpartnershipdemonstrations.com](http://www.pierpartnershipdemonstrations.com)

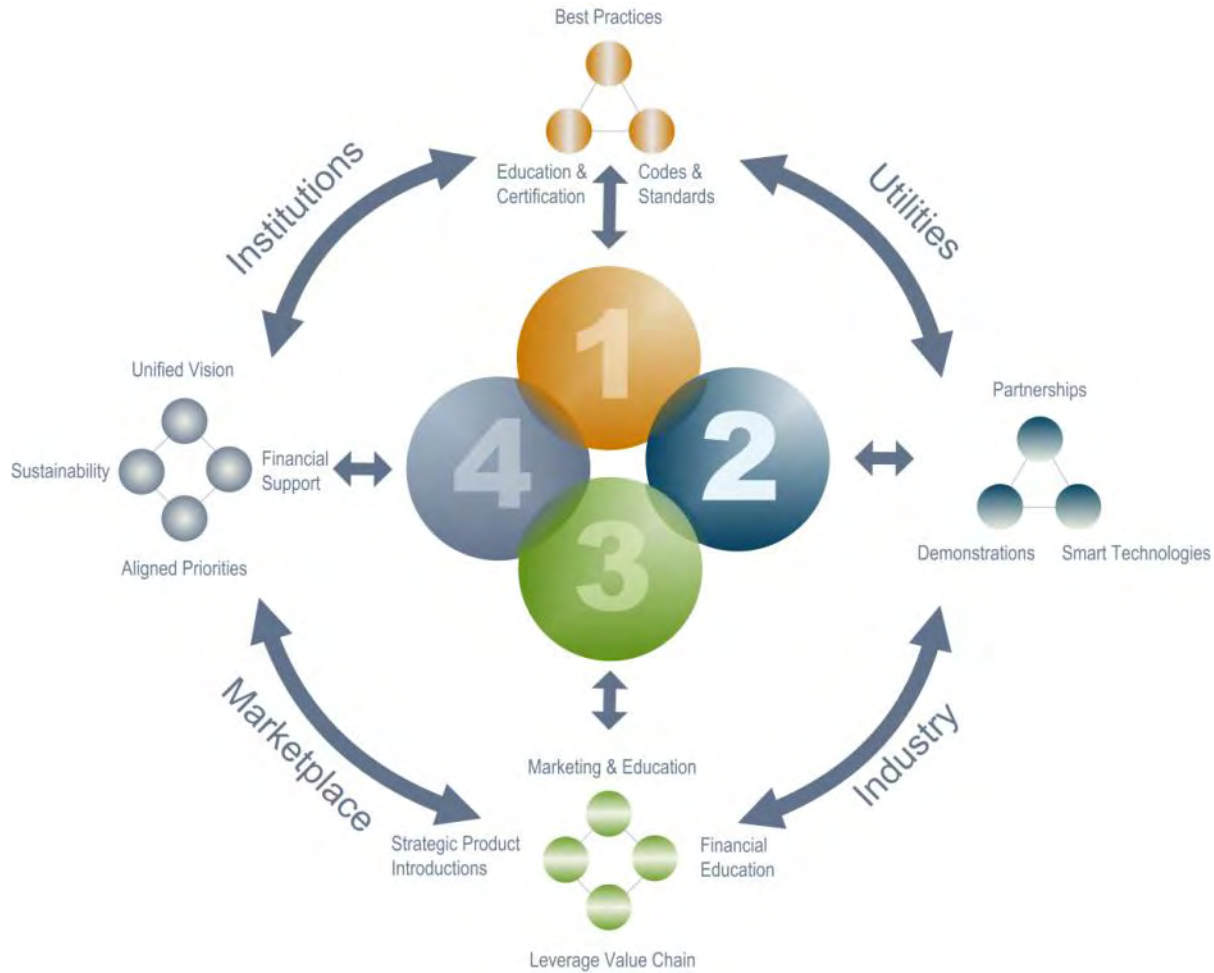


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# CPUC STRATEGIC LIGHTING PLAN



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# CONTACT INFORMATION

Thank You.

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