

## Pacific Gas and Electric Company Pacific Energy Center

### SUMMARY:

Since 1991, The Pacific Gas and Electric Company (PG&E) Pacific Energy Center (PEC) has provided architects, engineers, interior designers, and building operators with seminars, design consultations, tool loans, and print resources to reduce the amount of energy used by new and existing commercial buildings. Though information is widely available on the design and operation of energy-efficient buildings, there are few organizations that are dedicated solely to the education of building professionals to assist with the creation of energy efficient designs. The Pacific Energy Center provides over 125 seminars annually on new building envelope technologies, renewable energy systems, daylighting, electric lighting, commissioning, and HVAC systems and controls. Located in downtown San Francisco, the Energy Center primarily serves the Bay Area commercial building community. However, its courses, tools, and services are available to anyone working on a project in California.

Energy efficiency forms a strong foundation from which to address other green building issues. In line with our support of an integrated design approach, the Energy Center offers a number of programs on water use reduction, indoor air quality, resource-efficient building materials, and indoor air quality. In addition, Energy Center programs aim to expose decision makers to the economic advantages of energy efficiency and green building. This focus helps to bring about permanent changes in design and operations practices and to create more energy efficient buildings within the state of California.



Staff of the Pacific Energy Center.



Staff of the Pacific Energy Center demonstrating the heliodon, a sun simulation device.

## 1. LEADERSHIP

Since 1991, the Pacific Gas and Electric Company (PG&E) Pacific Energy Center (PEC) has provided design advice, training, information, and access to design and measurement tools. The Energy Center is funded by California utility ratepayers through the public goods charge, a California State surcharge on utility bills used to fund assistance programs for low-income utility customers and energy efficiency programs including rebates and education. Because of this, the services offered at the Energy Center are free.

The Energy Center provides over 125 seminars each year. The goal of these trainings is to help building designers understand how design decisions affect energy efficiency and to guide them in making good choices. Energy Center trainings target architects, engineers, building owners, and facility managers to address building energy use at all phases of design and operation. Trainings are generally either half-day or full day workshops. Individual programs typically include a mix of lecture, case studies, hands-on activities, group discussions or exercises, and/or demonstrations of design strategies, equipment, tools, and technologies. When content and learning approach permit, classes are also simulcast over the Internet.

Some trainings address whole-building schematic design decisions that shape big picture energy use. Others look at individual systems, such as ventilation or electric lighting, needed to ensure low mechanical and electrical loads. Energy Center trainings also aim to maintain or improve energy performance once a building is occupied. We provide trainings and resources for architects, engineers, owners, and facility managers to evaluate ongoing building performance in terms of both energy use and occupant satisfaction.

While California's Title 24 Energy Standards set minimum building energy performance standards in California, performance much better than code is possible with the right of skills and knowledge. Many of our programs assist building designers to significantly exceed energy performance requirements. These skills are recognized as critical to achieving the greenhouse gas reduction

goals set by the 2030 Challenge and endorsed by the American Institute of Architects (AIA), the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), and the U.S. Green Building Council (USGBC). To support the reduction of greenhouse gas emissions, we encourage an integrated design approach, and offer sets of trainings that address specific issues pertinent to design of the building envelope, electric lighting, and mechanical systems, building operations, and on-site renewable energy.

Building envelope courses concentrate on site analysis and orientation, design for daylight, wall and roof assemblies, and location and selection of glazing. Lighting courses address human perception, lighting quality, and how to match appropriate energy-efficient lighting technologies and controls to the requirements of the space. The integrated design approach promoted by the Energy Center reduces the need for active mechanical systems, yet recognizes that these systems may be necessary for certain building types. HVAC courses demonstrate approaches and technologies that achieve high levels of thermal comfort, indoor air quality, and occupant control while using the least amount of energy.

The Energy Center also trains architects, engineers, commissioning agents, and building operators in the use of several types of software. Trainings include software used to document compliance with the Title 24 energy standards and evaluate energy implications of architectural, daylighting, electric lighting, and HVAC design decisions. Building commissioning software developed by the Energy Center allows facility managers to easily collect and compare data on a variety of building systems, enabling them to tune these systems and improve energy performance.

In addition to courses and software development, the Energy Center established a Tool Lending Library (TLL) in 1994 that loans measurement devices and other building assessment tools at no charge. The TLL currently offers over 4,000 pieces of equipment that measure building performance variables including power, light, temperature, solar radiation, indoor air quality, and equipment operation. Each year, the TLL

processes approximately 850 tool loans. The Energy Center offers trainings on the use of tools for site analysis, solar access studies, commissioning of new buildings, and improvements to operational energy use in existing buildings. We also offer advice on measurement protocols and education about how buildings should operate to achieve expected performance levels in terms of energy efficiency and occupant comfort. The Energy Center also trains architects and building owners on use of the internet-based survey tool developed by UC Berkeley's Center for the Built Environment to assess occupant satisfaction. We firmly believe that a successful building must be energy efficient and provide a comfortable working and living environment for all its occupants. The CBE survey tool is one way to learn about how building occupants rate their own work environments.

The Energy Center is a recognized leader in providing information on renewable and distributed energy systems, including photovoltaics, wind energy, solar thermal, cogeneration through combined heat and power, and fuel cells. We have provided hundreds of trainings on these topics to design professionals, contractors, and building owners over the last ten years.

Energy efficiency, achieved through excellent building envelope design, integrated daylighting and electric lighting, and super efficient HVAC systems, forms a strong foundation from which to address other green building issues. In line with our support of an integrated design approach, the Energy Center offers a number of programs on water use reduction, indoor air quality, resource-efficient building materials, and indoor air quality. Because of the increasing popularity and use of the LEED rating system, several of the Energy Center workshops discuss topics such as commissioning, materials choice, and energy performance within the LEED framework. Other workshops include discussion of such topics as the effect of the ASHRAE adaptive comfort standard on HVAC system design and building energy use and how to meet the 2030 Challenge adopted by the AIA.

Through its range of offerings, the Energy Center has played an important role in helping building professionals learn about potential benefits

and drawbacks of specific design and operational actions.

## 2. SIGNIFICANT ENVIRONMENTAL BENEFITS

In evaluating building performance, energy is one of the more easily quantified metrics. The focus of almost all Energy Center programs is to reduce building energy use, often specifically using the State's Title 24 energy standards as the metric. However, in order to quantify the impact of the classes at the Energy Center, we would have to measure the energy consumed by the buildings designed or operated by each attendee over the course of their careers, and compare that against some baseline energy consumption.

Instead, periodic phone surveys (approximately every two years) are conducted of a sample of workshop attendees by a third party. The survey gathers information on "workshop influences on barriers to adoption of efficiency practices, participant satisfaction, appropriateness of marketing and communications methods, and workshop effects on specification practices, equipment purchases, and operational behaviors." Respondents are asked to rate the workshops and their elements, and they were also asked to rate how willing they would be to recommend the workshop to a colleague.

A short-term goal of the Energy Center training program is that workshop attendees will depart in possession of information and skills that they can apply to improve the energy efficiency of building designs or facility operations. Feedback collected during the most recent phone survey of workshop attendees shows that the Energy Centers is making good progress towards that goal.

A long-term goal of the Energy Center training program is that as attendees are educated about energy efficiency, they will be better able to promote and implement energy efficient designs, as well as feel more confident about purchasing energy efficient equipment. Again, the results of the phone survey indicate that this is the case.

A large majority (78%) of the workshop attendees were identified as "market actors" in

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construction, building design, engineering, or sales, while another 12% were managers of buildings. Overall satisfaction with the Energy Center was excellent, with a stated satisfaction rate of 96%. 88% of respondents would recommend the workshop they attended to a colleague. Selected results of the phone survey are presented in the Appendix.

### **3. POTENTIAL MODEL FOR BUSINESS COMMUNITY**

Because it is funded with public goods money through the CPUC, the Pacific Energy Center does not have competitors. Instead, it is asked to collaborate with the other energy centers in the State of California to improve energy efficiency statewide. Any sharing of program information between the energy centers supports the goals of the CPUC.

Certain aspects of the training program at the Energy Center are transferable to other businesses. Through our workshops, architects and other building designers learn skills and concepts of energy efficiency and sustainable design that increase their ability to meet new requirements and market demands for higher-performing buildings. Several design firms, with advice from the Energy Center technical staff, have increased internal education on energy efficiency and sustainable design for their staff. Trainings held at the Energy Center provide a venue where architects can meet and network with other building designers interested in energy efficiency. A few design firms have begun hosting brown bag lunches, presentations, joint workshops, and other, more social, forms of sustainable design discussion and education. In the past, the PEC has catered courses to specific businesses to provide training for their building operators. These opportunities and requests for catered trainings are evaluated on a case-by-case basis with cost effectiveness as one metric for developing customized training.

A key aspect of Energy Center trainings is that we do not permit company representatives to present trainings unless the training is of a non-commercial nature. Course instructors are instructed to discuss merits of different products

and technologies, but are barred from endorsing specific manufacturers.

Energy Center workshops are generally either half-day or full day workshops that take place in a classroom. Almost all programs include case studies, hands-on activities, group discussions or exercises, or demonstrations of design strategies, equipment, tools, and technologies. Certain programs, such as those focused on building performance and commissioning, make use of the entire Energy Center facility as attendees use tools from the lending library to evaluate the performance of different building systems. These programs, and others that use specialized classroom, are hard to teach in other locations. Lighting programs involve demonstrations in the Energy Center lighting classroom, which contains exhibits that demonstrate fundamental lighting concepts and has the capability of showing different lighting technologies and effects for side-by-side comparison. The solar analysis training involves hands-on exercises in which attendees apply the shading device design principles they learn during the lecture to a design problem and then test their solutions on a direct sun and shading simulation tool called the heliodon (See Figure 1). The concepts and fundamentals taught in these classes could be taught in other locations, in shorter modules to accommodate work schedules, without the demonstrations.

Trainings in specific software tools are more directly transferable, requiring only the software and laptops, not a specialized classroom. Program coordinators and technical staff organize evening lectures, outside of normal business hours, to educate those who cannot attend trainings during the day. The evening lectures offered by the Energy Center are generally either a lecture by a single speaker or a moderated panel discussion, and these could also be held at other locations, by companies, non-profit institutions, or other organizations. Some of the workshops and evening lectures are webcast, to reach a broader geographic audience.

### **4. DEMONSTRATING PROGRAM COMMITMENT**

Energy conservation programs have a long history with the State of California and Pacific Gas and Electric Company (PG&E). More than 20 years

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ago, the California Public Utilities Commission (CPUC) instituted regulations that “de-coupled” utility revenues from energy sales. This legislation created an incentive for California utilities such as PG&E to promote energy efficiency, and to establish training centers such as the Pacific Energy Center, rather than sell additional power.

Support for energy efficiency programs, and more recently greenhouse gas emission reductions, has been part of the PG&E corporate culture since the 1980s. This support occurs at all levels throughout the corporation, starting with the Chief Executive Officer, Peter Darbee. Recently, he endorsed both California and Federal legislation to limit greenhouse gas emissions, demonstrating leadership on environmental issues at the highest level of our company.

From the top down, PG&E corporate leaders support the mission of the Energy Center. These leaders work with the CPUC to ensure continued funding from the State of California. In addition, PG&E staff work closely with the CPUC to set goals for the number of classes and broad subject areas to cover and ensure that the Energy Center meets its annual goals for number of courses and content. Meeting the goals set by the CPUC is the responsibility of Robert Marcial, the director of the Energy Center.

Long-term planning involves several components. Funding and goal-setting by the public utilities commission currently occurs in three-year cycles, allowing the Energy Center to look ahead two years as it plans its courses. To support the goals set by the utilities commission and also by PG&E, the Energy Center must conduct a certain number of trainings across several specified subject areas. Robert and the technical staff assess trends in the building industry, new regulations, and emerging technologies to provide up-to-date technical information and to teach fundamental concepts of energy efficient design and operations within the specified subject areas. The training sessions address strategies for saving energy while also creating healthy, productive environments for building occupants.

## 5. COLLABORATIVE EFFORT

Program coordinators work with a variety of partners throughout the year to develop potential course content and educational criteria. Partners internal to PG&E include the Codes and Standards and Emerging Technologies programs and PG&E senior staff who develop technical performance evaluations for customer rebate programs.

In order to remain abreast of new research, regulations, products, and technologies that may impact course development, the Energy Center director and technical staff maintain external partnerships with organizations such as Lawrence Berkeley National Laboratory (LBNL), the University of California, Berkeley Center for the Built Environment, the California Energy Commission’s (CEC) Public Interest Energy Research (PIER) program, and the California Lighting Technology Center (CLTC). These organizations are key players in shaping discussion of future energy efficiency standards, new technologies, and applications of existing technologies.

In addition, the Energy Center relies on its technical staff and a variety of technical consultants and trainers in Northern California. These include organizations such as Hescong Mahone Group (for daylighting), Architectural Energy Corporation and Richard Heath and Associates (fenestration/building envelope), Taylor Engineering and Rumsey Engineers (commercial HVAC), and EnergySoft LLC and the California Energy Commission (Title 24 code compliance). These consultants and trainers are widely recognized as experts in their field.

A key responsibility of our technical staff is to anticipate training needs for new technologies, products, and regulations. One way this is accomplished is through active participation in National and Bay Area professional organizations and educational institutions. These include various committees at the San Francisco Chapter of the American Institute of Architects, the ASHRAE TC1.5 Computer Applications Committee, the ASHRAE Standard 55 Committee, the USGBC LEED Curriculum Committee, the USGBC Education Steering Committee, the USGBC LEED-NC Corresponding Committee, the USGBC Northern

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California Chapter Green Building Resources Committee, the Society of Building Science Educators, the California Commissioning Collaborative, the Laney College Environmental Control Technology Program, and the Lighting California's Future Program.

One member of our technical staff serves on the AIA/SF Board of Directors, and our Director is the current president of the Golden Gate Chapter of ASHRAE. The Energy Center's technical staff also teaches and attends the LEED-NC and LEED-EB technical reviews conducted by the USGBC, and trainings on software such as Ecotect and eQuest.

The Energy Center also works with professional organizations to develop new cooperative channels for educational program delivery. One such example is a partnership with the Building Owner and Managers Association (BOMA) Building Energy Efficiency Program (BEEP) targeting small and medium sized commercial building customers.

These efforts allow the Energy Center to discern new educational opportunities and prepare for new technologies and requirements that can be addressed through our seminars.