SUMMARY OF UC EMISSION REDUCTION PILOT TESTS UNDERWAY

Pilot Test	What Is Being Evaluated?	Why Important?	Barriers to Implementation
Biogas Energy Project • UC Davis	• Can an anaerobic digester be used to efficiently convert organic waste into a substantial source of clean energy?	• Potential dual benefits: landfill and energy.	
Plasma Gasification • UC Davis	• Viability of plasma gasification in a campus "production environment."	• Potential dual benefits: landfill and energy. • Possible extension to other campuses.	• Scale necessary to achieve investment payback
Lab Air Change Reduction • UC Irvine	• Energy savings • User safety • Ease or difficulty of retrofitting into existing labs/existing control systems	• Needed in order to reduce ACH in labs. Major opportunity to address research universities' primary energy consuming buildings.	• Policy shift needed from criteria-based safety standards to performance-based standards. • Interfacing difficult with some building control systems.
Fume Hood Sash Automatic Closers • UC Irvine • Available for wider pilot testing through PIER Demo program by CIEE/ Western Cooling Efficiency Center at UC Davis	• User acceptance • Ease of retrofit installation • Reliability and robustness	• Needed to achieve ACH goals in high-density hood environments or where low-flow hoods are not possible	
Vivarium • UC Irvine • Manifolded cages • Control cage ventilation rates via Aircuity • Reduce holding room ACH	• Control of cage ventilation rates using particulate and ammonia sensors • Feasibility of concept and the ability to attain animal care standards	• High, 24X7 energy usage • Many vivaria throughout UC	

Lab Building Exhaust Stack Discharge Air Speed • UC Irvine	• Can energy cost savings be realized by reducing air speed flow through exhaust stacks while not compromising safety?	• High, 24X7 energy consumption • Successful concept could be deployed broadly across all campuses	
"Smart" Plug Strips • UC Irvine • UC Berkeley	• User acceptance • Product performance	• 24X7 office parasitic loads may be greater than we realize	• Customer acceptance
LED Lab Task Lighting • UC Irvine • Organized through PIER Demo Program and available for wider pilot testing through PIER Demo program by CIEE/California Lighting Technology Center (CLTC) at UC Davis	• User acceptance • Feasibility of reducing general illumination using task lighting, occupancy sensors, and daylighting.	• Reduce heat load and required ACH as well as direct illumination energy savings	• Price/performance still needs to improve • Occupant acceptance • Equipment on counters limits installation of under cabinet task lighting.
Low-Flow Fume Hoods • UC Irvine	• User safety at 60-80 FPM face-velocity compared to conventional hoods at 100 FPM face-velocity	• Needed in lab design "toolkit" to help attain lower lab ACH	• Site-specific variance from CA OSHA • System-wide variance or new regulation
Energy-Efficient Lighting in Parking Structures • Various campuses	• Comparison of energy efficient lights and light retrofit devices • Product performance for optimum safety and energy efficiency	• 24X7 energy usage	
Bike Sharing • UC Irvine • UC San Diego • UC Berkeley	• User acceptance • Product performance	• Greenhouse gas reductions • Health benefits • Efficient use of space	• Initial capital costs • Unproven technology
Integrated Office Lighting Systems • UC Santa Barbara • Through PIER Demo Program by CIEE / CLTC at UCD	• Product performance relative to Title 24 energy requirements • User acceptance • Improved user productivity and performance	• Needed in order to reduce wasteful energy consumption of office lighting due to use of traditional overhead style luminaries, which typically waste energy over-lighting non-task areas.	

Integrated Classroom Lighting Systems -1 • UC Santa Barbara • Through PIER Demo Program by CIEE / CLTC at UCD	• Effectiveness of a complete integrated classroom lighting system as opposed to various components from multiple sources • Product performance relative to Title 24 energy requirements • User acceptance • Student productivity and performance improvements due to improved lighting • Energy savings provided by scene control and dimming controls	• Needed as a cost-effective, energy-efficient solution to traditional classroom lighting. Traditional lighting provides luminaries, controls, and associated components from a variety of manufacturers, which decreases overall system functionality, and increases operations and maintenance costs. ICLS provides an integrated package, under a single warranty. Applicable to new construction.	
Integrated Classroom Lighting Systems - 2 • UC Berkeley • Independently organized by Paul Black of UCB through UC/CSU/IOU Partnership	• Effectiveness of providing a complete integrated classroom lighting system as opposed to various components from multiple sources • Product performance relative to Title 24 energy requirements • User acceptance • Student productivity and performance improvements due to improved lighting • Energy savings provided by scene control and dimming controls	• Needed as a cost-effective, energy-efficient solution to traditional classroom lighting. Traditional lighting provides luminaries, controls, and associated components from a variety of manufacturers, which decreases overall system functionality, and increases operations and maintenance costs. ICLS provides an integrated package, under a single warranty. Applicable to new construction.	
Open Standard for Lighting Controls (DALI XP) • UC Davis • Through PIER Demo Program by CIEE / CLTC at UCD	• New open standard for control devices controlling digitally addressable ballasts • Ease of lighting control reconfiguration • Effectiveness of proposed control command set • Energy savings associated with integrated scene control, occupancy sensing, and dimming controls • User acceptance	• Proof-of-concept demonstration of proposed open protocol • Standard provides a viable way to provide reconfigurable lighting systems that do not require rewiring or additional equipment when lighting requirements in a space change. • Viable option to achieve scalable demand response	

Bi-Level Smart Exterior Lighting • UC Davis • Through PIER Demo Program by CIEE / CLTC at UCD	• Cost-effectiveness and quality of exterior lighting products operating on bi-level, occupancy based controls • Safety and illumination requirements of bi-level product compared to State requirements • Products include HID, Induction, and LED light sources in a variety of fixture styles • User acceptance	• Significantly reduces unneeded energy consumption of exterior, high-wattage luminaries • Reduced night sky pollution • Extended lamp life, which reduces maintenance costs and component waste. • Reduce energy-consumption in continuously lit applications such as parking garages	
Smart Exterior Lighting (misc. fixture types) • UC Davis • Independently organized through UC/CSU/IOU Partnership and CLTC at UC Davis	• Cost-effectiveness and quality of exterior lighting products • Safety and illumination requirements • Products include HID, Induction, and LED light sources in a variety of fixture styles • User acceptance	• Significantly reduces unneeded energy consumption of exterior, high-wattage luminaries • Reduced night sky pollution • Extended lamp life, which reduces maintenance costs and component waste. • Reduce energy-consumption in continuously lit applications such as parking garages	
Bi-level Stairwell Luminaire • UCLA • UC Santa Barbara • UC San Diego • UC Irvine • UC Riverside • UC Berkeley • UCOP • Through PIER Demo Program by CIEE / CLTC at UCD • The deployment of this technology has progressed to group purchases of large numbers of fixtures in conjunction with the UC/CSU/IOU Partnership, as well as recommendation for universal system-wide application by the Strategic Energy Planning Process.	• Performance and quality of luminaires with integrated occupancy sensors that control light output between high and low modes • Energy savings associated with placing low-occupancy spaces on occupancy control integrated into existing building equipment • User acceptance	• Needed to reduce energy wasted on over lighting vacant spaces simply for the possibility of future safety or comfort concerns of room occupants.	

Hybrid Smart Bathroom Vanity Luminaire and Smart Wall Switch • UC Davis • UC Santa Barbara (2007 Conference) • Through PIER Demo Program by CIEE / CLTC at UCD	• Performance and quality of bathroom luminaires and wall switches with integrated occupancy sensors and LED night lights • Energy savings associated with placing low-occupancy spaces on occupancy control integrated into existing building equipment. • User acceptance	• Needed to reduce energy wasted on over lighting vacant spaces simply for the possibility of future safety or comfort concerns of room occupants.	
Sylvania Load Shed Ballast • UC Santa Barbara • Through PIER Demo Program by CIEE / CLTC at UCD	• Demand response capability integrated into lamp ballast • Power-line carrier communication for lighting demand response • Product performance • User acceptance	• Cost-effective methods are needed for retrofitting existing lighting loads into demand response programs • Lighting is an untapped DR resource	
Cost Effective Lighting Demand Response (CEDR) • UC Irvine • Independently organized through CLTC at UC Davis	• Retrofit technology to capture lighting loads previously unrealized in demand response programs • Test CEDR equipment in real-world environment • Product performance • User acceptance and ease of use	• Cost-effective methods are needed for retrofitting existing lighting loads into demand response programs • Lighting is an untapped DR resource • Provides a viable DR solution based on power line carrier technology that does not require additional wiring	
VAV Static Pressure Reset (SAV with InCITe) • UC Office of the President • UC Berkeley (Independently organized through UC/CSU/IOU Partnership) • Through PIER Demo Program by CIEE	• Energy savings resulting from incorporating optimized static pressure reset control for existing VAV systems • Ease of retrofit installation • Feasibility of reducing HVAC system airflow without adversely affecting occupant comfort	• Most VAV systems operate at a constant duct static pressure control setting. At lower loads, additional savings are gained by allowing the static pressure to be reduced.	

Demand-Control Kitchen Ventilation (Hood VAV) • UC Berkeley • UC Santa Barbara • UCLA • Through PIER Demo Program by CIEE	• Energy savings associated with variable speed control of commercial kitchen exhaust hood fans • Feasibility of reducing hood exhaust energy without adversely affecting hood performance • Ease of retrofit installation • User acceptance	• Constant volume exhaust fans run all day, even when not needed, resulting in high energy consumption • Needed to reduce wasteful energy consumption of hood exhaust fans, as well as make-up unit fan energy and make-up air heating and cooling energy	
Wireless VAV Conversions (Discharge Air Regulation Technique or DART) • UC Santa Barbara (2007 Conference) • UC Berkeley (Independently organized through UC/CSU/IOU Partnership) • Through PIER Demo Program by CIEE / CLTC at UC Davis	• Energy savings resulting from incorporating wireless variable air volume control for existing constant volume HVAC systems • Ease of retrofit installation • Feasibility of reducing HVAC system airflow without adversely affecting occupant comfort	• Needed to reduce wasteful energy consumption of Constant volume HVAC systems • Wireless technology simplifies retrofit installation and reduces cost by avoiding having to work above ceiling, asbestos abatement and disrupting occupants.	
Energy-Efficient Downlight System • UC Davis • Through PIER Demo Program by CIEE / CLTC at UCD	• Energy savings • Ease of installation • User acceptance	• Manufacturers have not produced efficient downlighting systems acceptable to builders and users. This technology bridges that gap to increase lighting efficiency.	
Air Flow Measurement and Control • Through PIER Demo Program by CIEE	• Control effectiveness	• Maintenance of good ventilation rates must complement efficiency improvements.	
Large Duct Sealing • UC Davis • Through PIER Demo Program by CIEE	• Ability to identify duct systems with substantial leakage (good project candidates) • Energy savings	• Research-level surveys of similar buildings indicate large rates of duct leakage, wasting fan power and sometimes heating and cooling energy when the ducts are outside the conditioned space. Leakage rates are highly variable, with cost-effectiveness of sealing measures dependent on the magnitude of losses.	• This demonstration has had limited success to-date and is being re-scoped

Package Rooftop HVAC Diagnostics • UCLA • UC San Diego • Through PIER Demo Program by CIEE	• Energy savings • Integration with campus energy programs	• Package rooftop HVAC units are difficult to maintain, leading to energy waste.	
Monitoring-Based Commissioning (MBCx) • Systemwide through UC/CSU/IOU Partnership • Karl Brown/CIEE Assistance to UC/CSU/IOU Partnership with support by PIER Demo Program through CIEE/LBNL	• Performance of MBCx project portfolio with regard to degree of energy and peak energy use reduction, cost-effectiveness • (Initial planning for evaluation of) Persistence	• Monitoring-based commissioning is being recommended for all major campus facilities (buildings and plants) in all campus Strategic Energy Plans, based on performance to-date in 2004-05 and 2006-08 UC/CSU/IOU Partnership program cycles.	
Benchmarking • Systemwide through UC/CSU/IOU Partnership • Through PIER Demo Program by CIEE / LBNL	• Ability of benchmarking to identify best candidate buildings for (monitoring-based) commissioning	• Thorough monitoring-based commissioning has proven cost-effective on a portfolio basis, it remains beneficial to assess candidate buildings to improve the overall cost-effectiveness of scaled-up commissioning programs.	
Advanced HVAC Design Guide Case Study • UC Merced • Through PIER Demo Program by CIEE / LBNL	• Effectiveness of design guide techniques in getting efficient HVAC designs built • Energy performance of resulting building relative to comparables	• Though they employ simultaneous heating and cooling for control, often leading to large amounts of energy waste both on and off-peak, VAV Reheat systems remain code-allowed and widely used. Improved designs that minimize the potential for waste are needed.	

Evaluation of Energy Information Systems • Systemwide Applications • Campus Case Studies TBD • Through PIER Demo Program by CIEE / LBNL	• Attributes of product offerings • Select system case studies	• Product offerings for Energy Information Systems (EIS) and related energy performance tracking capability are expanding, with significant additional capability since the last review in 2003. This project can provide valuable information for campuses in their monitoring-based commissioning efforts and general energy management activities.	
Low Energy Campus Planning and Design (Toward Zero-Net) • UC Merced • Karl Brown/CIEE Assistance to UC Merced	• As-operated performance of first UC Merced buildings relative to planning targets and as-designed numbers • Progress toward a campus using 50% or less energy than the 20th Century (1999) UC/CSU building stock • Potential to achieve a net-zero energy campus	• The establishment of the 10th UC campus at the beginning of the 21st century provided the opportunity to plan and build a very-low-energy campus, with efficient design applied campus wide, and extensive monitoring to assess performance and create lessons learned for continuous improvement in campus development.	
Laboratory Design Standards to Promote Daylighting • UC Davis	• Energy savings		
Replacement of lab & other freezers with Energy Star rated equipment. • UC San Diego	• Effectiveness of Energy Star equipment for Lab uses.	• Replacing old freezer equipment will significantly electrical requirement.	• Availability of Energy Star rated equipment
Paperless Recruiting • UC Irvine • UC San Diego	• User acceptance • Emissions reductions from eliminating materials (paper, binders, etc.) given to search committees during the recruitment process.		• User acceptance
Elimination of Banner Sheets • UC San Diego	• User acceptance • Effectiveness in reducing computer lab energy through reduced printing	• Reduction of unnecessary printing will reduce energy and paper use.	• Ability to track individual print jobs and track costs.

Fleet Conversion to B20 Biodiesel • UC San Diego	• Life-cycle impacts on fleet by switching to B20 Biodiesel.	• ULSD Biodiesel produces less particulates and GHGs • Using Biodiesel reduces dependence on foreign oil.	• Potential damage to engine components. • Quality of biodiesel fuel.
Green Line B100 Biodiesel Bus • UC San Diego	• Life-cycle impacts and engine performance. • Actual emission reductions.	• If pilot "Green Line" proves successful, may expand B100 to additional shuttles/routes.	• Long-term engine performance.
Automatic Vehicle Locator • UC San Diego • UC Irvine	• Improved shuttle scheduling through real time tracking. • Effect of real time shuttle tracking on shuttle ridership.	• Reduced emission through improved shuttle scheduling. • Decreased SOV emissions with increased campus shuttle ridership	• Cost of AVL equipment.
2.8 MW Renewable Energy Fuel Cell • UC San Diego	• Performance of fuel cell using treatment plant biogas and reclaimed water. • Overall efficiency of system including waste heat for absorption cooling, DC power, and bio-fuel production.	• Fuel cell generates useful energy from methane currently flared. • Cost of energy decoupled from rising natural gas, oil, and utility price increases.	• New PPA business model for utilizing "grants in lieu of tax credits" • Integrating DC output of fuel cells with DC applications, e.g. modular data centers and energy storage
Mobile Data Center (MDC) Evaluation • UC San Diego	• Viability of using SunMicro System MDCs in lieu of individual server rooms. • Real time comparison of MDC's actual power vs. San Diego Super Computer Center.	• MDC's are reported to use 40% less power than standard server room. • MDC's can be used to replace individual server room on either long or short term basis.	• Infrastructure costs of MDC
Ballasted PV System Comparison • UC San Diego	• Solar energy production of flat mounted solar quilt system. • Solar energy production of non-penetrating roof mounted, tilted "Skyline" system.	• Installation of ballasted PV system is less intrusive than standard roof mounted PV system.	• Installation of further PV on central campus limited by 1 MW CSI cap.
5.5 kW Concentrated PV • UC San Diego	• Applicability of CPV to campus renewable energy portfolio	• CPV offers greater efficiency than standard PV (25% - 30% efficiency)	

Biogas Injection • UC San Diego	• Effectiveness of augmenting cogeneration natural gas supply with biogas. • Acceptance of IOU to injecting wastewater treatment, food waste or landfill biogas into natural gas pipeline.	• Provides useful energy production from unused and inefficiently used gas, and offsets CO_2 emissions of flared gas. • If approved will provide test case of gas injection.	• IOU willingness to accept injected gas. • Near real time monitoring of biogas purification
Electric (on-board CNG fast charging) Buses • UC San Diego	• CNG-Hybrid Technology • Ability to maximum electric power operation through operational controls • State-of-the-Art fast charging technology	• Incorporating electric buses into campus shuttle operations will significantly reduce GHG and particulate emissions. • Limiting CNG engine operation will make shuttles essentially "all-electric vehicles."	• Cost of buses • Cost of infrastructure (CNG Station, Fast Chargers, and trickle chargers).
Alternative Vehicle Program • UC San Diego • UC Berkeley	• Viability of alternative fuel vehicles to support campus activities. • Cost effectiveness of converting fleet.	• Overall campus emission reduction through increased use of electric, hybrid, and CNG vehicles.	• Cost of procuring and operating vehicles.
Transit Smart Card • UC San Diego	• User acceptance • Product performance • Travel behavior changes	• Transit mode shift • More data on transit usage patterns	• Privacy concerns • Initial capital costs
Real Time Building Energy Displays • UC San Diego • UC Berkeley	• Effectiveness of real time building energy display in modifying occupant energy use.	• Behavior modification is key element in increased building energy efficiency and use.	• Cost of installation and operation of metering and displays.
Carbon "Foodprint" Labels • UC Irvine	• Effectiveness of labeling the carbon footprint of entrees in student dining halls.	• Behavioral change is key to reducing food related greenhouse gas emissions	• Student's willingness to choose lower emission foods
"Green Up" Wellness Program • UC Irvine	• Effectiveness of employer sponsored wellness program focused on being environmentally friendly.	• Campuses are like cities, they can't go green unless the people do	• Employee acceptance/ participation
Wireless Lighting Contorls • UC Berkeley (Independently organized through UC/CSU/IOU Partnership)	• Viability of new wireless lighting controls that give staff greater flexibility	• Allows staff to set operation schedules for fixtures that previously could not be turned off	• Acceptability and case of use

PC Power Management Software • UC Berkeley (Independently organized through UC/CSU/IOU Partnership) • UC Irvine	• Feasibility of software to allow external control of PC power settings	• Computers use up to 10% of campus electricity and currently are rarely shut off.	• Acceptability and case of use • Adapting system to allow usage with Remote Access
Desktop Virtualization • UC Irvine	• Effectiveness of replacing desktop PCs with 'thin client' devices connected to a virtualized PC running in a data center	• Reduction of computer energy consumption	• Acceptance and participation of campus units