



MEMORANDUM

TO: Phil Moffitt, Cape Light Compact; Wendy Todd, National Grid; Monica Kachru, NSTAR
FROM: Jennifer Mitchell-Jackson and Hannah Arnold, Opinion Dynamics
DATE: October 23, 2012
RE: Post-Secondary Energy Efficient Education Program Literature Review Findings

This memo provides insights into post-secondary education programs administered around the country. The goal of this research was to identify post-secondary education programs that quantify energy savings and claim these savings in regulatory filings.¹ As described below, we found significant programming and evaluation related to Building Operator Certification (BOC) programs, as well as training and education for both end-users and market actors.

Literature Review Findings

The majority of evaluation reports related to post-secondary energy education programs focus on BOC. Of the ten post-secondary program evaluations we reviewed, six related to BOC programs and almost all of these quantified savings. In addition, we identified two non-BOC education programs that quantified savings. However, it was less common for program administrators to claim these savings. In fact, among those programs quantifying savings, only two claimed them in regulatory filings.

Table 1 summarizes energy savings estimates for all of the programs we reviewed. Among BOC programs, kWh savings range from 0.04 kWh to 0.72 kWh per square foot. For those BOC programs that calculated it, gas savings ranged from less than 0.01 to 0.02 therms per square foot. In terms of non-BOC programming, evaluation reports typically present an annual savings figure.

While the BOC program design is described in greater detail below, it is worth noting that many of the BOC evaluations that we assessed included the computation of multiple savings metrics including savings per graduate and savings per square foot per graduate. The former estimates savings per graduate at a site, taking into account instances where more than one program graduate works at the same site. The savings per square foot metric provides a normalized savings estimate, accounting for both the size of the participant building and the number of program graduates from the site. This metric is useful for comparing program results to baseline energy intensities or regional savings potential estimates, which are typically reported as savings per area. This is also the most

¹ The team focused its research on evaluation reports identified through the BOC national website, as well as CALMAC and the Consortium for Energy Efficiency (CEE) database.

accurate metric to use for extrapolation of savings to the population, as well as a default value to apply to future program participants.

Table 1. Summary of Programs Reviewed

Program Type	Program Name and Sponsor	Quantified Savings	Claimed Savings	kWh Savings	Therm Savings
BOC	Minnesota Midwest Energy Efficiency Alliance (MEEA)	Y	Y	0.72 kWh/sq. ft.	0.02 therms/sq. ft.
	Northwest Energy Efficiency Alliance (NEEA) ^a	Y	N	0.42 kWh/sq. ft.	0.01 therms/sq. ft.
	Northeast Energy Efficiency Partnerships (NEEP)	Y	N	0.18 kWh/sq. ft. per participant	<0.00 therms/sq. ft. per participant
	Arizona Public Service (APS)	Y	N	0.04 kWh/sq.ft.	--
	Kansas City Power & Light (KCP&L)	Y	Y	0.02 kWh/sq.ft. per participant	0.52 therms/sq.ft. per participant
	CA Statewide BOC	N	N	--	--
Other	CA Statewide Education (SEE)	Y	N	700 GWh (annual)	6 million therms (annual)
	PG&E Time of Sale Energy Renovation Program (TOSER)	Y	N	15.7 annual GWh	1.84 million therms (annual)
	SDG&E Local Energy Code Training Program (ECT)	N	N	--	--
	SCE Energy Design Resources (EDR)	N	N	--	--

^a The program serves Washington, Oregon, Idaho and Montana.

Among educational programs that do not focus exclusively on building operators, program administrators determine measure-specific savings and annual savings due to actions taken as a result of course participation. For example, the administrators of the Time of Sale Energy Renovation Program (TOSER) program developed an estimate of annual savings averaged over the homes that implemented upgrades through Energy Efficient Mortgages (EEMs). Savings for the CA Statewide Education program, which includes training and education efforts at nine energy centers throughout the state, are also presented in annual terms. However, only the savings from end-users were assessed. The evaluation did not measure the market effects or incremental efficiency gains among market actors that leverage the available educational opportunities.

Energy Savings Calculations

Across all of the programs we reviewed, program savings are generally estimated based on changes in practices resulting from knowledge gained through a course or training, as well as the installation of energy efficient equipment. Table 3 presents the energy saving measures and actions encouraged and quantified through various programs. Unless otherwise noted, each “X” in the table below relates to the installation of a particular measure. Operations and Maintenance (O&M) activities are also highlighted as applicable.

When quantifying savings from BOC programs in particular, evaluators will include both measure installations and O&M activities when estimating total energy savings attributable to the program. However, the evaluator will also identify cases in which participants received an incentive from a program administrator for equipment installations. While attributable to the BOC program, these measures and associated savings are traditionally claimed through other program administrator programs. As a result, the savings associated with incentivized projects are typically subtracted from the total savings attributable to the program. The result is program savings net of program administrator incentivized projects (see Table 2).

Table 2. Savings Estimation for BOC Programs

Phase	Savings Calculated	Details
1	Program Attributable	Savings from actions taken by participants and attributed to the program
2	Program Net of PA Incentives	Program attributable savings minus any savings associated with PA incentive (or other) programs

In general, the studies we reviewed found that a large percentage of savings associated with measure installations were removed when rebates were factored into the analysis. For example, in the NEEP study, evaluators found that savings per enrollee per square foot were halved when rebated measures were removed from the analysis. Similarly, the MN MEEA evaluation found that two thirds of savings attributable to the program were removed when rebated measures were excluded.

Table 3. Basis of Savings Quantified by Program

Measures Installed and O&M Changes	BOC Programs					Other Programs	
	NEEA	MN MEEA	KCP&L	NEEP	APS	CA SEE	TOSER ^a
Lighting Controls	X	X	X (I, O&M)	X		X (I, O&M)	
Lighting Equipment	X	X	X	X		X (I, O&M)	X
Efficient Motors	X	X	X (I, O&M)	X (O&M)	X (O&M)	X (I, O&M)	
VFDs	X	X	X	X (O&M)		X	
HVAC	X (I, O&M)	X (I, O&M)	X (I, O&M)	X (I, O&M)	X (I, O&M)	X (I, O&M)	X (I, O&M)
Domestic Hot Water	X	X				X (I, O&M)	

Measures Installed and O&M Changes	BOC Programs					Other Programs	
	NEEA	MN MEEA	KCP&L	NEEP	APS	CA SEE	TOSER ^a
Energy Management System (EMS)	X	X	X (O&M)			X (I, O&M)	
Economizer	X	X		X (O&M)			
Air Compressor		X (I, O&M)	X (O&M)	X (O&M)	X (O&M)	X (I, O&M)	
Air Handler Seals			X (I, O&M)	X	X (I, O&M)		
Pipe Insulation			X	X		X (I, O&M)	
Drive Power		X (O&M)					
Electrical PM	X (O&M)	X (O&M)					
Building Shell	X (O&M)					X	X
Water System			X (O&M)			X (I,O&M)	X
Solar Equipment						X	
Appliances						X (I, O&M)	

Note: "I" indicates Installed equipment while "O&M" indicates changes to Operations and Maintenance practices.

^a Quantified measures in the TOSER program are those measures covered by energy efficient mortgages.

Among post-secondary energy education programs, the estimation of energy savings requires detailed information about the energy saving actions that participants took as a result of program participation, as well as the locations in which those individuals made the changes. Evaluators generally conduct interviews with program participants to gather this data, and may also leverage secondary data to estimate savings associated with particular measures.

In particular, program administrators need to know the size of buildings that building operators are responsible for, as well as the building type, and heating and cooling fuels. It is also critical to understand the baseline or existing behavior of program participants (whether building operators or other audiences), as well as changes in those behaviors since program participation. The methodology used by evaluators to gather this information and assess program impact includes:

- **Participant Surveys:** Depending on the level of program participation, evaluators either attempt a census or develop a sample that is as representative as possible of the participant population. Key metrics such as building type and size may also factor into the sampling approach used. In addition, evaluators may gather data in phases so that detailed inputs needed for engineering analysis are gathered only from those participants who took action that was influenced by the program.
- **Non-participant Research:** In some cases, evaluators will use non-participating building

operators as a comparison group to highlight the impact of educational programming.

- **Secondary Data Review:** To support the engineering analysis, evaluators may draw upon existing data sources such as the Commercial Buildings Energy Consumption Survey (CBECS), the California Commercial End-Use Survey (CEUS), and the Database of Energy Efficiency Resources (DEER) to determine savings for specific measures, as well as to gather information on baseline load intensities among other uses.

To provide context around the impact evaluation approaches employed in this area of energy efficiency program, we describe the program design and implementation of the programs we reviewed for this effort below.

Post-Secondary Energy Education Program Overview

Building Operator Certification Programs

The Building Operator Certification program (BOC) is a comprehensive training program for professionals working as building operators that empowers participants with the knowledge needed to make energy efficient improvements to building equipment and changes to O&M practices. Participants attend a series of courses, receive an accredited Building Operator Certificate of completion and then apply what they have learned in the commercial building in which they work.

BOC offers two series of courses that provide different levels of certification. Level 1 is comprised of seven one-day classes that cover topics such as Building Systems, Energy Conservation Techniques, O&M Practices for Sustainable Buildings, and Efficient Lighting Fundamentals. Level 2 is slightly more advanced, and is comprised of four core courses and two supplemental electives, covering topics such as Preventative Maintenance & Troubleshooting Principles, HVAC Controls & Optimization, Advanced Indoor Air Quality, and Water Efficiency for Building Operators. Class activities include lecture, discussion small group exercises, facility tours and exams.

Each course typically lasts one month and includes lectures, tests and quizzes, group activities and assignments specific to each student's work facility. Lecture materials are typically provided by regional BOC program administrator, such as the Northwest Energy Efficiency Alliance (NEEA) and the Midwest Energy Efficiency Alliance (MEEA). While projects and activities vary among each program, work-site assignments include Energy Star® Portfolio Manager Benchmarking and lighting surveys.

Once certified, building operators apply their training by implementing various energy efficient upgrades at their facility. Technology categories promoted directly by the program include: Lighting Controls, Lighting Equipment, Efficient Motors, VFDs, Efficient Heating, Efficient Cooling, Efficient Domestic Hot Water, Efficient Energy Management System, and Economizers.

Program participants must renew their certification after five years. To complete the renewal process, operators must take five to ten hours of coursework (depending on their level) per year that they wish to extend their certification. Coursework hours can be accumulated either in-person or via webinars accompanied with a quiz.

Other Post-Secondary Programs

In contrast to the BOC programs outlined above, the other programs we reviewed can serve both end-user and market actor audiences. However, due to differences in the nature of their work, different approaches are needed to characterize savings. While end-users are likely to have applied their course knowledge to a limited number of sites, market actors can make changes to everyday practice, and thus each market actor could influence many different energy saving choices and many

more sites than end users.

In the case of the CA Statewide Education program, utility sponsored Energy Centers provide training to a broad range of market actors with significant variability in the types of services they provide, the projects they complete, and the size and type of clients they serve. In addition, there is a multiplier effect with market actors as energy-saving changes that become standard practice for this group have the greatest potential to provide significant energy savings throughout a state given their ability to affect numerous design projects, equipment installations, and otherwise influence customer decisions and practices in the course of conducting their business.

This creates unique evaluation challenges that in some states have necessitated a mixed method approach to evaluation. This strategy has utilized market actor responses to participant surveys to identify the different kind of market actors that take action as a result of taking a course, and to inform the development of in-depths interview guides designed to refine the evaluator's understanding of the specific actions taken by market actors. In the CA study, the evaluator conducted case studies of a limited sample of market actors to develop a more complete understanding of the influence of course participation, the manner in which market actors' work with clients, and the magnitude of the energy savings associated with those changes.

Best Practices

Based on our review of the post-secondary energy education programs presented in this memo, we highlight the following best practices. While many of these practices are applicable to different types of programs, we have focused on BOC related program design and evaluation issues as this program has the greatest likelihood of implementation in Massachusetts.

- **Track participants and participant characteristics through pre-participation surveys or program workbooks.** It is critical for the program to understand the type of individuals participating in energy education programs. In particular, program administrators should track whether participants are end-users or market actors, as well as the role they play within their respective organizations. The actions that each participant may take based on program training also depends on both whether they serve as a decision-maker within their organization, and whether their team has the power to make decisions internally.

In addition to gathering information about participant characteristics, the program should track the number of buildings managed by each participant, the square footage of the buildings, and the fuel used at each one. This information can be gathered as part of the course or after participation, but is essential to estimating impacts particularly for BOC programs.

- **Consider targeting or screening potential participants based on their building type and potential for savings.** Depending on the ultimate goal of the program, it may benefit program administrators to identify target facility types with the potential for significant savings and actively market the program to staff working in those types of facilities. NEEA employed this strategy when first implementing its BOC program, which focused on healthcare facilities. In addition, a CA retro-commissioning workshop series offered by one of the state's energy centers, pre-screened participants to ensure that they had a building that could serve as a case study, and that they were able to commit to a series of 12 full day workshops (i.e., 84 hours) on how to increase energy efficiency in their building. These types of outreach strategies may improve the likelihood of energy saving action as a result of program participation.
- **Build follow-up on actions taken into the curriculum.** A number of BOC programs include

participant surveys on the last day of class in which participants provide feedback on the value of the coursework they completed, and details about how they have applied what they learned. As an example, the Kentucky Power and Light (KCP&L) program uses end-of-training surveys to assess the actions that participants have taken or plan to take based on the knowledge acquired through the program. These types of surveys can aid in evaluation by helping to provide a framework for identifying likely participant actions that will be further explored through evaluation surveys.

- **Use engineering analysis and participant survey data to calculate program savings.** As our review of the existing evaluation literature demonstrates, self-reported data on behavior change, knowledge gain, and measure installation as a result of program participation forms the foundation of most methodological approaches to quantifying savings. Evaluators have also utilized non-participant research when feasible to gain additional insight into the influence that educational programming has on participants compared to other factors.

Evaluators should then use the survey data collected to estimate savings associated with the actions taken by participants. For BOC programs, evaluators may also supplement this engineering analysis with data from existing End Use Surveys or reports.

A. APPENDIX - PROGRAM DESCRIPTIONS

Minnesota MEEA BOC

Since 2005, the Midwest Energy Efficiency Alliance (MEEA) has partnered with the Minnesota Department of Commerce (MN DOC) and Minnesota Power to offer a BOC program. In the 2010 program year, MN MEEA certified 230 level 1 and level 2 building operators and taught eleven Level I course series and four Level II course series.

Energy savings are primarily derived from energy efficiency upgrades installed by certified operators post-training, as well as reported changes to O&M practices. Two utilities, Otter Tail Power and MERC, have claimed savings from this program in regulatory filings.

Program Name	Quantified Savings	Claimed Savings	Evaluated	Reports Available
Minnesota MEEA	Y	Y	Y	Y

Source: Navigant Consulting, Inc. "Evaluation of MN BOC Training". Prepared for the Midwest Energy Efficiency Alliance and the Minnesota Office of Energy Security. March 2010.

Table 5. MN MEEA Evaluation Overview

Date of Study	March 2011
Data Collection Method	<ul style="list-style-type: none"> Secondary research Phone survey (n=50)
Indicators of Success	<ul style="list-style-type: none"> kWh/ft² therms/ft²
Number of Operators Certified	230 certified operators
Average Square Feet	194,500 ft ²
Energy Savings Calculation	<ul style="list-style-type: none"> The evaluator used modeling techniques to develop energy usage estimates. Measure level estimates varied by measure. <p>Lighting Controls Example: <i>Savings</i> = <i>End Use Intensity (kWh or therms per ft²)</i> * <i>savings ratio</i> * <i>affected area (ft²)</i></p>
Energy Savings	<ul style="list-style-type: none"> 1.04 gross kWh per sq. ft., 0.72 kWh per sq. ft. attributable to the program, and 0.06 kWh per sq. ft. net utility rebates. 0.03 gross therms per sq. ft., 0.02 therms per sq. ft. attributable to the program, and 0.01 therms per sq. ft. net utility rebates.

Best Practices	<ul style="list-style-type: none"> • When it is not feasible to perform non-participant research, secondary data can help to determine baseline energy usage within those end-uses where past participants complete projects • Respondent ratings of the influence of the BOC program can help to calculate net savings • To more accurately measure BOC attributable impact, it's important to take into account any other utility programs (such as rebate programs) that may have encouraged similar installations or changes in O&M behavior
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Northwest Energy Efficiency Alliance BOC

Begun in 1997, the Northwest Energy Efficiency Alliance's (NEEA) BOC program, formerly a part of the national BOC initiative, covers Washington, Oregon, Idaho and Montana. NEEA had actively certified 1,196 building operators as of 2011.

The energy savings associated with the program are primarily derived from energy efficiency upgrades performed by certified building operators post-training, as well as reported changes to O&M practices. While NEEA has tracked and verified energy savings as a result of this program, these savings have not been claimed in regulatory filings by partner utilities.

Program Name	Quantified Savings	Claimed Savings	Evaluated	Reports Available
Northwest Energy Efficiency Alliance (NEEA)	Y	N	Y	Y

Source: Navigant Consulting, Inc. "Long-Term Monitoring and tracking Report of 2011 Activities". Prepared for the Northwest Energy Efficiency Alliance. July 2012.

Table 4. NEEA Evaluation Overview

Date of Study	July 2012
Data Collection Method	<ul style="list-style-type: none"> • Baseline survey of non-participants (n=17) • Survey of BOC participants (n=20)
Indicators of Success	<ul style="list-style-type: none"> • Total savings and savings due to the BOC. The former includes savings from all actions while the latter includes only savings directly influenced by the program. • MWh per operator • kWh per square foot • therms per square foot

Number of Operators Certified	150 new operators (1,196 cumulative)
Average Square Feet	286,000 ft ² per operator
Energy Savings Calculation	<p>Annual Savings: # certified operation in last 5 year × sq. ft. per operator × energy consumption per sq. ft. × savings from certification</p> <p>End Use Savings: EUI (kWh or Therm/ft²) × Total Savings Ratio × Normalized Affected Area (ft²),</p> <p>Savings Due to BOC: Total Savings × BOC influence (%)</p> <p>Per Operator: 286,000ft² per operator * kWh or therm consumption per ft² of participating facilities * savings from certification (percentage of consumption)</p> <p>Per Square Foot: Per Operator Savings (kWh or therms)/286,000 ft²</p>
Energy Savings	<ul style="list-style-type: none"> • 119 MWh per certified operator • 0.42 kWh per square foot (recommended)
Best Practices	<ul style="list-style-type: none"> • Baseline analysis of non participants to obtain a control group for impact analysis

Northeast Energy Efficiency Partnerships BOC

Since 2000, Northeast Energy Efficiency Partnerships (NEEP) has offered its BOC program to several of the Northeast and Mid-Atlantic states.² NEEP is currently sponsored by many of the regional utilities and energy organizations, including Cape Light Compact, National Grid and NSTAR. Between 2000 and 2003, NEEP offered both level 1 and level 2 course series and certified 873 building operators. In the 2002-2003 program year, 813 building operators enrolled in the program (86% were level 1 and 14% were level 2). Of those enrolled, 526 graduated from level 1 (75% certification rate) and 65 graduated from level 2 (57% certification rate).

Energy savings are primarily derived from energy efficiency upgrades installed by certified operators post-training, as well as reported changes to O&M practices.

Program Name	Quantified Savings	Claimed Savings	Evaluated	Reports Available
Northeast Energy	Y	N	Y	Y

² States covered by the program include CT, MA, ME, NH, NJ, NY and RI.

Efficiency Partnerships (NEEP)				
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Source: RLW Analytics. "Impact and Process Evaluation Building Operator Training and Certification (BOC) Program". Prepared for NEEP. June 2005.

Table 7. NEEP Evaluation Overview

Date of Study	June 2005
Data Collection Method	<ul style="list-style-type: none"> Participant survey (n=110) Non-participant survey (n=45)
Indicators of Success	<ul style="list-style-type: none"> Electric, natural gas, oil and water savings per enrollee per square foot
Number of Operators Certified	878 certified operators
Average Square Feet	662,862 ft ²
Energy Savings Calculation	<p>Measure Level Savings: $\frac{\text{Facility Sq. Ft.} * \text{Measure Savings per Sq. Ft.}}{\text{No. of Staff Enrolled}}$</p> <p>Average Participant Savings: $\frac{\text{Total Participant Savings}}{\text{Total Enrollees}}$</p> <p>Energy Savings: $\frac{\text{Avg. Participant Savings}}{\text{Avg. Facility Sq. Ft.}}$</p>
Energy Savings	<ul style="list-style-type: none"> 0.18 kWh/ft² (2003) 0.36 kWh/ft² (2002) Savings are also presented by school and non-school participants

Arizona Public Service BOC

Arizona Public Service's (APS) Building Operator Training program (BOT) encapsulates BOC courses and Facility Management Training (FMT) offered in PY 2006. As of 2007, APS has had 84 enrollees, 32 of which were BOC participants and 52 of which were FMT participants.

Energy savings are primarily derived from energy efficiency upgrades installed by certified operators post-training, as well as reported changes to O&M practices.

Program Name	Quantified Savings	Claimed Savings	Evaluated	Reports Available
Arizona Public Service (APS)	Y	N	Y	Y

Source: Summit Blue and Opinion Dynamics Corporation. "APS Measurement, Evaluation, & Research Final Report: Building Operator Training Program". September 2008.

Table 8. APS Evaluation Overview

Date of Study	September 2008
Data Collection Method	<ul style="list-style-type: none"> Participant survey (n=17)
Indicators of Success	<ul style="list-style-type: none"> Annual energy savings (MWh)
Number of Operators Certified	<ul style="list-style-type: none"> 32 certified operators and 52 Facility Management Technician (FMT) participants
Average Square Feet	200,000 ft ²
Energy Savings Calculation	<ul style="list-style-type: none"> Calculations varied by measure. Please see the report for details on these calculations.
Energy Savings	<ul style="list-style-type: none"> 1,714,138 annual gross kWh 0.04 gross kWh/ft²

Kansas City Power & Light BOC

Since 2007, Kansas City Power & Light (KCP&L) has partnered with the Midwest Energy Efficiency Alliance (MEEA) and the Missouri Department of Natural Resources (MO DNR), who administer the BOC program. As of 2009, four Level I BOC course series had been taught and 79 building operators had been certified. The program did not offer level 2 courses during the first two program years, but has subsequently begun offering them.

In general, enrollment in the BOC program requires a significant investment of time. In particular, the full BOC Level I course series (all level 1 course requirements) took six months for participants to complete. As a special incentive, KCP&L offered a \$575 rebate on the enrollment fee (covering approximately 50% of the cost) to operators who completed the certification program.

Energy savings are primarily derived from energy efficiency upgrades installed by certified operators post-training, as well as reported changes to O&M practices. KCP&L has claimed program savings in regulatory filings.

Program Name	Quantified Savings	Claimed Savings	Evaluated	Reports Available
Kansas City Power & Light (KCP&L)	Y	Y	Y	Y

Source: Opinion Dynamics Corporation. "Evaluation of Kansas City Power and Light's Building Operator Certification Program". Prepared for KCP&L. September 2009.

Table 6. KCP&L Evaluation Overview

Date of Study	September 2009
Data Collection Method	<ul style="list-style-type: none"> • Telephone survey (n=26) • Follow-up in-depth interviews (n=11) • Review of post-training evaluation forms
Indicators of Success	<ul style="list-style-type: none"> • kWh/ft² • therms/ft²
Number of Operators Certified	79 certified operators
Average Square Feet	786,000 ft ²
Energy Savings Calculation	<ul style="list-style-type: none"> • Calculations varied by measure and are detailed in the report. For example: <p>Energy Efficient Lighting Savings: <i>Pre – Measure Lighting Intensity</i> <i>* % Load Reduction</i> <i>* Sq. Ft. Affected</i></p>
Energy Savings	<ul style="list-style-type: none"> • 0.023 kWh/ft² • 0.63 therms/ft²

CA Statewide BOC

The California Statewide Building Operator Certification program, which began in 2002, includes eight course series taught in seven locations within the service territories of Pacific Gas & Electric (PG&E), San Diego Gas & Electric (SDG&E), Southern California Edison (SCE) and Southern California Gas Company (SCG). In the 2002 program year, only the utilities offered only the level 1 course series and 158 of 219 enrollees received their certification (72% certification rate). The utilities did not quantify energy savings for the 2002 program year.

Program Name	Quantified Savings	Claimed Savings	Evaluated	Reports Available
CA Statewide BOC	N	N	Y	Y

Source: Research Into Action. "Evaluation of the 2002 Statewide Building Operator Certification and Training Program". Prepared for PG&E. November 2003.

Table 9. CA Statewide BOC Evaluation Overview

Date of Study	PY 2002
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Data Collection Method	<ul style="list-style-type: none"> Participant survey (n=67) Program administrator survey (n=37)
Indicators of Success	<ul style="list-style-type: none"> Number of operators certified Number of courses series taught Drop-out rate (lower better)
Number of Operators Certified	<ul style="list-style-type: none"> 158 certified operators
Additional Outcomes	<ul style="list-style-type: none"> 8 Level 1 series taught 3% drop-out rate

CA Statewide Energy Education

The California Statewide Energy Education and Training program is offered through nine energy centers located within the service territories of Pacific Gas & Electric (PG&E), San Diego Gas & Electric (SDG&E), Southern California Edison (SCE) and Southern California Gas Company (SCG). Each of the centers offers unique programs with the overall goal of providing information to utility customers about energy efficient technology and ways to reduce energy usage. The program also targets market actors, such as builders and contractors, to promote the use of energy efficient building design, retrofits and renovation.

The programs included in this evaluation include:

- PG&E Education and Training Program
- SCE Education, Training and Outreach Program
- California Center for Sustainable Energy/Energy Resource Center Partnership
- SCG Education Training Program

Since the effort began in 2006, the centers have offered 840 different courses attended by 39,793 utility customers. Of the 547,560 hours of training offered, 55% were focused on market actors, 30% were focused on commercial end-users, and 15% were focused on residential end-users. Overall, 20,000 market actors were reached by the program.

Activities offered by all nine centers include classes, seminars and workshops, as well as trainings, demonstrations and consultations. All of the centers also offer websites and informational brochures. In addition, eight centers offer outreach activities, such as facility tours and trade shows. "Lending Libraries" and energy efficiency technology testing are offered by four and two of the centers, respectively.

Program Name	Quantified Savings	Claimed Savings	Evaluated	Reports Available
CA Statewide Energy Education (CA SEE)	Y	N	Y	Y

Source: Opinion Dynamics Corporation. "Indirect Impact Evaluation of the Statewide Energy Efficiency Education and Training Program". Prepared for the CPUC. November 2003.

Table 10. CA SEE Evaluation Overview

Date of Study	PY 2006-2008
Data Collection Method	<ul style="list-style-type: none"> instructor and participant surveys (Wave 1: n=2,864, Wave 2: n=4,907) Database and course material review
Indicators of Success	<ul style="list-style-type: none"> End-user annual GWh savings Average GWh savings per market actor Self-reported knowledge change Behavioral change of market actors
Energy Savings Calculation	<ul style="list-style-type: none"> Engineering analysis
Energy Savings	<ul style="list-style-type: none"> 544 net annual GWh among end-users 0.26 GWh per market actor
Additional Outcomes	<ul style="list-style-type: none"> 87% reported moderate to large knowledge increase 77% of commercial participants reported changes in behavior

Time of Sale Energy Renovation Program

Between 1999 and 2000, Pacific Gas and Electric (PG&E) offered the Time of Sale Energy Renovation Program (TOSER), which promoted the use of energy efficient mortgages (EEMs) by offering training seminars to supply-side housing market actors—primarily real-estate agents and lenders. TOSER saw EEMs as a way to reduce the barriers to implementing energy efficient improvements, especially initial cost of investment, by offering financing for upgrades to new home buyers. While PG&E quantified the energy savings associated with the EEMs implemented since the program began, it did not claim these savings.

Program Name	Quantified Savings	Claimed Savings	Evaluated	Reports Available
Time of Sale Energy Renovation program (TOSER)	Y	N	Y	Y

Source: XENERGY Inc. "2000 Market Effects Study of the TOSER EEM Program". Prepared for the PG&E. March 2001.

Table 13. PG&E's TOSER Evaluation Overview

Date of Study	March 2001
Data Collection Method	<ul style="list-style-type: none"> • Participant telephone survey (n=98) • Home-buyer survey (n=45) • Non-participant baseline survey (n=75)
Indicators of Success	<ul style="list-style-type: none"> • EEMs implemented • Annual GWh savings • Annual therm savings • Annual source BTU savings • Average annual MW demand savings
Energy Savings Calculation	<ul style="list-style-type: none"> • Savings based on HERS ratings conducted for homes that implemented an EEM at the time of purchase
Energy Savings	<ul style="list-style-type: none"> • 15.7 annual GWh savings • 1.84 million annual therm savings • 341 billion source BTUs annually • 3,73 average MW annually

Local Energy Code Training Program

In 2003, San Diego Gas and Electric's (SDG&E) Local Energy Code Training program (ECT) provided a series of seminars to industry professionals, such as builders, architects, planners, and engineers on Title 24 code requirements, energy efficient measure installation, and new construction software training.

The ECT program offered a total of 28 different seminars covering topics such as Advanced Manual D, High Performance Duct Systems, Manual J, MICROPAS, and Zoning. The average size of the seminars was four to five attendees and in total, 124 participants, representing 102 firms, attended the seminars. The most popular seminar topics related directly to Title 24 code (Manual D and Manual J). Seminars on High Performance Duct Systems had the third highest attendance.

SDG&E did not quantify energy savings as result of the ECT program. Instead, program reach (number of seminars and participants), self-reported behavior changes, installations and information-sharing were used as measures of success.

Program Name	Quantified Savings	Claimed Savings	Evaluated	Reports Available
Local Energy Code Training (ECT)	N	N	Y	Y

Source: RLW Analytics. "Measurement and Evaluation Study of the 2003 SDG&E Energy Code Training Program". Prepared for SDG&E. July 2004.

Table 11. SDG&E's ECT Evaluation Overview

Date of Study	July 2004
Data Collection Method	<ul style="list-style-type: none"> • Telephone participant survey (n=43)
Indicators of Success	<ul style="list-style-type: none"> • Number of seminars offered • Number of participants • Percent of participants implementing seminar material • Percent of participants sharing information related to the program
Program Outcomes	<ul style="list-style-type: none"> • 28 seminars (covering 8 topics) • 124 participants • 77% self-report implementing program material • 34% self-report sharing information related to the program

Energy Design Resources

Offered by Southern California Edison (SCE) since 1998, Energy Design Resources (EDR) provides publications, software tools, and training to market actors and O&M professionals, such as architects, engineers, lighting designers and building operators. The overarching purpose of the program is to provide these professionals with techniques and technologies that promote energy efficient new construction. As of 2002, EDR had become a part of the larger Savings By Design program offered by SCE.

Examples of the publications offered through the program include electronic newsletters, a "Commissioning Handbook", and case studies on Southern California projects. Software tools included eQuest® (estimates the energy savings impact of design options), eVALUator (financial analysis), SkyCalc (an Excel-based tool for maximizing lighting and HVAC energy savings) and EDR Charette (graphically displays design impacts on energy efficiency of typical buildings). EDR also offered a series of technical seminars for staff (given at company location), virtual workshops, and an online course on high performance lighting,

SCE did not quantify energy savings as result of EDR. Rather, program reach (number of participants) was used as the primary performance metric. In total, the evaluator identified 3,172 unique program participants and among the participants surveyed, engineers (34%), architects (29%), and energy consultants (17%) were the three occupation observed most frequently.

Program Name	Quantified Savings	Claimed Savings	Evaluated	Reports Available
Energy Design Resources (EDR)	N	N	Y	Y

Source: Opinion Dynamics Corporation. "Energy Design Resources (EDR) Evaluation". Prepared for the SCE. March 2003.

Table 12. SCE's EDR Evaluation Overview

Date of Study	March 2003
Data Collection Method	<ul style="list-style-type: none">• Secondary research of EDR tools and materials• In-depth interviews with program administrators• Internet-based participant survey (n=405)
Indicators of Success	<ul style="list-style-type: none">• Program participants (based on email addresses)