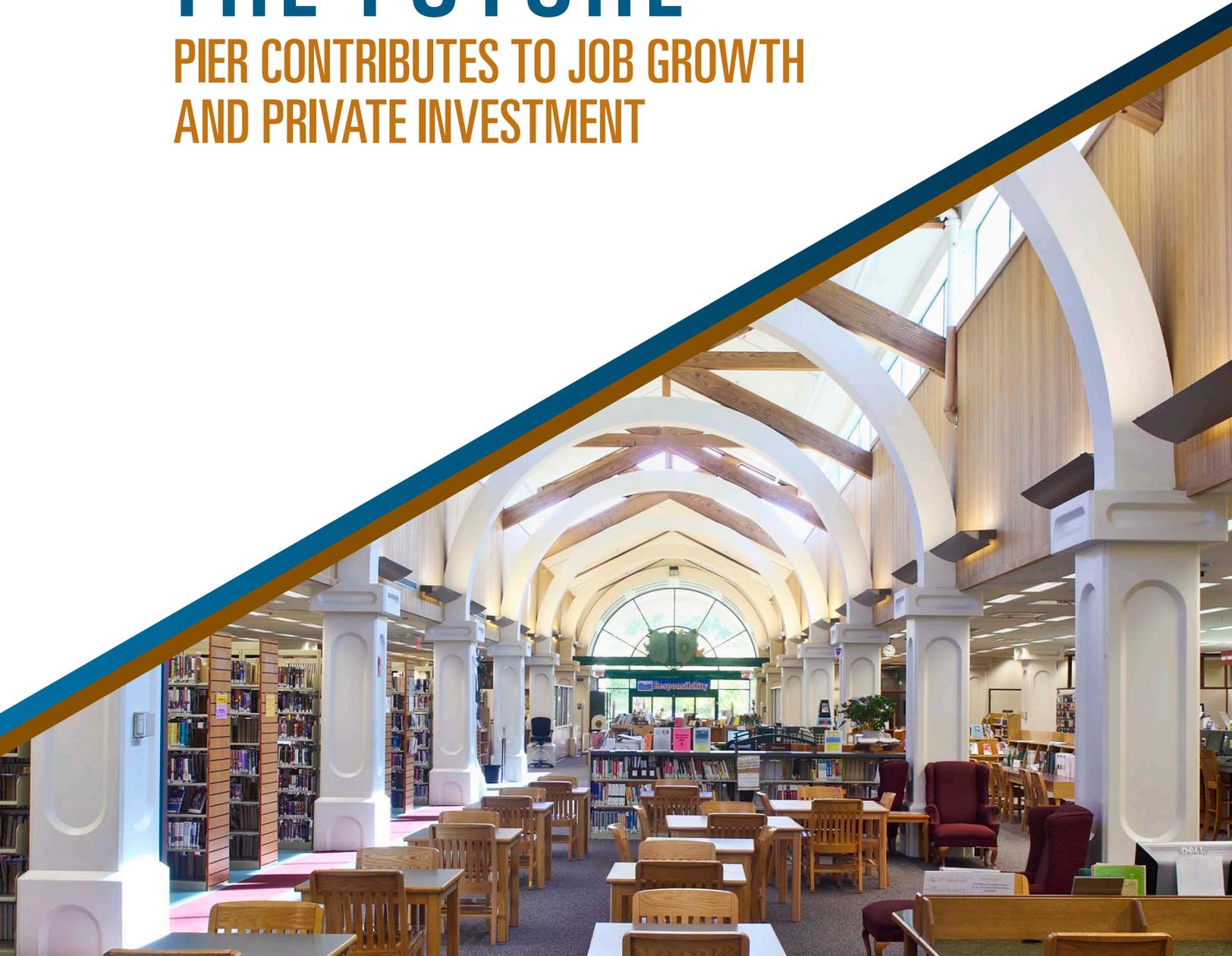


ENERGY EFFICIENCY RESEARCH POWERS THE FUTURE

PIER CONTRIBUTES TO JOB GROWTH
AND PRIVATE INVESTMENT



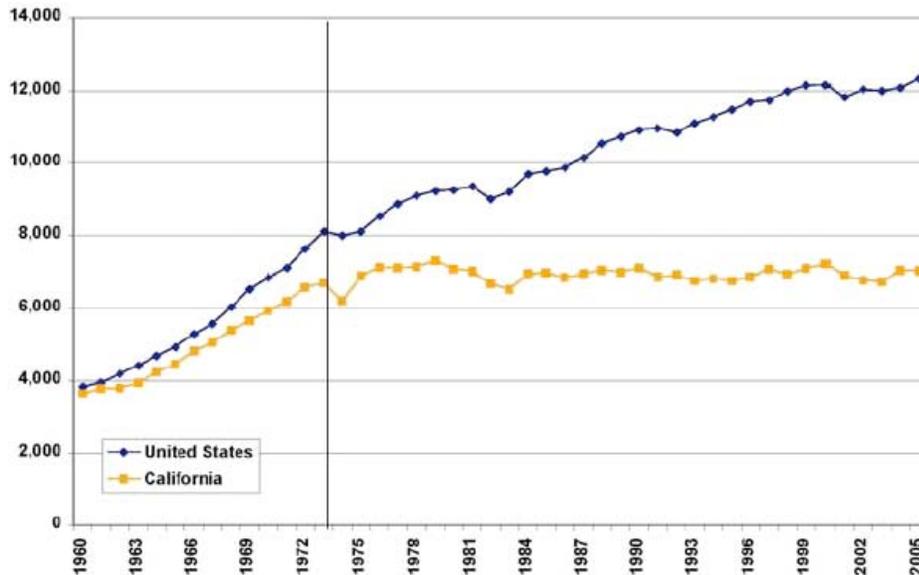
Californians use less electricity per capita than the residents of any other state in the nation. By leading the country in energy efficiency, California has saved consumers billions of dollars, created jobs in new, cutting-edge industries, and improved the environment while reducing the need to build power plants. Part of the credit for these achievements goes to California's unique Public Interest Energy Research (PIER) Program.

Over the past 40 years, Californians increased the size of their homes and added scores of new energy-using devices, from large refrigerators, dishwashers, audio equipment, large screen TVs, DVD players, game consoles, computers and more. As a result, the average use of electricity in the United States increased by roughly 50 percent since the 1970s. Over the same time, per capita energy use in California remained virtually flat.

California avoided the cycle of ever-increasing demands for electricity after the Legislature created the California Energy Commission in 1974. To increase energy efficiency and provide savings to California ratepayers, the Energy

Commission implemented the country's first energy efficiency building and appliance standards in 1978. The regulations in California's Appliance Efficiency Standards (Title 20) and Building Energy Efficiency Standards (Title 24) are periodically refined. Research funded by the PIER Program since 1998 has supported improved state standards. As an example, the results of several recent research projects were incorporated into the building and appliance standards. This included research on television energy use, external power supplies, battery chargers, residential furnace fans, cool roofs for homes, home attic ducts, kitchen pipe insulation and underground pipe insulation. The research justified support for efficiency standards in these areas and when fully implemented will save Californians more than \$1 billion annually. PIER has and continues to fund research on other energy efficiency measures that may be included in future standards to help Californians further reduce energy use and cost.

California Holds the Line on Electricity Consumption (Per Capita Electricity Sales in Kilowatt Hours per Person)



Source: California Energy Commission

BUILDING ENERGY EFFICIENCY RESEARCH

PIER has invested about \$180 million to make both new and existing residential and commercial buildings more energy-efficient. These research and development efforts will ultimately help the state reach its goal of creating zero-net-energy buildings — buildings that create as much energy as they consume.

LIGHTING

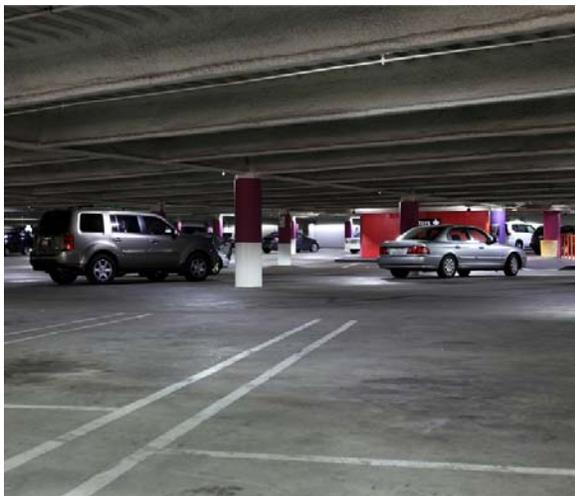
Since lighting consumes nearly 25 percent of California’s electricity, the PIER Program explored ways to provide high-quality, more energy-efficient lighting at the lowest possible cost. The program supported the development of the California Lighting Technology Center, a research facility located at the University of California, Davis. The center works with lighting companies to develop tailor-made lighting innovations. One example of a PIER-funded product is the bilevel smart lighting, which combines occupancy and daylight sensors to allow enough light for security at low power and boosts lighting, to higher levels when people are present. This concept is especially effective in stairwells, corridors, parking lots, and garages and will be included in the 2013 Title 24 standards.

Other examples include:

- Integrated office and classroom lighting systems, which meet the needs of offices and classrooms, from solitary desktop reading to viewing group audio-visual presentations.
- Hybrid smart wall switch and luminaire for hotels, which provide enough light so guests can locate switches.
- Light-emitting diode downlights, which integrate dimmable LEDs into a recessed downlight to achieve high light output, continuous dimming, and low power consumption.

HEATING, VENTILATING, AND AIR CONDITIONING

The use of air conditioning has increased in California’s commercial buildings and homes and has become one of the state’s largest energy users and contributors to peak demand. Poorly designed or poorly installed systems waste electricity. Air ducts often leak 20 percent of conditioned air into attics. A typical air conditioner uses significant energy to dehumidify the air, but most of California enjoys a dry, Mediterranean climate. Because manufacturers sell equipment designed for all climate conditions, Californians pay unnecessarily higher energy costs for their indoor comfort. Air-conditioning systems tailored to California can produce the same results using much less energy and can save Californians an estimated \$200 million to \$500 million per year.



Bilevel fixtures use occupancy sensors to reduce light levels when the space is unoccupied (left image) and fully illuminates the space when someone walks into the space (right image). **Source:** Courtesy of Energy Solutions

Working with manufacturers and researchers, PIER funded California-oriented cooling solutions, such as advanced evaporative air conditioners, radiant floor cooling, and under-floor air distribution systems. PIER also funded development of advanced diagnostic equipment to automatically detect operational problems and worked with utility companies and the Energy Commission's efficiency standards staff to create incentives and performance requirements to ensure California's thermal and ventilation requirements are met in the most energy-efficient way.

WHOLE BUILDING DESIGN AND PERFORMANCE

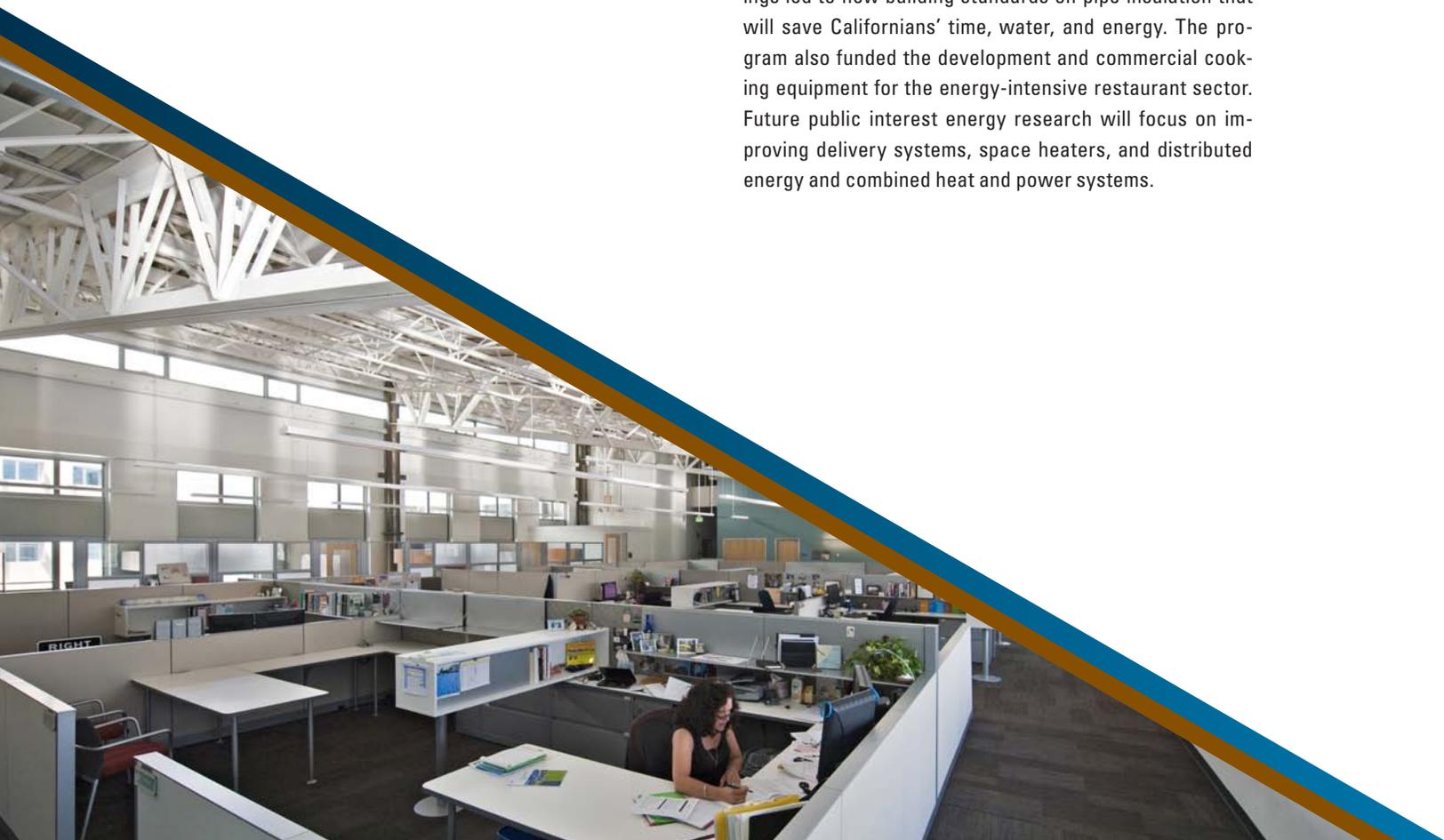
PIER is working to make buildings more efficient by promoting new envelope systems and other building components that are efficient, durable, and cost-effective. One PIER program developed innovative cool roof materials that reflect heat and sunlight to keep building interiors cooler. Another project determined that tighter building systems did not make buildings susceptible to mold growth. Additional research will assess the most effective ways to measure the performance of building envelopes and promote techniques that achieve high performance.

APPLIANCES AND PLUG LOADS

Consumer electronics – with their constant drain of electricity called *plug loads* – represent one of the fastest growing sectors of energy consumption in California. Because electronic products evolve so quickly and most of the companies developing them are located in other countries, the industry is difficult to regulate. PIER funded research that justified support for efficiency standards for flat-screen televisions, external power supplies, and battery chargers for consumer electronics. The new standards will save Californians more than \$1 billion in annual energy costs once the existing stock of such devices is replaced. PIER is working with researchers to improve the efficiency of consumer electronics, including requiring consumer electronics to use a low-power mode while not actively operating.

NATURAL GAS-ORIENTED RESEARCH

Residential and commercial customers account for 29 percent of the state's natural gas demand. To insure high-quality, energy-efficient service from natural gas appliances, PIER funded development of a variety of efficient water heaters for residential use, including the hybrid optimized tankless water heater and advanced solar water heating. Information PIER learned by studying the efficiency of hot-water distribution systems in homes and multifamily buildings led to new building standards on pipe insulation that will save Californians' time, water, and energy. The program also funded the development and commercial cooking equipment for the energy-intensive restaurant sector. Future public interest energy research will focus on improving delivery systems, space heaters, and distributed energy and combined heat and power systems.



INDUSTRIAL, AGRICULTURE, AND WATER ENERGY EFFICIENCY

California is home to many industries including agriculture, food processing, electronics, e-commerce, water and wastewater treatment, and petroleum production and refining. All of these sectors depend on a continuing supply of clean, economical, reliable energy to remain competitive. Through its industrial, agriculture, and water research program, PIER focuses on helping these industries save money and energy while solving environmental problems.

Since 1997, PIER has invested about \$45 million on industrial, agriculture, and water projects. The results of this public interest research – made publicly available at no charge – have led to commercially marketed products like these:

THERMOSORBER

This gas-fired hot water heat pump has been demonstrated in the food processing industry and has the potential to reduce electricity consumption by roughly 80 percent and thermal energy consumption by about 40 percent when both its cooling and heating capacity are fully utilized. This technology uses steam or hot water or waste heat to drive the absorption cooling cycle. Rejected heat is recovered as hot water.

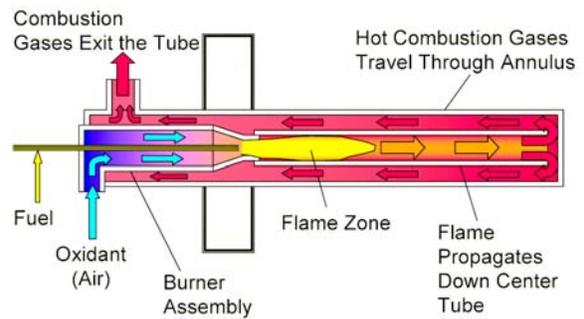


Source: Energy Concepts Co.

REVERSE ANNULUS SINGLE ENDED RADIANT TUBE (RASERT)

California’s heat-treating industries — companies that apply heating and cooling operations to a metal or alloy, such as metal smelting and galvanizing — operate an estimated

5,200 radiant tube assemblies. PIER funded and successfully demonstrated the Reverse Annulus Single-Ended Radiant Tube in industrial burners used for steel galvanization at California Steel in Fontana. The results showed both energy savings and reduction in air emissions. If only 5 percent of the radiant tube assemblies in California were replaced with RASERTs, industry could save an estimated \$3.4 million annually.



Source: Gas Technology Institute, 2008

WINESECRETS

This project successfully demonstrated the use of electrodialysis to remove sediment from wine. This method of stabilization is a reliable energy-saving alternative to conventional cold stabilization technology. Many small and large wineries in California use this technology. If adopted by all California wineries, this process could save winemakers about \$2.6 million annually.



Source: Courtesy of Winesecrets

ADVANCED GAS-FIRED DRUM DRYER

A new drying technology demonstrated at a large California garlic processing plant increased processing efficiency from 25 percent to 40 percent. The technology could save the food processing industry \$21 million in annual natural gas costs when used to dry fruits and other food products.

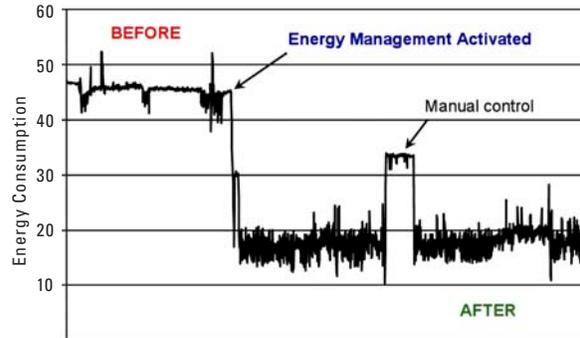


Source: Courtesy of Gas Technology Institute

COOLING CONTROLS CUTS DATA CENTER ENERGY COSTS

Using PIER funds, the Lawrence Berkeley National Laboratory (LBNL) led a demonstration project that showed alternative, direct-current-based power distribution systems can reduce the total system energy use in a data center by 5 to 7 percent compared to the most efficient alternating current (AC) systems, and up to 28 percent compared to typical AC distribution systems.

Additionally, Vigilent (formerly Federspiel Controls) demonstrated the use of cooling control technology integrated with wireless network sensors to control data center cooling. These technologies reduced cooling energy by 19 to 78 percent in eight state-owned data centers—resulting in annual savings of more than \$240,000. If all data centers could cut cooling energy use by 26 percent using this technology, the resulting annual savings would be nearly



Courtesy: Vigilent Activities

\$200 million.

OTHER PIER PROJECTS

Additional industrial research includes:

- Demand response research and demonstrations focused on helping industrial customers cut peak energy demand and associated costs.
- Water and wastewater efficiency research to demonstrate technologies that reduce energy associated with treatment and process, increase use of recycled water, and document associated benefits.
- Anaerobic digesters and combined heat and power applications research to demonstrate technologies that can increase biogas production to generate electricity and natural gas while meeting the state's air emission requirements.

Technologies under development in these areas will increase water and energy efficiency while helping industry reduce operating cost.



**“ THE CHEAPEST
ENERGY IS WHAT
YOU DON'T USE.”**

– ARTHUR H. ROSENFELD

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