California Workforce Education & Training Needs Assessment

For Energy Efficiency, Distributed Generation, and Demand Response

DONALD VIAL CENTER ON EMPLOYMENT IN THE GREEN ECONOMY
Institute for Research on Labor and Employment
University of California, Berkeley

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Executive Summary

My Fellow Californians,

Over three years ago, the California Public Utilities Commission recognized that California's ambitious energy efficiency and greenhouse reduction goals required long term strategic planning. In September 2008, the Commission approved the California Long-Term Energy Efficiency Strategic Plan (Plan) in September 2008 providing a roadmap, through the year 2020 and beyond, for a dramatic scaling-up of statewide energy efficiency efforts designed to meet California's clean energy challenges and goals. The objective of the Plan is to push forward sustained market transformation, thus moving California toward long-term, deep energy savings.

The Plan targets, chapter-by-chapter, four market sectors and seven cross cutting sectors. While the industry and cross cutting sectors are the bones of the Plan, four specific programmatic goals—the big bold energy efficiency strategies—may be considered its heart. In the development of the Plan, we recognized that California would not be able to meet these ambitious goals without adequate numbers of trained personnel working the various fields of energy efficiency. Thus we directed the utilities to include a workforce education and training component as one of the cross cutting sectors in the Plan.

With the input of the utilities and other relevant stakeholders at the Plan workshops, the Commission adopted a vision for workforce education and training:

"By 2020, California's workforce is trained and fully engaged to provide the human capital necessary to achieve California's economic energy efficiency and demand site management potential."

The Plan lays out two goals to achieve this vision. First, establish energy efficiency education and training at all levels of California's educational systems. Second, ensure that minority, low income and disadvantaged communities fully participate in training and education programs at all levels of the energy efficiency and demand side management industries.

While the Plan provides several strategies to meet each of the goals, it recognized that in the immediate future, the state must initiate a needs assessment: an in-depth formal statewide training and education resource inventory of current efforts and an assessment of the training and education resources necessary for successful delivery of the long range goals set forth in the Plan. Thus over the past year, the Donald Vial Center has been conducting interviews and collecting and analyzing data on California workforce resources and issues in the energy efficiency sector. The information and recommendations provided within this report summarize the information collected and present an independent analysis of these issues.

This report is a key step in the implementation of the Workforce Education and Training Chapter of the Plan. It gives us a strong idea of where we are and recommendations on how we can ensure that we have a properly trained workforce to enable us to meet California's clean energy goals, particularly with regard to energy efficiency.

Sincerely,

Dian M. Grueneich
Former Commissioner
California Public Utilities Commission

AUTHORS:

DONALD VIAL CENTER ON EMPLOYMENT IN THE GREEN ECONOMY
UNIVERSITY OF CALIFORNIA, BERKELEY

Carol Zabin
Karen Chapple
Ellen Avis
Jessica Halpern-Finnerty

T. William Lester
Sergio Montero
Michael Reich
Lynn Scholl
Peter Berck
Salafai J. (Susie) Suafai
Zach Church
Tory Griffith
Kate Stearns

RESEARCH INTO ACTION, INC.

Jane Peters
Nathaniel Albers

CENTERS OF EXCELLENCE, CALIFORNIA COMMUNITY COLLEGES

Elaine Gaertner
Evgeniya Lindstrom
John Carrese

PUBLIC/PRIVATE VENTURES

Joshua Freely

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April Armstrong, Mersiha Spahic — *Research Into Action*
Nicole Porter, Lori Sanchez — *Centers of Excellence, California Community Colleges*
Sean Campion, Matt Lewis, Elizabeth Mattiuzzi, Lacy Stark, Mi Thich, Dave Graham Squire — *UC Berkeley*
Elizabeth Redman — *Cross Sector Strategies*

EDITING AND PRODUCTION:

Jenifer MacGillvary and Sandra Laughlin — *UC Berkeley*

CPUC AND IOU STUDY TEAM:

Robin Walther — *Study Manager on Behalf of Southern California Edison Company*
Carlos Hernandez — *Southern California Edison Company*
Lisa Paulo — *California Public Utilities Commission*
Kelly Hymes — *California Public Utilities Commission*

WORKFORCE SUMMIT PLANNING COMMITTEE:

Commissioner Dian Grueneich — *California Public Utilities Commission*
Barbara Baran — *California Budget Project*
Panama Bartholomy — *California Energy Commission*
Linda Collins — *Career Ladders Project*
Cesar Diaz — *State Building and Construction Trades Council*
Marcy Drummond — *Los Angeles Trade-Technical College*
Cecilia Estolano — *Green For All*
Barbara Halsey — *California Workforce Investment Board*
Dan Henrich — *PDE Total Energy Solutions*
Bernie Kotlier — *LMCC-IBEW-NECA*
Kip Lipper — *Office of Senate President pro Tem Darrell Steinberg*
Pete Price — *Office of Speaker John Perez*
Daniel Villao — *California Construction Academy, UCLA Center for Labor Research and Education*

RESEARCH REVIEW AND EXPERT ADVICE:
Carl Blumstein — *California Institute for Energy and Environment*
Marian Brown, Carlos Hernandez, Shahana Samiullah — *Southern California Edison Company*
Barbara Cox, Bernie Kotlier — *LMCC-IBEW-NECA*
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All errors and conclusions are the sole responsibility of the lead authors, Carol Zabin and Karen Chapple.

EXECUTIVE SUMMARY

I. PURPOSE AND SCOPE OF STUDY

This report presents the results of the California Workforce Education and Training Needs Assessment for Energy Efficiency, Demand Response, and Distributed Generation (CA Workforce Needs Assessment, or the WE&T Needs Assessment), conducted throughout calendar year 2010. It has benefitted from the contributions of many individuals and organizations, including those who helped plan and participated in the December 2010 Workforce Strategies, Energy Efficiency, and Green Jobs Summit.

This project was carried out under joint management by the California Public Utilities Commission (CPUC) and the investor-owned utilities (IOUs) of California, with Southern California Edison (SCE) serving as the lead utility for the IOUs.[1] The project was funded by the ratepayers of California under the auspices of the CPUC.

The WE&T Needs Assessment is a third-party report and does not necessarily represent the viewpoints of the CPUC or the four IOUs, although it was reviewed by CPUC and IOU staff for factual accuracy.

I.A. WHY A WORKFORCE NEEDS ASSESSMENT?

The WE&T Needs Assessment was called for in the California Long Term Energy Efficiency Strategic Plan (EE Strategic Plan).[2] The EE Strategic Plan, adopted by the CPUC in September 2008, provides a road map for a dramatic scaling up of statewide efforts to meet California's clean energy goals for energy efficiency.[3] The objective of the Plan is to compel sustained market transformation, thus moving California toward long-term deep energy savings in the residential, commercial, industrial, and agricultural sectors of its economy. The EE Strategic Plan is a central element in the implementation of the California Global Warming Solutions Act of 2006 (AB 32) and is also a main component of the implementation of AB 758, California's Comprehensive Energy Efficiency Program for Existing Residential and Nonresidential Buildings law, passed in 2010.

Workforce Education and Training was one of the key issues addressed in the EE Strategic Plan, with this WE&T Needs Assessment identified as a necessary first step to guide further action. The importance of the workforce in achieving the state's clean energy goals was articulated in the EE Strategic Plan in the following vision statement:

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[1] The four major IOUs serving California's electric and natural gas customers are: Pacific Gas and Electric Company (PG&E), Southern California Edison Company (SCE), San Diego Gas and Electric Company (SDG&E), and Southern California Gas Company (SoCalGas).

[2] California Public Utilities Commission (2008). *California Long Term Energy Efficiency Strategic Plan: Achieving Maximum Energy Savings in California for 2009 and Beyond*. Retrieved from: http://www.cpuc.ca.gov/NR/rdonlyres/D4321448-208C-48F9-9F62-1BBB14A8D717/0/EEStrategicPlan.pdf.

[3] California Public Utilities Commission (2008). D.08-09-040. *Decision Adopting the California Long Term Energy Efficiency Strategic Plan* (D.0809040). Retrieved from: http://docs.cpuc.ca.gov/published/FINAL_DECISION/91068.htm. The CPUC adopted the plan and also required that beginning in 2009 the adopted strategies were to be incorporated in energy efficiency program planning and implementation.

> *"By 2020, California's workforce is trained and fully engaged to provide the human capital necessary to achieve California's economic energy efficiency and demand-side management potential."*[4]

The Plan also recognizes the impact of energy efficiency programs and policies on career opportunities for California's students, job seekers, and workers. It specifically calls for promoting the inclusion of low-income, minority, and disadvantaged communities in energy efficiency training programs; establishing energy education and training for employment in the energy efficiency workforce at all levels of California's educational system; and engaging in a collaborative effort among state agencies, educational institutions, community-based and non-profit organizations, private industry, and labor to these ends. This direction explicitly articulates the importance of equity issues and career opportunities for all Californians, not only those with ready access to college and professional jobs. It also recognizes that developing a qualified energy efficiency workforce involves working with collaborators from the workforce community who have as their primary goal improving job opportunities and workforce outcomes for Californians.

The CPUC's mandate is focused on the regulation of the energy and several other industries, but as a driver of investment in energy efficiency and related activities its actions impact the quantity and kinds of jobs that are created in the state. The CPUC's recognition that its work affects the state's workforce goals is analogous to its early foresight that achieving the state's environmental objectives is intertwined with and heavily influenced by state energy policy.

The dual goals of clean energy and improving job opportunities and workforce outcomes for Californians, including those from disadvantaged communities, has led the WE&T Needs Assessment to focus explicitly on strategies that value both of these two goals, as well as to identify the trade-offs between these goals where they exist. The conceptual framework for connecting these goals is based in business and economic literature and is known as *high-road economic development*. High-road economic development consists of a market environment that favors business strategies built on quality work and innovation, resulting from investments in a workforce that is both highly skilled and rewarded for those skills. Such workforce investments, in turn, encourage the development of a stable and professionalized workforce with the capacity to adapt to new technologies and practices. In contrast, *low-road economic development* consists of a competitive environment that favors competing on the basis of cost rather than quality. This leads to jobs that do not pay as well and/or do not have career ladders and results in higher turnover, undermining worker and employer incentives to invest in training.

I.B. STUDY SCOPE AND RESEARCH DESIGN

The WE&T Needs Assessment addresses three key elements of California's clean energy policy: energy efficiency, demand response, and distributed generation. These elements are focused on the customer side of the energy market and are strategies that result in the more efficient use of energy resources. Energy efficiency reduces the amount of energy required for specific services, while demand response is aimed at reducing peak demand and the need for new generation resources. For this study, distributed generation is limited to customer-owned renewable energy generation and supporting storage technologies that are less than 20 MW in size. This set of strategies is referred to as *demand-side management* in the energy community. In the rest of this document we use the term

[4] California Public Utilities Commission (2008). *Long Term Energy Efficiency Strategic Plan: Achieving Maximum Energy Savings in California for 2009 and Beyond,* page 74. Retrieved from http://www.cpuc.ca.gov/NR/rdonlyres/D4321448-208C-48F9-9F62-1BBB14A8D717/0/EEStrategicPlan.pdf.

energy efficiency and related strategies (or policies/programs) or *energy efficiency and related DSM strategies (or policies/programs)* as a shorthand for all these demand-side management strategies.

The WE&T Needs Assessment is a statewide study and includes all policies and programs within the scope just described, not only those under the jurisdiction of the CPUC or implemented by the IOUs. In addition, the recommendations for workforce strategies are not limited to those that can be carried out only by the CPUC or the utilities, but rather are aimed at all entities with the capacity to effectuate the needed changes.

Our research approach considers the effects of energy efficiency and related policies on both the demand and supply sides of the labor markets. The study relies on a mix of quantitative and qualitative methodologies, which are explained in each chapter and the appendices.

The first area of research analyzes the impact of federal and state energy efficiency policies and programs on jobs and the labor market. It includes both a quantitative analysis of job growth, job transformation, and unemployment, and a qualitative analysis of workforce and labor market dynamics that affect the state's achievement of energy efficiency goals and workforce goals in three key sectors. Given the lack of widespread industry-recognized licenses, certifications, and other skill standards, this study does not assess the specific skills required to meet the work quality standards for all jobs impacted by energy efficiency and related policies and programs.

The second area of research is a comprehensive assessment of the many pieces of California's workforce development system and its collective capacity to prepare, place, and/or retrain workers for the jobs that are created or transformed by energy efficiency and related policies and programs. It includes analyses of issues related to the inclusion of low-income, minority, and disadvantaged communities and to the development of K-12 career development programs. Given that reliable outcomes data is not available for most training programs, this study is not an evaluation of the effectiveness of each specific training program in imparting skills and competencies to participants.

The final part of the study identifies lessons learned and recommendations for action. In order to make the Needs Assessment as useful as possible in motivating and guiding future action, the research team was directed to engage and gain feedback from stakeholders in both the energy and the workforce development communities. This engagement began with the participation of the Energy Efficiency WE&T Task Force, a CPUC stakeholder committee addressing workforce issues related to the EE Strategic Plan, which helped define the scope of the Needs Assessment. In addition to group and individual discussions throughout the research process, the research team presented preliminary results and recommendations at the Workforce Strategies, Energy Efficiency, and Green Jobs Summit (the Workforce Summit), held at UC Berkeley on December 8, 2010, and offered opportunities for feedback through participatory workshops and solicitation of comments. A stakeholder committee guided the development of the Workforce Summit, which included then-CPUC Commissioner Dian Grueneich, legislative leadership staff, and key policymakers and stakeholders in the workforce development and energy communities. The research team is confident this report reflects broad (though not universal) agreement among stakeholders about the major issues and recommendations, but remains solely responsible for its contents.

II. SUMMARY OF RESULTS

II.A. PART ONE: ECONOMIC RESTRUCTURING AND LABOR MARKET ISSUES AFFECTING THE STATE'S CLEAN ENERGY AND WORKFORCE GOALS

The condition of the California economy sets the overall context for analyzing the impact of energy efficiency and related policies and programs on jobs, and subsequently the possible need to adjust workforce development policies and programs. At present, two major problems plague the California economy. The first, a result of the Great Recession and the jobless recovery, is California's unemployment rate, which remains at over 12 percent as of early 2011. The second problem is the long-term structural bifurcation of the state's labor market into well-paid, higher-skill jobs and low-wage, lower-skill jobs, with little growth of jobs in the middle.

This situation has two implications for the WE&T Needs Assessment. First, the high and persistent unemployment rate means that, at present, there is a large queue of unemployed workers, particularly in the construction sector, where the number of jobs dropped over 40 percent since the peak in 2006. Second, the bifurcation of the labor market means that, without specific policy interventions, the jobs created by the investments in energy savings will mimic the wage disparities seen in the rest of the economy, with some high-wage jobs in professional occupations and many low-wage jobs for those without a college degree. These wage disparities have immediate and serious social implications for families and communities in California, and they ultimately affect the competitiveness and efficiency of the California economy.

II.A.1. JOB IMPACTS AND LABOR SUPPLY

The WE&T Needs Assessment forecasts the number of jobs that will be created in 2010, 2015 and 2020 as a result of the energy efficiency and related policies and programs in California, using a variety of modeling and estimation techniques and three scenarios for levels of investment (low, medium, and high) during the next ten years. Using our medium scenario, we project these programs and policies will result in an investment of about $11.2 billion dollars from ratepayers, state, federal, and private sources for 2020, as shown in Figure 1, up from an investment of about $6.6 billion in 2010. This investment is projected to create a total of 211,000 jobs for that year, including *direct jobs* generated by the investments in energy efficiency activities, *indirect jobs* resulting from demand for inputs for these activities, and *induced jobs* resulting from the increased household and business incomes and reduced energy expenditures from these activities. These are person-year jobs, meaning that each job represents one full-time, one-year job, not one *permanent* job. This forecast shows that energy efficiency and related investments resulting from programs and policies identified in this report provide a significant stimulus to the California economy.

The number of directly-generated jobs in energy efficiency and related activities is projected at 52,371 full-time equivalent jobs for the year 2020; the remaining jobs are the result of the indirect and induced labor demand. These direct jobs represent a significant growth from the 27,718 total direct jobs we estimate were generated in 2010 from energy efficiency and related policies and programs. Direct jobs are the focus of this study because they are directly linked to energy efficiency and related activities and thus to the potential need for skill development.

As shown in Table 1, the number of trained workers needed to fill the new jobs created is projected to be at least 78,205 over the 11-year period beginning in 2010. This number is larger than the number of full-time equivalent jobs (38,937 net of 2009) because most jobs include both energy efficiency and other work. That is to say, the work from one new full-time equivalent job will distributed to more than one worker. To forecast training needs, the key estimate is the yearly increment of workers needed to fill new positions, above and beyond those hired in the previous year, since the latter were presumably already trained before hire. For the year 2020 alone, the

number of new workers that require specific training in energy efficiency and related sectors is forecast at 5,262. Thus, from a total job creation forecast of 211,000 workers in 2020, the number of new slots available for workers needing specific skills in energy efficiency and related activities is only 5,262.

Figure 1. Investment in Medium Scenario by Source and Year

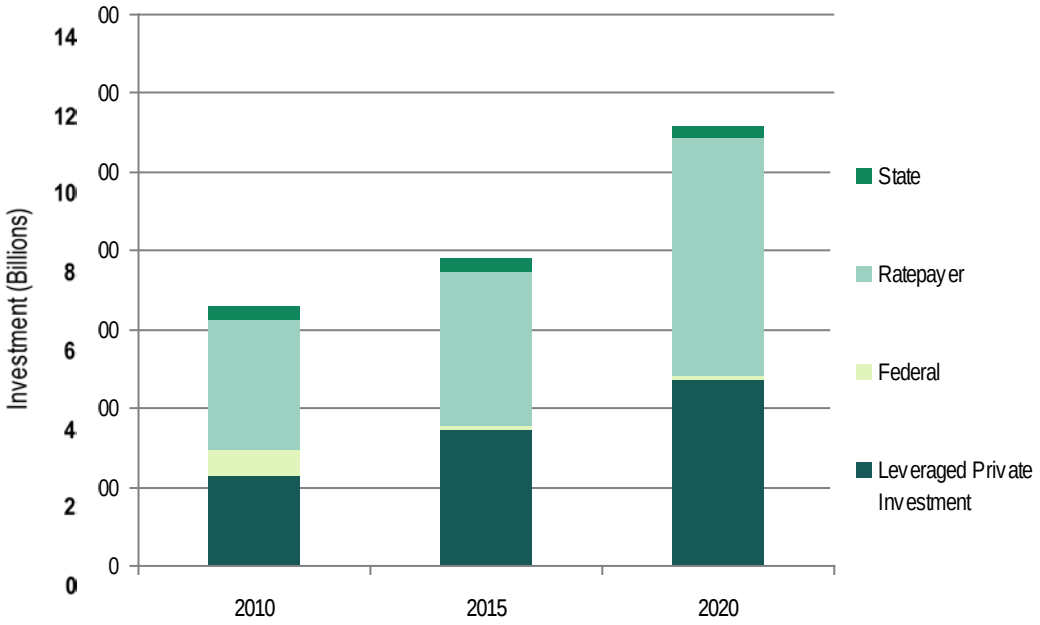

Table 1. Energy Efficiency Incremental Worker Training Projections, Medium Scenario, by Occupational Group, Total and Per Year

Occupational Group	Total Direct New Workers (Net of 2009)		Direct New Workers Per Year (Net of All Previous Years)	
	2015	2020	2015	2020
Administration	2,205	3,798	104	319
Administration (Sales-Related)	3,110	4,961	195	370
Architecture and Engineering	2,812	4,748	—	387
Building Envelope (Construction Trades)	27,452	37,282	1,145	1,966
Building Envelope (Performance Trades)	1,004	1,487	39	96
Management (Blue-Collar)	5,883	8,395	173	502
Management (White-Collar)	1,096	1,855	62	152
Manufacturing	48	97	—	10
Mechanical and Electrical Trades	8,286	15,582	628	1,459
Total	51,896	78,205	2,301	5,262

Two-thirds of the direct jobs are expected to be in the construction trades (e.g., electricians, plumbers and pipefitters, sheet metal workers, carpenters, laborers, and construction supervisors). Another 17 percent of the jobs are in the fields of architecture and engineering, management, and public administration (including utility and third-party program administrators). The remaining 16 percent are in manufacturing, advertising, office administration, and other industries.

Most of the new jobs are in traditional occupations, dwarfing the number of workers in new and emerging specialized occupations (e.g., solar installers or energy auditors). This finding is based on current staffing patterns; if specialized energy efficiency occupations become more prevalent over time, this balance may change. The degree of specialization depends partly on business decisions, but also on what certifications the state encourages and which training programs it funds.

At present, there are a significant number of unemployed and underemployed skilled workers in all of these industries. Graduates of training programs will compete against these experienced workers and can be expected to have difficulty in finding work utilizing their newly acquired skills, a point echoed many times in interviews we conducted with training providers as part of this study. In all sectors, this pool of unemployed workers is likely to exceed the number of new jobs created in the energy efficiency and related sectors at least until 2020.

In addition, the number of workers *currently* employed in energy efficiency and related occupations far outweighs the number of new workers that are projected to enter these fields through 2020. Some, if not many, of these incumbent workers are likely to require skills upgrade training as new best practices and new technologies are introduced.

The quantitative analysis shows that, at least through 2020, concerns about shortages of new workers for energy efficiency and related work are unwarranted, particularly for the most prominent energy efficiency occupations. There may be difficulty hiring for specialized niches, such as professionals with significant work experience, or short-term shortages for positions with new certification requirements, but these are the exception. In contrast, concerns about shortages of *jobs* for graduates from education and training programs are real and likely to persist through 2020, particularly for those with less than four years of college. As a result, great caution should be used in considering the funding of new training programs. For achieving energy efficiency goals the focus should be on upgrading the energy efficiency skills and knowledge of the incumbent workforce.

II.A.2. WORK QUALITY AND JOB QUALITY IN KEY ENERGY EFFICIENCY SECTORS

We conducted qualitative case studies of three critical energy efficiency related markets—heating, ventilating, & air-conditioning (HVAC); residential home retrofits; and commercial lighting. Through these in-depth examinations we sought to better understand the dynamics behind the quantitative analysis and to detect any labor market problems that are impeding the state's efforts to achieve its clean energy and workforce goals. Each of the sectors chosen for the case studies has the potential for vastly reducing energy use and thus is the focus of major policies and programs that incentivize or mandate specific action.

The HVAC sector (which cuts across residential and commercial sectors) is the single largest contributor to peak load demand, with residential and small commercial HVAC comprising up to 30 percent of peak load demand in summer months. The EE Strategic Plan targets a 50 percent improvement in efficiency in the HVAC sector by 2020, and a 75 percent improvement by 2030. The statewide IOU budget for the HVAC sector in 2010-2012 is approximately $127 million.

The residential sector represents about one-third of California's current electricity and natural gas consumption. The EE Strategic Plan sets ambitious targets for energy use reduction in existing housing stock,[5] and aims to give all eligible low-income customers the opportunity to participate in the fully-subsidized Low-Income Energy Efficiency (LIEE) program. The statewide residential retrofit incentive program mandated in AB 758 is now under the umbrella of Energy Upgrade California and has a budget of approximately $275 million from all funding sources. The IOU LIEE program has a budget of approximately $310 million for 2010 and the federally funded low-income programs have increased their budget to $257 million due to a temporary influx of 2009 American Recovery and Reinvestment Act (ARRA) funds.

The commercial lighting sector represents about 35 percent of all energy use in the state's commercial sector. The EE Strategic Plan aims to reduce commercial lighting energy use by 60 to 80 percent in 2020. The 2010-2012 IOU program budget dedicates $89 million for programs to support advanced lighting in the commercial sector.

In all three sectors, the key workforce issue that surfaced in our interviews was the high incidence of poor quality installation, affecting immediate energy savings and the growth of the energy efficiency sector. This issue is most dramatic in the HVAC sector, where prior studies have reported that 30 to 50 percent of new HVAC systems and up to 85 percent of replacement systems are installed incorrectly, and that by 2020 potential energy savings from higher quality HVAC installation and maintenance could eliminate the need for the equivalent of two combined-cycle gas-fired 500 MW power plants.[6] This same issue is prevalent in the residential retrofit and commercial advanced lighting sectors, where poor quality installation and the resulting failure to deliver on expected energy savings has undermined market growth, including financing.

Our analysis suggests that training workers with appropriate skills is necessary, but not sufficient, for achieving proper installation and maintenance of energy efficiency materials and equipment. In the residential and small commercial sectors, including HVAC and other retrofit activities, markets are characterized by low-road conditions that make it difficult for businesses to compete on the basis of quality. These conditions include lax enforcement of building permits, codes and standards, and employment laws, and in some trades contractor licensing that does not require testing of competency. In the HVAC sector, for example, less than 10 percent of HVAC change-outs are carried out with building permits, so code enforcement is rarely triggered.[7]

One of the results of these low-road conditions is that workers are not rewarded for high standards of competence. Although additional documentation and assessment are needed, interviews revealed that there are low wage floors and limited career ladders for most jobs in the low-income weatherization, residential building retrofit, and residential and small commercial HVAC markets. Low wages are correlated with high turnover, and do not encourage employers or workers to invest in training.

In these circumstances, public investments in workforce education and training are frequently lost as workers leave the field in search of better opportunities. These investments also do not lead to changes in practice because, without enforcement of building permits, codes and standards, and other quality standards, employers compete on cost and have little incentive to improve quality. Thus, poor outcomes for workers in the energy efficiency and related sectors are closely related to the loss in energy savings due to improper installation and poor maintenance practices.

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[5] "By 2020: 25% of existing homes have a 70 % decrease in purchased energy from 2008 levels; 75% of existing homes have a 30% decrease in purchased energy from 2008 levels; 100% of existing multi-family homes have a 40% decrease in purchased energy from 2008 levels." (CPUC, 2008, p.19).

[6] Messenger, M. (2008). Strategic Plan to Reduce the Energy Impact of Air Conditioners. California Energy Commission Staff Report. CEC-400-2008-010. p. 31

[7] Ibid.

In contrast, the commercial lighting industry is a high-road industry. General electrician, the key trade in commercial light installations, is the only specialty trade in California that requires both workers and contractors to obtain a license based on a test of competency. The trade also has a large unionized contractor base that funds five-year apprenticeship training programs and ties skill increases to wage increases, and as a consequence has a stable and professionalized workforce. These conditions provide the infrastructure needed to make investments in skills upgrading that lead to actual improvements in work quality and energy savings. Thus, when specific work quality problems are identified, the mechanisms are in place for quickly upgrading skills to address them.

While it is challenging for policies and programs whose primary objective is energy efficiency to fundamentally change these markets' broader dynamics, policymakers do have options in terms of how they address these conditions. Although constrained by budgets and program goals, in the fully subsidized low-income sector, the CPUC and the utilities can, for the most part, set the rules of the labor market.

As a general rule, utility ratepayer- and publicly-funded programs have addressed quality through back-end inspections and verification, but not by conditioning incentives or contracts on up-front contractor and worker quality standards. This is now changing. There are several examples of new programs that are attempting to "carve out" higher quality segments in these markets and thereby improve installation and maintenance of energy efficient equipment and systems. Clearly, the utility programs cannot drive the market by themselves, but they can contribute to building the high road. In the sectors discussed here, they are collaborating with other state agencies and federal programs in new attempts to do just that.

HVAC: The utilities are part of a statewide effort to improve quality in residential and small commercial HVAC using several strategies. These include the development of the Western HVAC Performance Alliance, an industry and government partnership convened by the utilities to solicit feedback and build support for the implementation of the EE strategic plan. The statewide effort also includes the combined efforts of several agencies to close off the low road by improving enforcement of building permits and the state's new energy efficiency building codes.

At the same time, the IOUs are helping to build the high road through new incentive programs focused on quality installation and maintenance that have very stringent quality and certification requirements for both contractors and workers. They are also making substantial investments in HVAC training, though currently these do not incorporate a clear strategy to link training to changes in employer practices. If these statewide efforts are successful, they will support the development of a more stable and professionalized workforce. They will also likely drive up the up-front costs of HVAC installation. While further evaluations are warranted, the expectation is that over the long run, higher energy savings, particularly the more valuable peak energy savings from properly installed HVAC systems, along with savings from higher worker retention rates, will compensate for these higher initial costs.

RESIDENTIAL BUILDING RETROFIT: Energy Upgrade California is the new statewide effort by the California Energy Commission (CEC), CPUC, and others to implement AB 758 and the EE Strategic Plan for the residential sector. Its main strategies are to encourage a whole-house (rather than single measure) approach to retrofit, to align funding and quality assurance mechanisms, and to expand financing. These strategies are designed to carve out a home performance market with a strong focus on quality work and the delivery of substantial energy savings. At present, whether this program will be able to create good jobs (e.g., living wages, benefits, and career ladders) for the residential retrofit workforce is less certain, as near-term cost considerations seem to be paramount. Thus far, the program design only includes standards and certification for contractors, with no requirements for workers. In addition, the standards that do exist emphasize building envelope and auditing, rather than quality installation of HVAC and other building systems with known quality concerns.

Low-Income Energy Efficiency programs, which have received significant additional funding through both one-time ARRA funds and on-going ratepayer funds, continue to take a traditional single measure approach to energy

retrofits. Sometimes this work is based on subcontracting individual measures to other firms or individuals in ways that discourage leveraging of all available funding sources or linking of measures in a whole-house approach. The IOU LIEE programs, whose goal is to help low-income families reduce energy bills, may have an opportunity to both increase energy savings and improve access to good jobs if they are restructured.

Two sometimes overlapping strategies to encourage quality jobs and quality work can inform California's residential programs. These are high-road agreements and certification strategies. Both of these efforts are being promoted by the Obama administration through its Recovery through Retrofit Working Group.

High-road agreements governing retrofit programs or other construction projects require contractors to abide by labor standards (wage floors) and local hire requirements, thereby promoting both job quality and access to jobs for workers from low-income, minority, and disadvantaged communities. If tied to training investments, high-road agreements can lead to a more qualified, stable, and professionalized workforce. Many retrofit programs that incorporate high-road programs are attempting to incorporate bundling of work to achieve greater scale and lower cost, and to attract contractors that are more accustomed to these types of requirements. High-road agreements have been instituted in a number of cities in California. In Los Angeles, for example, any project funded by the LA Redevelopment Agency (the largest redevelopment agency in the country) must adhere to a high-road agreement. Showing federal support for this strategy, the Department of Energy (DOE) ARRA Better Buildings Initiative is funding a number of residential retrofit programs based on high-road agreements, including programs in Portland and Seattle. High-road agreements and other demand side strategies are not as well developed in California as in some parts of the country, but similar strategies are being explored in Oakland, Los Angeles, Santa Clara, and San Francisco.

Certification strategies encourage employers to adopt graduated levels of certifications that are tied to corresponding wage progressions. Responding to the focus on certification, the DOE has developed a set of industry guidelines for skill standards and certifications for the main worker job categories in residential retrofit and is encouraging their voluntary adoption by states and employers. These guidelines include skill standards for the installer job category, the most numerous job in retrofit projects, paving the way for higher skills and perhaps higher wages in these entry-level jobs.

COMMERCIAL ADVANCED LIGHTING CONTROLS: Efforts to expand the market for advanced commercial lighting controls have also been stymied by deficiencies in quality installation. However, innovative leadership by the utilities and the International Brotherhood of Electrical Workers-National Electrical Contractors Association (IBEW-NECA) labor management partnership, combined with more favorable labor market conditions, are successfully addressing the problem. In the lighting sector, the utilities proactively set standards that support quality work when strategies to deploy advanced lighting controls were in early stages of development. They did so through the creation of an industry partnership, now called the California Advanced Lighting Controls Training Program (CALCTP), which developed a new certificate available only to already skilled licensed electricians. This type of industry partnership is known in the workforce development world as a *sector strategy*.[8] Initially, Southern California Edison funded curriculum development for this skills upgrading, and in a relatively short period of time this training has been disseminated throughout the network of electrical apprenticeship programs, community college programs, and utility training centers. New knowledge, imparted in a 40-hour journey upgrade training, is integrated into a pre-existing base of solid occupational training, usually achieved through a five-year apprenticeship program.

[8] Sector strategies will be explained more fully in section II.B.1. Overview of California's Workforce Development Infrastructure and Strategies, below.

This sector strategy was embedded in the apprenticeship structure, where employers are already at the table, so the partners and mechanisms are in place to work out agreements on skill standards and changes in practice. Setting standards and targeting incentive programs to contractors whose workforce has achieved these standards, has paved the way for contractors to compete on the basis of quality in this industry. Though the training is not for entry level workers, the expansion of the market will allow new apprentice slots to open up, providing new opportunities for long-term occupational training and pathways into middle class careers.

The CALCTP presents a model for future IOU workforce planning and sector strategies for the deployment of new clean energy measures and initiatives. Examples of emerging areas include new forms of energy storage, integrated demand-side management, electric vehicle charging stations, commercial building benchmarking, and others not yet ready for deployment.

CALCTP shows how utilities (with ratepayer funds) can participate in sector strategies that convene industry stakeholders and partner with existing state training and education institutions to implement training programs that directly tie training to jobs. In addition, the utilities have a clear role in helping to determine and promote rigorous skill standards and certifications. Certification requirements contribute to quality by both improving the technical skills of workers and raising the bar for contractors, enabling them to compete on quality rather than cost cutting. Certifications should ideally be industry-recognized and/or state-approved standards that measure high levels of competence through third-party testing *and* work experience requirements. To the extent possible, certifications should also be linked to post-secondary degrees or state-certified apprenticeships.

With the support of the CPUC, the utilities can take critical leadership roles in expanding the high quality segments of the market and addressing the workforce obstacles that impede achievement of the state's clean energy goals. Spearheading sector initiatives and mandating certification standards in ratepayer programs can support improved worker outcomes, as well as the improved work quality needed to meet the state's clean energy goals. With strong pre-apprenticeship programs to provide pipelines into the skilled trades, this model also has the potential to provide opportunities for Californians from disadvantaged communities.

II.B. PART TWO: WORKFORCE TRAINING AND EDUCATION INFRASTRUCTURE

II.B.1. OVERVIEW OF CALIFORNIA'S WORKFORCE DEVELOPMENT INFRASTRUCTURE AND STRATEGIES

California's workforce development system is extensive but fragmented. Key components are the state's Workforce Investment Act (WIA) funding entities comprising the state and local Workforce Investment Boards (WIBs)—funded by the federal Department of Labor—and the postsecondary education system, which consists of universities, four-year colleges, community colleges, and the state's Department of Education. The state's involvement in workforce development also includes funding incumbent worker training through the Employment Training Panel, and certifying and regulating the apprenticeship programs. In addition, private organizations run fee-for-service training, and philanthropy supports community-based training organizations and other training initiatives. There is limited coordination among the WIBs, the community colleges, apprenticeships, and other training and education agencies. The WIA system is currently driven by a "work first" mandate, with the bulk of resources going to the One-Stop Career Centers to help job seekers find any job as quickly as possible, rather than make investments in training. The limited resources in WIA for training specific populations are funneled through individual training vouchers, and do not facilitate training and education infrastructure planning and development.

The effectiveness of the training and education system differs by sector and skill level. There is a coherent system for training workers in professional and managerial occupations, as California's community colleges are articulated with the state's four-year colleges and universities through the California Master Plan for Higher Education. Many professional occupations, such as engineers and architects, also have widely recognized systems of certification and licensing, which support competency as well as providing assurance that workers will be compensated for their skill level.

On the other hand, with the exception of apprenticeship, the training system for middle-skill occupations is much less effective—often neither helping workers obtain good jobs nor helping employers recruit and retain skilled workers. This is due to the lack of coordination and articulation among training institutions, the common disconnect between training and jobs, and the lack of widely recognized skill standards and associated credentials that measure competency.

Two complementary and interrelated strategies have been supported by both the Obama administration and the state of California as key directions for reform of the middle skill job training system. The first is sector strategies, which are training initiatives built on partnerships among business, labor, post-secondary education institutions (including apprenticeship), and other stakeholders. Sector strategies usually involve intermediaries who organize multiple employers in a specific sector, and plan and execute training initiatives based on employers' commitment to consider hiring training program graduates, and/or train incumbent workers. The second and related strategy is the development and industry adoption of portable and stackable credentials and certifications. These then provide clear guideposts for training institutions and can support high-road development by putting an emphasis on quality training and quality work. Apprenticeship embodies both sector and certification strategies, but they are not widespread in other parts of the state's workforce development infrastructure.

Widespread agreement on the importance of these strategies has led to state efforts to improve training for middle-skill jobs in energy efficiency and other green sectors in California. With the influx of ARRA dollars for investments and training funds in these sectors, the Green Collar Jobs Council, a committee of the California WIB, became an important venue for interagency coordination and collaboration, particularly between the California Energy Commission and the state's workforce development agencies. The Green Collar Jobs Council's stated vision is to "serve as a catalyst for the creation of sustainable regional sector strategies." It was instrumental in launching the California Clean Energy Workforce Training Program, which attempted to integrate some of the elements of sector strategies into energy efficiency occupations, and the Regional Industry Clusters of Opportunity Grants, which promoted sector planning. At this time, these efforts are too new to be evaluated.

II.B.2. TRAINING AND EDUCATION PROGRAMS IN ENERGY EFFICIENCY RELATED FIELDS

With this overall context in mind, the WE&T Needs Assessment developed a resource inventory of existing training and education programs serving the industries and occupations affected by energy efficiency and related policies and programs. Table 2 provides an overview of the seven key institutional categories we discerned in this inventory. We were able to identify about 1,080 training programs consisting of 1,540 individual training tracks among four-year colleges and universities, community colleges, apprenticeships, community-based training organizations (CBOs), private training organizations, and Regional Occupational Programs (ROPs). A training program refers to a department at a particular college or ROP, an apprenticeship committee, or a distinct community-based or private organization, some of which have multiple tracks (i.e., they may issue credentials at different levels or with different specializations). These individual tracks are the relevant unit of analysis for Part 2, because they lead to different career pathways and employment outcomes.

Table 2. Institutional Overview

Institution	Description	Average Length of Training
Four-Year Colleges and Universities	• Training for qualified high school graduates and community-college transfer students • Long-term pre-employment education for professional or managerial jobs that are linked to professional licenses and continuing education	4 years
Apprenticeships	• Long-term training in the building and mechanical trades • Apprentices typically start with little or no experience, and learn to be experts in their trade while working full-time for an employer and receiving classroom instruction • Wages increase with skill level • Most joint apprenticeships offer skills upgrade training for journey workers to update or enhance their skills*	3 to 5 years
Community Colleges	• Post-secondary education that is open to those with limited resources and low basic skill levels • Students may obtain an associate's degree after two full-time years of study, and/or receive a vocational certificate in a shorter amount of time, usually one year • There are multiple pathways, including into apprenticeship, transfer to four-year, or stand-alone training for entry-level, semi-skilled jobs** • Incumbent workers also access community college classes, primarily for re-skilling or skills upgrade training	6 months to 2 years (some custom programs as short as 4 weeks)
Community-Based Training Organizations (CBOs)	• Serve disadvantaged, minority, and low-income populations with limited occupational skills and work experience at the front end of the career pathway • Most provide work readiness and pre-employment skills training, and may offer pre-apprenticeship • Typically short-term	3 days to 3 months
Private Industry Training Organizations	• Can be private for-profit organizations, non-profits, or trade associations • Offer pre-employment or incumbent worker training in the energy efficiency, renewable energy, or the building trades • Training is typically very short-term with longer programs for some specialty trades • Programs are often costly compared to other institutions, but receive some public Workforce Investment Act (WIA) funds when trainees can use WIA individual training accounts to pay for training	1 day to 6 months
Regional Occupational Programs (ROPs)	• Offer career and technical education courses at high schools • Help provide students with the skills needed for entry-level positions within the career track of their choice, or for entry into additional vocational or post-secondary training	6 months to 2 years
IOU Energy Training Centers	• Energy Training Centers primarily provide short-term classes and seminars • Although open to anyone, many classes are targeted toward experienced incumbent contractors and professionals looking to acquire specific skills in energy efficiency and related topics • Main goal is to provide knowledge that will help save energy	1 to 5 days

* We did not capture complete information on journey upgrade courses in our inventory of training programs, although they are a critical part of continuing education for journeypersons which were mentioned in almost all apprenticeship interviews.

** We did not capture complete information on contract education in our analysis because we were focused on community college programs that lead to a certificate or a degree.

The inventory includes all programs that train for the most prominent occupations based on our job projections, as well as programs that self-identify as training for "green jobs" skills. This captures both traditional occupations that are involved in implementing energy efficiency work, as well as the new and emerging "specialty" occupations focused solely on a particular set of energy efficiency-related skills. This inventory includes administrative program

data (where available) including graduation information for institutions in the relevant occupations throughout California. From the inventory we drew a random sample and then carried out an in-depth survey. The survey instrument was designed to capture the role, depth and breadth, skills, and range along a career path from lower to higher skills of each type of training and education institution, and to address distinctions across them. Out of 1,540 individual tracks, we interviewed 485.

Table 3 shows a summary of the occupational specialties of the programs identified in the training program inventory, documenting the number of programs training for each major occupation within each institutional type. Each primary occupation was classified as one of three main occupational types: professional, traditional trades, and emerging energy efficiency trades.

The majority of training programs—and the most comprehensive—are in traditional construction trades occupations and professional/managerial occupations. Universities and apprenticeships offer the longest, most in-depth training programs, serving to bring workers from a novice level to a level of competence and mastery of their field over the course of a number of years. The minority of training programs that are specialized in energy efficiency are either very short advanced incumbent worker classes, mostly for professionals, or short-term, narrowly focused entry-level or intermediate-level technical training at CBOs, private organizations, or community colleges.

Community colleges have the most programs and serve multiple purposes, including as transfer institutions to four-year professional education, as skills upgrading for incumbent workers and as career technical training leading to terminal certificates and degrees. Although the community colleges issue a number of certificates and degrees, these do not always have value in the market because in many occupations there are not clear industry-recognized certifications. This lack of market value may partially explain the disproportionately low number of graduates per program. Private training organizations also offer certificates to graduates, but a significant portion of these are self-issued and their value to students and employers is not clear.

Figure 2 shows the career pathways that exist in the professional occupations (architecture, engineering, construction management, etc.), including the clear training pathways and articulation agreements between community colleges and four-year colleges and universities. The community colleges provide a path of educational opportunity for disadvantaged students, and themselves articulate with high school or adult bridge programs to help break down barriers to post-secondary education. There are about 660 students obtaining transfer degrees and about 9,700 students obtaining four year or postgraduate degrees (mostly engineering) for the relevant subject areas each year.

In addition to the long-term occupational training in preparation for a professional career, over 1,000 individual skills upgrading classes are available at IOU Energy Training Centers each year, and about 2,000 classes at private organizations. Professional workers can count some of these as continuing educational requirements for licensure or professional association membership renewal. These short-term, high-volume trainings focus on a particular skill and are generally open and applicable to many different, but related occupations. For example, the U.S. Green Building Council offers training in the Leadership in Energy & Environmental Design (LEED) system, which is often attended by architects, engineers, real estate developers, construction managers, and others.

Table 13.2 Number of Program Tracks by Primary Occupation, 2010

Main Trade Or Skill Set	Four-Year and Graduate	Community College	Private	Apprenticeship—Joint	Apprenticeship—Unilateral	ROP	CBO	TOTAL
Professional / Managerial								
Architecture	24	70	1					95
Civil Engineering	45	5						50
Construction Management	11	31	17					59
Electrical Engineering								0
Engineering, General	54	123	3			26		206
Engineering and Architecture (Drafting / Design)		162				44		206
Law/Policy	2	1						3
Management	3							3
Mechanical Engineering	63							63
Total for Professional / Managerial	202	392	21	0	0	70	0	685
Traditional Trades								
Boilermaker				1				1
Bricklayer				3	1			4
Carpenter		13		20	5			38
Cement Mason				1	1			2
Construction Inspector		41	5					46
Electrician		24	4	42	13			83
Elevator Constructor				2	1			3
General Construction Worker		29				117	17	163
Glazier				3				3
Heat and Frost Insulator				2	1			3
HVAC/R Worker[1]	2	64	11	15	4			96
Laborer				10	3			13
Operating Engineer[2]				9	3			12
Plasterer				5				5
Plumber, Pipefitter, and Steamfitter		2		58	7			67
Roofer / Waterproofer				8	2			10
Sheet Metal Worker[1]		5		33	4			42
Sprinkler Fitter				5	3			8
Total for Traditional Trades	2	178	20	217	48	117	17	599
New and Emerging Trades								
Auditing and/or Inspection		11	107					118
Renewable Energy and Energy-Efficiency Specific[3]		25	56		2	24	22	129
Total for New and Emerging Trades	0	36	163	0	2	24	22	247
Total	204	606	204	217	50	211	39	1,531

Note: We did not include information for utility Energy Training Centers here because data by occupation is not collected according to primary occupation. See Chapter 12 for information on training areas.

Table 3 (continued) Number of Program Tracks by Primary Occupation, 2010

[1] Most HVAC/R training tracks for apprenticeship are incorporated in the committees for plumbers, pipefitters, and steamfitters. Others are refrigeration-specific committees. Sheet metal workers work with HVAC systems as well.

[2] Including stationary engineers as well.

[3] Many emerging occupational training programs teach a variety of skills for energy efficiency and renewable energy so we use a broad category here. Audit and/or inspection refers to programs specializing only in audit and/or inspection. Some renewable energy and energy-specific programs may also teach some aspects of auditing or inspection in addition to other skills.

Figure 2. Pathways: Professional and Managerial Occupations, Estimated Annual Graduates Statewide

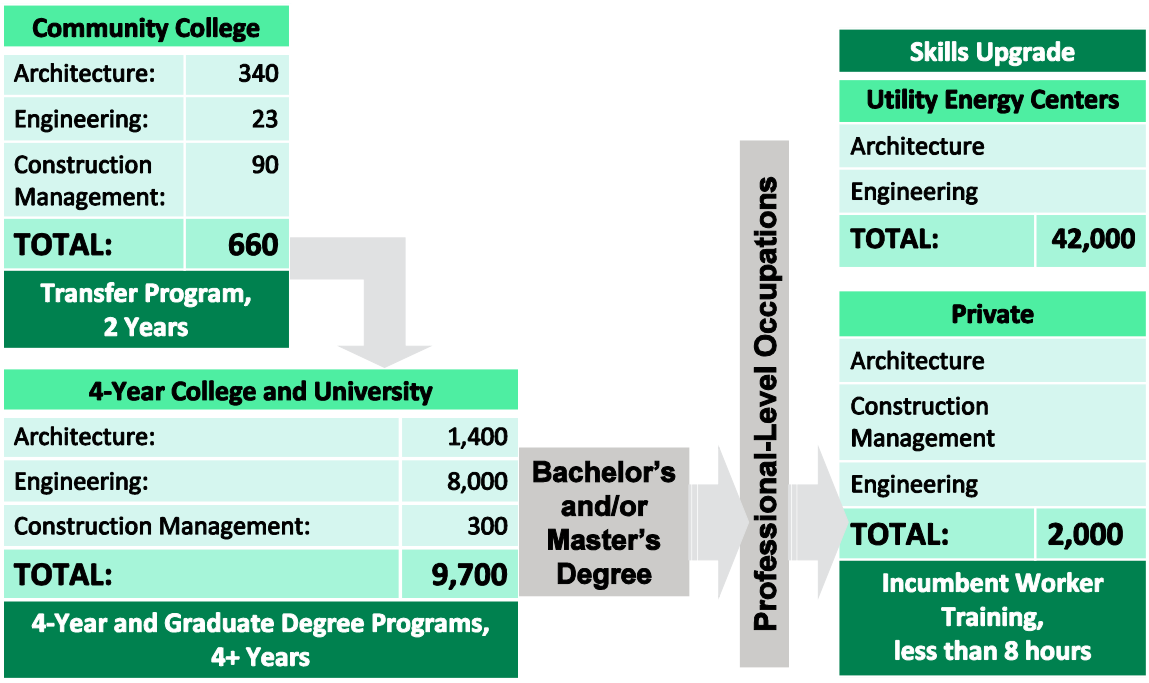


Figure 3 shows career pathways in the commercial and public sectors for construction trades. The primary occupations are in the traditional building trades, with energy-specific skills training included in broader occupational training. Apprenticeship is the main site of long-term, advanced training for these jobs, with about 4,500 graduates per year. Compared to other training programs for construction trades, apprenticeships offer training with significantly greater depth and scope, incorporate numerous industry recognized certifications, and result in the best worker outcomes in terms of jobs and wages. Although apprenticeship has few educational requirements other than testing, there are many applicants for few slots, and disadvantaged workers often face barriers to entry. Pre-apprenticeships help increase access to apprenticeship by offering short-term training in basic soft and hard skills, introductory occupational skills, and preparation for the entrance exams. Pre-apprenticeship programs are operated by CBOs, community colleges, and ROPs. However, not all pre-apprenticeship programs are clearly linked to apprenticeship, nor do these programs consistently follow best practices.

Figure 3. Pathways: Commercial and Public Sectors, Construction Trades and Energy Specialties, Estimated Annual Graduates Statewide

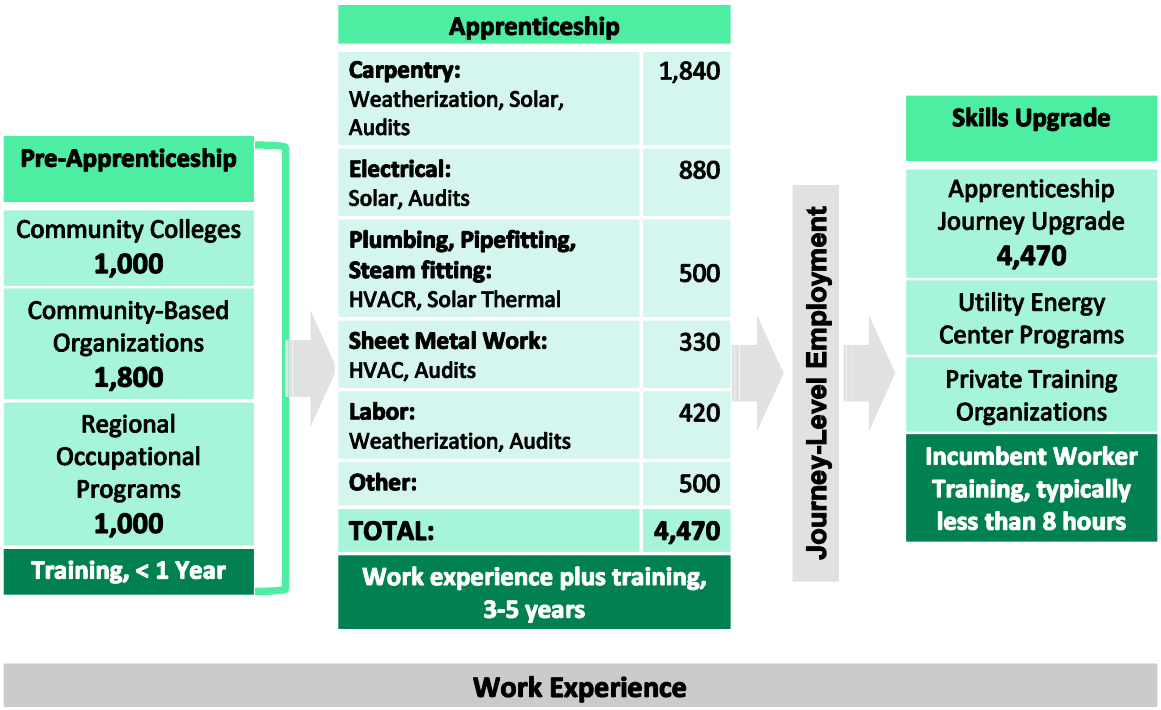
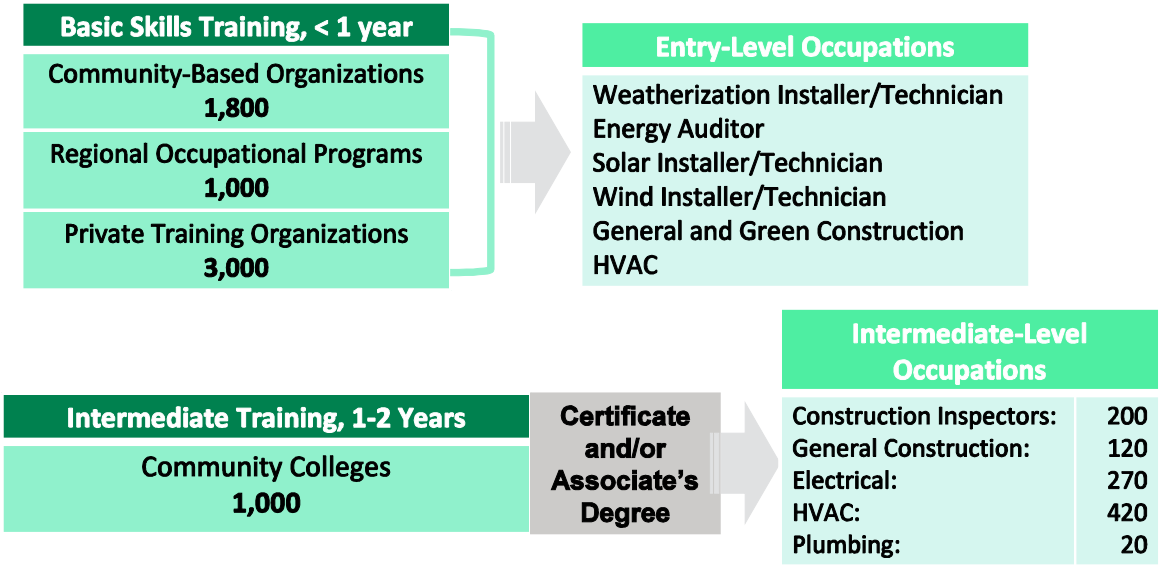


Figure 4 shows that career pathways are not well developed in the residential sector. In this sector there is a much spottier training infrastructure and many fewer graduates from training programs. Most workers enter the residential construction industry with no formal training and learn the trade on the job. As a result, workers gain skills primarily through work experience, based on the particular needs of the employer rather than on industry-wide standards. There are some entry-level programs at CBOS, ROPs, and community colleges, but these are of short duration and low skill levels, and seem to mostly lead into low-wage jobs. Private training institutions are the most prominent in entry-level residential work, but have unknown outcomes for workers.

Community colleges graduate about 1,000 students per year, statewide, with either certificates or two-year degrees in residential technical specialties such as HVAC worker, auditor, and building inspector. Some community colleges have started new energy programs, such as those for training solar technicians, or offer classes within other programs that focus on solar or energy efficiency. Although there are also classes in the IOU Energy Training Centers for the residential sector, these are typically taken by contractors or professionals, and less commonly by construction workers (illustrated in Figure 2).

Not only is formal training in residential construction sparse, but the different levels of training are not linked to each other in either the job market or in training pathways. Some programs at community colleges are attempting to forge these links—to create career paths from weatherization installer to auditor to HVAC technician, for example. However, we found no evidence that these efforts have yielded tangible results so far.

Figure 4. Pathways: Residential and Small Commercial Sectors, Construction Trades and Energy Specialties, Estimated Annual Graduates Statewide



The IOU WE&T programs funded by utility ratepayers are the only state resources dedicated to skills and knowledge development specifically in energy efficiency and closely related areas and, thus, these programs are an essential resource for skills upgrade training for professionals and contractors. The eight IOU Energy Training Centers, located throughout California, are particularly important as hubs of best practice skills and knowledge in energy efficiency and related areas, including training for deployment of emerging technologies. The Energy Training Centers have a budget of about $76 million for the 2010-2012 program cycle. In 2009, they offered over 1,000 classes to almost 43,000 attendees in a variety of areas related to energy efficiency and other DSM activities; most classes are a few hours in length and are taken by contractors, engineers, and other professionals. The Energy Training Centers are expanding their collaborations to reach beyond professionals and contractors and into relevant career education programs in community colleges, and four-year colleges and universities. There are opportunities to collaborate on curriculum review and updating with apprenticeship programs, four-year engineering and architecture programs, and community college technical programs. Sector strategies offer a model for utility participation in industry partnerships, particularly with employer groups that have ongoing commitments to training a stable workforce.

The IOUs also administer the smaller (approximately $16 million for 2010-2012) *Connections* initiatives, which include five programs targeting K-12 and college student populations. These are mostly energy awareness initiatives carried out in collaboration with schools and colleges, but they have begun to integrate career education. For the K-12 programs, the IOUs are developing deeper ties with the career preparation programs in California high schools. Of particular note are the IOU collaborations with the California Partnership Academies, which are the state's primary career technical initiative aimed at lowering drop-out rates and guiding students into post-secondary training and career tracks in specific occupations.

Another critical piece of the workforce development system is labor exchange—the matching of job openings to job seekers. The WE&T Needs Assessment identified and reviewed two main types of electronic job matching services: niche green job boards and comprehensive job matching services. Niche job boards are generally privately operated and paid for by the employer or job seeker, serve clean energy or other green niche markets. Job boards

generally serve professionals. Comprehensive job matching services, for the most part, are connected to one of the state's 259 WIA funded One-Stop Career Centers, and provide a full set of services including job listings, resume writing, career counseling, and, for eligible groups, training and support services. One-Stop Career Centers represent a federal investment of billions of dollars and cover all sectors, not just energy efficiency and related sectors.

The WE&T Needs Assessment also specifically analyzed the barriers keeping low-income, minority, and other disadvantaged individuals from entering energy efficiency careers, as well as the policy solutions and best training practices that can help create access to good jobs in these sectors. The large public investment in the energy efficiency and related sectors presents a potentially viable opportunity to build pathways out of poverty for individuals who have been historically disadvantaged in the labor market, particularly because of the relatively high percentage of energy efficiency jobs that do not require a college degree. The analysis showed that the lessons learned in other sectors about pathways out of poverty apply to the energy efficiency sectors as well. First, training that is integrated into sector strategies with strong employer commitment have shown the most success in linking job seekers to living wage jobs with career paths. Second, when targeted sectors are not resulting in living wage jobs with career pathways, as in many jobs in the residential sector, strategies to build pathways out of poverty must address policies and other interventions to improve job quality. In energy efficiency sectors, specifically, opportunities for inclusion of disadvantaged, minority, and low-income workers will emanate from support for pre-apprenticeship programs that can prepare job seekers for entry and success in apprenticeship programs, as well as from labor demand strategies, such as high-road agreements and industry adoption of stackable and portable certifications tied to wage ladders.

III. FINDINGS

The WE&T Needs Assessment findings provide the basis for developing the specific recommendations presented below.

Key findings from Part 1 of the WE&T Needs Assessment include:

- → The forecast of large overall stimulus and job creation coupled with the relatively small number of new jobs needing workers with specific training in energy efficiency and related skills;
- → The primacy of the building and construction trades, which make up about two-thirds of the overall jobs resulting directly from energy efficiency and related programs and policies;
- → The predominance of work in traditional construction trades, rather than in narrow specialized emerging occupations, disproving the view that such jobs are fundamentally different than other construction trades jobs, and highlighting the importance of greening the traditional trades;
- → The long queue of experienced unemployed workers, particularly in the construction trades;
- → The problems of work quality, particularly in residential and small commercial retrofit and HVAC, which are attributable to low-road market conditions and cannot be solved by training alone; and
- → The limited existence of industry recognized skill certifications in the relevant occupations.

Key findings from Part 2 of the WE&T Needs Assessment include:

- → The overabundance of training programs that can serve energy efficiency and related occupations, spread in many institutions but not coordinated under one strategy;
- → The availability of the state-certified apprenticeship infrastructure for the most prominent occupations, one of the few highly functional forms of training for middle-skill jobs, serving the needs of both employers and workers;

- → The availability of a strong public post-secondary education system (though now under acute budgetary pressure) that is effective for professional occupations requiring a four-year degree, but less so for other occupations;
- → The partial incorporation of energy efficiency skills and knowledge into apprenticeship programs and the two- and four-year colleges, and the opportunity for greater degrees of incorporation;
- → The particular weakness in articulated training paths or links to good jobs for the residential occupations compared to the more strongly articulated training paths in the professions and the commercial and public sector trades;
- → The lack of guideposts on which skills to train for, particularly in the residential sector, due to lack of industry recognized credentials;
- → The recent growth of short-term training for new workers in specialized occupations in private organizations and community colleges, which does not build on the strengths of California's workforce infrastructure and may not lead to good careers for graduates.

IV. RECOMMENDATIONS

Our targeted recommendations fit into two overarching prescriptions that are driven by the state's intertwined clean energy and workforce goals. They address the role that the California state government has in shaping the kinds of jobs that are created as the state moves towards a clean energy economy, as well as the role of the workforce development infrastructure in effectively responding to this economic restructuring. Implementing these recommendations will require some redirection of programs since clean energy programs have not consistently addressed their implications for the state's workforce objectives. The recommendations are not limited to those that can be carried out only by the CPUC or the utilities, but rather are aimed at a broader set of state agencies and stakeholders that can drive the needed changes.

- CREATE AND ENFORCE STANDARDS to expand the higher quality segments of energy efficiency sectors: Establish policies and require utility and other publicly-funded programs focused on energy efficiency and other demand-side management activities to clearly delineate and align the skills, certifications, and additional standards governing workers and contractors, so that quality work conditions can be maintained and workforce planning can occur.
- IMPROVE WE&T PLANNING AND COORDINATION: Establish state-level policies, support effective collaborations, and provide incentives to improve workforce planning and coordination among clean energy agencies and workforce agencies, and among the major education and training institutions, particularly apprenticeships, community colleges, and utility training programs. Emphasis should be placed on sector strategies built on partnerships between business, labor, and training and educational institutions.

Below we present specific recommendations, which will require partnerships, coordination, and collaboration on the part of all stake-holders.

IV.A. RECOMMENDATIONS FOR CPUC, CEC, UTILITIES AND OTHER AGENCIES AND STAKEHOLDERS SUPPORTING INVESTMENT IN ENERGY EFFICIENCY AND DEMAND-SIDE MANAGEMENT ACTIVITIES

State agencies, utilities, and others involved in energy efficiency and related programs and policies should determine and align skill certifications and analyze costs and options for encouraging their adoption by industry in the following ways:

- INCENTIVE PROGRAMS: Require contractors who participate in energy efficiency rebate and incentive programs to have third-party certifications, licenses, building permits, and/or meet other relevant standards and certifications. Certification requirements should apply to both workers and contractors.

- DIRECT CONTRACTS: Award state and utility direct-install contracts using a best-value contractor rating system that includes documented history of high-quality work, hiring of workers with appropriate certifications, ongoing investments in worker training, and compliance with building codes and employment laws.

- LOW-INCOME STATE AND IOU RESIDENTIAL PROGRAMS: For fully subsidized low-income programs, modify program objectives to include workforce outcomes. Assess current workforce outcomes and if they are not adequate, use high-road agreements and sector strategies to pilot incorporation of the new national DOE skill standards and certifications or other strategies to improve both energy efficiency and workforce outcomes.

- ENERGY UPGRADE CALIFORNIA FOR RESIDENTIAL: Require Energy Upgrade partners and implementation contractors to include, not only building envelope standards, but also standards for HVAC installations and other building systems. Establish pilot programs that include high-road agreements as part of the portfolio of funded programs, paying particular attention to strategies that bundle jobs to achieve a large enough scale to attract a broad set of contractors, including those with strong administrative and training capacity.

- ENERGY UPGRADE CALIFORNIA FOR COMMERCIAL: Require the use of high-road agreements, including apprenticeship, prevailing wage, and local hire provisions. The use of high-road agreements will support higher quality installations, increase the benefits of training investments, and promote the achievement of California's workforce goals.

- LICENSING: Review and, if warranted, change licensing requirements for building and construction trades contractors and technicians to ensure competency-based licensing.

- PUBLIC CHARGE REAUTHORIZATON: Include desired workforce outcomes in the list of goals for energy efficiency, low-income, and renewable energy programs (including distributed generation) with the reauthorization of the public goods charge.

- SECTOR STRATEGIES: Encourage drivers of energy efficiency investments to support sector strategies for deployment of new measures and technologies such as energy storage, integrated demand side management, commercial building benchmarking, and others, through co-funding, participation in setting work and skill standards, and serving as conveners of contractors and other key stakeholders.

- REPORTING OF WAGES, TURNOVER, AND OTHER LABOR CONDITIONS: Modify program evaluation methodologies and protocols for energy efficiency, demand response, and distributed generation to require the inclusion of worker outcomes, including compensation, benefits, turnover, and retention rates. Existing methodologies address energy and environmental costs and benefits but do not address workforce costs and benefits. Workforce issues affect both the costs and benefits of these programs, by way of the quality of installations and maintenance and the benefits associated with investments in training. Moreover, the

achievement of the state's energy efficiency goals needs to be considered alongside the achievement of the state's workforce goals.

IV.B. RECOMMENDATIONS FOR WORKFORCE DEVELOPMENT POLICYMAKERS, FUNDERS, AND PRACTITIONERS

- SECTOR STRATEGIES: Support workforce development funders (including Workforce Investment Boards, the Employment Training Panel, etc.) and training and education institutions as they develop, serve as intermediaries for, and coordinate their programs with sector strategies. When key elements of sector strategies already exist, as in the case of the Western HVAC Alliance for example, the workforce development community should participate by providing co-funding and technical assistance on sector strategy best practices, in addition to providing training and education services.

- GREENING TRADITIONAL OCCUPATIONAL PROGRAMS: Incorporate energy efficiency skills and knowledge into traditional occupations in the construction trades and the relevant professions, particularly engineering and architecture. This greening should focus on the main training institutions of apprenticeship, community college, and four-year colleges, and be a preferred alternative to creation of new, shorter-term, narrowly focused programs in specialized skills related to energy efficiency.

- INCUMBENT WORKER TRAINING: Focus resources on incumbent worker training and journey upgrade training. Consider the adoption of meaningful continuing education requirements for licenses and certifications to support participation of incumbent workers in these trainings and to integrate energy efficiency into the main knowledge and skill base of the relevant professions and trades.

- COMMUNITY COLLEGE AND APPRENTICESHIP COLLABORATION: Promote system-wide collaboration between the community colleges and the apprenticeship programs at the pre-apprenticeship, apprenticeship, and continuing education levels. Leverage the strength of the community colleges in providing pathways for students from disadvantaged communities.

- CERTIFYING PRE-APPRENTICESHIP: Support and strengthen pipelines into skilled trades work, using models such as PG&E's Power Pathways program, other successful community college pre-apprenticeship programs, and high school career academies. These pre-apprenticeship programs should be linked to state-certified apprenticeship programs and built on best practice models. Efforts to build stronger pipelines should be connected to clean energy investment policies, including high-road agreements with local hire clauses.

- DATA ON TRAINING OUTCOMES: Promote improved data availability on outcomes for training program participants by making available (with security safeguards) administrative data on employment of publicly-funded training program graduates. Job placement rates and career advancement should be adopted as priority metrics of program success. New policy is needed to make existing data available for research, while safeguarding privacy and confidentiality.

IV.C. RECOMMENDATIONS FOR CHANGES TO UTILITY WORKFORCE EDUCATION AND TRAINING PROGRAMS

- SUPPORT SECTOR STRATEGIES: Initiate, help fund, and partner with other organizations to develop robust sector strategies in key energy efficiency sectors such as HVAC, building operations and maintenance, benchmarking, and other emerging areas (as well as LIEE or other programs undergoing review or redesign).

- TRAINING CENTER CLASSES: Modify the structure of classes offered by the Energy Training Centers to increase the number of course series that are longer in length than current typical classes, focus on a specific occupation, have a workplace-based hands-on component, and offer clear learning objectives that lead to certification.

- COLLABORATIONS: Expand collaborations between the Energy Training Centers and building and construction trades associations. The emphasis should be on collaborations with high-road associations demonstrating commitment to investments in ongoing workforce training, such as participating in apprenticeship programs.

- CURRICULUM DEVELOPMENT OR UPDATING: Actively participate in the content development, review, and updating of curricula, and support instructor professional development for the main "home institutions" that train building and construction professionals and trades people, such as apprenticeship programs, community colleges, and four-year institutions. Energy Training Center staff should be encouraged to share their expertise as appropriate to ensure that curricula incorporate up-to-date information on new technologies and practices.

- GOALS FOR INCLUSION OF DISADVANTAGED WORKERS: Adopt as a goal for the Energy Training Centers the inclusion of low-income, minority, and disadvantaged workers and job seekers. Develop and implement specific programs in collaboration with organizations that have a track record in this arena, emphasizing sector strategies that can lead to placement in good jobs with career ladders.

- EVALUATION OF WORKFORCE OUTCOMES: Assess and determine what additional information is required to evaluate workforce outcomes for the Energy Training Centers. At a minimum, the Energy Training Centers should begin to collect information from participants on occupation, prior education, and work experience and demographic characteristics.

- CAREER DEVELOPMENT AND ENVIRONMENTAL INTEGRATION IN K-12 PROGRAMS: Increase the emphasis on career awareness and career exploration in ratepayer-funded education programs serving K-8 students and support career preparation programs in career academies and Regional Occupational Programs. Evaluate and work toward the integration of environmental and ratepayer-funded energy curricula. There is substantial evidence that the integration of environmental and energy curricula will increase the support of teachers for these programs. These efforts should be supported by strong collaborations with K-12 schools, particularly those programs, like the California Partnership Academies, that target disadvantaged students.

- EVALUATION OF K-12 EDUCATION PROGRAMS: Work with education agencies, schools, and funding partners to allow for the collection and reporting of demographic information on students participating in

ratepayer-funded Connections education programs. The present lack of information hampers the evaluation of existing programs.

IV.D. RECOMMENDATIONS FOR FURTHER RESEARCH AND CAPACITY BUILDING

- WORKFORCE OUTCOMES OF ENERGY EFFICIENCY PROGRAMS: Expand funding for research on the implications of energy efficiency and related investments on jobs, job quality, and job access, and on employment and career outcomes for training program graduates. Comparative research that captures the impact of different labor conditions on energy efficiency outcomes should be prioritized. Basic job and workforce information is needed for the state's major clean energy and efficiency investments, including wages, turnover, retention and workforce characteristics.

- SECTOR STRATEGIES RESEARCH AND TECHNICAL ASSISTANCE: Provide funding to support research on, and technical assistance and capacity building for, existing and emerging sector strategies in the energy efficiency sectors. These funds should be used to disseminate best practices of CALCTP and other successful sector initiatives to new initiatives, and to provide technical assistance to these initiatives.

- FUTURE WE&T NEEDS ASSESSMENTS: Future studies in targeted sectors are needed to assess the specific skill requirements and effectiveness of training programs. These needs assessments, including the one programmed for HVAC, should not be limited to skill gaps analyses but should include analyses of key labor conditions such as wages, career ladders, turnover and retention rates, and employer investments in training and retention. Needs assessments should include an employer survey of the various segments of the targeted sector in order to gather this information. This approach is critical to assess the higher quality segments of the industry, determine skill standards and certifications when necessary, and ensure that training investments help support the higher quality segments of each market.

- NATIONAL CENTER FOR THE CLEAN ENERGY WORKFORCE: Support the California Energy Commission's proposal to create a National Center for the Clean Energy Workforce. The mandate of the proposed center is to help California grow a clean energy economy by promoting high-road economic and workforce development. The proposed center would work toward these ends by supporting research, providing technical assistance, and serving as an information clearinghouse and communications hub. In these ways, the center would help the state achieve energy savings while improving the lives of California workers.

The Donald Vial Center carries out research on the emerging green economy and climate change policy in California, as these relate to the labor market, to workforce development, and to workforce policy.

The Center for Labor Research and Education (Labor Center) is a public service project that links academic resources with working people.

Both the Labor Center and Donald Vial Center are projects of the UC Berkeley Institute for Research on Labor and Employment

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Research Into Action, Inc., is a social marketing and evaluation research firm. They specialize in evaluation research and market assessment design and analysis services in the fields of energy efficiency, renewable energy, and natural resource management.

The Centers of Excellence is an initiative of the California Community Colleges Economic and Workforce Development (EWD) Program that supports the community colleges by providing customized data on high growth, emerging, and economically critical industries and occupations and their related workforce needs.

Public/Private Ventures (P/PV) is a national consulting non-profit organization dedicated to creating and strengthening programs that improve lives in low income communities.

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INSTITUTE FOR RESEARCH ON LABOR AND EMPLOYMENT
2521 Channing Way #5555
Berkeley, CA 94720-5555
Phone: (510) 643-7068
Fax: (510) 643-1694

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