



U.S. Department of Energy
**Energy Efficiency
and Renewable Energy**

Bringing you a prosperous future where energy
is clean, abundant, reliable, and affordable

Federal Energy Management Program



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The
Solutions
Network

You Can Benefit from Public Interest Research and Development

PIER Buildings Program Overview

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California Energy Commission

Agenda

- PIER Buildings Program Overview
- Commercial Lighting Products
- Commercial HVAC Products
- Residential Products



What is PIER?

Public Interest Energy Research Program

- Initiated in 1998 as a part of California electricity deregulation and funded at \$62M/Yr
- It's the research counterpart to the public goods energy efficiency program administered by the utilities and the Renewables Program administered by the CEC
- The mission of PIER is to conduct public interest energy research that seeks to improve the quality of life...by providing environmentally sound, safe , reliable and affordable energy services and products



PIER Buildings Program Goals and Outcomes

- More affordable, comfortable, energy efficient buildings from improved designs, construction methods, and operational strategies
- More reliable electricity systems through lowered peak demand
- Healthier, energy efficient indoor environments
- Improved customer choices for affordable, energy efficient technologies



What's Different About PIER?

- Applied research with strong emphasis on issues and market partnerships – no research for the sake of research
- Strong emphasis on collaborations
 - Avoid duplication/builds on past work/ensures relevance
 - Regular coordination with IOUs via the Emerging Technology Coordinating Council to transition research to the marketplace
 - State partnerships (DGS/DOF, ARB, T-24)
 - Market Partnerships (California builders, Collaborative for High Performance Schools, California Commissioning Collaborative, major equipment manufacturers)
- Leadership role in R&D in the country



PIER Program Managers

PIER Program Director: Martha Krebs

Energy Efficiency Research Office, Nancy Jenkins

Residential and Commercial Bldgs, Ann Peterson

Industrial/Agricultural/Water, Pramod Kulkarni

Energy Generation Research Office, Elaine Sison-LeBrilla

Renewables, Vacant

Advanced Generation, Art Soinski

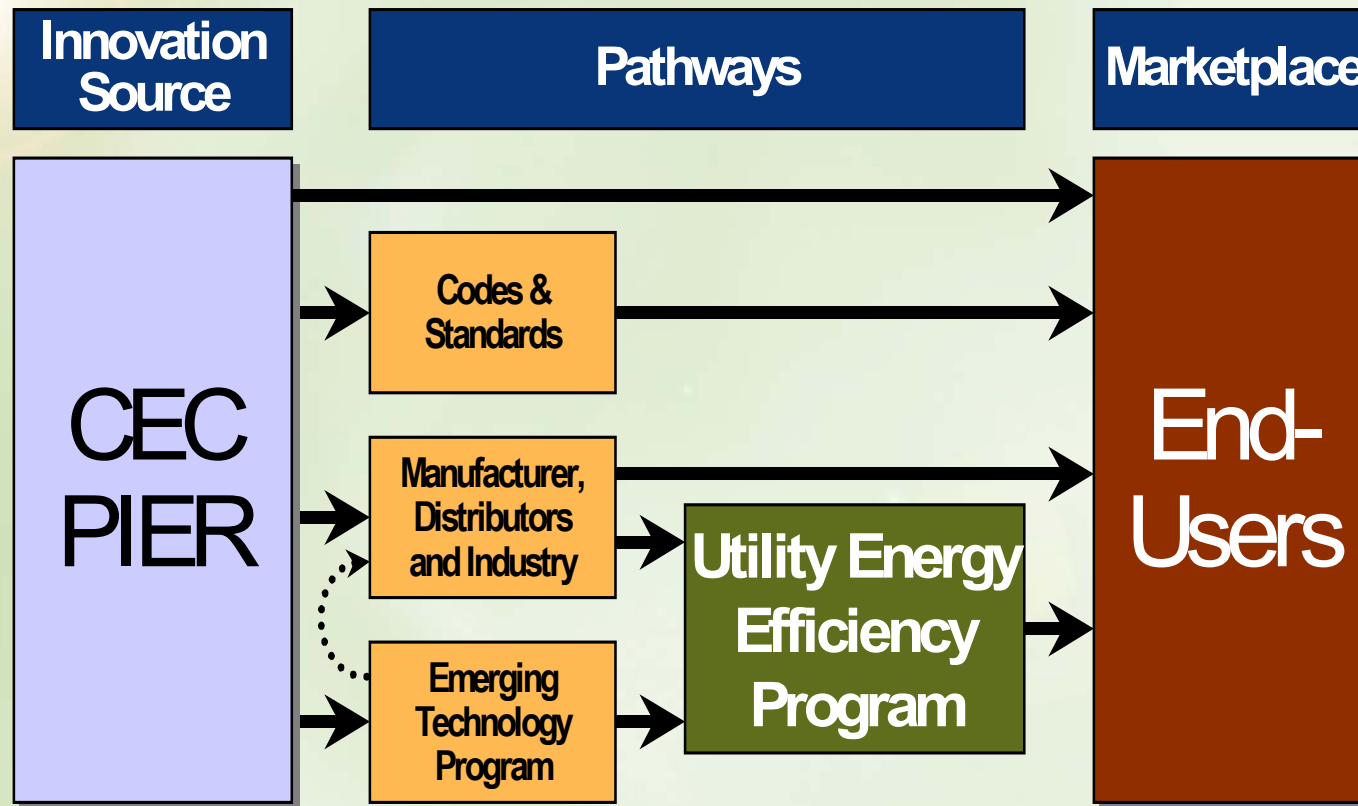
Environmental & Energy Systems Integration, Laurie ten Hope

Environmental, Kelly Birkinshaw

Energy Systems Integration, Mark Rawson



PIER Pathways to Market



PIER Buildings Program Scope

- Primarily focuses on shorter term, applied research in new and existing buildings
- End uses include HVAC, building systems, water heating, appliances, office equipment
- Research products include design information/specifications, technologies (hardware), software, controls, and others
- Covers the entire building life cycle from component development/design, construction, commissioning, operation



PIER Buildings Program Overall Approach

- Establish context based on California energy policies and overall PIER goals
- Identify Issues
- Develop plans responsive to buildings issues, overall PIER goals and statewide energy policy
- Implement the plans through numerous strategies
- Evaluate how we are doing, recalibrate based on that evaluation, revise plans for the future



PIER Buildings Program R&D Issues

Issue 1: Inland Growth

- *Population growth and economic development trends in hot inland areas will change California's energy consumption patterns, resulting in substantially increased energy consumption and costs, as well as increased peak demand spikes and compromised grid reliability*

Issue 2: Demand Response

- *Customers do not have affordable and effective tools, technologies, controls, and strategies to respond to future time dependent price structures for electricity (to be demand responsive)*



PIER Buildings Program

R&D Issues

Issue 3: Affordability

- *Because affordability is the primary driver for building equipment purchase decisions, development of lower first-cost options for energy efficient products, as well as lower operational costs for energy consuming systems, are essential for increasing the adoption of energy efficiency measures in California*

Issue 4: Non-energy Drivers

- *Decisions regarding building components, systems, and operations are generally made based on non-energy considerations, but understanding and addressing the substantial energy impacts of key non-energy considerations such as health, safety and productivity are critical to improving energy efficiency in California's buildings*



PIER Buildings Program

R&D Issues

Issue 5: Existing Buildings

- *New construction accounts for only a few percent of California's building energy usage each year. Although opportunities to impact energy use in existing buildings are more limited than for new buildings, the existing building sector is so large that efficient replacement products, improved operational strategies, and appropriate intervention tactics that can reach the existing building market are critical*

Issue 6: Operational Issues

- *Systems and equipment frequently perform less efficiently than predicted due to sub-optimal integration of subsystems and components, improper installation, poor maintenance, and user's inability to detect and diagnose equipment performance degradation, thereby reducing the equipment life and increasing energy costs*



PIER Buildings Program R&D Issues

Issue 7: California Uniqueness

- *Technologies, products, strategies and business models developed for national markets do not adequately address California's unique building energy needs, and do not take advantage of state organizations, programs, and initiatives which can help facilitate improved building energy efficiency.*

Issue 8: Electronics

- *The digital revolution has opened up new, more affordable opportunities for energy savings and peak demand management in buildings, but the proliferation of entertainment and information systems has also significantly increased plug loads*



Commercial Lighting Products

Integrated Classroom Lighting System
Classroom Photosensor and Controls
Sensor Placement and Orientation Tool
Hotel Bathroom Nightlight
Bi-Level Stairwell Fixture
LED Hybrid Outdoor Fixture
Low-Glare Outdoor Luminaire
LED Task Light



Integrated Classroom Lighting System (ICLS)

Problem

- Many classroom lighting systems provide mediocre lighting with high energy costs
- High-efficiency systems require separate specification of control components, increasing design and component costs
- Also, multiple warranties for individual components can lead to confusion

Solution

- The ICLS combines high quality lighting, increased flexibility, daylighting, and energy efficiency
- Plug and play components minimize design, installation, and commissioning time



Integrated Classroom Lighting System (ICLS)

Features

- Two or three rows of optically efficient direct/indirect fixtures with 3500K XPS T8 lamps
- Automated dual-technology occupancy sensor, with manually switched rows for daylighting control; optional daylight dimming
- One source for layout, pricing, and warranty

Benefits

- High-quality, glare-free lighting ensures occupant satisfaction
- 20-45% savings versus conventional new and older systems



Integrated Classroom Lighting System (ICLS)

Applications



- K-12, university, or institutional classrooms
- PIER project demonstrated ICLS in 19 classrooms at 6 California schools
- Currently available from Finelite (www.finelite.com)
- A public specification is also available

Classroom Photosensor and Controls

Problem

- Photosensors and associated control systems dim or raise fluorescent lighting systems as daylight changes
- Daylighting control systems often require extensive and costly commissioning... but do not always provide consistent, accurate light levels

Solution

- A new system allows users to commission photosensors and calibrate light levels quickly using a remote hand-held tool
- Controls optimize interaction between common classroom electric lighting systems and daylighting



Classroom Photosensor and Controls

Features

- Controls handle common daylighting configurations: side-lighting only, top-lighting only, or combination
- Advanced photosensor design accurately senses daylight availability
- Operates with manual controls and occupancy sensors

Benefits

- Integrated photosensor, occupant adjustment control, power pack, and commissioning tool speed installation and commissioning
- Control can reduce classroom lighting energy use up to 60% and reduce lighting peak demand by 40%



Classroom Photosensor and Controls

Applications



- Design is optimized for classrooms and other instructional spaces, but is also appropriate for standard offices
- Wattstopper expects to release this product in 2006

Sensor Placement and Orientation Tool (SPOT)

Problem

- Photosensor performance varies widely, affecting daylighting controls performance
- Designers struggle to ensure proper integration of daylighting controls
- Quickly estimating energy savings is also a challenge

Solution

- SPOT helps designers establish correct photosensor placement for a daylighting/lighting design
- It also estimates overall system performance
- SPOT promotes successful controls operation and maximizes energy savings



Sensor Placement and Orientation Tool (SPOT)

Features

- Consists of an Excel interface with a Radiance calculation engine
- Allows user to vary photosensor placement and evaluate alternate designs
- Calculates nighttime illumination levels and range of daylight contribution throughout the year

Benefits

- Simple, easy-to-use interface
- No cost to purchase!
- Enables better daylighting design, which can produce up to 60% savings



Sensor Placement and Orientation Tool (SPOT)

Applications

- Developed for classrooms, applicable to other spaces
- LAUSD school designers trained in March 2005
- Won two product awards at Lightfair 2005
- To obtain SPOT, visit www.archenergy.com/SPOT/index.html



Hotel Bathroom Nightlight

Problem

- Typically, bathroom lights are left on between 5-8 hours per occupied day in hotels
- Often people leave the bathroom lights on at night as nightlights
- Often people leave bathroom lights on when they leave the room

Solution

- The Hotel Bathroom Nightlight combines a motion sensing switch and nightlight to control lighting based on occupancy
- The efficient LED nightlight remains on whenever lights are off, providing constant illumination



Hotel Bathroom Nightlight

Features

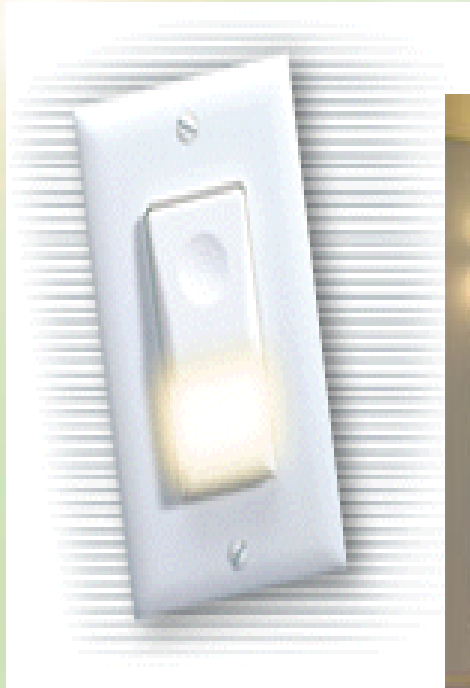
- Built-in LED nightlight illuminates room whenever overhead lights are off
- Adjustable time delay from 15-120 minutes meets varying needs; manual-ON or auto-ON for operational flexibility
- Wall switch and bathroom vanity products developed

Benefits

- Cuts bathroom lighting energy use about 50%, with simple payback of 2.5/5.5 years for new/retrofit projects
- Reduced lamp operation also lengthens lamp-changing cycle and reduces maintenance cost



Hotel Bathroom Nightlight Applications



- Hotel rooms and institutional spaces
- Watt Stopper WN-100 wall switch available now
- Smart vanity fixture installed in 132 hotel/assisted living rooms with SMUD
- 2005 demonstrations planned with UC/CSU

Bi-Level Stairwell Fixture

Problem

- Stairwells are lit 24 hours/day
- 9-11 highlights the need for well-lit stairwells
- But... stairwells are unoccupied up to 95% of the time

Solution

- Bi-level T8 fixture with a motion sensor to reduce light in unoccupied stairwells
- PIER researchers tested LaMar bi-level fixtures in four buildings



Bi-Level Stairwell Fixture

Features

- Many available lamp, ballast, and fixture configurations
- Meets code illumination requirements
- Integrated motion sensor simplifies installation

Benefits

- 40–60% energy savings
- 3-8 year payback, depending on new/retrofit



Bi-Level Stairwell Fixture



Applications

- Any stairwell with high-wattage T12 or T8 fixtures
- Further demonstrations planned on UC/CSU campuses and California State buildings
- To learn more about LaMar products, visit www.occusmart.com



LED Hybrid Outdoor Fixture

Problem

- Many exterior lights use small, inexpensive incandescent lamps
- Incandescent lamps are inefficient and burn out quickly, increasing operating costs and raising security concerns
- CFLs last 2-4 years but are expensive and sometimes don't fit into existing fixtures

Solution

- The LED Hybrid Fixture combines LED technology with an occupancy sensor and incandescent lamp, with lower energy use and operating cost than either conventional or CFL fixtures



LED Hybrid Outdoor Fixture

Features

- A photocell controls a 5W amber LED array for continuous nighttime operation
- An occupancy sensor turns on the incandescent lamp when motion is detected

Benefits

- Cuts operating costs 50–90%, depending on occupancy
- LEDs with 10–15 year life continue to provide light when incandescent lamps burn out
- LEDs meet 2005 Title 24 efficacy requirements



LED Hybrid Outdoor Fixture



Applications

- Currently available from Shaper Lighting in post-mounted and entry/porch fixtures suitable for commercial, institutional, or residential applications
- UC/CSU demonstrations planned

Low-Glare Outdoor Luminaire

Problem

- Commonly-used wall pack luminaires have poor light output control, leading to sky glow and light trespass
- Conventional wall packs have effective light projection of only 30' at mounting heights of 15'

Solution

- Low-glare wall sconce with a semi-cutoff design that reduces light pollution
- Low-glare wall sconce effectively projects light up to 45' from a mounting height of 15'
- Optical efficiency allows 33% fewer luminaires per installation, reducing installation and operations cost



Low-Glare Outdoor Luminaire

Features

- Available in 100W or 150W ceramic metal halide lamps with electronic ballasts
- Comparable lamp life to HPS—20,000 hours
- Whiter light with higher color quality than HPS

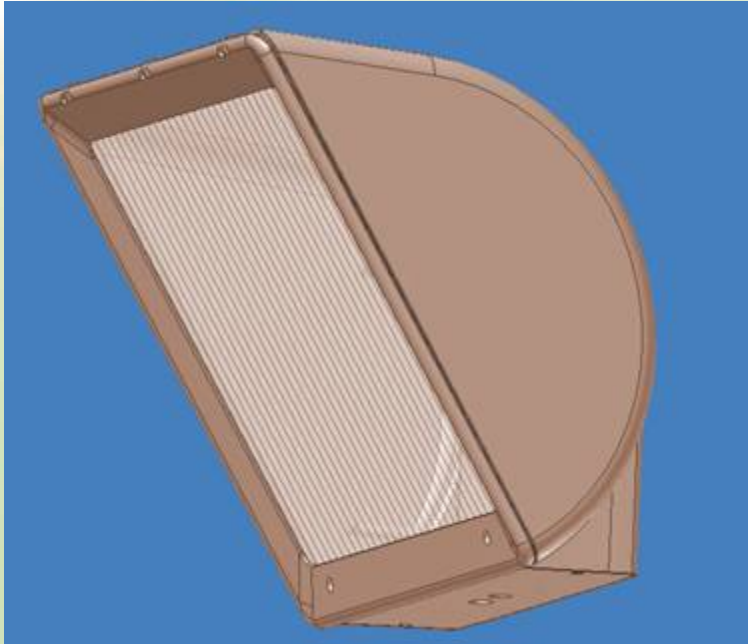
Benefits

- 30% energy savings in new/retrofit applications with 100W unit versus 150W HPS fixtures
- More uniform, higher quality lighting with less light pollution



Low-Glare Outdoor Luminaire

Applications



- Commercial and institutional buildings
- Gardco Lighting, model 151 Forward Form Wall Sconce available now (www.sitelighting.com)
- Pole-mounted perimeter light is also available
- UC/CSU demos planned in 2005

LED Task Light

Problem

- Task lights often use incandescent lamps because they are inexpensive, with good optical properties
- However, incandescent lamps have high energy use and can get dangerously hot
- CFLs are bulky and pose difficulties in focusing the light

Solution

- Researchers from LBNL developed a high-performance prototype LED task light
- The 11.5W lamp uses two rows of 1W LEDs to provide equivalent lighting to a 40W incandescent or 18W CFL



LED Task Light

Features

- High-brightness LEDs
- Advanced optical design
- Improved thermal management, with long LED life and high light output

Benefits

- Cuts energy use by 70% compared to incandescent task lights and 40% compared to CFLs
- Specialized optics provide proper light distribution on the work plane
- 50,000 hour LED life expected, far exceeding 750 hours for incandescent and 10,000 for fluorescent



LED Task Light

Applications



- LED task lights are ideally suited for office buildings, single- and multi-family dwellings, dormitories, and hotels
- Luxo has an LED version of its Arketto lamp with this technology (www.luxous.com)

Commercial HVAC Products

Small HVAC Design Guide

Rooftop A/C Diagnostics

Hot/Dry Air Conditioner

Improved Classroom Heat Pump

AHU Functional Test Guide

Building Vulnerability Assessment Tool

Green Building Specifications

Green Building Studio



Small HVAC Design Guide

Problem

- Packaged HVAC systems are common in small commercial buildings
- These systems often perform poorly due to poor design, installation, maintenance, and/or operations

Solution

- The *Small HVAC System Design Guide* provides solutions for common problems in the design, operation, and maintenance of rooftop HVAC systems



Small HVAC Design Guide

Features

- Explains integrated lighting/envelope design strategies for reducing HVAC load
- Recommends specifications for packaged units, economizers, and thermostats
- Explains how to size HVAC units properly
- Provides guidelines for commissioning and maintenance

Benefits

- Design Guide strategies can reduce HVAC energy consumption of buildings by 25-35%, with payback under .02-2.4 year payback



Small HVAC Design Guide

Applications

- Buildings with single-package rooftop air conditioners and heat pumps
- Available at www.energy.ca.gov/reports/2003-11-17_500-03-082_A-12.PDF



Rooftop A/C Diagnostics

Problem

- Rooftop air conditioners for small commercial and institutional buildings are often poorly maintained
- Problems can go undetected for long periods, resulting in high energy costs, shortened equipment life, and comfort/health issues
- Fault Detection and Diagnosis (FDD) technologies attempt to monitor equipment with embedded sensors, but existing products have been expensive and limited to detecting one problem at a time

Solution

- A cost-effective, automated FDD technology that detects early signs of equipment malfunction and handles multiple simultaneous problems



Rooftop A/C Diagnostics

Features

- Uses sensors embedded in RTU controller to monitor temperatures at various points in the cooling cycle
- Analyzes the difference between monitored and expected temperatures to detect imminent problems
- Alerts facilities manager to problems

Benefits

- \$400-\$1000 annual energy savings with <1-year payback in PIER field test
- Better maintenance scheduling, lower maintenance costs, and fewer unplanned outages
- Improved occupant health/comfort



Rooftop A/C Diagnostics

Applications

- Anywhere rooftop A/C units are used
- FDD builds on the HVAC Service Assistant system available from Honeywell
- Honeywell is evaluating FDD technology in a field test at one of their manufacturing sites



Hot/Dry Air Conditioner

Problem

- Air conditioning loads drive California summer peak electrical demand
- High growth areas are in hot climate regions
- However, most air conditioners are optimized for more humid climates

Solution

- PIER researchers are investigating a Hot-Dry Air Conditioner (HDAC) optimized for Western climates



Hot/Dry Air Conditioner

Features

- High efficiency at high ambient temperatures
- Cools air without dehumidifying it significantly
- 3-ton split and 5-ton packaged unit prototypes

Benefits

- HDAC is expected to reduce energy use by 10-20% and demand by 15-25%, for 5-15% additional cost



Hot/Dry Air Conditioner

Applications

- Residential and small commercial buildings
- Optimized for hot-dry areas throughout the West
- Currently testing prototypes
- For more information, visit <http://www.hdac-des-pier.com/>



Improved Classroom Heat Pump

Problem

- More than 80,000 Relocatable Classrooms (RCs) in California house about 2 million students
- The heat pumps typically used to heat and cool RC's are noisy, and energy-inefficient
- Also, previous PIER work showed that most RC's are under-ventilated

Solution

- LBNL is designing and testing a much improved classroom heat pump in partnership with a leading manufacturer



Improved Classroom Heat Pump

Features

- Prototype performs at about SEER 13.5
- Noise reduction from ≤ 45 dB(A)
- Continuous ventilation meeting California state code requirements

Benefits

- 56% energy savings and about 50% noise reduction from SEER 10 baseline unit



Improved Classroom Heat Pump

Applications

- Relocatable Classrooms and other applications for wall-mounted heat-pumps
- Currently field-testing units in 16 classrooms
- For more information, visit
<http://eetd.lbl.gov/IEP/IVSE/ivse.html>



AHU Functional Test Guide

Problem

- Air handler units (AHUs) often don't work as designed
- Building operators and providers of commissioning services lack standardized procedures to verify AHU performance
- The result is uncomfortable occupants and high energy bills

Solution

- The *Functional Testing Guide for Air Handling Systems* helps building operators and commissioning providers standardize AHU testing procedures



AHU Functional Test Guide

Features

- 16 chapters cover individual air-handler components in detail
- Provides background on underlying theory, test procedures, design issues, and information on common problems
- Provides hyperlink access to the functional tests collected in the Commissioning Test Protocol Library (CTPL) developed by PG&E

Benefits

- Saves energy and improves building comfort by assisting with AHU problem identification and diagnosis



AHU Functional Test Guide

Applications

- New and existing commercial buildings with built-up AHUs
- Guide is available at http://buildings.lbl.gov/hpcbs/Element_5/02_E5_P2_1_1.html
- California utilities are funding a web-based guide for their Energy Design Resources website



Air handler on site, prior to installation and commissioning

Building Vulnerability Assessment Tool

Problem

- 9-11 highlighted the need to secure buildings against chemical, biological, and radiological attack
- Preparation and advance planning can reduce both likelihood and severity
- But... most available information is tailored to technical consultants, not building owners/operators

Solution

- The Building Vulnerability Assessment and Mitigation Program (BVAMP) provides facility managers with an easy-to-use software tool for identifying basic steps to secure buildings and develop mitigation plans



Building Vulnerability Assessment Tool

Features

- Paper-based building walkthrough questionnaire
- Software-based interactive questionnaire
- Recommendation report

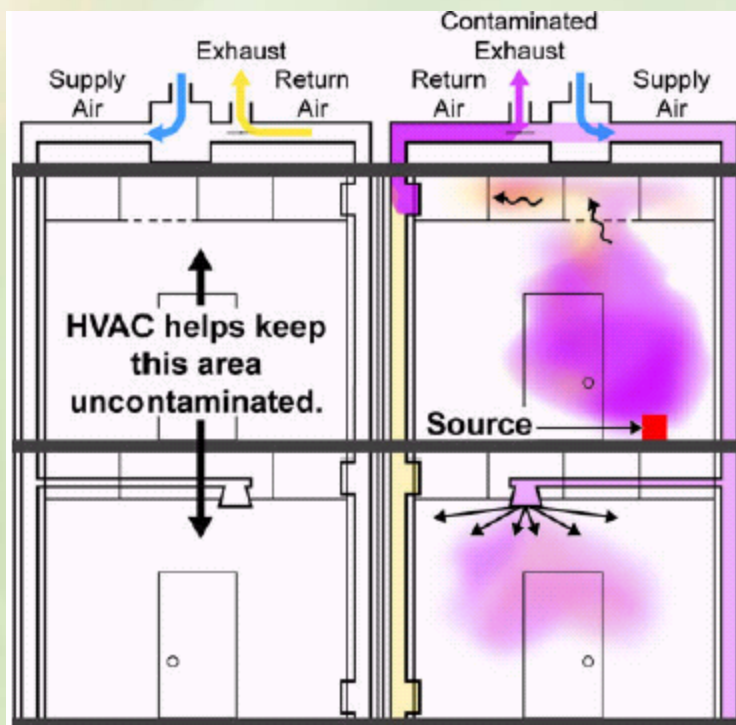
Benefits

- Practical, building-specific advice for:
 - improving emergency preparedness
 - developing emergency building system control protocols
 - planning for shelter-in-place responses
 - restricting access to building systems and information
- It's free!



Building Vulnerability Assessment Tool

Applications



- Designed for typical commercial office buildings
- For use by building owners, facility managers, safety managers, and private contractors
- For free download, visit LBNL's Secure Building website at <http://SecureBuildings.lbl.gov>

Green Building Specifications

Problem

- While ample information is available about energy efficient components and systems, that information often does not make it into the plans and specifications - the construction documents that guide contractors in the field
- Typically, specifications from previous jobs are recycled and evolve slowly over time
- Therefore, standard specifications usually fail to include up-to-date requirements for energy efficient materials, systems, and commissioning

Solution

- The *Reference Specifications for Energy and Resource Efficiency* provide a ready-made set of reference specifications for architects and engineers to insert into construction documents



Green Building Specifications

Features

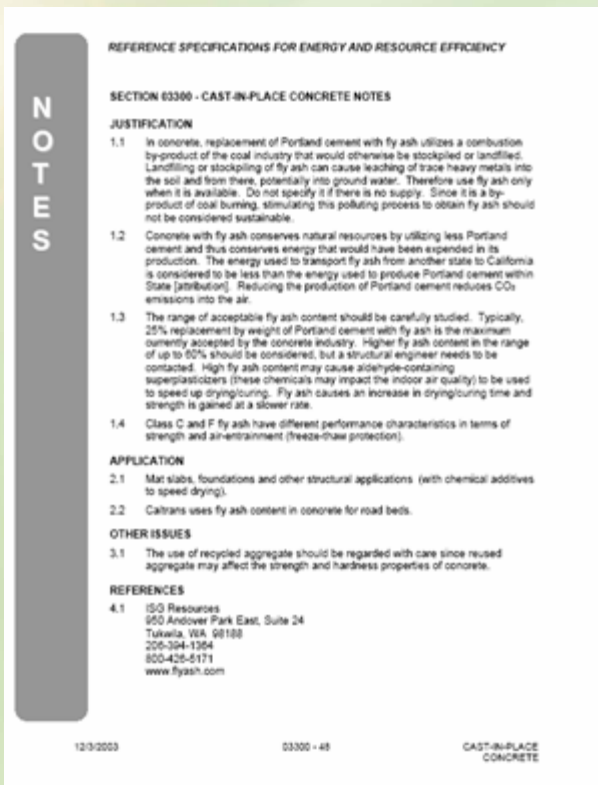
- Covers energy efficiency considerations of insulation, roofing, windows and skylights, HVAC, lighting, commissioning
- Considers Indoor Air Quality/material emissions
- Promotes resource efficiency by covering material recycled content, recyclability, sustainably harvested wood, and site waste management
- Divided into standard specification divisions

Benefits

- Reduces time and improves quality of specifications for green buildings such as LEED projects



Green Building Specifications Applications



- The *Reference Specifications for Energy and Resource Efficiency* are available at no charge from Architectural Energy Corporation at <http://www.archenergy.com/library/pier/refspec/>



Green Building Studio

Problem

- Energy analysis is often performed late in the design phase—when cost-effective options for boosting efficiency are limited
- Energy simulation programs, such as DOE-2 and EnergyPlus, are powerful but require time-consuming data entry

Solution

- The Green Building Studio (GBS) is a web-based service that enables designers generate an energy analysis model automatically from within popular 3D CAD software packages



Green Building Studio

Features

- Exports complex building geometries from 3D CAD packages using Green Building XML (gbXML)
- Uses DOE2 engine to model whole-building energy use and present results using base case and Savings by Design assumptions
- Allows access to DOE2 input files for further analysis

Benefits

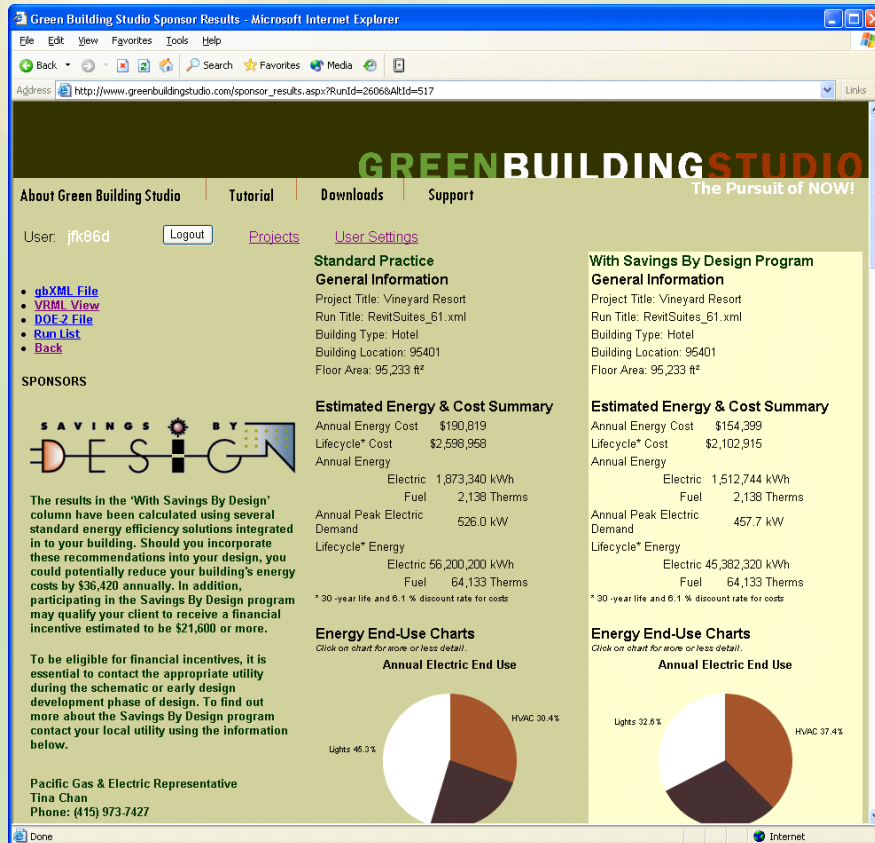
- Enables energy analysis early in the design process
- Saves time and cost to produce a first-rev energy model
- Facilitates information sharing with energy engineers for more detailed analyses



Green Building Studio

Applications

- Projects using 3D CAD
- Works today with Autodesk and Graphisoft CAD tools
- Further development, testing, and validation underway with support from PIER, PG&E, NEEA, and EPA
- For more information, visit www.greenbuildingstudio.com



Residential Products

Kitchen Lighting System

Colored Cool Roofs

Residential Night Ventilation Cooling

Indirect-Direct Evaporative Cooler

Next-Generation Heat Pump Water Heater



Kitchen Lighting System

Problem

- Recessed downlights are increasingly popular in residential new construction and remodelling, especially in kitchens
- A typical kitchen with six incandescent downlights uses 450W!
- Screw-based CFL retrofit solutions suffer from poor lifetime and lumen output, and commercial-grade CFL fixtures cost 5-10 times as much as residential incandescent fixtures

Solution

- A high-quality yet affordable residential CFL downlight which uses one ballast to operate two lamps with a plug-and-play wiring system



Kitchen Lighting System

Features

- High-performance optics and high-quality CFL
- Thermally enhanced ballast configuration
- Master-slave configuration with plug-and-play wire connections

Benefits

- 75% energy savings versus incandescent downlights
- Plug-and-play installation cuts labor cost by about 20%, making installed cost competitive with incandescent downlights
- Meets new 2005 Title 24 residential lighting requirements for California



Kitchen Lighting System

Applications



- Residential kitchens, hallways, and any other incandescent downlight application
- Model CKP62 available from as Lithonia Lighting
- Lithonia has also developed models CCR62 and CCR82 for commercial applications

Colored Cool Roofs

Problem

- Cool roofs cut cooling loads by up to 20% by using reflective materials to limit solar heat gain
- White cool roofs are highly effective and have gained acceptance in flat-roof applications
- However, residential cool roofs are not popular because homeowners prefer dark colors

Solution

- New roofing products incorporate dark-colored pigments that reflect non-visible sunlight



Colored Cool Roofs

Features

- Available in dark colors just like traditional roofing materials
- Reflectivity of 25-40% versus 4-15% for traditional roofing materials (light-colored roofs can achieve reflectivity of around 70%)

Benefits

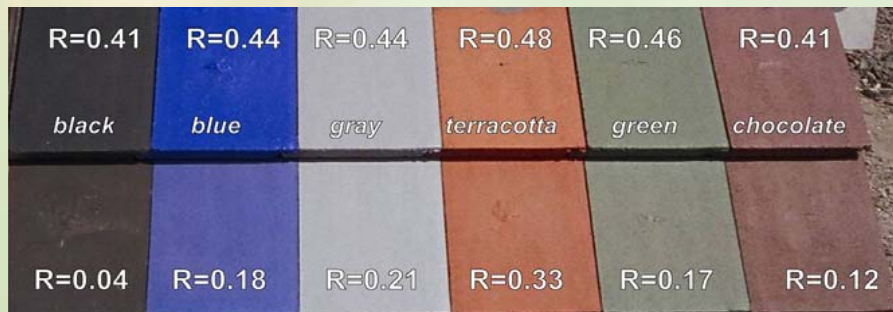
- Saves energy and peak demand
- May qualify for Title 24 compliance credits in California



Colored Cool Roofs

Applications

- Residential applications are the primary target for cool-colored roofing materials
- Cool roofs work best in cooling-dominated climates
- For more information, visit <http://coolcolors.lbl.gov/>



| | | | | | |
|--------------|-------------|-------------|-------------------|--------------|------------------|
| R=0.41 | R=0.44 | R=0.44 | R=0.48 | R=0.46 | R=0.41 |
| <i>black</i> | <i>blue</i> | <i>gray</i> | <i>terracotta</i> | <i>green</i> | <i>chocolate</i> |
| R=0.04 | R=0.18 | R=0.21 | R=0.33 | R=0.17 | R=0.12 |

Tiles with coatings made from cool-colored pigments (in the top row) look similar to conventional tiles (in the bottom row) but offer improved solar reflectance (R) values.



Residential Night Ventilation Cooling

Problem

- Even in mild coastal climates, home builders typically install air conditioners in new homes
- This increases peak demand and strains utility systems on hot summer days
- In California, 37% of peak electrical demand is driven by residential loads!

Solution

- The NightBreeze system circulates fresh night-time air through a home, pre-cooling its thermal mass
- This reduces or eliminated the need for air-conditioning during peak daylight hours



Residential Night Ventilation Cooling

Features

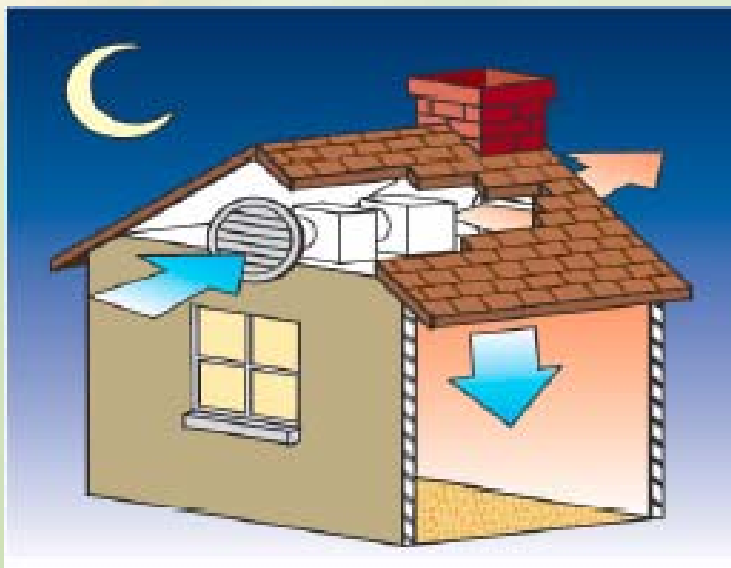
- Ventilation system with filtration integrated into central HVAC
- Efficient hydronic fan-coil heating and optional air conditioning coil
- Quiet, high-efficiency, variable-speed blower motor
- User-friendly thermostat control

Benefits

- Significantly reduced cooling energy and peak power demand with improved indoor environmental quality



Residential Night Ventilation Cooling Applications



- New residential construction in relatively dry climates with high diurnal temperature swings
- Follow-on PIER project is testing forced-air furnace version of NightBreeze
- For more information, contact Davis Energy Group

Indirect-Direct Evaporative Cooler

Problem

- Evaporative coolers in residential applications save energy and cut demand compared to conventional vapor compression air conditioners
- However, traditional “swamp coolers” don’t always provide adequate cooling in very hot weather, and can cause uncomfortable indoor humidity levels

Solution

- The Indirect-Direct Evaporative Cooler (IDEC) uses two-stage evaporative cooling to produce cooler, dryer air than typical evaporative coolers



Indirect-Direct Evaporative Cooler

Features

- Innovative counter-flow heat exchanger
- Quiet electronically-commutated motor
- Corrosion-resistant plastic housing and heat exchanger
- Energy efficiency ratio (EER) from 40 to 136, depending on fan speed

Benefits

- 85-95% energy savings and 80-90% demand savings compared to compressor-based cooling



Indirect-Direct Evaporative Cooler

Applications

- Homes and small commercial buildings in hot/dry climates
- Applications where indoor air quality is especially important, such as modular classrooms
- OASys product will be marketed by Speakman CRS
- For more information, contact Davis Energy Group (<http://www.davisenergy.com/>)



Next-Generation Heat Pump Water Heater

Problem

- Electric water heaters are expensive to operate
- Gas water heaters have lower operating costs, but gas is not available in all areas, and is not always practical in retrofit situations
- Heat-pump water heaters are more efficient than conventional electric heaters, but have historically been expensive to manufacture, install, and maintain

Solution

- The Watter\$aver is designed to work as a drop-in replacement for conventional electric water heaters, at lower cost and higher reliability than past HPWH's



Next-Generation Heat Pump Water Heater

Features

- Fits into the same space as a typical electric water heater
- Includes a backup electric-resistance-mode heating element to minimize chances of running out of hot water
- Design optimized for first cost and reliability

Benefits

- In California field test, participants saved between 28-52% on their electric bills
- HPWH also provides cooling and dehumidification when it is installed in conditioned space



Next-Generation Heat Pump Water Heater

Applications



- Retrofit of existing electric water heaters
- New residential construction where gas service is unavailable
- Visit www.ecrinternational.com for more information about the Watter\$aver

Contact Information

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PIER Buildings Website:
<http://www.energy.ca.gov/pier/buildings/index.html>



