

2007 Public Good Report

Sacramento Municipal Utility District

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SMUD.org

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SMUD Public Good programs 2007

The Sacramento Municipal Utility District's Public Good programs benefit our customers and the Sacramento- community every day. Shade trees cool and beautify our neighborhoods; customers take advantage of SMUD rebates on energy-saving appliances and commercial equipment to help lower their electric bills; programs help low-income customers make ends meet; other programs turn sunlight into electricity.

Together, these programs form an important part of the dividends our customers receive from a customer-owned utility governed by an elected Board of Directors. Long before a legislative mandate required Public Good programs, SMUD built a national reputation as a leader in many of these areas, including energy-efficiency, clean energy projects and research and development.

The investment in Public Good programs for municipal utilities must equal at least 2.85 percent of 1994 revenues, according to state mandate. However, each year, SMUD has budgeted significantly more than the minimum required. In 2007, SMUD committed more than \$59 million to Public Good programs, including more than \$3 million to supplement or implement additional energy-efficiency programs for customers.

This report details the broad Public Good programs that SMUD carried out in 2007. For more information about any of the programs, call the phone number listed in this document, or visit www.smud.org.

About Public Good programs

California law requires utilities to maintain specific programs that contribute social and environmental benefits to the state. These Public Good programs may include:

- Cost-effective, demand-side management services to promote energy-efficiency
- New investment in renewable energy resources and technologies consistent with existing statutes and regulations that promote those resources and technologies
- Research, development and demonstration programs for the public interest, to advance science or technology that is not adequately provided by competitive and regulated markets
- Services provided for low-income electricity customers including, but not limited to, targeted energy-efficiency services and rate discounts

Energy Efficiency

Total 2007 Expenditures: \$21.7 million

As a national leader, SMUD has made "energy efficiency" a catchphrase in the Sacramento region. SMUD programs help customers get the most power for their energy dollar and reduce their demand for electricity. Through its energy-efficiency programs, SMUD has shown customers how energy efficiency can make sense for them and for our community.

Residential

Residential Energy Advisory Services Program: \$.7 million

To help improve efficiency in single-family homes, SMUD performed more than 500 on-site energy assessments and provided advisory services to more than 35,000 customers in the form of online and DVD audits, as well as through telephone assistance.

Residential Equipment Efficiency Program: \$2.5 million

Rebates and energy-efficiency loans for home improvement projects designed to provide energy savings, primarily from building shell and heating and cooling efficiency improvements, were offered by SMUD to its customers. The District financed and/or provided rebates for more than 3,500 high-efficiency central air conditioners and heat pumps and provided financing for nearly 1,500 homes to replace customers' old, inefficient windows with high-performance windows. In addition, nearly 200 duct systems were sealed using the Aeroseal duct sealing process, and rebates were provided for more than 1,200 whole-house fans and nearly 70 solar hot water heater systems.

Residential New Construction Program: \$.7 million

California's minimum cooling energy standards are among the most stringent in the nation, and SMUD, through its Residential New Construction program, encourages builders to construct homes that go well beyond these standards. Through its Advantage Home program, SMUD provided builder incentives for more than 1,000 homes completed in 2007. In addition, SMUD launched a new SolarSmart® homes program that combines energy efficiency with integrated rooftop solar systems in new single-family homes. New homebuyers in SolarSmart communities now enjoy the benefits of energy bills that are nearly 60 percent lower than homes without these features. Nearly 140 SolarSmart homes were completed in 2007, with thousands more to be built over the next several years.

Residential ENERGY STAR® Retail Lighting Program: \$2.6 million

Through marketing partnerships with SMUD, retailers and lighting manufacturers sold more than 1.4 million energy-efficient compact-fluorescent light bulbs and approximately 7,500 energy-efficient lighting fixtures. These partnerships were also accompanied by marketing campaigns designed to increase customer awareness of energy-efficient ENERGY STAR® lighting products.

Residential Appliance Efficiency Program: \$.9 million

Customers who purchased or replaced refrigerators, room air conditioners, and clothes washers or dishwashers that use electric hot water heating were able to take advantage of SMUD rebates on ENERGY STAR® rated high-efficiency models. Rebates for

approximately 6,700 refrigerators, 560 room air-conditioners, 500 high-efficiency clothes washers and 350 dishwashers were provided through this program.

Refrigerator Recycling Program: \$1.2 million

Old and inefficient residential refrigerators consume significantly more energy than newer models. Through this program, SMUD provides customers with a nominal incentive to have their old working refrigerators picked up and disposed of through a process that recycles the components, insulation and chlorofluorocarbons in an environmentally sound manner. More than 8,200 old refrigerators were recycled in this manner.

Residential Pool Efficiency Program: \$.3 million

SMUD added nearly 1,000 new pool owners to the program in 2007. Educational materials and promotional messages encourage customers to operate their pool pumps and sweeps during off-peak hours. In addition, customers replacing old pool pumps or installing new pools could take advantage of rebates to install high-efficiency pumps and motors to their pool systems. Rebates were provided for more than 250 such installations.

Residential Shade Tree Program: \$1.6 million

Properly placed shade trees can help reduce a home's cooling costs. In cooperation with the Sacramento Tree Foundation, SMUD provided nearly 14,000 free shade trees to homes, schools and public areas.

Commercial

Commercial Retrofit Program: \$3.4 million

SMUD provided incentives and financing, energy surveys and advice on new technology and installation support for all its commercial, industrial and agricultural customers. Incentives were provided for 275 projects for the installation of high-efficiency lighting and HVAC systems, motors, refrigeration systems, and process equipment in medium and large commercial and industrial facilities. In addition, SMUD continued to work with school districts and facility managers to implement projects and operation and maintenance measures designed to save energy and reduce the use of non-renewable resources and waste streams within these facilities.

Commercial New Construction (Savings By Design) Program: \$.8 million

The objective of the Savings-By-Design program is to work with designers, architects, builders, and owners to incorporate the highest efficiency features and equipment in their projects beginning in the early conceptual and design stages and through project construction and completion. Design assistance and rebates, as well as owner rebates and incentives, were provided for 20 new commercial construction projects in 2007.

Prescriptive Lighting Incentive Program : \$2.9 million

Nearly 900 lighting retrofits were performed by local contractors for small- and medium-sized commercial customers to replace or upgrade old, inefficient lighting systems and bulbs with new high-efficiency fluorescent or high-intensity discharge lamps and fixtures. Also offered were occupancy sensors and other lighting controls to reduce energy usage and costs for customers in this market segment.

Commercial Upstream/Distributor Incentive Program: \$.73 million

Working with local suppliers and dealers of motors and HVAC equipment in Sacramento, SMUD implemented a program that provides incentives to these companies players to stock high efficiency equipment for contractors and installers for use in commercial projects in our service area. In 2007, high-efficiency equipment for more than 500 installations was supplied for local projects through this program.

For more information about SMUD's energy efficiency program, residential customers can call 1-888-742-7683 while Commercial & Industrial customers can call 1-877-622-7683.

Services for low-income and special needs customers

Total 2007 expenditures: \$20.9 million

Through the Public Good program, SMUD provides help for two specific groups of customers: those with low incomes and those who depend on electrically powered medical equipment.

Qualified low-income customers can receive a discount on their electric bill through SMUD's Energy Assistance Program Rate (EAPR). Low-income customers also can qualify for free weatherization improvements and other energy-efficiency improvements for their homes.

With certification from a physician, customers who use electrically powered medical equipment or have special medical conditions are eligible for the Medical Equipment Discount (MED) Rate.

Energy Assistance Program Rate credits: \$13.9 million*

More than 57,000 low-income customers benefited from the subsidized EAPR rate. Each of these customers met specific income criteria.

Medical Equipment Discount Rate Credits: \$3.4 million*

Over 9,000 customers qualified for the MED Rate discount. The program is available to homes with a full-time resident requiring use of an electric medical device.

Rate Discount Administration: \$1.5 million

SMUD administers the programs for customers who qualify for EAPR and MED Rate discounts.

Low-income Weatherization: \$1.3 million

Some 943 low-income households benefited from SMUD's free weatherization program. To help customers of modest means make their homes more energy efficient, comfortable and safe, SMUD provided free attic insulation, weather-stripping, shade screens, compact fluorescent bulbs, low-flow showerheads, faucet aerators, water heater wraps, pipe wrap and minor home repairs. Customers with unsafe and energy-guzzling halogen floor lamps exchanged them for energy-efficient fluorescent torchiere lamps. About 515 low-income homeowners qualified to have their old refrigerators replaced.

The Community Partners Program is an extension of SMUD's Low-Income Program, allowing the utility to work with other agencies and community-based organizations to

offer additional services. By partnering with SMUD, gas-heat customers benefited from the same services as electric-heat customers, plus they received combustion testing and repairs on their gas equipment. SMUD was able to leverage funding and secure \$395,000 in extended services for our customers. These services included major home repairs, including roof and plumbing repairs; home modifications for disabled and elderly customers; and appliance replacement, such as clothes washers and microwaves.

During summer months SMUD lent portable evaporative coolers to customers whose health was being affected by excessive heat. The units were lent to customers until their central systems could be repaired or until they no longer required them for the health and safety of a family member.

Bill Assistance: \$.7 million

SMUD's low-income bill assistance activities help with payments on electricity bills for customers facing tough financial times. Bill assistance is provided from either local community organizations or through customer donations.

In 2007 more than 1,700 households experiencing a financial crisis received help to keep the lights on with nearly \$300,000 in assistance through SMUD's EnergyHELP assistance program. Through all bill assistance channels, 10,500 customers were helped by more than \$2.6 million in assistance.

For more information about SMUD's Energy Assistance Program Rate, MED Rate services and low-income weatherization programs, call 1-888-742-SMUD. (7683).

(*) Although not shown as an operating expense on SMUD's financial statements, the District includes discount rates to low-income and medical equipment assisted customers in the total public good commitment.

Renewable energy resources and technologies

Total 2007 Expenditures: \$5.7 million

20-plus Years of Solar Leadership

SMUD's renewable energy programs continued to focus on the development and deployment of photovoltaics. In 2004, SMUD celebrated the 20th anniversary of the District's first solar photovoltaic (PV) installation, the 1.1 MW Rancho Seco PV 1 system. Beyond the celebration of 20 years of solar production, continued success in residential, commercial, and utility-scale deployment of grid-connected PV systems has kept SMUD the national leader in solar-electric generation. SMUD's established programs serve as models for other public and public-private PV programs throughout the state. In all, SMUD interconnected more than 1.1 MW of PV in Sacramento in 2007.

Residential PV retrofit: \$1.3 million

Nearly a decade ago, SMUD initiated its PV Pioneer I program by designing and installing PV systems on residential structures in the Sacramento area. SMUD owned these systems, received the electrical output, and took full responsibility for operation and maintenance. In 2001, SMUD has introduced the PV Pioneer II program in which the customers, rather than SMUD, own the systems. As a result, homeowners are able to take advantage of "net metering," where SMUD credits customer's accounts at retail prices for surplus energy produced by the PV system.

In 2007, the program continued the success of its first years by installing approximately 191 kW of PV arrays on 57 houses. This brings the total number of customer-owned residential retrofit systems to nearly 420.

Residential New Construction: \$.9 million

One of the newest PV programs at SMUD targets the residential new construction market. This program solicits builders to work as partners with module manufacturers in the installation of Building Integrated Photovoltaics (BIPV) products during the construction of new homes. To date, the program has coordinated the installation of more than 280 PV systems on new homes for a total of 420 kW of PV.

SMUD partnered with Premier Homes, the U.S. Department of Energy (DOE), the National Renewable Energy Laboratory (NREL), and ConSol to build the first “Zero Energy Home” community in Sacramento: Premier Gardens. Premier Gardens is a 95-home “in-fill” subdivision designed for first-time, entry-level buyers. It’s located approximately 3 miles southeast of SMUD headquarters. The homes combine innovative construction and energy-efficient appliances with a state-of-the-art, roof-integrated solar electricity system to reduce the home’s total electric bills by about 60 percent and natural gas bills by 25 percent. Originally one of the highest cost PV installations, BIPV has proven to be one of the most cost-effective ways of installing PV, particularly when it is done with a builder who is willing to install PV on every home in the subdivision, as was the case with Premier Gardens.

Commercial Buildings: \$1.2 million

In 2005, SMUD transitioned its Commercial PV installation program to a contractor-based program. Under this program, SMUD provides the customer a rebate on the cost of the PV system and ensures that the system is installed and interconnected properly. This was a change from SMUD’s previous commercial building PV program, which installed more than 1,200 kW of customer-owned PV in approximately 4 years. The new structure encourages the development of a complete industry for the installation of commercial PV in Sacramento, with contractors taking responsibility for the entire design and construction process. Under the new program, SMUD supplied rebates to four commercial installations totaling approximately 275 kW.

Utility Scale PV Installations: \$1.6 million

Since the installation of PV-1 20 years ago, SMUD has commissioned an additional 2,550 kW of utility scale PV.

Training Programs and Workshops

To facilitate development of local PV installation contractor skills, SMUD hosted two rounds of technical training at the Energy and Technology Center. This training was composed of two courses, a two-day introductory class followed by a five-day advanced class that included hands-on installation of a PV system. The training program was based on the task analysis developed by the North American Board of Certified Energy Practitioners (NABCEP) as part of its PV installation contractor certification program.

Community Outreach

SMUD participated in two major fundraising efforts for regional non-profit organizations serving Sacramento's homeless population and children's arts programs. SMUD's PV demonstration trailers provided power for event participants at Fremont Park and

Fairytale Town in Land Park. SMUD's PV technicians offered demonstrations of solar technology to attendees, building awareness of SMUD's solar programs and the principles of renewable energy. The solar trailers were used to power various events at the local Earth Day celebrations at California State University, Sacramento.

Solar technology demonstrations were also given at Sacramento Unified School District job fairs and teacher seminars, as well as at a Middle School Renewable Energy Fair in Folsom, exposing a new generation of teachers and students to career and educational opportunities in solar and renewable energy.

Research, development and demonstration programs to advance science or technology.

Total 2007 expenditures: \$5.1 million

Energy Efficiency R&D Total: \$2.6 million

A majority of the energy-efficiency research activities were focused on individual technology demonstration efforts as part of the Customer Advanced Technologies demonstration program, better known by its acronym: CAT. A majority of the CAT research was focused on air conditioning technologies in 2007. Below is a synopsis of the primary individual technologies that were tested.

Intelli-Hood: Lurking in commercial kitchens throughout the world are some voracious beasts. Each year they gobble up vast amounts of energy and profits. In fact, according to the American Gas Association, they waste more than \$2 billion of energy each year in the U.S. food-service industry alone! What are they? Commercial ventilation systems. During the last half of 2007, SMUD worked closely with the Los Rios Community College District and Hyatt Regency Sacramento to test Melink Corporation's Intelli-Hood® Control system.

The Intelli-Hood system is designed to control the speed of exhaust hood fans and the air handler to match actual ventilation requirements. The Intelli-Hood® system uses optical (infrared) and temperature sensors to detect the presence of smoke and heat (the two by-products of cooking) and varies the speed of the fans accordingly.

Data obtained from our two test sites showed impressive energy savings – between 57 and 63 percent. Furthermore, both customers reported significant reductions in the noise levels in the kitchens.

To learn more, please download the technology evaluation report via the CAT program Web page: <http://www.smud.org/education-safety/cat.html>

MicroPlanet HVR: SMUD and other electric utilities strive to provide their customers with power at “acceptable voltage levels” at all times (e.g., nominal voltage plus or minus 5 percent). Practically speaking, this means that some customers receive voltage at the higher end, while others receive voltage at the lower end of the spectrum. Theoretically, customers receiving higher voltages are overdriving their equipment and wasting energy. However, if the supply voltage is too low, electrical equipment may be severely damaged.

During the past three years, SMUD has conducted a series of laboratory and field tests for MicroPlanet Inc.'s High Voltage Regulator (HVR). The tests were co-sponsored by the American Public Power Association's Demonstration of Energy-Efficient Developments (DEED) program and were designed to determine the energy and performance impacts of the HVR upon air conditioners and lighting systems.

The MicroPlanet HVR reduced overall energy consumption at the test site by 6.8 percent. To learn more, please download the technology evaluation report via the CAT program Web page: <http://www.smud.org/education-safety/cat.html>.

Coolerado Cooler Update: The Coolerado Cooler is an innovative indirect evaporative cooling system that provides the same comfort levels as traditional air-conditioning systems, yet operates at a fraction of the cost. SMUD is continuing our study of eight Coolerado Coolers in the Sacramento area. So far the thermal performance of these units has been very impressive, but much more work is needed to enhance system reliability and durability.

Desert CoolAire Hybrid Air Conditioner: According to the California Non-Residential New Construction (NRNC) database, packaged rooftop air conditioning systems provide cooling for 47 percent of commercial floor space in the United States. Ninety percent of units sold have cooling capacities of less than 10 tons; five-ton systems are by far the most popular. Unfortunately, since most of these units are located on hot rooftops, they operate well below their rated efficiencies --especially during periods when outside air temperatures exceed 100°F (when cooling is most needed).

Recognizing the need for low energy cooling solutions, the Northwest Energy Efficiency Alliance decided to support development of a packaged, hybrid air conditioner known as the Desert CoolAire system. In 2005, Desert Aire Corp. combined a promising new indirect evaporative heat exchanger (the Delphi HMX) with compressor-based cooling and gas heating to create a "hybrid" system. This HMX technology is the same heat exchanger used in Coolerado Coolers. The goal for this system is to significantly reduce energy use and peak electric demand, while providing the air quality benefits of a 100 percent outside air system. DesertAire produced 12 prototype "CoolAire" rooftop units.

In 2006, SMUD expanded the research to Sacramento, and with help from the American Public Power Association's Demonstration of Energy Efficient Developments (DEED) program, supported installation and testing of three units. Two of the units were installed at American River College; the third was installed at the offices of Stafford King Wiese Architects.

Field studies for the first generation of the Desert CoolAire system were completed in 2007. The system shows a lot of promise, but key refinements are needed before the unit can be fully commercialized. In the meantime, an executive summary and two reports are now available via the Customer Advanced Technologies (CAT) program Web site: www.smud.org/education/cat/index.html.

Freus Update: Freus is a water-cooled (evaporative condensed) air conditioner designed for residential applications. Although water-cooled systems are fairly common in large commercial cooling applications, this is one of the few systems designed for homes. The

thought of an ultra-high efficiency residential air conditioner was very attractive and so began a five-year journey.

Between 2002 and 2006, SMUD provided R&D grants to 30 customers to install and test Freus systems. The first two years were a bit rough. Although the units were energy efficient, problems such as circulating pump failures, mismatches between the indoor and outdoor coils, improperly adjusted float valves and clogged pump intake screens were far too common. For more information, please download the technology evaluation reports via the CAT program web page <http://www.smud.org/education-safety/cat.html>).

During the development of Freus, the manufacturer demonstrated a commitment to improve the product and support customers throughout our pilot program. This is vitally important for emerging technologies. Manufacturers must be ready to address the inevitable problems that arise and provide support to customers.

Despite a rough beginning, Freus improved dramatically due to system upgrades and efforts to train contractors. Since experience revealed that Freus systems require regular maintenance to function correctly, the manufacturer is now including a two-year service plan with all new units. So, after five long years, Freus became eligible for a special SMUD rebate, as well as financing in 2007.

Demand Response Behavioral Studies: SMUD is collaborating with research contractors, research organizations and academic institutions on three separate research projects. These efforts study customer motivation and behavior in relation to energy usage and production, direct load control, and dynamic pricing. All three studies commenced in spring 2007 and are expected to be completed by spring 2009.

The Residential Home Energy Display Pilot (Power Choice) measures customer response to time-of-use (TOU) rates. The study compares the energy usage of residential TOU customers receiving education and usage feedback devices via in-home displays to that of residential TOU customers not receiving these interventions and to non-TOU customers. This study is in collaboration with Research Into Action, Dethman Associates, and Washington State University. It is funded by the California Energy Commission (CEC) through the Demand Response Research Center (DRRC) at Lawrence Berkeley National Laboratory (LBNL) with in-kind SMUD Public Good contribution.

The Small-Commercial TOU Thermostat Pilot (Small-Business Summer Solutions) measures customer demand response. The study compares the effects on load and energy use of small commercial customers on a new critical peak time-of-use rate with those on a temperature-reset direct load control program. Both groups receive programmable communicating thermostats. This study is a collaboration with Heschong Mahone Group, Roger Levy, and Mithra Moezzi, and is funded by SMUD and the CEC, with additional SMUD in-kind Public Good contribution.

The Near Zero Energy Home Energy Display Pilot measures the effects of consumption and production feedback on customer energy and demand response. The study compares the effects on load and energy use of existing NZEH homeowners receiving education and usage/production feedback devices (in-home displays) to that of existing NZEH homeowners not receiving these interventions and to equivalently efficient non-solar homeowners. This study is a collaboration with ConSol, General

Electric, Florida Solar Energy Center, California State University, Chico, and the National Renewable Energy Laboratory (NREL). It is funded by the Building Industry Research Alliance (BIRA) and Building America (U.S. DOE) with in-kind SMUD public good contribution.

Electric Transportation R&D:

More than 36,000 pounds of Nitrogen Oxide (NOx) emission reductions were achieved through SMUD's Mobile Emission Reduction Projects in 2007. NOx is the primary ozone precursor pollutant that leads to smog and harmful breathing conditions in our area. Our program also reduced CO2 green house gas emissions by 1,890 tons. Below are highlights from the individual projects.

Plug-in Hybrid Electric Vehicle Technology: \$7,834

In 2007 plug-in hybrid vehicle activities were mostly limited to information dissemination on SMUD's plug-in Prius for the testing we conducted in 2006. SMUD also participated in several industry collaborative research projects with the Electric Power Research Institute (EPRI). Additional conversion testing with new battery technologies is planned for 2008 with partial funding through an APPA grant.

SMUD / EPRI Collaborative Research Activities on Plug-in Hybrids

SMUD is a member of EPRI's Electric Transportation Program Advisory Council and participates with EPRI in many areas of electric transportation-related research projects. With regard to plug-in hybrids, SMUD has been active in four related EPRI Projects including the Daimler Chrysler Plug-in Hybrid Sprinter Van demonstration testing, the Eaton-Ford plug-in bucket truck demonstration testing, EPRI-Natural Resources Defense Council Plug-in Hybrid Environmental Impacts study, and the EPRI Regional Economic Impact of Plug-in Hybrids, which included Sacramento

Unfortunately, the Daimler Chrysler Plug-in Hybrid Sprinter Van Demonstration program was cancelled before SMUD took delivery of any of its test vehicles. The program was cancelled when Daimler Chrysler sold its Chrysler Group.

The Eaton-Ford Plug-in Hybrid Bucket Truck project was initiated with SMUD making a commitment to be a member of the demonstration test team. The vehicle is a utility-style bucket truck with a 37-foot aerial lift on a Ford 550 medium duty truck platform. SMUD has several of this type of vehicle in its fleet and hopes that a successful demonstration of this truck will help SMUD meet its EPA Act Compliance requirements for this class of vehicle, which has very limited compliance options. PG&E currently is operating a non-plug-in version of this vehicle.

The EPRI-NRDC Plug-in Hybrid emissions study is a landmark report on the projected impacts of plug-in hybrids in years to come. Many previous emissions-impact studies had only considered current electricity generation technology and did not project the impact of anticipated environmental regulations. Another key aspect of this report was the participation of the Natural Resources Defense Council (NRDC), one of the world's preeminent environmental organizations. NRDC's scrutiny of the data from an environmental perspective gives this study industry-wide credibility and is already listed as one of the most important references on this subject. The study projected well-to-wheels emissions through 2030 for both California and the nation. With California's clean electricity generation mix, the results showed that plug-in hybrids produce about

half the greenhouse gas emissions of normal vehicles. Nationally, with more than 50 percent of the power generated by coal, the analysis showed that plug-in hybrid emissions are just slightly cleaner than gas-powered vehicles. As new regulations prompt utilities to produce cleaner electricity, emissions from plug-in hybrids will continue to improve.

The EPRI Plug-in Hybrid Economic impact study looked at six separate city/regions in the United States, including Sacramento. The draft report included erroneous rate data for Sacramento, and SMUD asked that the analysis be re-done to correct this deficiency

Airport Electric Ground Support Equipment Program

SMUD continued its work with United Airlines, FMC Corporation and the Electric Transportation Engineering Corp. to develop a new electric pushback tractor. SMUD manages the project for United Airlines as part of an agreement with the California Air Resources Board. The prototype electric vehicle was completed in 2006, and in early 2007 it was discovered that the test vehicle's battery pack interfered with the aircraft's nose gear. Since 90 percent of the resources have already been spent on this project, a decision was made by all parties to scrap the vehicle and spend the remaining resources on another project. In late November SMUD finally received written permission from United Airlines to release the funds for another project. A new project that will use the remaining funds will be developed in 2008.

Truck Idle Reduction through Electricity

In 2007 SMUD supported two on-board truck equipment programs and continues promotion of low cost infrastructure. These projects include the following three activities:

U.S. DOE / California Energy Commission Clean Cities Grant

This program is in partnership with Sacramento Metropolitan Air Quality Management District (SMAQMD) and New York State Energy Research Agency (NYSERDA). The primary scope for this program was to deploy 100 low-cost truck electricity inverter units, evaluate their usage, and identify market barriers. The program began in 2005 and achieved 86 inverter sales through 2007. Market barriers identified during the first two years of the program have led to the program being restructured to include installation costs for the truckers. SMUD arranged to have the 49er Travel Plaza, located at Interstate 80 and West El Camino, support installation of the remaining equipment. SMUD set up a table inside the main door used by truckers to provide information on the program and sign up participants. Signups for inverter installation quickly reached capacity. Installations were completed at the 49er, and truckers in general have been pleased with the program. The program ended, with two defective inverter units out of the 100 goal being returned to the manufacturer (Xantrex).

U.S. EPA Region 9 Idle Reduction Program:

SMUD competitively bid for and was awarded this project in 2005. After some major partners chose not to participate, SMUD partnered with Cascade Sierra Solutions, an Oregon-based non-profit agency that helps long-haul truckers obtain funding and financing to upgrade their trucks for environmental compliance. To date, SMUD and Cascade Sierra Solutions have deployed 26 dual-fuel truck auxiliary power units that enable truckers to turn off their engines and either plug into the grid to run truck cab loads or use a small diesel generator if electricity is not available. This essentially

completes half the U.S. EPA effort. The remainder of the project will be completed in 2008 with truck plug-in infrastructure being installed in both Northern and Southern California.

Caltrans Elkhorn Rest Area Infrastructure Project

In 2007 SMUD was contacted by the local Caltrans regional office about installing low-cost truck idle reduction infrastructure at the Elkhorn rest area on southbound Interstate 5 near Sacramento International Airport. SMUD worked with Caltrans to develop a plan to install four 120V electrical outlets in the rest area. A proposal developed by SMUD was accepted by Caltrans, It provides for Caltrans funding, with additional funding, if needed, coming from SMUD's U.S. EPA grant. Contracts to conduct the work were signed by Caltrans during the last week of 2007, and the work will be performed in 2008.

Electric Light Rail Energy Storage Technology

In 2006, SMUD helped Regional Transit (RT) perform a systems analysis to look at operational aspects of an ultracapacitor-based energy storage system. The purpose was to determine whether an energy storage system could help RT stabilize low voltage conditions on its system of direct current substations along the older Folsom Line while providing demand reduction and energy savings.

In the spring of 2007, SMUD applied for and received a \$400,000 research grant from the California Energy Commission. SMUD then began negotiating with Regional Transit and Siemens to go forward with the analysis. Negotiations continued through the remainder of the year.

U.S. Department of Energy Fuel Cell Vehicle Demonstration Project

In 2007, SMUD completed its second full year of fuel-cell vehicle testing for Ford and Daimler Chrysler as part of the U.S. Department of Energy research activity. SMUD is testing five Ford Focus and two Daimler A-Class Mercedes fuel-cell vehicles as part of this effort. Contract requirements to achieve 12,000 miles per year on the Ford fuel cell vehicles were met along with support of 50 community outreach events where the vehicles were showcased. Vehicle testing will continue through September 2009.

As part of this effort, some Public Good money was expended on the PV-array canopy and educational aspects of the hydrogen refueling station. Major construction activities for the station were initiated in August and completed by the end of the year. The station will be used prominently in public education and tours for local, state and international groups as part of the hydrogen research activities ongoing in Sacramento.

Develop New Renewable Technologies: \$2.3 million

The following is an overview of SMUD programs to develop new renewable technologies:

Local Biomass Program: \$.1 million

SMUD's Local Biomass Program converts problem wastes and residues into renewable energy while providing environmental protection and economic development. SMUD is committed to provide an incentive of 13 percent of the capital cost of building anaerobic digesters at local dairies to handle manure on some of Sacramento's 43 dairies.

Construction began on two in 2007, and those units are expected to begin generating renewable electricity in the first half of 2008.

The Leftovers to Lights program is helping identify ways to convert local food waste to renewable energy. One of the dairy digesters under construction can accommodate additions of food waste once a permit to co-digest is acquired. Permitting agencies are becoming more favorable to co-digestion due to continued effort by SMUD and others.

SMUD also partnered with the Regional Sanitation District to examine the feasibility of increasing the biogas produced at the regional wastewater (sewage) treatment plant by accepting grease trap waste and liquid food processing wastes. SMUD agreed to participate in a pilot test in 2008, beginning with development of a detailed test plan. The test will involve adding grease waste and food processing waste to one of the six digesters at the plant. Performance of the test digester will be monitored and compared with performance of the remaining digesters. If the pilot test is successful, full operation may begin as early as 2009.

Future Wind Development

SMUD has been conducting a Wind Integration Study for its service and control area. The task of adding hundreds of megawatts of wind energy to help SMUD meet its renewable portfolio standard goals would present huge challenges to system operators due to the variable nature of the resource and the lack of an accurate wind forecasting system. However, wind energy is the most plentiful and usually least expensive renewable option.

This study, completed in April 2008, modeled the additions of Solano Phase 3 and other wind plants in Northern California and Southern Oregon - 850 MW in total - and evaluated grid operations assuming that the Iowa Hill pumped storage project is constructed. The models simulate the operations within the SMUD/WAPA balancing area using historical load and wind production data. The results will provide insights into the operational impacts on our existing fossil-fuel and hydro systems while determining the integration costs for each scenario under consideration.

Solar Research and Development

In 2008, SMUD plans to complete its first photovoltaic R&D project under the DOE's Solar America Initiative, in which SMUD has partnered with BP Solar to undertake various field demonstrations. This initial project will combine PV with a battery system in an extremely efficient new "Home of the Future" and test the combination's effectiveness at reducing the need for grid power to operate the home's air conditioning system. It is expected that the air conditioning load during the super peak hours will be reduced by 70 percent or more.

Also planned to be completed in 2008 is an online solar map and customer siting tool for PV. The Google-based map will detail all of the current PV locations in Sacramento and will provide PV potential for commercial and residential buildings throughout the county. The commercial information is being developed with the assistance of CH2MHill using aerial imagery to develop highly accurate estimates of rooftop PV potential. This information will be used in conjunction with billing information and the CleanPower Estimator economic calculator to develop the estimated value of PVs for commercial and residential customers.

As a result of the City of Sacramento winning an award as a Solar America City, SMUD will be working with the City and the Sacramento Tree Foundation to develop guidelines for tree planting in new developments to maximize the potential for PV, while also making the best use of tree shading to minimize cooling needs

Pending awards from the New York State Energy Research and Development Authority, and the Department of Energy, SMUD also has plans to work with partners in enhancing maintenance and performance monitoring tools for the industry, including a SolarSentry panel-level monitoring demonstration, and a proposal from Expert Microsystems to develop predictive maintenance software for large-scale PV plants.

Combined Cooling, Heating and Power

SMUD continued to investigate opportunities for combined cooling, heating and power (CCHP) applications in 2007. SMUD is assessing these projects as part of its efforts to identify greenhouse gas reduction opportunities, improve end-use energy efficiency, and provide customers with energy-saving strategies. The majority of the opportunities in SMUD's service territory are in the commercial, institutional and light industrial sectors including hospitals, universities, colleges, nursing homes, schools, hotels, office buildings, jails, prisons, food processing plants and other similar facilities.

In 2007, feasibility studies were completed for a data center, the Railyard Development Project, Sacramento International Airport Modernization Project, Blue Diamond, and Sacramento County Downtown. In 2008, recommendations will be made to the SMUD Board of Directors to proceed with projects that are technically and economically feasible, and SMUD will investigate potential new projects in the commercial, institutional and industrial sectors.

Hydrogen

In 2007, SMUD continued to support the development of sustainable hydrogen infrastructure as a founding member of the Hydrogen Utility Group (HUG). The HUG was formed in 2006 by electric utilities in the United States interested in hydrogen infrastructure and applications that increase the value of energy service to customers.

SMUD's technical and policy depth in hydrogen has been important to the development of the U.S. Department of Energy's FuelCell Car demonstration program. In recognition of this, SMUD staff was again chosen in 2007 by the U.S. DOE to provide technical peer review of selected DOE Hydrogen infrastructure programs.

LEEDERS

(Leadership in Energy Efficiency, Demand & Environmental Solutions)

Total 2007 Expenditures: \$1.1 million

LEEDERS is a SMUD-wide initiative designed to enhance existing energy efficiency programs and launch new ones, with the goal of reducing electricity demand and improving environmental practices throughout the community. Members of the LEEDERS team have developed a series of goals and recommendations, many of which were initiated in 2007. Among the LEEDERS accomplishments:

SMUD Building Receives LEED Certification: SMUD has obtained the platinum LEED certification (highest level possible) for its Customer Services Center facility.

LED Lighting Demonstration: SMUD is undertaking two research demonstration projects of LED lighting technology at its campus. The first is an application of LED lighting in our parking lots, and the second project is evaluating the functionality and costs of LED task lighting in an office environment.

Green Purchasing: A District team is evaluating the potential for giving preference to energy-efficient and environmentally preferred products in the procurement process for all equipment, materials, and services purchased by SMUD.

Solar Partners: SMUD has persuaded all seven local government jurisdictions in our service territory to waive their varying permit fees and standardize the process for installing photovoltaic systems. Staff worked with elected officials, city managers and building officials to get local governments to join “Solar Partners” and agree to waive permit fees of \$200 to \$800; standardize the application submittal package; provide on-the-spot permit review; and conduct final inspections within 24 hours

Residential retrofit PV installations have increased significantly since the implementation of Solar Partners.