

PY2013-2014 CALIFORNIA STATEWIDE WORKFORCE EDUCATION AND TRAINING PROGRAM

CONTRACTOR TRAINING MARKET CHARACTERIZATION



Prepared by



For the
California Public Utilities Commission
Energy Division

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1. Executive Summary

This report presents the findings from Phase 2 of the PY2013-2014 California Statewide Workforce Education and Training (WE&T) Skill Standards for IOU Resource Program Study. The overall goal of Phase 2 is to characterize the residential and non-residential contractor training market, including an inventory of all residential program skill requirements and Department of Energy (DOE) certification trainings.¹ We focused on three high-profile programs and contractors: the Residential Energy Upgrade California (EUC) Home Upgrade Program, the Residential HVAC Program, and the Non-residential Lighting Program.

1.1 Findings

- Our review of available trainings and certifications in California for the three programs under study found that the wide variety of trainings available in the state sufficiently meets the training needs of contractors and technicians. In fact, many experts we interviewed believe that the awareness of trainings is a greater obstacle than the number and availability. Contractors and technicians may need help determining which are the best trainings for their needs. IOUs may be able to help package together trainings and provide guidance for individuals at different points in their careers.
- Of the trainings we reviewed, most are offered nationally as well as in California and most are classroom-based with written exams. Industry stakeholders and experts believe, however, that hands-on training, such as that included in the California Advanced Lighting Controls Training Program (CALCTP) or required by union apprentice programs, is preferable.
- Programs vary in their training requirements for contractors and technicians and usually provide trainings and mentoring to meet these requirements. The residential HVAC and non-residential lighting programs do not explicitly require market-based, non-IOU trainings, but many cover relevant topics and skills.
- Residential EUC and HVAC industry experts provide mixed feedback about the impact of individual trainings and certifications on contractors' quality of work. The expert panel believed that trainings and certifications can improve the quality of work, but not in all cases, and that they have not seen strong scientific-based evidence that contractors and technicians that hold certain certifications do better work than others. The lack of evidence may be partially due to the prevalence of alternate training sources (both formal and informal) from which technicians can learn the needed skills. Note that this is the expert panel's collective opinion.
- While the gaps in contractor and technician skills vary by program type, the gaps that were common to most programs centered on understanding the value of energy efficiency, how different systems work together, and how to communicate these concepts to customers. Commonly cited gaps also included understanding customer needs and being able to bid, manage, and supervise work.

¹ The DOE National Renewable Energy Laboratory (NREL) worked with industry experts through the Guidelines for Home Energy Professionals Project to create "blueprints" for energy professional certifications. These certifications focus on skills needed for the Weatherization Assistance Program and so are most applicable to skills needed for the EUC Whole House program. The DOE does not address certificates related to general Residential HVAC, or to Non-Residential Lighting programs.

1.2 Conclusions

- IOUs may consider encouraging, but not requiring, additional skills or trainings by rewarding those that meet those thresholds with marketing support or additional incentives. This encouragement also allows the programs to have two levels of participating contractors and potentially develop metrics to compare the work being done by both.
- Despite the logical connection, there appears to be a lack of compelling evidence that contractors and technicians participating in individual trainings or certifications perform better work than others not receiving that training or certification, suggesting a need for a comparative study. In 2016, as part of Phase 3, Opinion Dynamics plans to conduct such a study on a small scale to see if there is a difference in terms of energy savings, non-energy benefits, or costs as a follow up to this study.

2. Methodology

This report presents the findings from Phase 2 of the PY2013-2014 California Statewide WE&T Skill Standards for IOU Resource Program Study. The overall goal of Phase 2 is to characterize the residential and non-residential contractor training market including an inventory of all residential program skill requirements and all DOE certification trainings. We focused on three high-profile programs and contractors: the Residential EUC Home Upgrade Program, the Residential HVAC Program, and the Non-residential Lighting Program.

2.1 Research Questions

We sought answers to the following research questions:

- What trainings do ratepayer-funded California IOU residential and non-residential retrofit programs offer or require? How do these trainings leverage or align with each other, and leverage and align with WE&T funded courses? Are there benefits to increasing the alignment of training curricula and requirements across all these training areas?
- What is the landscape of contractor residential and non-residential retrofit related certification efforts outside of IOU programs? How closely do these align with DOE Job Task Analyses (JTA) skill standards (current/future)?
- What DOE JTA skill standards are relevant to California? How do they map to the certification/licensing requirements in CA? What are the gaps and where should these gaps be addressed?
- Should California incorporate federal DOE residential or non-residential retrofit skills standards for technicians into program requirements for contractors/technicians? If yes, how should they be incorporated? Do the standards need to be tailored to California for best results? Should the EUC Whole House program and/or California Energy Commission Home Energy Rating (CEC HERS) II rating require demonstration of minimum contractor/technician skill standards? How could this be accomplished given the myriad of retrofit and HVAC certification systems in the marketplace?

Table 1 shows the methods we used to answer the Phase 2 research questions:

Table 1. Phase 2 Research Methodology

Research Objectives		Method				
Area	Question	Stakeholder Interviews	Literature Review	Content Analysis	Gap Analysis	Expert Panels
Alignment among program training, requirements, and WE&T courses	What trainings do ratepayer-funded IOU residential and non-residential programs offer or require?		<input checked="" type="checkbox"/>			
	How do these trainings leverage or align with each other, and with WE&T funded courses?			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
	Are there benefits to increasing the alignment of training curriculum and requirements across all these training areas?	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	What is the landscape of contractor related certification opportunities outside of IOU programs?		<input checked="" type="checkbox"/>			
Alignment and gaps among contractor certifications, DOE skill standards, and state requirements	How closely do these align with DOE skill standards (current/future)?			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
	What are DOE skill standards, and which are relevant to CA?		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
	How do they map to the certification/licensing requirements in CA?			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
	What are the gaps and where should these gaps be addressed?	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Possible state incorporation of DOE skills standards	Should California incorporate federal DOE retrofit skills standards for technicians into requirements for contractors/technicians for program participation and ratepayer-funded workforce training programs (WE&T or program-specific)?	<input checked="" type="checkbox"/>				<input checked="" type="checkbox"/>
	If yes, how should they be incorporated?	<input checked="" type="checkbox"/>				<input checked="" type="checkbox"/>
	Do the standards need to be tailored to California for best results?	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
	Should the Whole House (Energy Upgrade CA) program and/or CEC HERs II rating require demonstration of minimum contractor/technician skill standards?	<input checked="" type="checkbox"/>				<input checked="" type="checkbox"/>
	How could this be accomplished given the myriad retrofit and HVAC certification systems in the marketplace?	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		

This report presents an inventory of trainings and certifications available in California for three programs under study. When cataloging trainings, we focused on the high level content of the training, the level of participant targeted, and the general training mode (e.g., classroom, online, or field). Due to budget constraints, we did not analyze each training in terms of its educational objectives (e.g., comprehension vs. application) or adult learning process (e.g., the motivation and level of engagement of learners). The trainings under study likely vary considerably in their objectives, implementation, and effectiveness, but this study did not explore those characteristics.

2.2 Stakeholder Interviews

We conducted 26 interviews with stakeholders to gain insight into IOU-offered trainings and courses. These interviews identified opportunities to better align utility program training and certification requirements and revealed skills in need of additional development.

In order to understand program specific needs, we spoke with utility, industry, and regulatory representatives about contractor/technician capabilities in the programs under study.

- **IOU Program Staff:** Utility program staff included WE&T staff and program managers for each of the three program types. These interviews provided information on the certification and training requirements of their programs, descriptions of training and certification processes for ensuring quality jobs, and a description of the skills of contractors and technicians participating in their programs.
- **Industry Stakeholders:** We interviewed representatives from various relevant industry associations, such as the Western HVAC Performance Alliance (WHPA) and the North American Technician Excellence (NATE). These stakeholders described the range of trainings available to contractors outside of utility programs, including local trainings offered through California Community Colleges, local chapters of national organizations such as NATE, regional organizations like HVAC Excellence, and trainings offered by manufacturers/retailers such as Honeywell.
- **Other Knowledgeable Parties:** We also spoke with other staff knowledgeable about workforce training opportunities in California, including an author of the Don Vial Center (DVC) Guidance Plan, and staff at the California Energy Commission (CEC).

Table 2 breaks out the 26 stakeholders we interviewed by type.

Table 2. Completed Stakeholder Interviews

Stakeholder	Completed interviews (n=26)	Purpose	
		Advantages and disadvantages of aligning program training, requirements	Understand alignment and gaps among contractor certifications, DOE skill standards, and state requirements
IOU WE&T staff	1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
IOU commercial & industrial program managers (non-residential lighting)	3	<input checked="" type="checkbox"/>	
IOU residential HVAC program managers	8	<input checked="" type="checkbox"/>	
IOU EUC WH program managers	3	<input checked="" type="checkbox"/>	
CEC staff	1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
DVC Guidance Plan authors	1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Industry associations (e.g., NATE, WHPA)	9	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

2.3 Literature Review

We reviewed various information and studies to identify: (1) the trainings the ratepayer-funded IOU residential HVAC, EUC Home Upgrade, and non-residential lighting programs offer or require; (2) the landscape of contractor related certification programs offered through the WE&T Centergies or other entities in CA; and (3) the DOE skill standards relevant to California. Table 3 shows we reviewed 19 secondary sources. Additionally, we researched trainings online.

Table 3. Literature Reviewed

No.	Source
1	Needs Assessment (Donald Vial Center)
2	IOU resource program PIPs and manuals
3	2010-2012 BCE/HEER market characterization/process evaluation (RIA/EMI)
4	2010-2012 EUC WH Studies (SBW/ Opinion Dynamics)
5	2010-2012 HVAC contractor study (EMI)
6	2010-2012 Lighting Study (Evergreen Economics)

No.	Source
7	WIA/ETP/One Stop and Career Cluster resources
8	IREC and ANSICA resources suggested by CalCERTS
9	CalCERTS gap analysis of CA and DOE training for HERS Building Performance Contractors
10	DOE website and publications, such as: https://www4.eere.energy.gov/workforce/projects/workforceguidelines http://energy.gov/eere/wipo/guidelines-home-energy-professionals-certifications
11	WE&T Centergies course catalogue
12	Findings from the Statewide CALCTP/Contractor Training Assessment Project Study
13	HVAC Energy Efficiency Maintenance Study (Davis Energy Group/ WCEC)
14	WHPA Certification Working Groups Gaps Reports
15	WHPA “IndustryValuedCredentials” workbook, “Matrix” tab
16	“Developing HVAC Workforce Education & Training 2009 – 2011” 12/2008, prepared for Southern California Edison by Better Buildings Incorporated
17	“Census-2011-Tech&ContractorCredentials” workbook from Better Buildings Incorporated
18	“HVACIndustryCensus-Overview-Final” PPT presentation, Better Buildings Incorporated, date unknown
19	Feedback from market experts, e.g., Robert Marcial (PG&E, WE&T), Dick Rome (ETC), Milena Simeonova (PEC)
20	General online searches and review

We reviewed IOU and regional energy network (REN) websites for contractor and rater trainings necessary to participate the three program types under study. We did not focus on non-skills-based requirements such as insurance or general licenses. Consistent with the statewide approach, the IOUs and RENs generally have the same contractor and rater training requirements.

We also conducted a content analysis to explore and compare how the trainings align with each other, with WE&T funded courses, with DOE skill standards, and with certification requirements in California. Additionally through the content analysis, we explored whether DOE skill standards need to be tailored to California, and identified any immediately noticeable gaps. For each of the three program types, we present a table provide an overview of the training content.

2.4 Expert Panels

After completing the evaluation tasks listed above to characterize the contractor trainings for three contractor types, we presented our findings to panels of industry experts for additional input. We assembled two panels: one panel included stakeholders with expertise in the residential HVAC and whole house upgrade markets and the other included non-residential lighting market experts.

In an effort to conduct a well-rounded review of the market characterization and to avoid any potential biases, we sought to include a variety of expert opinions in the panels, representing the views of utility programs and program implementers, training implementers, contractors, and other relevant experts. The table below lists the types of subject matter experts that provided input:

Table 4. Expert Panel Members

Residential HVAC & Home Upgrade Panel	Non-Residential Lighting Panel
Residential HVAC program implementer	Non-residential lighting controls training implementer (CALCTP)
EUC program implementer	Northern California non-residential lighting contractors (x2)
Large residential HVAC contractor	Southern California non-residential lighting contractors (x2)
Large EUC contractor/IOU training center staff	IOU non-residential lighting program staff
HVAC program evaluator	California Labor Management Cooperation Committee staff
IOU HVAC program staff	
IOU EUC program staff	
HVAC industry training group (AHRI/NATE)	
Western HVAC Performance Alliance (WHPA) member	

Opinion Dynamics facilitated two sessions with expert panel members via webinar. We held the first panel for the residential panel on July 28, 2015 and for the non-residential panel on August 6, 2015. We convened the second sessions for both panels on September 3 and September 4, respectively. The organization of the expert panels was as follows:

- **Session One** – Opinion Dynamics facilitated an initial meeting of the expert panels to introduce the study and present the high level findings from the Contractor Training Market Characterization. After the meeting, we sent the panel members a memo of findings to review along with a list of questions to consider.
- **Review Period** – We provided panel members with a two week review period to look over the findings memo and to respond to our questions. After their review, panel members submitted their input to Opinion Dynamics who then summarized the panel members’ input and prepared materials for the second discussion session.
- **Session Two** – After receiving and compiling input from the expert panels, we reconvened the expert panels to discuss the Contractor Training Market Characterization and the summary of their feedback. We facilitated discussion of the results provided by the panels and gave panel members another opportunity to clarify input and come to a consensus on issues if needed.

When reviewing the high level findings from the Contractor Training Market Characterization memo, we asked the expert panelists to answer the following questions:

1. Are there any trainings available in California related to energy efficiency that are missing from the list? What are they and who offers them?
2. Are there any programs or organizations outside of the utility energy efficiency programs that require any of these trainings? If so, which programs or organizations and which trainings?
3. Should any of the energy efficiency programs require a certain training course or certification in the marketplace that is not currently required? Why or Why not? What are the benefits and what are the drawbacks?
4. Are there other types of training related to energy efficiency that contractors participating in utility programs need that are not currently available in the marketplace? If so, please describe.
5. What key skills do contractors in the market need to ensure that their work meets high energy efficiency standards? Does this skills gap differ for contractors that participate in energy efficiency programs and for those who do not? If yes, how so?
6. Should there be a statewide (or national) set of skill standards that contractors must meet to install energy efficient equipment? Why or why not? What are the benefits and what are the drawbacks?

Additionally, for the EUC Home Upgrade Program, we asked:

- a. Should California incorporate federal DOE retrofit skills standards for technicians into requirements for contractors/technicians for EUC program participation?²
- b. Do the DOE retrofit skill standards need to be tailored to California for best results?
- c. Should the EUC Home Upgrade program require demonstration of minimum contractor/technician skill standards similar to the DOE standards? Why or why not?

2.5 Additional Studies

In addition to the primary and secondary research efforts described above, the evaluation team also leveraged recent research led by the IOUs to further understand the value of the California Advanced Lighting Controls Training Program (CALCTP) training. The IOUs were leading a *Lighting Controls Training Assessment Study* at the same time as this research and the two studies shared insights with each other and collaborated throughout the data collection process..

3. Findings

This section provides our findings for each of the three program types under study. For each program, we provide the following findings:

- IOU program training requirements and offerings, including the enforcement of these requirements
- Content analysis, describing the landscape of relevant certification and training outside of IOU programs

² The DOE skill standards are discussed in more detail in Section 3.3 below.

- Alignment with IOU requirements
- Gaps in contractor and technician skills

3.1 Residential HVAC

3.1.1 IOU Program Trainings and Requirements

Program Training Requirements and Offerings

According to the IOU program staff we interviewed, the IOUs have similar training requirements for their residential HVAC programs. These include training on program requirements, applicable software, correctly sizing systems, and proper installation and maintenance techniques. The programs offer a mix of courses and field training. Table 5 lists each IOU’s offerings and requirements.

Table 5. Residential HVAC Program Training Requirements and Offerings by IOU

IOU	Training Requirements and Offerings
PG&E	For PG&E’s quality maintenance (QM) program, the implementer offers 1.5 days of training covering program requirements, building science, gas safety, and other program elements. To offer the air flow correction measure, contractors must be either BPI certified or take a six-day gas safety course. A series of four courses is offered for Quality Installation training through the PG&E training center, including Title 24, Manual J, Manual D, and advanced Manual D. QM contractors who have taken all four classes are designated quality installation contractors on the PG&E website.
SCE	For the SCE residential HVAC programs: Training for the residential HVAC Quality Installation program is organized by the implementer, Conservation Services Group (CSG), and includes a one-day software training (given by providers Brightsource and Elite); a three-day design training with review of Manual J, D, and F; a one-day field training with installation and commission of HVAC equipment; a half-day program administration training; and on-going mentoring during the program. Subject matter expert firms MSDC and EAT also assist with contractor training and mentoring.
SDG&E	Firms participating in the QI/QM program are required to take a training offered by the implementer, DNV GL, in addition to meeting other program requirements (e.g., being a full-service HVAC firm and operating within 25 miles of SDG&E territory). Program training for QI contractors consists of: one-to-two days of Manual J and Z software training; a three-day class on applied Manual J,D, and S concepts; one-day field training; and on-going mentoring of contractors. Training for QM contractors entails completing five HVAC test modules; an office training on program requirements; one day in the field; one-to-three ride-alongs with implementer staff; and ongoing mentoring.

Enforcement of Program Requirements

Utility program staff also provided detailed descriptions of the processes the IOUs use to ensure that contractors continue to meet the program’s expected level of performance.

- For PG&E, after approval by the program, contracting firms send individual technicians to the Build It Green (BIG) training courses. Technicians attend training sessions in person and bring their EPA certification cards. Once the technicians satisfy all program requirements, BIG issues a username for

program participation. Contracting firms must actively submit jobs to the program so they do not have to retake the training courses. The program tracks failures at the technician level. All technicians start with a high job inspection rate for fieldwork. After 10 jobs, the number of inspections is reduced. Both BIG and the IOU inspect work quality.

- For SCE, the first five sites of every new contractor are verified through a combination of technical design review and field verification on site. Conservation Services Group (CSG) is the program's implementer and performs inspections. After verifying the first five sites, CSG continues inspections at different rates depending on the number of jobs submitted to the program. If a contractor does not pass five inspections in a row, their performance is assessed and they may be removed from the program.
- SDG&E only processes rebate applications for contractors and technicians who meet program qualification requirements. Training and other qualifications are tracked in an internal program database. The implementer performs QC for the program.

3.1.2 Content Analysis

Landscape of Residential HVAC Contractor Certification and Training Outside of IOU Programs

We reviewed 91 unique trainings and certifications targeting residential HVAC contractors offered by 15 unique organizations. Table 6 presents detailed information about the HVAC trainings and certifications available in California, including the level of contractor targeted, whether the training is required by the IOU programs, whether the training has an energy efficiency focus, the required prerequisites, and the mode of the training and test.

- None of the identified trainings are explicitly required by the residential HVAC programs, although many cover relevant topics and skills, such as proper sizing and quality installation.
- Nearly all trainings and certifications we reviewed are offered nationally: only three identified trainings (from the U.S. Workforce Investment Act (WIA) Eligible Certifications) are offered just in California.
- Eleven percent of the reviewed trainings and certifications are offered at IOU training centers.
- Fifty-three percent of the reviewed trainings and certifications do not specify a target level for training, while 16% target apprentice or employment-ready contractors, 18% target journeyman or professional-level contractors, and 13% target senior or master-specialist-level contractors.
- Nearly all trainings are based in classrooms. Trainings held only in classrooms account for 82% of reviewed trainings, while trainings with classroom and online elements made up 9% of trainings, and trainings with classroom and field training elements made up another 4%.
- Eighty-six percent of the trainings/certifications we reviewed used only a written exam, with an additional 11% using both a written and practical exam.

Table 6. Summary of Residential HVAC Trainings Available in California

Organization	Certification/Training	Type	Required for IOU Program	Offered at Training Center	Level Targeted	Energy Efficiency Focus	Market Served	Prerequisites Required	Training Mode	Test
Air Conditioning Contractors of America (ACCA)	Existing Homes – Residential Services & Installation (RSI)	Certification	No	No	None specified	No	National	None specified	Online	Practical
Air Conditioning Contractors of America (ACCA)	Accredited RSI HVAC Verifiers	Certification	No	No	None specified	No	National	None specified	Online	Written
Associated Air Balance Council (AABC)	Test and Balance Engineer	Certification	No	No	None specified	No	National	8 years' experience	Not specified	Written
Associated Air Balance Council (AABC)	Test and Balance Technician	Certification	No	No	None specified	No	National	3 years' experience	Classroom and field	Written and practical
U.S. Workforce Investment Act (WIA) Eligible Certifications	Environmental Control Technologies/Technicians, Certificate in Sustainability and the Built Environment, Other (150599)	Certification	No	No	None specified	Yes	California	High school diploma	Classroom and online	Written
U.S. Workforce Investment Act (WIA) Eligible Certifications	Heating, Air Conditioning, Ventilation and Refrigeration Maintenance Technology/Technician (HAC, HACR, HVAC, HVACR) (470201)	Certification	No	No	None specified	Yes	California	High school diploma	Classroom and online	Written
U.S. Workforce Investment Act (WIA) Eligible Certifications	Heating, Ventilation, Air Conditioning and Refrigeration Eng (150501)	Certification	No	No	None specified	Yes	California	High school diploma and driver's license	Classroom and online	Written
Environmental Protection Agency (EPA)	608 - Universal	Certification	No	No	None specified	Yes	National	None specified	Classroom and online	Written
Environmental Protection Agency (EPA)	608 Type 1	Certification	No	No	None specified	Yes	National	None specified	Classroom and online	Written

Findings

Organization	Certification/Training	Type	Required for IOU Program	Offered at Training Center	Level Targeted	Energy Efficiency Focus	Market Served	Prerequisites Required	Training Mode	Test
Environmental Protection Agency (EPA)	608 Type 2	Certification	No	No	None specified	Yes	National	None specified	Classroom and online	Written
Environmental Protection Agency (EPA)	608 Type 3	Certification	No	No	None specified	Yes	National	None specified	Classroom and online	Written
Green Mechanical Council	Duct and Envelope Analyst	Certification	No	No	None specified	Yes	National	None specified	Classroom	Written
Green Mechanical Council	Residential Energy Auditing	Certification	No	No	None specified	Yes	National	None specified	Classroom	Written
Green Mechanical Council	Residential Heat Load Certification/ Residential Heat Load Analyst	Certification	No	No	None specified	Yes	National	None specified	Classroom	Written
Green Mechanical Council	System Performance	Certification	No	No	None specified	Yes	National	None specified	Classroom	Written
HVAC Excellence	HVAC-Certified Subject Matter Expert	Certification	No	No	Subject Matter Educator	No	National	Core (Capstone) + 1 HVAC certification	Classroom	Written
HVAC Excellence	Air Conditioning – Employment Ready	Certification	No	No	Apprentice – Employment Ready	No	National	None specified	Classroom	Written
HVAC Excellence	Air Conditioning - Professional	Certification	No	No	Journeyman - Professional	No	National	Core trade exam	Classroom	Written
HVAC Excellence	Air Conditioning – Master Specialist	Certification	No	No	Master Specialist	No	National	Pass written Professional Level exam or equivalent	Classroom	Written and practical
HVAC Excellence	Duct and Envelope Testing - Specialty	Certification	No	No	None specified	Yes	National	None specified	Classroom	Written
HVAC Excellence	Electric Heat - Certified Subject Matter Educator	Certification	No	No	Subject Matter Educator	Yes	National	Core (Capstone) + Electric. Heat certification	Classroom	Written

Findings

Organization	Certification/Training	Type	Required for IOU Program	Offered at Training Center	Level Targeted	Energy Efficiency Focus	Market Served	Prerequisites Required	Training Mode	Test
HVAC Excellence	Electric Heat - Employment Ready	Certification	No	No	Apprentice - Employment Ready	No	National	None specified	Classroom	Written
HVAC Excellence	Electric Heat - Professional	Certification	No	No	Journeyman - Professional	No	National	Core trade exam	Classroom	Written
HVAC Excellence	Gas Heat - Certified Subject Matter Educator	Certification	No	No	Subject Matter Educator	No	National	Core (Capstone) + 1 HVAC certification	Classroom	Written
HVAC Excellence	Gas Heat - Employment Ready	Certification	No	No	Apprentice - Employment Ready	No	National	None specified	Classroom	Written
HVAC Excellence	Gas Heat - Professional	Certification	No	No	Journeyman - Professional	No	National	Core trade exam	Classroom	Written
HVAC Excellence	Gas Heat - Master Specialist	Certification	No	No	Master Specialist	No	National	Core trade exam	Classroom	Written and practical
HVAC Excellence	Green Awareness - Specialty	Certification	No	No	None specified	Yes	National	None specified	Classroom	Written
HVAC Excellence	Heat Pump - Certified Subject Matter Educator	Certification	No	No	Subject Matter Educator	No	National	Core (Capstone) + 1 HVAC cert	Classroom	Written
HVAC Excellence	Heat Pump - Employment Ready	Certification	No	No	Apprentice - Employment Ready	No	National	None specified	Classroom	Written
HVAC Excellence	Heat Pump Installer - Professional	Certification	No	No	Journeyman - Professional	No	National	Core Trade Exam	Classroom	Written
HVAC Excellence	Heat Pump Service - Professional	Certification	No	No	Journeyman - Professional	No	National	Core Trade Exam	Classroom	Written
HVAC Excellence	Heat Pump - Master Specialist	Certification	No	No	Master Specialist	No	National	Core Trade Exam	Classroom	Written and practical

Findings

Organization	Certification/Training	Type	Required for IOU Program	Offered at Training Center	Level Targeted	Energy Efficiency Focus	Market Served	Prerequisites Required	Training Mode	Test
HVAC Excellence	Residential & Light Commercial Hydronic Heat - Employment Ready	Certification	No	No	Apprentice - Employment Ready	No	National	None specified	Classroom	Written
HVAC Excellence	Residential & Light Commercial Hydronic Heat - Professional	Certification	No	No	Journeyman - Professional	No	National	Core Trade Exam	Classroom	Written
HVAC Excellence	Residential & Light Commercial Hydronic Heat - Master Specialist	Certification	No	No	Master Specialist	No	National	Core Trade Exam	Classroom	Written and practical
HVAC Excellence	Oil Heat - Employment Ready	Certification	No	No	Apprentice - Employment Ready	No	National	Core Trade Exam	Classroom	Written
HVAC Excellence	Oil Heat - Master Specialist	Certification	No	No	Master Specialist	No	National	Core Trade Exam	Classroom	Written and practical
HVAC Excellence	Low Pressure Hydronic Heat - Employment Ready	Certification	No	No	Apprentice - Employment Ready	No	National	Core Trade Exam	Classroom	Written
HVAC Excellence	Low Pressure Hydronic Heat - Master Specialist	Certification	No	No	Master Specialist	No	National	Core Trade Exam	Classroom	Written and practical
HVAC Excellence	Residential Heat Load Analyst - Specialty	Certification	No	No	None specified	No	National	None specified	Classroom	Written
HVAC Excellence	Duct and Envelope Testing	Certification	No	No	None specified	No	National	None specified	Classroom	Written
HVAC Excellence	R-410A	Certification	No	No	None specified	No	National	None specified	Classroom	Written
HVAC Excellence	Certified Carbon Monoxide Inspector	Certification	No	No	None specified	No	National	None specified	Classroom	Written
HVAC Excellence	System Diagnostics and Troubleshooting Procedures HVACR - Employment Ready	Certification	No	No	Apprentice - Employment Ready	No	National	None specified	Classroom	Written

Organization	Certification/Training	Type	Required for IOU Program	Offered at Training Center	Level Targeted	Energy Efficiency Focus	Market Served	Prerequisites Required	Training Mode	Test
HVAC Excellence	Basic Refrigeration and Charging Procedures - Employment Ready	Certification	No	No	Apprentice - Employment Ready	No	National	None specified	Classroom	Written
HVAC Excellence	Carbon Monoxide Safety - Employment Ready	Certification	No	No	Apprentice - Employment Ready	No	National	None specified	Classroom	Written
HVAC Excellence	System Performance - Specialty	Certification	No	No	None specified	No	National	None specified	Classroom	Written
National Comfort Institute (NCI)	Certified Carbon Monoxide and Combustion Analyst	Certification	No	No	None specified	No	National	None specified	Classroom and field	Written
National Comfort Institute (NCI)	Certified Residential Air Balancer	Certification	No	No	None specified	No	National	HVAC System Performance	Classroom	Written and practical
National Comfort Institute (NCI)	Certified Residential System Performance Analyst	Certification	No	No	None specified	No	National	None specified	Classroom	Written
National Comfort Institute (NCI)	Residential HVAC System Renovation & Retrofit	Certification	No	SCE	Journeyman - Professional	No	National	NCI HVAC System Performance or Air Balancing Certification	Classroom and field	None
National Environmental Balancing Bureau (NEBB)	NEBB Certified Professional - Building Envelope Enclosure Testing	Certification	No	No	None specified	No	National	Holds a management job	Classroom	Written and practical
National Environmental Balancing Bureau (NEBB)	NEBB Certified Professional - Testing, Adjusting, and Balancing	Certification	No	No	None specified	No	National	Training can offset years' experience.	Classroom	Written and practical
National Environmental Balancing Bureau (NEBB)	NEBB Certified Technician - Testing, Adjusting, and Balancing	Certification	No	No	None specified	No	National	Training can offset years' experience.	Classroom	Online

Organization	Certification/Training	Type	Required for IOU Program	Offered at Training Center	Level Targeted	Energy Efficiency Focus	Market Served	Prerequisites Required	Training Mode	Test
National Inspection Testing Certification (NITC)	NITC Journey Level HVAC/ NITC Journey Level Air Conditioning & Refrigeration	Certification	No	No	None specified	No	National	UA training program or equivalent	Classroom	Written
National Inspection Testing Certification (NITC)	STAR. (Service Technician, Air-conditioning & Refrigeration) HVACR Mastery	Certification	No	No	None specified	No	National	a UA training program or equivalent	Classroom and online	Written
National Inspection Testing Certification (NITC)	STAR Residential-Light Commercial HVAC Mastery	Certification	No	No	Journeyman - Professional	No	National	a UA training program or equivalent	Classroom , online, and field	Written
North American Technician Excellence (NATE)	Air Conditioning (both for Installation and for Service)	Certification	No	ETC	Apprentice - Employment Ready	No	National	"technical training for theoretical knowledge"	Classroom	Written
North American Technician Excellence (NATE)	Air Distribution Installation	Certification	No	ETC	Apprentice - Employment Ready	No	National	"technical training for theoretical knowledge"	Classroom	Written
North American Technician Excellence (NATE)	Air-to-Air Heat Pumps - Installation	Certification	No	ETC	Apprentice - Employment Ready	No	National	"technical training for theoretical knowledge"	Classroom	Written
North American Technician Excellence (NATE)	Gas Furnaces	Certification	No	ETC	Apprentice - Employment Ready	No	National	"technical training for theoretical knowledge"	Classroom	Written
North American Technician Excellence (NATE)	Gas Hydronics	Certification	No	ETC	Apprentice - Employment Ready	No	National	"technical training for theoretical knowledge"	Classroom	Written
North American Technician Excellence (NATE)	Ground Source Heat Pump Loop Installer	Certification	No	ETC	Senior Technician	No	National	"technical training for theoretical knowledge"	Classroom	Written

Organization	Certification/Training	Type	Required for IOU Program	Offered at Training Center	Level Targeted	Energy Efficiency Focus	Market Served	Prerequisites Required	Training Mode	Test
North American Technician Excellence (NATE)	HVAC Efficiency Analyst (Senior Level)	Certification	No	ETC	Senior Technician	No	National	2 other NATE certifications, and "technical training for theoretical knowledge"	Classroom	Written
North American Technician Excellence (NATE)	HVAC Performance Verifier (Home Energy Rater or HERS)	Certification	No	ETC	None specified	Yes	National	pass a national online core competency test	Classroom	Written
Refrigeration Service Engineers Society (RSES)	Active Specialist - Controls Specialist	Certification	No	SCE	None specified	No	National	RSES Certificate Member (CM)	Classroom	Written
Refrigeration Service Engineers Society (RSES)	Active Specialist - Domestic Service Specialist	Certification	No	No	None specified	No	National	RSES Certificate Member (CM)	Classroom	Written
Refrigeration Service Engineers Society (RSES)	Active Specialist - Dynamic Compression Specialist	Certification	No	No	None specified	No	National	RSES Certificate Member (CM)	Classroom	Written
Refrigeration Service Engineers Society (RSES)	Active Specialist - Heat Pump Specialist	Certification	No	No	None specified	No	National	RSES Certificate Member (CM)	Classroom	Written
Refrigeration Service Engineers Society (RSES)	Active Specialist - Heating Specialist	Certification	No	No	None specified	No	National	RSES Certificate Member (CM)	Classroom	Written
Refrigeration Service Engineers Society (RSES)	Active Specialist - HVACR Electrical Specialist	Certification	No	No	None specified	No	National	RSES Certificate Member (CM)	Classroom	Written
Refrigeration Service Engineers Society (RSES)	Certificate Member (CM)	Certification	No	No	None specified	No	National	RSES Active Membership	Classroom	Written

Findings

Organization	Certification/Training	Type	Required for IOU Program	Offered at Training Center	Level Targeted	Energy Efficiency Focus	Market Served	Prerequisites Required	Training Mode	Test
Sheet Metal Workers International Association (SMWIA)	Journeyman	Certification	No	No	None specified	No	National	All apprentice training completed	Classroom and field	Written and practical
Testing, Adjusting and Balancing Bureau (TABB)	HVAC Fire Life Safety Level One Certification Program	Certification	No	No	None specified	No	National	None specified	Classroom	Written
Testing, Adjusting and Balancing Bureau (TABB)	Testing, Adjusting and Balancing	Certification	No	No	None specified	No	National	None specified	Classroom	Written
United Association Service Technician, Air-conditioning & Refrigeration (UA STAR)	Air conditioning (journeyman level)	Certification	No	No	Journeyman	No	National	UA Journeymen or during 5-yr apprenticeship	Classroom	Written
United Association Service Technician, Air-conditioning & Refrigeration (UA STAR)	Air distribution (journeyman level)	Certification	No	No	Journeyman	No	National	UA Journeymen or during 5-yr apprenticeship	Classroom	Written
United Association Service Technician, Air-conditioning & Refrigeration (UA STAR)	Gas heating	Certification	No	No	Journeyman	No	National	UA Journeymen or during 5-yr apprenticeship	Classroom	Written
United Association Service Technician, Air-conditioning & Refrigeration (UA STAR)	Heat pumps	Certification	No	No	Journeyman	No	National	UA Journeymen or during 5-yr apprenticeship	Classroom	Written

Findings

Organization	Certification/Training	Type	Required for IOU Program	Offered at Training Center	Level Targeted	Energy Efficiency Focus	Market Served	Prerequisites Required	Training Mode	Test
United Association Service Technician, Air-conditioning & Refrigeration (UA STAR)	High pressure/low pressure refrigerants	Certification	No	No	Journeyman	No	National	UA Journeymen or during 5-yr apprenticeship	Classroom	Written
United Association Service Technician, Air-conditioning & Refrigeration (UA STAR)	Servicing equipment and systems	Certification	No	No	Journeyman	No	National	UA Journeymen or during 5-yr apprenticeship	Classroom	Written
United Association Service Technician, Air-conditioning & Refrigeration (UA STAR)	System commissioning	Certification	No	No	Journeyman	No	National	UA Journeymen or during 5-yr apprenticeship	Classroom	Written
United Association Service Technician, Air-conditioning & Refrigeration (UA STAR)	UA STAR Certification/Journeyman	Certification	No	No	Journeyman	No	National	UA Journeymen or during 5-yr apprenticeship	Classroom	Written
Various CA community colleges	Advanced Refrigeration	A.A. degree	No	No	None specified	Yes	National	High school or equivalent	Classroom	Written
Various CA community colleges	Air Conditioning & Refrigeration	A.A. degree	No	No	None specified	Yes	National	High school or equivalent	Classroom	Written
Various CA community colleges	Air Conditioning & Refrigeration	Certificate	No	No	None specified	Yes	National	High school or equivalent	Classroom	Written

Findings

Organization	Certification/Training	Type	Required for IOU Program	Offered at Training Center	Level Targeted	Energy Efficiency Focus	Market Served	Prerequisites Required	Training Mode	Test
Various CA community colleges	Basic Refrigeration & Control Systems	A.A. degree	No	No	None specified	Yes	National	High school or equivalent	Classroom	Written
Various CA community colleges	Energy Management & Climate Policy	A.A. degree	No	No	None specified	Yes	National	High school or equivalent	Classroom	Written
Various CA community colleges	Heating, Ventilation, and Air Conditioning	Certificate	No	No	None specified	Yes	National	High school or equivalent	Classroom	Written
Various CA community colleges	HVACR/HVAC	A.A. degree	No	No	None specified	Yes	National	High school or equivalent	Classroom	Written

Alignment with IOU Requirements

Our review of the landscape of HVAC contractor trainings and certifications in California found numerous offerings that provide technicians with specialization in specific types of HVAC equipment as well as different levels of mastery. Most of the trainings incorporate elements of the skills required by the IOU programs, such as calculating buildings' heating and cooling loads and correctly installing the equipment. There is likely significant overlap in content between many of the non-IOU trainings offered in California and the requirements of IOU programs, but the non-IOU programs also include material and skills beyond the core requirements of the IOU programs.

Effectiveness of Trainings

The expert panel provided mixed feedback about the impact of individual trainings and certifications on contractors' quality of work. The panel believed that trainings and certifications can improve the quality of work but not in all cases. However, the panelists concede that they have not seen strong evidence that contractors that hold certain certifications do better work than others. The evaluation team also has found no scientific-based evidence to support that there are specific energy and non-energy benefits to these trainings even though most in the industry would agree that trainings are beneficial to the market. The lack of evidence may be partially due to the prevalence of alternate training sources (both formal and informal) from which technicians can learn the needed skills in addition to the various levels of field experience by which contractors can also learn and apply skills that are taught through certification programs. This diversity of experience and education amongst contractors make it challenging to isolate the impact of one single training in a research study.

The panel discussed that training may be invested in the wrong in individuals. Some members of the panel believed that the desired outcomes could also be achieved by focusing on experience and credentials (e.g., journeyman status) instead of specific trainings and certifications. Panelists also discussed how contractors could train technicians to verify that their work meets predetermined performance targets.

3.1.3 Gaps in Contractor and Technician Skills

Interviews with industry stakeholders who have experience in the California HVAC market revealed a number of skill gaps in the market among contractors and technicians. They stated that, in their experience, they see two groups of HVAC contractors and technicians: 1) those who have received formal training from unions, community colleges, or industry certification organizations, and 2) those who have been in the industry for many years and have learned by doing. Members of the second group often do not have a formal education in the fundamentals needed to understand and properly diagnose an inefficient HVAC system and therefore may lack the technical skills needed to achieve deep HVAC efficiency savings. Additional research may be needed to research this perceived segmentation.

Industry stakeholders also noted that only a limited portion of the overall workforce participate in IOU HVAC programs. In the experience of these stakeholders, participating contractors tend to be more informed than the general workforce. They believe that many non-participating contractors do not know that the IOU programs exist or have only very limited knowledge of them. To reach the rest of the contractors, several stakeholders suggested that IOUs need to “do most of the heavy lifting” and make it very easy for these contractors to participate. One industry association representative suggests, “Make it so easy they can't NOT do it.”³

³ Although the panel did not discuss this, it should be noted that residential HVAC and EUC programs currently have a robust supply of contractors and the amount of participating contractors is not an issue at this time.

The expert panel discussed two barriers to participation. First, the panelist suggested that the visibility of available trainings is more of a barrier to a trained workforce than the number of trainings offered or their quality. Second, panel members believed that contractors need guidance on trainings and certifications to pursue, given the large number of trainings available. They suggested that it may help contractors if IOUs or another group could package together recommended trainings, recognizing that technicians will have different training needs at different points in their careers.

The HVAC-related skill gaps in the market among California HVAC contractors and technicians identified by industry stakeholders and the expert panel include:

- Taking responsibility for the energy-related performance of installed/serviced/maintained systems
- Specific technical skills, including:
 - Quality installation, including duct design and duct sealing
 - Knowledge of electrical systems
 - Knowledge of refrigerants and correctly charging a system
 - Managing air flow
 - Psychrometrics (i.e., measuring the moisture in the air and latent heat capacity)
 - Sizing and designing HVAC systems correctly, including how to correctly calculate heat gain/heat loss
- Understanding of home performance work and the concept of a “house as a system,” including how HVAC systems interact with the building
- Soft skills, including:
 - Marketing and selling projects based on the benefits of energy efficient equipment
 - Listening to the customer
 - Professionalism
- How to establish performance feedback loops, including gathering and analyzing data

Expert panel participants noted that there is a skill gap between participating and non-participating contractors that is likely due to the additional trainings taken by program participants. However, the panel also discussed that some of the gap in skills between participating and non-participating contractors could be because of self-selection. In their opinion, contractors seeking to maximize the benefits to their customers are more likely to embrace energy efficiency and will seek out and develop the necessary skills. Additionally, panelists remarked that some contractors do not follow all of the necessary rules when completing projects, such as pulling the proper permits, and these contractors will likely not participate in IOU programs to avoid scrutiny. The panel noted that this has an impact on the contractors’ quality of work but is not something that can be solved through training.

3.2 Energy Upgrade California Home Upgrade Program

3.2.1 IOU Program Trainings and Requirements

IOU Training Requirements

Review of training requirements for the Energy Upgrade California Whole House Program found that all IOUs require that contractors and raters hold BPI Building Analyst⁴ certificates and that raters also hold HERS II⁵ certificates. Both certifications indicate understanding of building science with respect to how the energy components of the home interact to form a whole system. However, the BPI certification is required to cover combustion appliance safety checks, while the HERS II certification is required for covering assessments and cost-effectiveness. There are some differences across the training requirements among the IOUs as shown in the following table.

Table 7. IOU Energy Upgrade California Whole House Program Training Requirements

Participant Type	Requirements	PG&E	Bay Area REN	SCE/ SCG/ SoCal REN	SDG&E
Contractor	BPI Building Analyst Certification or trained staff employed by a BPI-accredited company	☑	☑	☑	☑
	Home Upgrade Advanced Technical Training ^a	☑			
	Onboarding training (if not already PG&E approved) ^b		☑	☑	
	GUTS Online Training Program (for Home Upgrade projects) ^c			☑	
	Online Learning Center modules ^d	☑		☑	
Raters	BPI Building Analyst Certification	☑	☑	☑	☑
	HERS II Whole House Rater Certification	☑	☑	☑	☑
	Home Upgrade Advanced Technical Training ^a	☑	☑	☑	☑

⁴ The PG&E participant handbook explains that BPI Certifications cover “every aspect of whole-home performance evaluation and execution, for every style and age of home, in every climate zone of the United States. The house-as-a-system approach teaches students about the relationships between different components within the home, how to identify problems at the root cause and provide solutions that improve energy efficiency while providing important safety functions such as mold prevention, indoor air quality, carbon monoxide testing, and combustion appliance safety checks.” (p. 15)

⁵ The PG&E participant handbook explains a HERS II rater as “a person who has been trained, tested, and certified by a HERS Provider to properly gather information on the energy consuming features of a home, perform diagnostic testing at the home, evaluate the validity of that information, simulate and perform analysis for a California Whole-House Home Energy Rating or a California Home Energy Audit using an Energy Commission-approved HERS rating software program to estimate the energy consumption of a home using the information gathered on site, and complete all of the cost-effectiveness evaluations described in the HERS Technical Manual.” (p. 51)

Notes:

^a “This training is required for all BPI-certified professionals (or properly supervised BPI-Accredited company staff) who wish to submit combustion appliance safety test results to the Program. The course focuses on supplementary combustion appliance safety protocols that complement those specified by BPI. It also provides information on Program required duct testing techniques, which are not always covered by all types of BPI-certified professional training.” (EUC Home Upgrade 2013-2014 Participant Handbook for PG&E, Build it Green, Version 4.2, July 2, 2014)

^b This training includes an introduction to building science. Paraphrased from the following source (retrieved on 8/25/2014): <https://www.bayareaenergyupgrade.org/required-onboarding-trainings>

^c GUTS stands for “getting up to speed.” The course covers BPI Technical Standards, procedures, and testing protocols associated with audits and retrofits. Students who pass the course earn certification through the Energy Conservation Institute. Paraphrased from the following sources (retrieved on 8/25/2014): <http://www.ecginc.com/California-Home-Upgrade-Training-p/guts-heu.htm>; <http://www.socalenergyupgradecontractors.com/start>; <http://www.socalenergyupgradecontractors.com/faq#n970>

^d References to these modules appear on several SCG/SCE webpages, however we could not find a clear description of what the modules cover. They may cover “Training in the latest home performance standards” since this text appeared on a page we were delivered to when clicking on an “Online Learning Center” link. (see the following links reviewed on 8/25/2014 for possible explanations of this additional training: <http://www.socalenergyupgradecontractors.com/get-trained>; <https://socaltraining.macrovolt.com/oltMain.cfm?z=z>; <http://www.socalenergyupgradecontractors.com/start>;

Enforcement of Program Requirements

EUC Home Upgrade program staff described the IOUs’ enforcement of the program requirements of valid licenses (CSLB) and certifications (BPI).

- PG&E uses two methods to check contractor licensing and insurance requirements. First, the implementer performs random sampling quarterly and annually to determine whether licenses (CSLB) and certifications (BPI) are still valid. Contractors are asked to resubmit documentation to show that licenses and certifications are current.
- For SDG&E, the implementer ICF tracks contractor status through a Vision Database. If paperwork is missing, the affected contractor receives notifications from the account manager. If the issue is not resolved, the contractor is removed from the program.

IOU Training Offerings

California IOUs offer a variety of training related to the EUC Home Upgrade program. Training is provided by the program implementers as well as through the IOU training centers.

- For PG&E, the program implementer Build It Green (BIG) provides training for EUC contractors. The program’s training offerings have changed over time in response to program needs and have included business development, sales, marketing, technical training, and program-specific training. These program-specific trainings include an orientation, energy modeling, jobs submissions to the program, BPI certification prep, and mentoring. Every contractor has five free mentoring sessions with BIG staff, which can be used for in-field support or more training in a specific area such as modeling or energy savings. BIG also offers ad hoc support to meet contractors’ training needs.
- SDG&E requires contractors to attend an orientation training, to be BPI certified, and to have their first three jobs reviewed by Richard Heath and Associates (RHA), which performs quality control for ICF, the program implementer. SDG&E also offers a voluntary marketing boot camp and other training through their energy center on such topics as Title 24, BPI, HVAC, and HVAC installation.

3.2.2 Content Analysis

Landscape of Residential HVAC Contractor Certification and Training Outside of IOU Programs

We reviewed 64 unique trainings and certifications targeting residential home performance contractors offered by 14 unique organizations. Table 8 provides an overview of the content identified across several Residential Home Performance trainings available in California.

- IOUs require two of the certifications reviewed for participation in the EUC Home Upgrade program: BPI Building Analyst Certification (or BPI Contractor with trained staff) for contractors and raters, and HERS II Whole House Rater certification for raters.
- Approximately one-third of trainings are available only in California; the remaining two-thirds are offered nationally.
- Sixteen percent of the trainings and certifications are offered at IOU training centers.
- Thirty-six percent of trainings target professionals, master specialists, advanced, or skilled contractors, while 31% target entry-level or apprentice-level contractors. Thirty-three percent of the trainings and certifications do not specify a targeted level for training.
- Nearly all trainings and certifications have a classroom component. Thirty-one percent of trainings and certifications are exclusively classroom-based, 20% have classroom and field components, and 11% have classroom and online elements. Eight percent of trainings are offered online, and another 3% are offered as field training. Twenty percent of trainings did not have a specified training mode, and the training mode for 6% is unknown.
- Fifty-five percent of trainings/certifications that we reviewed use only a written exam. Thirty-nine percent use either a written and field exam or a written and practical exam. Only 2% of trainings/certifications used an oral and practical exam. A further 5% did not specify an exam mode.

Table 8. Summary of Residential Home Performance Trainings Available in California

Organization	Certification/Training	Type	Required for IOU Program	Offered at Training Center	Level Targeted	Energy Efficiency Focus	Market Served	Prerequisites Required	Training Mode	Test
Various CA community colleges	Building Performance and Energy Assessment	AS degree or certificate	No	No	Entry-level	Yes	California	High school or equivalent	Classroom and field	Written
Various CA community colleges	Green Buildings: Environmental Design, Energy Management and Performance Based Construction	Certificate	No	No	Entry-level	Yes	California	High school or equivalent	Classroom	Written
Various CA community colleges	Construction Inspection	AA degree or certificate	No	No	Entry-level	No	California	High school or equivalent	Classroom	Written
Various CA community colleges	Building Inspection Technology	AA degree or certificate	No	No	Entry-level	No	California	High school or equivalent	Classroom	Written
Various CA community colleges	Construction Technology	AA degree or certificate	No	No	Entry-level	No	California	High school or equivalent	Classroom and field	Written
Various CA community colleges	Energy Auditor	Certificate	No	No	Entry-level	Yes	California	High school or equivalent	Classroom	Written
Various CA community colleges	Energy Efficiency Residential CSU	Course	No	No	Entry-level	Yes	California	High school or equivalent	Field	Written
Various CA community colleges	Renewable Energy Technician / Energy Efficiency Technology	AS degree	No	No	Entry-level	Yes	California	High school or equivalent	Classroom and field	Written and practical
Various CA community colleges	Sustainable Energy Studies	Certificate	No	No	Entry-level	Yes	California	High school or equivalent	Classroom and field	Written
Various CA community colleges	Weatherization and Energy Efficiency	Certificate	No	No	Entry-level	Yes	California	None specified	Classroom and field	Written and practical

Findings

Organization	Certification/Training	Type	Required for IOU Program	Offered at Training Center	Level Targeted	Energy Efficiency Focus	Market Served	Prerequisites Required	Training Mode	Test
California Energy Commission (CEC)/ CalCERTS	HERS I - Basics	Training/certification	No	No	Entry-level	No	California	None specified	Classroom	Written
California Energy Commission (CEC)/ CalCERTS	HERS II - Hands-On-Lab	Training/certification	No	No	Not specified	No	California	HERS I and EPA 608 Type II or Universal certification	Field	Written and practical
California Energy Commission (CEC)/ CalCERTS	HERS III - Alterations to Existing Homes (T-24)	Training/certification	No	No	Not specified	Yes	California	HERS II	Classroom and field	Written and practical
California Energy Commission (CEC)/ CalCERTS	HERS IV - Newly Constructed Homes (T-24)	Training/certification	No	No	Not specified	No	California	HERS III	Classroom and field	Written and practical
California Energy Commission (CEC)/ CalCERTS	HERS VII – Independent Whole House Rater (HERS II)	Training/certification	Yes	No	Not specified	No	California	HERS IV	Classroom and field	Written and practical
California Energy Commission (CEC)/ CalCERTS	HERS X - Building Performance Contractor Certification	Training/certification	No	No	Not specified	No	California	HERS VII and BPI Analyst & Envelope	Classroom and field	Written and practical
California Energy Commission (CEC)/ CalCERTS	HERS X.1 - HERS BPC CA specific topics/challenge	Training	No	No	Not specified	No	California	HERS Whole House Rater and BPI Analyst & Envelope	Classroom	Written and practical
California Energy Commission (CEC)/ CalCERTS	HERS XI – Refrigerant Charge & Airflow Verification	Training	No	No	Not specified	No	California	HERS III	Classroom	Written and practical
California Energy Commission (CEC)/ CalCERTS	HERS XII -Whole House Rater Fast Track for Building Performance Contractor Certification	Training/certification	No	No	Not specified	No	California	BPI Analyst & Envelope	Classroom	Written and practical
California Energy Commission (CEC)/ CalCERTS	XIII – HERS Building Performance Licensed Contractor Orientation	Training	No	No	Not specified	No	California	None specified	Classroom	Written and practical

Findings

Organization	Certification/Training	Type	Required for IOU Program	Offered at Training Center	Level Targeted	Energy Efficiency Focus	Market Served	Prerequisites Required	Training Mode	Test
U.S. Department of Energy (DOE)/ BPI	Crew Leader (HEP Certification)	Certification	No	No	Advanced	Not specified	National	None specified	Not specified	Written and practical
U.S. Department of Energy (DOE)/ BPI	Retrofit Installer (HEP Certification)	Certification	No	No	Advanced	Not specified	National	None specified	Not specified	Written and practical
U.S. Department of Energy (DOE)/ BPI	Quality Control Inspector (HEP Certification)	Certification	No	No	Advanced	Not specified	National	None specified	Not specified	Written and practical
U.S. Department of Energy (DOE)/ BPI	Energy Auditor (HEP Certification)	Certification	No	No	Advanced	Not specified	National	None specified	Not specified	Written and practical
Building Performance Institute (BPI)	Building Analyst Professional	Certification	Yes	ETC	Skilled	Yes	National	None specified	Online	Written
Building Performance Institute (BPI)	Envelope Professional	Certification	No	ETC	Skilled	Yes	National	None specified	Online	Written
Building Performance Institute (BPI)	Independent BPI Rater	Certification	No	ETC	Advanced	Yes	National	None specified	Classroom	Not specified
Building Performance Institute (BPI)	BPI Rater Company	Certification	Yes	ETC	Advanced	Yes	National	None specified	Classroom	Not specified
Building Performance Institute (BPI)	BPI GoldStar Contractor with Rater Staff	Certification	No	ETC	Advanced	Yes	National	None specified	Classroom	Not specified
Building Performance Institute (BPI)	Air Leakage Control Installer (RBE-WHALCI)	Certification	No	ETC	Entry Level	Yes	National	None specified	Classroom	Oral and practical
Building Performance Institute (BPI)	Building Science Principles	Certification	No	ETC	Entry Level	Yes	National	None specified	Online	Written

Findings

Organization	Certification/Training	Type	Required for IOU Program	Offered at Training Center	Level Targeted	Energy Efficiency Focus	Market Served	Prerequisites Required	Training Mode	Test
Building Performance Institute (BPI)	Air Conditioning and Heat Pump Professional	Certification	No	ETC	Skilled	Yes	National	None specified	Classroom	Written and practical
Building Performance Institute (BPI)	Heating Professional	Certification	No	ETC	Skilled	Yes	National	None specified	Classroom	Written and practical
U.S. Department of Energy (DOE)/ BPI	Home Energy Score Qualified Assessor	Certification	No	No	Advanced	Yes	National	None specified	Online	Written
Carbon Monoxide Safety Association (COSA)	Carbon Monoxide Safety	Training	No	No	Not Specified	No	National	None specified	Classroom	Written
Carbon Monoxide Safety Association (COSA)	Combustion Analysis and Fuel Efficiency - Entry Level	Training	No	No	Entry	No	National	None specified	Classroom	Written
Carbon Monoxide Safety Association (COSA)	Combustion Analysis and Fuel Efficiency - Advanced Level	Training/ Certification	No	No	Advanced	No	National	None specified	Classroom	Written
Green Mechanical Council	Duct and Envelope Certification	Certification	No	No	Not Specified	Yes	National	None specified	Not specified	Written and practical
Green Mechanical Council	Residential Energy Auditor -	Certification /training curriculum	No	No	Not Specified	Yes	National	None specified	Classroom and field	Written and practical
Green Mechanical Council	Residential Heat Load Certification	Certification /training	No	No	Not Specified	No	National	None specified	Not specified	Written
Green Mechanical Council	System Performance Certification	Certification	No	No	Not Specified	Not specified	National	None specified	Not specified	Written
HVAC Excellence	Combustion Appliance Zone - Employment Ready Certification	Certification	No	No	Apprentice - Employment Ready	Not specified	National	None specified	Not specified	Written
HVAC Excellence	Natural Gas Combustion - Employment Ready Certification	Certification	No	No	Apprentice - Employment Ready	Not specified	National	None specified	Not specified	Written

Findings

Organization	Certification/Training	Type	Required for IOU Program	Offered at Training Center	Level Targeted	Energy Efficiency Focus	Market Served	Prerequisites Required	Training Mode	Test
HVAC Excellence	Carbon Monoxide & Combustion Analysis Employment Ready Certification	Certification	No	No	Apprentice - Employment Ready	No	National	None specified	Not specified	Written
HVAC Excellence	Combustion Analysis Professional Level Technician Certifications	Certification	No	No	skilled	Not specified	National	None specified	Not specified	Written
HVAC Excellence	Combustion Analysis Master Specialist Certification	Certification	No	No	Master Specialist	Not specified	National	None specified	Not specified	Written
HVAC Excellence	Carbon Monoxide Safety Employment Ready Certification	Certification	No	No	Apprentice - Employment Ready	Not specified	National	None specified	Not specified	Written
HVAC Excellence	Certified Carbon Monoxide Inspector (Specialty Certification)	Certification	No	No	Not specified	Yes	National	None specified	Not specified	Written
HVAC Excellence	Residential Energy Auditor	Certification / training	No	No	Not specified	Yes	National	None specified	Classroom and field	Written and practical
National Association of the Remodeling Industry (NARI)	High Performance Remodeling Program	training	No	ETC	Skilled	Yes	National	None specified	Classroom and online	Written
National Association of the Remodeling Industry (NARI)	Green Certified Professional (GCP) certification	Certification	No	No	Advanced	Yes	National	None specified	Classroom and online	Written
National Comfort Institute (NCI)	Carbon Monoxide & Combustion Analyst Training and Certification	Training/ certification	No	No	Skilled	No	National	None specified	Classroom and field	Written
National Comfort Institute (NCI)	Home Performance for HVAC Professionals Training	Training	No	No	Advanced	No	National	None specified	Classroom and field	Written and practical

Findings

Organization	Certification/Training	Type	Required for IOU Program	Offered at Training Center	Level Targeted	Energy Efficiency Focus	Market Served	Prerequisites Required	Training Mode	Test
National Energy and Sustainability Institute (NEASI)	Home Energy Audit Training (with NEASI certification)	Training/certification	No	No	Not specified	Yes	National	None specified	Online	Written
National Environmental Balancing Bureau (NEBB)	Building Enclosure Testing (BET) (Certified Professional)	Certification	No	No	Not specified	No	National	None specified	Not specified	Written and field
National Environmental Balancing Bureau (NEBB)	Testing, Adjusting and Balancing (TAB) (Certified Technician)	Certification	No	No	Advanced	No	National	None specified	Classroom	Written and field
National Environmental Balancing Bureau (NEBB)	Testing, Adjusting and Balancing (TAB) (Certified Professional)	Certification /training	No	No	Skilled	No	National	None specified	Not specified	Written and field
Residential Energy Services Network (RESNET)	Home Energy Survey Professional (HESP)	Certification /training	No	No	Entry	Yes	National	None specified	Not specified	Written
Residential Energy Services Network (RESNET)	RESNET EnergySmart Contractor	Certification /training	No	No	Not specified	Yes	National	Yes	Classroom and online	Written
Residential Energy Services Network (RESNET)	Certified Home Energy Rater	Certification / training	No	No	Not specified	Yes	National	None specified	Classroom and online	Written and field
Sustainable Building Advisor Institute (SBAI)	Certified Sustainable Building Advisor (CSBA)	Curriculum with certification	No	No	Not specified	Yes	CA, NY, AZ, WA	None specified	Classroom	Written
US Green Building Council (USGBC)	LEED Accredited Professional for Homes (LEED-AP)	Certification	No	No	Professional	Yes	National	None specified	Classroom and online	Written
US Green Building Council (USGBC)	LEED Green Associate	Certification	No	No	Entry	Yes	National	None specified	Classroom and online	Written

Findings

Organization	Certification/Training	Type	Required for IOU Program	Offered at Training Center	Level Targeted	Energy Efficiency Focus	Market Served	Prerequisites Required	Training Mode	Test
US Green Building Council (USGBC)	LEED for Homes Green Rater	Certification	No	No	Advanced	Yes	National	3 years' experience in residential construction field and understanding of building science and LEED for Homes Rating System	Classroom and online	Written

Alignment with IOU Requirements

We found many trainings and certifications related to whole house or home performance programs similar to the Energy Upgrade California Home Upgrade Program. Only two of these trainings are explicitly required by the IOU programs, but all build on these basic certifications to provide contractors and raters with the skills to perform their work better. Many available trainings and certifications duplicate the content of others, and contractors do not have to receive all of them. In addition, many trainings and certifications are not applicable to all contractors because of their focus on specific equipment, their level of mastery, or their niche market (e.g., LEED).

As part of EUC program operations, the IOUs have quality control checks in place to identify areas where contractors need more training. If the need for additional training is identified, the IOUs offer hands-on, sometimes in the field, training to help contractors apply what they learned in the classroom to real-world situations in homes. IOU staff familiar with both the program training and market training believe that the training specified in Table 8 is mainly classroom-based instructional training that meet the programs' stated requirements but may lack the real-world application offered by this additional program training.

Effectiveness of Trainings

Similar to the HVAC market, the expert panel believed that trainings and certifications can improve the quality of work of technicians, but not in all cases, and that there is not strong evidence that technicians that hold certain certifications do better work than others.

3.2.3 Gaps in Contractor and Technician Skills

Discussions with industry stakeholders and expert panelists experienced in the residential home performance market uncovered skill gaps among contractors and technicians similar to those in the residential HVAC market. The stakeholders also identified gaps in these skills of residential home performance contractors. These skill gaps occur in the following areas:

- Understanding the details of home performance work and applying learned concepts to practice
- Understanding of value of standards (e.g., ACCA 4/5) and how to communicate that value to customers
- Sizing and designing HVAC systems correctly, including how to correctly calculate heat gain/heat loss.
- Quality installation, including duct design and duct sealing.
- Knowledge of electrical systems.
- Knowledge of combustion safety
- Gathering and analyzing data and operation of diagnostic equipment to verify the effectiveness of projects
- Soft skills, including:
 - Marketing and selling projects based on the benefits of energy efficient equipment
 - Listening to the customer
 - Professionalism

The expert panel discussed the fact that two technicians in the same industry will be at different points in their careers, will have different gaps, and will therefore need different types and levels of training. Many panelists believed that the market provides sufficient training opportunities for contractors and technicians, but there is a need for increased visibility of these trainings. The panel discussed that contractors and technicians may need help determining which are the best trainings for their needs. IOUs may be able to help package together trainings and provide guidance for individuals at different points in their careers.

3.3 DOE Skills Standards

The U.S. Department of Energy (DOE) National Renewable Energy Laboratory (NREL) worked with industry experts through the Guidelines for Home Energy Professionals Project to create “blueprints” for energy professional certifications. These certifications focus on skills needed for the Weatherization Assistance Program and so are most applicable to skills needed for the EUC Whole House program. The DOE does not address certificates related to general Residential HVAC, or to Non-Residential Lighting programs.

The DOE does not administer classes or offer certifications, but rather licenses third parties to do so. To date, the only licensed third party is the Building Performance Institute (BPI). The certification blueprints focus on residential energy issues and align with the job task analyses (JTAs) specified by the National Renewable Energy Laboratory for single-family home energy upgrades. The table below lists and describes the relevant job classifications.

Table 9. DOE Weatherization and Whole House Related Skill Standards

Job Classification	Certification Details
Energy Auditor	Covers issues related to residential energy auditing, with a focus on the Weatherization Assistance Program (WAP). Topics include building science basics, house as a system, energy movement, and WAP health and safety guidance, etc.
Retrofit Installer	Covers issues related to residential weatherization installation, with a focus on the Weatherization Assistance Program Topics include housing as a system, building science basics, air sealing and building envelope, insulation, etc.
Quality Control Inspector	Covers issues related to residential quality control inspection, with a focus on the Weatherization Assistance Program. Topics include house as a system, interpreting infrared, building assessment, and report writing, etc.
Crew Leader	Covers issues related to leading residential work crews with a focus on the Weatherization Assistance Program. Topics include building and safety codes, materials tracking, quality control, etc.

Source: <http://energy.gov/eere/wipo/guidelines-home-energy-professionals-certifications>

In addition to developing skill standards for individuals’ certifications, the DOE also developed accreditation standards to ensure a high level of consistency and quality among training providers. The DOE selected the Interstate Renewable Energy Council (IREC) to provide accreditation to IOU training centers. According to the IREC website, the only accredited training provider in California is the Los Angeles Trade-Technical College, which is accredited to offer trainings for the Energy Auditor and Retrofit Installer Technician JTAs.

Members of the expert panels were not familiar enough with the DOE skill standards to comment on them. We also asked members if there should be a statewide or national set of skill standards that contractors must meet to install energy efficiency equipment. The panelists believed that skill standards could be beneficial, but only if implemented correctly. They believed that using standards to establish basic components for all trainings would be beneficial. However, they noted that installation of equipment can vary greatly by region

and climate zone and standards must take this variance into account. Additionally, panelists worried that if standards were too rigorous, they might drive contractors and technicians away from the home performance approach.

Some panelists discussed the creation of a statewide or national registry for self-certification combined with certified high performance metrics. In this setup, technicians would be trained in measuring the performance of their projects that could be compared to a standard of high performance.

3.4 Non-Residential Lighting

3.4.1 IOU Program Trainings and Requirements

IOU Training Requirements and Offerings

IOUs offer basic training related to non-residential lighting programs and very few requirements beyond statewide requirements such as insurance or general licenses. In addition to the offerings listed below, SCE, SDG&E, and PG&E offer CALCTP Installer and/or Acceptance Test Technician classes. We provide more detail on CALCTP in Section 3.4.3.

- SCE has no mandatory training requirement to submit jobs to the non-residential lighting program, but does offer training on program requirements, including program rules, measures, and application submittal. SCE also offers optional informational sessions conducted by the Customer Authorized Agent Support (CAA) group. CLEAResult offers training and project shadowing for the Trade Ally program. CCA and CLEAResult trainings are for calculated and deemed programs alike. Contractors participating in SCE programs are placed on a qualified firm list if they complete the trainings and project ride-alongs.
- SDG&E offers program training that covers program rules and documentation requirements, but does not have a technical focus. These trainings are not mandatory, and any contractor can submit a job to the program
- PG&E offers five training modules in Design, Title 24 Code⁶, LED Technology, Controls, and Lighting Retrofit. The training is provided as workshops and hands-on equipment, in partnership with lighting manufacturers and PG&E Products and Programs. There is a course overview and a lighting test at the end.

3.4.2 Content Analysis

Landscape of Non-Residential Lighting Contractor Certifications and Trainings Outside of IOU Programs

We reviewed 41 unique trainings and certifications targeting non-residential lighting contractors offered by 18 unique organizations. Table 10 lists the trainings and certifications related to non-residential lighting

⁶ Specific Title 24 Part 6 trainings include: Standards & Technology for Retail Lighting, Standards & Technology for Office Lighting, Nonresidential Indoor Lighting Mandatory Measures, and Nonresidential Indoor Lighting Perspective Requirements.

programs, along with more detailed information about the programs such as the level of contractor targeted, whether the training has an energy efficiency focus, the required prerequisites, and the mode of training and testing.

- None of the reviewed trainings and certifications are explicitly required by IOU programs.
- Trainings are evenly split with respect to the market they serve. Fifty-one percent of trainings and certifications are available only in California, while 49% are also available nationally.
- Thirteen percent of the trainings and certifications are offered at IOU training centers.
- Approximately 27% of trainings are offered at the level of an academic certificate or associate's degree. Three percent of trainings are offered as an apprenticeship, 34% are offered as a certification, 24% are targeted to those seeking continuing education or additional job training, 2% are entry-level training, 5% are high school-level trainings, and 2% are targeted to journeymen.⁷
- Nearly all trainings and certifications have a classroom component. Thirty-seven percent of trainings and certifications are exclusively classroom-based, 15% have classroom and field components, 20% have classroom and online elements, and 15% have classroom, online, and field components. Thirteen percent of trainings are offered online. The training mode for 2% is unknown.
- Forty-nine percent of the trainings/certifications that we reviewed use only a written exam. Seventeen percent use a written and practical exam. The testing mode is unknown for another 17%.

⁷ Note that percentages may not sum to 100% due to rounding.

Table 10. Non-Residential Lighting Trainings Content

Organization	Certification/Training	Type	Required for IOU Program	Offered at Training Center	Level Targeted	Energy Efficiency Focus	Market Served	Prerequisites Required	Training Mode	Test
Various 4-year colleges	Certificate in Green Building	Certificate	No	No	Certificate	No	California	None specified	Classroom	Written
Various 4-year colleges	Professional Certificate in Green Building Construction	Certificate	No	No	Certificate	Yes	California	Only open to students who have taken one or more courses within the Green Building Construction program.	Classroom and Online	Written
Various CCCs	Architecture	Certificate and AS degree	No	No	Certificate and AS degree	No	California	In order to earn the AS degree, students pass through a sequence of courses that pass through Level 1, Level 2, and Level 3 certificate	Classroom	Written
Various CCCs	Civil Design Technology	Certificate and AS degree	No	No	Certificate and AS degree	No	California	In order to earn the AS degree the student must complete 60 units, of which 18 must be completed through general education requirements.	Classroom	Written

Findings

Organization	Certification/Training	Type	Required for IOU Program	Offered at Training Center	Level Targeted	Energy Efficiency Focus	Market Served	Prerequisites Required	Training Mode	Test
Various CCCs	Computer Aided Drafting	Certificate and AA degree	No	No	Certificate and AA degree	No	California	To earn the AS degree, the student must take the 31 units required for the certificate, as well as the general education and institutional requirements for	Classroom and Field	Written
Various CCCs	Electrical Construction and Maintenance	Certificate and AS degree	No	No	Certificate and AS degree	No	California	Completion of the 48 credits for a certificate plus 12 additional credits.	Classroom	Written
Various CCCs	Electrical Technology	Certificate and AS degree	No	No	Certificate and AS degree	No	California	Completion of 34 credit plan for the certificate, plus 21 units of general education requirements, and sufficient elective credits to total 60 units.	Classroom	Written
Various CCCs	Engineering	AS degree	No	No	AA degree	No	California	60 credits required for graduation with the associates degree	Classroom	Written
Various CCCs	Green Building and Energy Management	Certificate and AS degree	No	No	Certificate and AS degree	Yes	California	Certificate of Achievement-Advanced in Energy Management and Climate Policy for AS degree. No prerequisite for certificate	Classroom	Written
Various CCCs	Sustainable Construction	Certificate	No	No	Certificate	No	California	None specified	Classroom	Not specified

Findings

Organization	Certification/Training	Type	Required for IOU Program	Offered at Training Center	Level Targeted	Energy Efficiency Focus	Market Served	Prerequisites Required	Training Mode	Test
Building Operator Certification (BOC)	BOC 1003 – Efficient Lighting Fundamentals	one day module	No	Yes	Certificate	Yes	National	BOC 1001 – Energy Efficient Operation of Building HVAC Systems, BOC 1002 – Measuring and Benchmarking Energy Performance	Classroom	Written and practical
California Advanced Lighting Controls Training Program (CALCTP) / California Energy Commission (CEC)	Certified Installer Electrician	Certification	No	Yes	Certification	Yes	California	4 online courses	Classroom and Practical Lab	Written and practical
California Advanced Lighting Controls Training Program (CALCTP) / California Energy Commission (CEC)	Acceptance Technicians	Certification	No	Yes	Certification	Yes	California	Must be one of the following: licensed electrical contractor, state certified general electrician, professional engineer, or commissioning agent	Classroom and Practical Lab	Written and practical
American Institute of Architects (AIA)	Multiple lighting trainings	Training	No	Yes	Industry training, continuing education	Yes	National	None specified	Classroom, Online, and Field	Written and field

Findings

Organization	Certification/Training	Type	Required for IOU Program	Offered at Training Center	Level Targeted	Energy Efficiency Focus	Market Served	Prerequisites Required	Training Mode	Test
American Lighting Association (ALA)	Certified Lighting Consultant	Certification	No	No	Certification	Yes	National	Applicants must be ALA members and pass the ALA Lighting Specialist certification through review of the "Residential Lighting Training Manual" and pass a final exam.	Classroom, Online, and Field	Written and practical
American Lighting Association (ALA)	Lighting Specialist	Certification	No	No	Certification	Yes	National	None specified	Classroom, Online, and Field	Written
American Lighting Association (ALA)	Lighting Associate	Certification	No	No	Certification	Yes	National	None specified	Online	Written
Association of Energy Engineers (AEE)	Certified Lighting Efficiency Professional (CLEP)	Certification	No	No	Certification	Yes	National	Between 3 and 10 years' experience in lighting efficiency, based on level of education.	Classroom, Online, and Field	Written
Association of Energy Engineers (AEE)	Certified Lighting Efficiency Professional I-in-Training (CLEPIT)	Certification	No	No	Certification	Yes	National	Less than 3 years' experience in lighting efficiency	Classroom, Online, and Field	Written
Illuminating Engineering Society (IES)	Offers a lighting fundamentals course (may be the SF chapter only)	Certification	No	PEC	Certification	No	California	None specified	Classroom	Not specified
International Association of Lighting Management Companies (NALMCO)	Certified Lighting Management Consultant (CLMC)	Certification	No	No	Certification	No	National	None specified	Classroom and Online	Written

Findings

Organization	Certification/Training	Type	Required for IOU Program	Offered at Training Center	Level Targeted	Energy Efficiency Focus	Market Served	Prerequisites Required	Training Mode	Test
International Association of Lighting Management Companies (NALMCO)	Certified Sustainable Lighting Consultant (CSLC)	Certification	No	No	Certification	Yes	National	Certified Lighting Management Consultant (CLMC)	Classroom and Online	Written
International Association of Lighting Management Companies (NALMCO)	Certified Apprentice Lighting Technician (CALT)	Certification	No	No	Certification	No	National	None specified	Classroom and Online	Written
International Association of Lighting Management Companies (NALMCO)	Certified Senior Lighting Technician (CSLT)	Certification	No	No	Certification	No	National	None specified	Classroom and Online	Written
National Council on Qualifications for the Lighting Professions (NCQLP)	Lighting Certified	Certification	No	PEC	Certification	No	National	Bachelor's Degree	Not specified	Written
National Lighting Contractors Association of America (NLCAA)	Non-Residential Lighting Technician Certification	Certification	No	No	Certification	No	National	None specified	Classroom, Online, and Field	Written and practical
GE Lighting	Fundamentals of Lighting	Training	No	No	Training	Yes	National	None specified	Classroom and Online	Not specified
Leviton Manufacturing Co., Inc.	Regional Factory Training by Leviton Security & Automation	Training	No	No	Training	No	National	None specified	Classroom and Online	Not specified
Lighting Controls Association	Multiple trainings, all focused on lighting controls	Continuing education	No	No	Continuing education	Yes	National	None specified	Online	Not specified

Findings

Organization	Certification/Training	Type	Required for IOU Program	Offered at Training Center	Level Targeted	Energy Efficiency Focus	Market Served	Prerequisites Required	Training Mode	Test
Lutron Electronics	Light Control for Energy Savings	Continuing education	No	No	Continuing education	Yes	National	None specified	Online	Not specified
Lutron Electronics	Light Control and LEED	Continuing education	No	No	Continuing education	Yes	National	None specified	Online	Not specified
Philips Lighting Controls	Industry training	Industry training	No	No	Continuing education	Yes	National	None specified	Classroom Online	Not specified
Universal Lighting Technologies	HID Ballast training and Fluorescent ballast basics I and II	Industry training	No	No	Continuing education	Yes	National	None specified	Online	Not specified
Various ROPs	Architecture (Design, Drafting, Engineering Design)	Training	No	No	Entry-level training	No	California	None specified	Classroom	Not specified
Various ROPs	Computer Aided Drafting	Training	No	No	Training	No	California	None specified	Classroom	Not specified
Various ROPs	Engineering Technology	Training	No	No	High School	No	California	None specified	Classroom	Not specified
Various ROPs	Environmental Energy Technology	Training	No	No	High School	Yes	California	None specified	Classroom and Field	Not specified
Various ROPs	General Contracting	Training	No	No	Training	No	California	None specified	Classroom and Field	Written and practical
Various ROPs	Green Construction	Training	No	No	Training	No	California	None specified	Classroom and Field	Written and practical
Various unions	Electrician	Journeyman	No	No	Journeyman	Yes	California	None specified	Classroom and Field	Written and practical
Various unions	Electrician, Inside Wireman	Apprentice-ship	No	No	Apprentice-ship	No	California	None specified	Classroom and Field	Written and practical

3.4.3 Gaps in Contractor and Technician Skills

To identify any skills gaps among contractors and technicians in the non-residential lighting market, the evaluation team used three sources: interviews with industry stakeholders, discussions with expert panelists market, and findings from recent IOU-led CALCTP studies.⁸

As part of the other recent CALCTP studies the evaluation team conducted interviews with industry stakeholders, consisting of IOU program managers and the CALCTP program administrator. These interviews revealed that skills related to lighting design and integration are the most important areas for the CALCTP training to cover. As lighting systems and controls become more sophisticated, stakeholders believe that contractors need to understand how various components of the system should be integrated. Additionally, according to IOU program managers, contractors should receive training on the proper design of lighting systems. The proper design should account for the needs and behaviors of the space's occupants as well as provide documentation of the rationale behind the design choices, which allows for the installer to modify the system if needed based on the realities of the construction process.

The non-residential lighting expert panel agreed with the gap in skills related to integrated lighting design including systems and controls. Panelists also noted that contractors and technicians had skills gaps related to their understanding of customer needs and their ability to bid, manage, and supervise work. The non-residential lighting expert panel did not produce as many additional findings. This expert panel was much less vocal compared to the residential panel and had difficulty coordinating schedules to attend panel discussions. In addition, the lighting panel was comprised of a greater share of contractors compared to the residential panel, potentially leading to the relatively fewer overarching market observations from the panel.

CALCTP training was designed to fill the integrated lighting design training gap in the non-residential lighting training market. CALCTP offers seven types of training in three categories:

- Installation
 - “Installation” for electricians
 - “Systems” for mid-level electrical contractor managers
 - “Business development” for top level electrical contractor managers
- Acceptance Testing
 - Field technician training
 - Employer training
- Building Operator Professional and Specifiers (in development)
 - Building operators
 - Advanced lighting control specifier for architects, engineers, lighting designers, and design build professionals

⁸ The IOUs led a study to further understand the value of CALCTP training, the *Lighting Controls Training Assessment*, which focuses on qualitative information.

The Lighting Controls Training Assessment study included several findings about the lighting and controls training market that are relevant to this report. That study explored and compared the CALCTP training content and delivery to lighting manufacturer trainings on lighting and controls. The relevant key findings from that study are:

- Only eight, or 22%, of the 36 manufacturers studied offer formal training for installers. However, many manufacturers do offer forms of training such as on-the-job-site training, and online self-study modules, YouTube training videos, and Webinars.
- In comparison to manufacturer training, CALCTP provides added value to contractors, or lighting installers, by offering a one-stop-shop for all training content, teaching about lighting systems and controls broadly instead of one specific product type, basic Title 24 compliance training, sound instructional design, extensive hands-on practice and results in a Certification. However, manufacturer trainings are less expensive and have the benefit of leveraging the latest technology from the manufacturer. Perhaps one of the greatest gaps that CALCTP training fills in the marketplace is that it is “product agnostic,” presenting general concepts that are not product-specific and representing products from multiple popular manufacturers. Installers value addressing multiple product brands as they often use several product brands with some brands being more suitable for certain kinds of designs or needs. Therefore, to meet the needs of the customer and the building, installers need to be familiar with multiple manufacturer products. Table 11 provides a summary comparison of CALCTP and manufacturer installer training.

Table 11: Summary Comparison of Manufacturer and CALCTP Installer Training

Area of Interest	Manufacturer Installer Training	CALCTP Installer Training
Learning Path	■ Difficult to identify all options	■ “One-stop shop”
Content Orientation	■ Product specific	■ Product “agnostic”
	■ Deep dive on specific products	■ Limited depth on a range of products
	■ Some basic concepts and Title 24 Part 6 requirements	■ Solid basic concepts; moderate Title 24 Part 6 requirements
Instructional Integrity and Delivery	<ul style="list-style-type: none"> ■ Wide range of instructional design quality and a variety of delivery modalities ■ Wide range of delivery styles 	<ul style="list-style-type: none"> ■ Sound instructional design quality and a variety of delivery modalities ■ CALCTP-trained instructors with a range of expertise and experience
Performance Evaluation	■ No pass/fail evaluation	■ Results in certification
Accessibility	■ Offered in numerous locations throughout the state	■ Offered in numerous locations throughout the state
	■ Costs range from free to \$250	■ Training is offered free at utility training centers
Hands-on Opportunities	■ Limited hands-on practice	■ Extensive hands-on practice
Up-to-date Technologies	■ Reflects latest technology	■ Is difficult to keep up to date

Source: Lighting Controls Training Assessment, Preliminary Report, December 2015

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