

California Energy Centers and Workforce Development: What Other States Can Learn

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ABSTRACT

The California Statewide Energy Efficiency Education and Training Program is one of the largest training programs of its kind in the country. California's Investor-Owned Utilities (PG&E, SCE, SCG, and SDG&E) operate nine Energy Centers that provide a wide variety of educational programs for both market actors and end-users. From 2006 through 2008, the centers offered 840 unique courses across 16 end-uses that were taken by close to 40,000 people.

In this paper, we present the results from a three-year evaluation of this program. The purpose of the evaluation was to assess the indirect energy efficiency impacts of the Statewide Energy Efficiency Education and Training Program. The evaluation had two main charges: identify changes in attitudes, awareness, and knowledge of energy efficiency, and quantify net energy savings for key components of the programs. In addition, we examined the role the Energy Centers play in the continuing education marketplace in California, which is the focus of this paper.

The results of the evaluation indicate that the Centers provide training that increases the knowledge of training participants and causes them to change their behaviors. Participants apply what they learn in the workplace, which results in measurable energy savings. The Centers play a vital role in providing workforce training. Similar training is either not as easily accessible or affordable. Given the success of this program, future programs could look to the California Statewide Education and Training Program as a model.

Program Background

The Statewide Energy Efficiency Education and Training Program is offered in the service territories of Pacific Gas & Electric (PG&E), Southern California Edison (SCE), San Diego Gas and Electric (SDG&E), and Southern California Gas Company (SCG). The program objective is to provide utility customers with information about energy-efficient technologies and practices that will help them reduce energy usage, lower their utility bills, reduce operation and maintenance costs, and improve their productivity at both home and work. The programs also provide training to a variety of market actors (i.e., architects, designers, engineers, distributors, and contractors) who use information and tools to design more efficient buildings or processes and to conduct energy efficiency retrofits and renovations.

Within the four Education and Training Programs (PGE2010, SCE2513, SDGE3009, and SCG3503) are nine unique Energy Centers. The Centers are the primary vehicle for the dissemination of information and the promotion of energy efficiency. The Energy Centers share a common objective of delivering energy efficiency information and training. However, each Center has unique program offerings that are targeted to distinct markets and participants, promoting diverse behavioral changes across different end-uses.

Table 1 displays the information delivery methods used by each Center. Although the Centers conduct a variety of activities, all emphasize their educational courses, workshops and seminars. Because of the common focus and the large number of participants, the courses were the main focus of this evaluation.

Table 1. Overview of Energy Center Efforts

Energy Center	Methods of Information Dissemination					
	Classes, Seminars and Workshops	Customer-specific Trainings, Demonstrations and Consultations	Lending Libraries	Outreach Activities (facility tours, trade shows, industry events)	Information Dissemination (Displays, Exhibits, Brochures, website)	EE Technology Testing
Southern California Edison						
Agricultural Technology Application Center (AgTAC)	√	√	√	√	√	
Customer Technology Application Center (CTAC)	√	√		√	√	
Technology and Test Centers (TTC)	√	√		√	√	√
Pacific Gas and Electric						
Pacific Energy Center (PEC)	√	√	√	√	√	
Stockton Energy Training Center (ETC)	√	√	√	√	√	
Food Service Technology Center (FSTC)	√	√			√	√
Southern California Gas						
Energy Resource Center (ERC)	√	√		√	√	
San Diego Gas and Electric						
SDG&E Energy Resource Center (ERC)	√	√		√	√	
CA Center for Sustainable Energy (CCSE)	√	√	√	√	√	

Evaluation Approach

The evaluation involved a number of research tasks. Initially, we collected background information on Center activities and customers participating in those activities. We used this information to design and conduct surveys with course participants. Additionally, we identified non-course activities that did not lend themselves to the same type of assessment used for the courses. We conducted case studies for these activities. The results presented in this paper draw mainly on the participant database review and participant surveys.

Reach of the Energy Centers

Over the three year evaluation period (January 1, 2006 – December 31, 2008), the nine Centers offered 840 unique courses that 39,793 unique people attended. Many people took more than one course so that the total number of course attendees was 97,997 across the three years.

The courses varied in length and structure from one hour lunch-time talks to multi-day seminars. The average length of a course was 5.7 hours. By summing the length of each of the 97,997 course attendances, we find that the Centers combined to offer 547,560 hours of training, which is the equivalent of approximately 350 four-year college educations (Figure 1).

The courses offered by the Centers covered 16 different end-use categories. The number and variety of end-uses is similar to those covered by IOU resource acquisition programs. In fact, many of the trainings sought to channel participants into the utilities' resource acquisition programs.

Figure 1. Program Participation Facts

Program Participation Facts: 2006-2008	
•	Number of Course Attendees: 97,997
•	Percent Taking More Than One Course: 39%
•	Number of Unique Course Takers: 39,793
•	Number of Courses with Unique Content: 840
•	Average Course Length: 5.7 hours
•	Total Hours of Training: 552,913 (~ 350 4 year college educations)

Table 2 provides a number of different measures of frequency of course offerings by end-use. These include the number of courses with unique content, the number of training sessions in which a unique course is offered more than once, the number of unique participants, the total number of participants, and finally the total hours of training.

HVAC is the leader across all categories. Regardless of the measure, the Centers offered more courses that were taken by more people for more hours on HVAC than any other end-use. One quarter of the Energy Center training hours were devoted to HVAC related topics. Courses on green building, lighting and renewables were also popular.

Table 2. Course Offerings and Participation Levels by End-Use: Nine IOU Energy Centers, 2006-2008

End-Use	Unique Courses	Training Sessions	Unique Participants	Total Participants	Hours of Training
HVAC	149	663	9,990	30,311	143,815
Green Building/Envelope	100	224	7,290	11,027	81,814
General/Other	141	323	8,342	11,312	62,774
Renewables	27	211	6,087	8,134	47,203
Lighting	120	310	6,262	10,032	44,444
Boilers/Furnaces/Water Heating	43	119	3,090	4,790	39,909
Commissioning	26	74	1,117	1,972	32,886
Title 24	50	187	4,204	5,995	29,567
Motors/Pumps	38	97	2,165	2,822	19,991
Commercial Cooking/Foodservice/Refrigeration	58	127	3,585	4,951	15,928
Controls/EMS	34	74	1,483	1,841	11,081
Financial Incentives	26	101	2,237	2,448	7,061
Compressed Air	11	31	897	990	6,637
Water Management	8	11	603	742	6,073
CHP/Gas Engines	5	5	297	363	2,194
Pools	4	24	254	267	1,538
Overall	840	2,581	39,7931	97,997	552,913

Reach by Market Segment

Our analysis provided a review of the market segments that were reached through the Centers' programs. In the course participant surveys, we asked a series of questions that were used to classify respondents by their occupation or reason for taking the course. We identified three main types of participants:

- Market actors who took the course to learn something they could apply in their client's facilities.
- Commercial end-users who took the course to learn something they could apply in their company's own facility or one they manage.
- Residential end-users who took the course to learn something they could apply in their homes or who did not have a specific purpose in mind.

As shown in Table 3, just over half of the unique course takers across all nine Centers were market actors (55%), followed by commercial end-users (30%) and residential end-users (15%). By multiplying these percentages by the total number of unique course participants from 2006 through 2008, we also provide an estimate of the number of course participants in each category.

¹ The number of unique participants is the number of unique individuals in each end-use. Because some people attended courses in multiple end-uses, the sum of the unique participants by end-use would be greater than the total number of unique participants overall. The overall number represents the actual number of unique participants across all end-uses and not the sum of unique participants by end-use.

Table 3. Course Participant Type

Participant Type	Percentage	Participants
Market Actors ²	55%	19,941
Commercial End-Users	30%	10,877
Residential End-Users	15%	5,439
Total	100%	36,257³

In all, the Centers reached over 10,000 commercial end-users and 5,000 residential end-users. Nearly 20,000 market actors attended Center courses from 2006 through 2008. Table 4 shows the breakdown of industry areas among market actors indicating the fields where the Centers have the most impact. Market actors from engineering or architectural design firms are the most common course attendees. Market actors working in construction, lighting and HVAC also make up a larger percentage of the Centers' students.

Table 4: Industry Area of Market Actors

	Percent (n=2,695)
Engineering or Architectural Design	36%
Construction	25%
Lighting	23%
HVAC	19%
Energy Technology Research/Consulting	15%
Renewables	14%
Facility Operations or Maintenance	9%
Government Agency/Regulatory/Inspector	9%
Boilers/Water Heating Sales	9%
Refrigeration	7%
Motors	7%
Pumping/Hydraulic Equipment	6%
Energy Conservation Services/Energy Audits	1%
Other	8%
Don't Know/Refused	6%

Note: Market actors could select more than one industry area so the percentages sum to more than 100%.

Impact on California Workforce Education and Training

The previous section showed that the training that takes place at the Energy Centers touched nearly 40,000 people from 2006 through 2008. In this section, we address the role the Energy Centers play in the workforce education and training environment.

² This includes Code officials (<1%), HERS raters (<1%) and teachers (2%).

³ In Table 4, we show that there were 39,793 participants. However, though our survey efforts, we learned that approximately 9% were ineligible to be included in our evaluation for a variety of reasons. Some were course instructors or energy center employees. Others registered for the course but were unable to attend. The adjusted number of unique participants is 36,257 and is the basis for our population estimates going forward.

Filling a Gap in Existing Training Offerings

To gain some additional insight into the Energy Centers role in the marketplace for workforce education and training, we gathered information related to three main questions: 1) aside from the Energy Centers, where else might individuals receive training on energy efficiency?; 2) what are the characteristics of the training alternatives?; and 3) how do the Energy Centers compare to these alternatives? Our goal was not to perform an exhaustive, quantitative study of the market, but rather to create a preliminary framework in which to view the Energy Centers.⁴ Participant comments regarding other venues at which they sought training served as the foundation for this assessment. In particular, when we asked course participants about the other places they had received training, they cited a range of organizations, professional associations, and programs. A general summary of some training locations identified through this research is provided in Table 5.

Table 5. Additional Training Providers

California Home Energy Rating Service	Community Alliance for Career Training and Utility Solutions
Air Conditioning Contractors of America	North American Technician Excellence
The Affordable Comfort Institute	The American Institute of Architects
The Building Performance Institute	The Tile Roof Institute
Leadership in Energy and Environmental Design (LEED)	Air Conditioning and Refrigeration Institute
Sheet Metal and Air Conditioning Contractors' National Association	

A review of these entities and additional searches for information revealed that the Energy Center trainings offer a stronger focus on energy efficiency than the other options available. For example, our research on the trainings mentioned by participants, including an Internet search, identified at least two HVAC courses offered in the state, but neither had an explicit energy efficient focus. While there is some indication that market actors completing North American Technician Excellence (NATE) preparatory courses have significantly higher field efficiencies than those who do not, the curriculum is not focused on this area of study.⁵

In addition, when we looked for lighting courses, we found no alternative courses in California for those wishing to concentrate on energy efficient lighting. However, a number of organizations do promote energy efficiency in various ways and Table 6 presents some of these alternative courses.

⁴ Our main method of exploration and data collection was an extensive internet search, which also helped to provide us with a sense of the experience facing those seeking out educational opportunities online. We also asked about this information in our in-depth interviews. One notable limitation of this approach, however, was the inherent difficulty in accessing information about the educational opportunities available through labor unions and informal peer networks. In terms of labor unions, limited access is afforded to non-members and for informal networks information is often available only by word of mouth or through other means that cannot be tracked online.

⁵ Source: <http://www.californiaenergyefficiency.com/docs/hvac/HVAC%20Draft%201-5-08.pdf>

Table 6. Alternative Courses

Sponsor	Description
Affordable Comfort, Inc. (ACI)	ACI is a non-profit organization training building and housing professionals to make homes energy efficient, using building science, testing and diagnostics-- a systems approach.
Building Performance Institute (BPI)	BPI is a national non-profit that accredits and certifies home performance market actors. It teams with other organizations to educate market actors using a whole house-systems curriculum created by NYSERDA
Leadership in Energy and Environmental Design (LEED)	Developed by the U.S. Green Building Council (USGBC), LEED provides building owners and operators a concise framework for identifying and implementing practical and measurable green building design, construction, operations and maintenance solutions.
Community Alliance for Career Training and Utility Solutions (CACTUS)	This appears to be a non-profit that offers many kinds of energy efficient classes including Residential Energy Services Network (RESNET) classes, weatherization classes, solar, ducts, and HERS throughout the state

The Energy Centers provided more depth and breadth in their course offerings than other organizations. For example, while the Energy Centers serve as a one-stop shop for training on a wide range of end-uses, as well as customized trainings, most of the organizations we researched focused solely on one end-use or on a particular type of professional training. In addition, even within these organizations’ areas of specialization, the number of courses offered appeared limited and certainly did not compare to the extensive course offerings at the various Energy Centers.

The scope of training opportunities offered at the Energy Centers is important --many of the Energy Center course participants take a large number of courses thereby demonstrating a demand for a range of topics. In fact, as shown in Table 7, most of the participants who take more than one course also focus on more than one area: 39% took multiple courses in only one area with the remaining participants taking trainings across a wider variety of areas (or end uses such as HVAC, lighting, etc.).

Table 7. Number of End-uses (or Areas) in Which Participants Taking More Than One Class Took Courses

Number of End-uses	Participants Who Took More than One Course (n=15,730)
1	39%
2-3	49%
4-5	9%
6 or more	3%

When we asked Energy Center course takers who also took other trainings how the other training they received compared with the Energy Centers, some consistent themes emerged. In general, course participants favored the Energy Centers because they provide the right level of information at no cost and are viewed as a trusted source of energy efficiency information. A number of participants also praised the level of the Center courses and the fact that they are not too lengthy, which can pose a barrier to attendance.

Participant comments also indicate that they favored the Energy Center classes based on their current curriculum and in-depth approach. Those who did not attend courses taught by other organizations echoed these comments and felt the Energy Centers offer everything they need – no cost, convenience and good quality.

The Energy Center trainings were also more easily accessible than some of the other trainings mentioned. In conducting an Internet search, Energy Centers appear much more frequently, and provided all of the information required for attendance (e.g., cost, content, length, location, timing). Participants who reported attending non-Energy Center trainings reiterated this sentiment, indicating that it was difficult to find user-friendly information. We researched the organizations participants mentioned, looking specifically for offerings in California and for energy efficiency content. We found that for half the organizations, it was very difficult to determine when and where any courses would be offered and what they might cover.⁶

The value of the Energy Center courses within the overall market for training is apparent from the course participant feedback. According to some of the market actors interviewed:

- *“If they didn’t exist it’s possible I wouldn’t have even gotten [the training] because any of the other courses or classes were a little bit more intensive [in terms of the amount of time required in the classroom].”*
- *“I would be very affected...I couldn’t afford to take it [the training] if it wasn’t for the Energy Centers.”*
- *“I’ve been trying to become a better lighting designer and I would have probably done it from some combination of you know manufacturers information and you know I might have hired consultants more.”*
- *Noting the fact that the course allows a service technician to offer greater value to his customers, one participant remarked: “Yeah, my work would be affected. [The] quality of the service technician that provides the service to the user or the consumer is of less value without that course.”*

Overall, we determined that the Energy Centers offer training that would not otherwise be available.

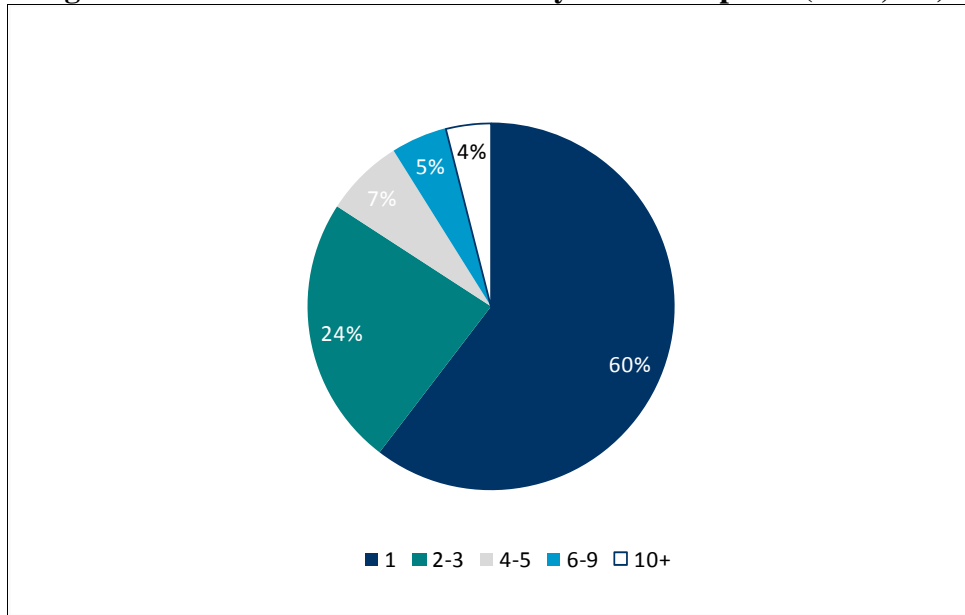
Providing Continuing Education

Our research demonstrates that there is clear demand for ongoing education. Given that 40% of participants took multiple courses (Figure 2)⁷, the evaluation team explored why participants took multiple courses and focused on participants who took five or more courses during the three year evaluation period. In particular, we wanted to know about the individuals’ motivations for attending the Energy Center courses and whether the Centers training would advance their careers.

⁶ We did not try to contact any of the organizations directly.

⁷ Overall, participants took an average of 2.5 courses. However, a few took a large number of courses with one person completing 124 courses. In addition, 25 people took 50 or more courses over the three year study period though they represent less than 1/10 of a percent of the total number of participants.

Figure 2. Number of Courses Taken by All Participants (n=39,793)



We conducted 36 in-depth interviews with frequent course takers to better understand their motivation and decision-making in regard to their educational choices.⁸ Among this group, the most common reason to take courses was to stay up-to-date on the practices in their field. Two of these respondents also noted the need to get continuing education credits to receive their architecture license. As described by the participants themselves:

- *“I’m constantly trying to find as many classes as possible to continue my education and deepen the level of detail about the whole building performance science. So yeah, it’s an ongoing educational process and I really enjoy it.”*
- *“They tend to have current information to help keep me updated.”*
- *“The first reason [I took the classes] would be for my education credits for the American Institute of Architects primarily. And then also just to keep up with what is happening and I do inspections and I’ve helped in acquiring properties, so it is good to know that information.”*
- *Course taking “has usually been for a specific purpose. I’m a HERS rater in California so I work a lot with all the energy code compliance for builders and contractors and so a lot of these things – you know, a lot of its update courses for my work.”*

The combination of subject areas taken by frequent course takers further suggests a deliberate approach to course selection and highlights the subjects in greatest demand. The magnitude of courses taken in the HVAC module along with the focus on other courses that collectively provide information related to building performance and envelope indicates that frequent course takers are creating their own interdisciplinary yet holistic curricula for professional development (Table 8).

⁸ The evaluation team conducted interviews with individuals that took courses in a number of end-uses, as well as those who took courses in a relatively small number of modules, such as market actors with defined areas of specialty.

Table 8. Most Popular Courses among Frequent Course Takers

Module Type	Number of Courses Taken
HVAC	22,227
Lighting	5,106
General	4,929
Green Building	4,876

When asked about the benefit of taking a series of courses, participants spoke about being better able to perform certain professional duties such as providing informed recommendations to their clients, as well as receive training on the use of energy analysis tools.

- *“I think it just helps me make better selections for my clients and a little bit more knowledgeable about the pluses and the minuses of various systems for their specific applications”*
- *“I felt that overall it was a huge shift in our ability to do the work by taking the classes and more clearly understanding the details of overall home performance.”*
- *“Now I can go in there [to a client] and explain in more detail about every type of insulation that is available to them. Whereas before I couldn’t do that, and I think that resulted in more insulation being installed.”*

The continuing education provided by the Energy Centers also has an impact on energy saving behaviors. Eighty eight percent (88%) of frequent course takers report taking energy saving actions as a result of what they learned in the course(s) compared to 67% among other course takers. As a result, it is clear that course participants utilize the Energy Centers as both a source of continuing education and mechanism for expanding both their energy efficiency knowledge and actions.

Training the Trainers

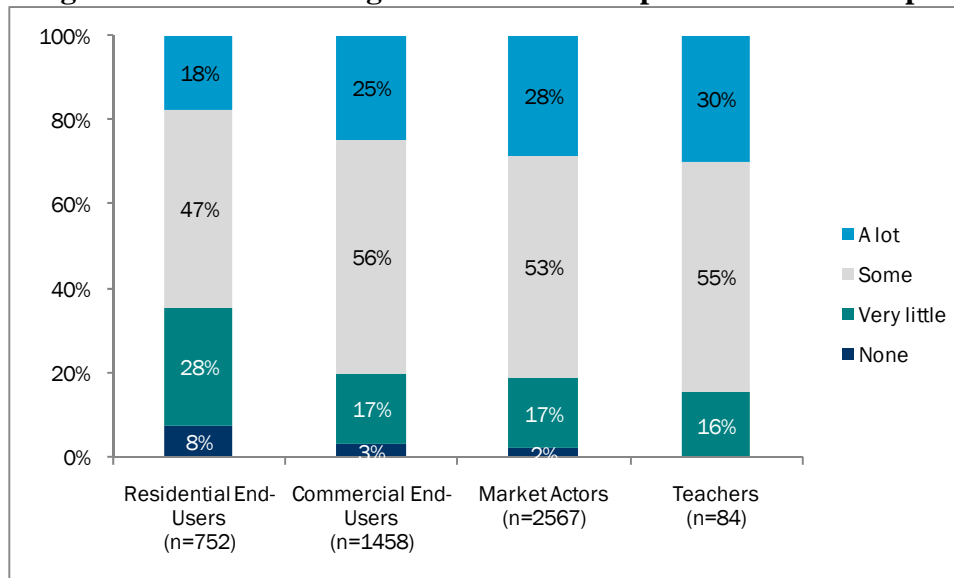
In addition to training market actors, building operators, and interacting with manufacturers, the Energy Center programs also touch educators who can help to expand the reach of the centers. Although the group of teachers that participated in our survey effort (n=84) is small in size, these participants are particularly well positioned to disseminate information provided by the Energy Centers, as well as train others on these topics.

The educators that took courses at the Energy Centers come from a variety of educational institutions such as school districts (12%), high schools (4%), and university systems (24%) such as the University of California, and Sacramento, Los Angeles and San Diego City Colleges. Other participants that hold a teaching role come from private companies, city departments or programs, other research and training centers, and unions. They also took a wide range of courses, with the largest number being in renewables, general energy efficiency, HVAC, green building and cooking as opposed to other topics.

As shown in Figure 3, compared with participants from other professional backgrounds, educators consistently come to their courses with some existing understanding of how to accomplish the concepts presented the course. Encouragingly, despite their existing knowledge base, almost all teachers also agree that the courses provided them with at least a little new

information (99%) suggesting that even for those individuals that start at a more advanced level, the courses offer a curriculum suitable for learners at all levels.

Figure 3. Prior Knowledge of How to Accomplish Course Concepts



In fact, most teachers learn a significant amount from the courses they take. For example, when asked how their knowledge had changed as a result of the courses, half of the teachers reported that their increase in knowledge was high (50%) while 45% reported a moderate increase. Strikingly, teachers that have the greatest familiarity with the course concepts prior to enrollment appear to benefit most in terms of knowledge gain as a result of the course.

As a result of taking the courses and gaining this energy efficiency knowledge, almost half of teachers (46%) strongly agree that they are more likely to recommend energy efficient equipment, designs or practices to their students. Based on a scale of 1 to 7 where 1 is “strongly disagree” and 7 is “strongly agree”, the mean rating among teachers was 5.9. In addition, beyond making recommendations, educators frequently share what they learned with their colleagues (89%), and also seek out additional information related to what they studied (77%), both activities closely related to general practices within their professional field.

Further, many teachers re-evaluate the way that they perform their jobs and make changes using the information they have gained through course taking. In fact, over three quarters of the teachers who took Energy Center classes (76%) state that they applied what they learned to change the services they provide to their students. In some instances, this change includes new or different types of recommendations. Almost two-thirds (64%) of the teachers that made changes describe them in this manner and elaborate on the type of equipment they recommend. Examples cited include ENERGY STAR rated equipment, variable frequency drives, solar fans and panels, and cooking or food service equipment.

Teachers also integrate what they learned in the Energy Center courses into their class curriculum. As one participant noted, “[I am] using ideas from the courses to update class discussions” while another said they “enhanced [the] technical content of consumer workshops.” A number of teachers also provide information to their own students about utility energy efficiency programs, direct them to the utilities’ websites for additional information and one participant takes students to the Energy Resource Center twice a term.

Overall, the Energy Center courses had a moderately high impact on teachers' decisions to make these types of changes. On a scale from 1 to 7 where 1 is "not at all influential" and 7 is "very influential", the average rating provided by teachers who took action is 5.3. The fact that these new or enhanced practices also became standard practice for 87% of the teachers further expands the Centers' reach as information is continually passed on to new groups of students.

Conclusion

This evaluation of the Statewide Education and Training Program showed that the program reaches a large number of participants who learn about energy efficiency topics and change their attitudes about what they could do to save energy. A large majority follow through by changing their behaviors and taking actions that do result in energy savings.

A majority of program participants take the courses to learn something they can use in their work (55% are market actors while 30% are commercial end-users. Quantitative and qualitative evidence suggests that the Energy Centers play an important role in educating these workers about the latest advances in energy efficiency technologies and practices. Without the Centers, many would not receive similar training as comparable training is not as convenient or affordable.

Though utilities or states that institute similar programs cannot be guaranteed similar levels of program effectiveness, this evaluation shows that it is possible to create a training program that touches large numbers of people, saves energy, and fills a gap in the marketplace for workforce education.