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PART I

PART 2

APPENDIX A:

METHODOLOGY FOR DEVELOPING EXPENDITURE ALLOCATIONS BY SECTOR

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I. INTRODUCTION

This document explains three key steps in the methodology used to project the number of jobs created in California by state and federal policies for energy efficiency, demand response, and distributed generation (hereafter "energy efficiency and related"). Green jobs forecasts have often used a micro or macro approach, using either surveys to forecast job creation or aggregated macro models to estimate policy driven demand and jobs. Our approach is unique in that it combines both micro and macro approaches. This allows us to take into consideration policy driven demand while not losing important detail on changes in specific green sub-sectors and occupations. This document explains our expenditure approach to model policy driven demand in California in the energy efficiency and demand-side management sectors by 2020.

The scope of this report addresses energy efficiency and demand-side management for those sectors addressed in the California Energy Efficiency Strategic Plan (EE Strategic Plan).[1] Demand-side management includes demand response as well as distributed generation with the exception of combined heat and power. Sectors addressed are consistent with energy-using sectors addressed in the EE Strategic Plan (i.e., residential, commercial, industrial, agricultural, and municipal pumping sectors). In addition to combined heat and power, sectors specifically excluded include transportation, distribution and transmission (e.g., electric transmission system, pipelines) and utility-scale generation. Table A.1 shows the policies examined by sector. The geographical scope is for California and the time horizon is 2020.

Comprehensive lists of policies and programs are identified in each of the subsections. For energy efficiency, these policies include customer information, customer incentives, upstream incentives for manufacturers and suppliers, and building codes and standards for appliances and equipment. For distributed generation, similar policies are considered as well as targeted rates to encourage solar installations in residential and commercial establishments. For demand response, policies include dynamic rates (e.g., rates that are tied to prices or load conditions), direct load control, and incentives for permanent load. These programs and rates are administered by federal, state, regional and local governments, and investor-owned and publicly owned utilities.

The study's assumptions about policy-driven investments had to be finalized by June 2010 in order to conduct the rest of the analysis, so any changes after June 2010 are not reflected in the estimates. Updating the investment numbers could be expected to change the specific expenditures in the short term (e.g., 2010). However, the overall conclusions would not be modified unless the reductions (or increases) in expenditures were known to be much different than projected for 2015 and 2020. Updating the detailed budget allocations would be unlikely to influence the specific occupations identified in Chapter 3. Only an extremely large increase in investment (e.g.,

[1] 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

more than doubling it) would alter the Chapter 3 findings that the labor supply in energy efficiency and related jobs greatly outnumbers the demand created by policy-driven investment. However, updating or reviewing this analysis would be warranted when there is a significant change in policies.

Table A.1 Study Sectors and Policies

Policy Area / Sector	Residential	Commercial	Industrial	Agricultural	Public
Federal Programs					
Retrofits	X	X	X		X
Low-income Weatherization	X				
Appliances and Equipment	X	X	X		X
Energy Efficiency and Renewable Energy Programs	X	X	X		X
ARRA programs	X	X	X		X
Utility Energy Efficiency Programs					
IOUs EE Portfolio	X	X	X	X	
Water-Energy Nexus	X	X	X	X	X
Low-Income Programs (LIEE)	X				
POUs EE Portfolio	X	X	X	X	
Codes And Standards + CPUC Big Bold Energy Efficiency Strategies + Pace					
Title 24	X	X			
Big Bold Energy Efficiency Strategies	X	X			
PACE programs	X	X			
Distributed Generation					
California Solar Initiative	X	X	X	X	X
New Solar Homes Partnership	X				
POU Solar Programs	X	X	X	X	X
Other Renewable (SGIP and ERP)		X			
Demand Response And Smart Meters					
Pricing and Direct Load Control	X	X	X	X	X
Demand Response Device Rebates	X	X	X	X	X
Smart Meters	X	X	X	X	X

The development of job projections for the WE&T Needs Assessment is part of an effort to understand the potential demand for workers, including both the number of workers as well as the level of education and skills of these workers, to achieve California's economic energy efficiency and demand-side management potential. The methodology described below was selected based on a review of alternative approaches. The approach selected ties job projections directly to policy initiatives and provides a path for developing job projections for alternative views (or scenarios) of future developments. The approach uses information on specific expenditures on energy efficiency and demand-side management resulting both from specific programs as well as from codes and standards.

The methodology used to develop job projections by industry includes four steps: (1) the identification of state and federal policies designed to promote energy efficiency and demand-side management for three scenarios, (2) the estimation of current or near-term expenditures as well as expenditures through 2020 (including those funded through taxes or funds collected from utility ratepayers as well as those funded by individual customers either in response to direct federal, state, and utility funding or to changes in codes and standards), (3) the allocation of these expenditures by detailed industry categories, and (4) the use of a macro-economic model to develop total

job projections by specific industry sectors using as input the additional expenditures allocated by industry developed as part of the step (3). The projections of direct jobs by industry are used to develop detailed projections by occupation, which are then matched to the projections of future labor supply.

The Environmental Dynamic Revenue Analysis Model (EDRAM) is the macroeconomic model used in Step 4. Developed by Professor Peter Berck of the University of California - Berkeley in collaboration with the California Department of Finance and the Air Resources Board (for more information, see Appendix A), [2] the model has been used recently to project the job creation effects of the AB 32 policy measures, including job creation due to "naturally occurring" energy savings. These policy measures include a number of energy efficiency and distributed generation policies. As a consequence, the incorporation of expenditures association with additional energy efficiency and demand-side policy measures requires careful attention.

Consistent with the scope of the report, expenditures are developed for programs and policies associated with energy efficiency and demand-side management, including demand response, smart meters, and distributed generation. The scope of our analysis includes energy efficiency programs run by investor-owned and publicly-owned utilities, state and federal codes and standards, low-income weatherization programs, federal energy efficiency programs, and the CPUC's "big, bold" energy efficiency strategies. We also included demand response programs, smart meters, and distributed generation programs. These programs include federal, state, local government, and utility programs. Our results are presented by year from 2010 through 2020, using 2010 as the baseline year.

The purpose of this document is to explain steps 1-3. A separate memo will address how the expenditures for these specific programs allocated by industrial sector are incorporated in the EDRAM model.

We followed a three-step process to develop job estimates associated with these policies. First, we estimated the public and private investments, by sector, associated with implementing the state and federal policies that contribute to the goals in the *Strategic Plan*. Next, we assigned the costs of these investments to economic sectors, using 4- and 5-digit North American Industry Classification System (NAICS) codes. NAICS uses a hierarchical coding system that allows for the classification of all economic activity into specific industry sectors. Assignment to detailed NAICS codes is a necessary step in order to link jobs projections to occupations, and ultimately, education and training programs. We assigned investments to NAICS based upon empirical research on similar investments in the past, using ten different methods tailored to information available for the specific public and private investments. Finally, we developed detailed indirect and induced job estimates using the E-DRAM macroeconomic model.

This methodology was designed to be as transparent as possible. The only part of this methodology that is not completely transparent is the E-DRAM model, which is a complex computable general equilibrium model. E-DRAM documentation is available but the model code is proprietary; access to this code was not acquired as part of the project. The remaining components of the analysis are available for review and are created in such a way that policy scenarios can be modified. The dollar amounts assigned to each policy – and the distribution of the dollars across NAICS codes – can readily be changed via a spreadsheet that lays out all the policies as well as the ten allocation methods.

Since the effects of these goals and policies will depend, in part, on funding and implementation decisions to be made in the future, we developed three policy scenarios that describe various levels of penetration for these

[2] For more information about E-DRAM, see California Air Resources Board, Economic Evaluation Supplement Climate Change Draft Scoping Plan Pursuant to AB 32 The California Global Warming Solutions Act of 2006, Appendix II Environmental Dynamic Revenue Assessment Model's Sources And Methods, December 2008, available at http://www.arb.ca.gov/cc/scopingplan/document/economic_appendix2.pdf

policies. A summary of policy scenarios is presented in Table A2 below. More detail on why we chose these scenarios is explained for each policy level in the following sections of this document.

Table A.2 Summary of Policy Scenarios

Low Scenario
Federal EE & Renewable Energy
75% of ARRA money is spent (2010-2012)
DOE Energy Efficiency and Renewable Energy Program (EERE) annual budgets continue constant until 2020 (no increase) HomeStar is not passed
Utility Programs (IOU and POU)
Follows low scenario in CEC Incremental Impacts of Energy Policy Initiatives report (2009) LIEE will continue at 25% of the objective for each three-year cycle (2012-14, 2015-17, 2018-20)
Codes and Standards & BBEES
10% increase from 2008 Title 24 in 2014 BBEES: 5-20% of units by 2011, 10-30% of units by 2015, 25-60% of units by 2020
Distributed Generation
CSI funds continue until 2016 (as currently budgeted)
SGIP funds continue until 2015 (as currently budgeted)
ERP funds continue until 2011 (as currently budgeted)
Demand Response and Smart Meters
Annual demand response program funding continues indefinitely at 1/3 of 2009-11 approved level for IOUs and at 2012 level for POUs IOUs funds for smart meters continues until 2015 (as currently authorized) POUs funds for smart meters continues until 2013
Medium Scenario
Federal EE & Renewable Energy
100% of ARRA money is spent (2010-2012)
DOE Energy Efficiency and Renewable Energy Program (EERE) annual budgets increase according to congressional budget expectations
HomeStar is passed (50% of the initially announced $6 billion)
Utility Programs (IOU and POU)
Follows medium scenario in CEC Incremental Impacts of Energy Policy Initiatives report (2009) LIEE will continue at 25% of the objective for each three-year cycle (2012-14, 2015-17, 2018-20)
Codes and Standards & BBEES
10% increase from 2008 Title 24 in 2014
Additional 10% increase from 2008 Title 24 in 2017 BBEES: 8-30% of units by 2011, 25-60% of units by 2015, 55-80% of units by 2020
Distributed Generation
CSI funds continue until 2016 and then they stay flat until 2020
SGIP funds continue until 2015 and then they stay flat until 2020
ERP funds continue until 2015 and then they stay flat until 2020
Demand Response and Smart Meters
Price-responsive DR program funding increases by 11% per year through 2017, relative to a baseline of 1/3 of the 2009-11 approved level, then remains constant IOUs funds for smart meters continues until 2015 (as currently authorized) POUs funds for smart meters continues until 2013 (smart grid federal grants of LADWP and SMUD are scheduled to end in 2013)

Table A.2 (continued) Summary of Policy Scenarios

High Scenario
Federal EE & Renewable Energy
100% of ARRA money is spent (2010-2012) and an extra 25% is spent/rolled over to the 2013-2015 period
DOE Energy Efficiency and Renewable Energy Program (EERE) annual budgets increase according to congressional budget expectations
HomeStar is passed (100% of the initially announced $6 billion)
Utility Programs (IOU and POU)
Follows high scenario in CEC *Incremental Impacts of Energy Policy Initiatives* report (2009) LIEE will continue at 25% of the objective for each three-year cycle (2012-14, 2015-17, 2018-20)
Codes and Standards & BBEES
Distributed Generation
SGIP funds continue until 2015 and then they stay flat until 2020
ERP funds continue until 2015 and then they stay flat until 2020
Demand Response and Smart Meters
Price-responsive DR program funding increases by 11% per year through 2017, relative to a baseline of 1/3 of the 2009-11 approved level, then they increase 5% through 2020
IOUs funds for smart meters continues until 2015 (as currently authorized) POUs funds for smart meters continues until 2013 (smart grid federal grants of LADWP and SMUD are scheduled to end in 2013)

II. FEDERAL PROGRAMS

II.A. PROGRAM DESCRIPTIONS AND BUDGET DATA BY SECTOR

Federal spending in energy efficiency and renewable energy in California comes mainly from the Department of Energy (DOE) and the American Recovery and Reinvestment Act of 2009 (ARRA).[3] On March 2, 2010, President Obama proposed a $6 billion HOME STAR program to fund energy-efficient retrofits of US homes. As proposed, HOME STAR would provide families with up to $3,000 per home for investments in energy saving home improvements. HOME STAR alone could bring about $700 million to the EE sector in California in the coming years. Because it remains a proposal, HOME STAR investments have only been included in our medium and high scenarios.

II.A.1. DOE'S ENERGY EFFICIENCY AND RENEWABLE ENERGY (EERE) PROGRAM

3 In addition, there are several distributed generation and energy efficiency tax credit programs at the federal level. We did not include these because of the lack of data on take-up rates. However, because we included participant costs for such programs, these expenditures are included in the model, as are the direct and indirect jobs created by them. Since the source of the funding is thus reported as from local consumers, rather than the federal government, it reduces the amount of money available for consumption of other goods and services. As a result, the EDRAM model likely underreports induced jobs related to these expenditures. This does not affect the Needs Assessment findings, which focus on direct jobs.

DOE funds for energy efficiency and renewable energy are mostly channeled through the Energy Efficiency and Renewable Energy (EERE) program. We calculated DOE energy efficiency and renewable energy spending in California from DOE's Fiscal Year 2011 Budget Request to Congress by state.[4] The results are shown in Table A.3 below. The EERE Program FY 2011 request includes $67.7 million dollars for California. The EERE Program, however, includes various projects and programs that are not necessarily within the scope of our project (e.g., vehicle technologies or biomass). Only the following EERE programs were included in our calculations:

- BUILDING TECHNOLOGIES PROGRAM: The BTP funds research and technology development to reduce commercial and residential building energy use.

- INDUSTRIAL TECHNOLOGIES PROGRAM: The ITP seeks to reduce energy intensity and carbon emissions by changing the way industry uses energy. ITP sponsors cost-shared research and design and supports advanced technologies and energy management best practices.

- FEDERAL ENERGY MANAGEMENT PROGRAM: The FEMP facilitates the Federal Government's implementation of sound, cost-effective energy management and investment practices in federal buildings to enhance the nation's energy security and environmental stewardship. FEMP guides federal agencies to use funding more effectively in meeting Federal and agency-specific energy management objectives.

- WEATHERIZATION ASSISTANCE PROGRAM: The WAP enables low-income families to reduce their energy bills by making their homes more energy efficient. Eligible residents must have incomes at or below 200% of the 2009 Federal Poverty Income Guidelines and Definition of Income.

- STATE ENERGY PROGRAM: The SEP provides grants to states and directs funding to state energy offices from technology programs in DOE's Office of Energy Efficiency and Renewable Energy. States use grants to address their energy priorities and program funding to adopt emerging renewable energy and energy efficiency technologies. SEP is intended to promote both EE and renewable energies.

- OTHER WEATHERIZATION AND INTERGOVERNMENTAL PROGRAMS: The WIP programs are comprised mostly of the Weatherization Assistance Program (WAP) and SEP. There are some other sub-programs such as the International Renewable Energy Program and the Tribal Energy Activities that relate to energy efficiency.

4 U.S. Department of Energy, Fiscal Year 2011 Request to the Congress, February 2010, available at http://www.energy.gov/about/budget.htm

Table A.3 DOE Energy Efficiency and Renewable Energy Program in California ($ millions)

	2009	2010	2011 (requested)	2011 (% of EERE)
Building Technologies	11.9	20.0	15.7	23.2%
Industrial Technologies	1.6	2.4	2.4	3.5%
Federal Energy Management Program	2.2	3.6	3.8	5.6%
Weatherization and Intergovernmental Program				
* Weatherization + Weatherization Assistance Program (WAP)	14.2	4.9	7.6	11.2%
* State Energy Program	2.0	2.1	3.2	4.7%
Total Selected EERE Programs	31.6	33.0	32.7	48.3%
Total EERE Budget	58.0	61.6	67.7	100.0%

Source: Author's calculations based on U.S. DOE FY2011 DOE Budget Request to the Congress by State, available at http://www.energy.gov/about/budget.htm

DOE WAP funds in California are leveraged by other funds such as the Low-Income Home Energy Assistance Program (LIHEAP). Our analysis also includes LIHEAP funds used to match DOE WAP. LIHEAP funds in California are managed by the California Department of Community Services and Development (CSD). According to the 2008 National Association for State Community Services Programs (NASCSP) Survey,[5] the total amount of funds in California going to weatherization assistance in that year was $32,830,668 (for 20,259 weatherized units). In our model, these funds (DOE WAP budgets + LIHEAP) are labeled as Non-ARRA WAP, because they are renewed every year as a general rule. We created a separate line for ARRA WAP funds because these funds have been authorized for three years and are not expected to be renewed.

By sector, we estimated the following percentages after examining the programs in detail as described in the Department of Energy budget:[6]

Table A.4 Share of DOE Energy Efficiency and Renewable Energy Program by Target Sector

DOE EERE Program	Residential	Commercial	Industrial	Agricultural	Public
Solar Technologies					100%
Wind Technologies					100%
Building Technologies	50%	50%			
Industrial Technologies			100%		
Federal Energy Management Program					100%
Weatherization Assistance	100%				
State Energy Program					100%

[5] National Association for State Community Services Programs (NASCSP), 2008 Weatherization Survey, available at http://www.nascsp.org/Weatherization-Publications/663/WAP-Annual-Funding-Surveys.aspx?iHt=33

[6] U.S. Department of Energy, Energy Efficiency and Renewable Energy, *FY 2010 Budget in Brief* (February 2009), available at http://www1.eere.energy.gov/ba/pba/budget_10.html. This document describes each EERE program in detail.

II.A.2. ARRA STIMULUS FUNDS

The American Recovery and Reinvestment Act is a $787 billion economic stimulus package approved in February 2009. The Act includes a combination of federal tax cuts, expansion of social welfare provisions and an increase in public spending in education, health care, infrastructure and the energy sector. Energy efficiency and renewable energy programs have received generous ARRA funding in an effort to decrease U.S. dependence on foreign fossil fuels, fight climate change and create green jobs in the construction and energy sectors.

Nationwide, DOE was allocated $32.7 billion in ARRA funds for existing and newly created programs, of which $16.7 billion was for Energy Efficiency, Renewable Energy and Transportation Electrification.[7] Some of the largest DOE ARRA programs are being managed at the state level, including the $186 million Weatherization Assistance Program (WAP). The California Energy Commission (CEC) received $314.5 million from ARRA to fund energy efficiency and renewable energy programs.[8] The CEC administers four ARRA programs:

- STATE ENERGY PROGRAM: California received $226 million in federal ARRA funding for the State Energy Program (SEP). (This was in addition to the regular SEP funding.) California's SEP is focused on increasing energy efficiency to reduce energy costs and consumption, cut reliance on imported energy, and reducing energy impacts on the environment. The CEC has allocated SEP funds in these areas:

  → Energy Efficiency Building Retrofit & Municipal Financing Program ($110 million)

  Funding opportunities released for three areas: Residential Building Retrofit, Municipal & Commercial Building Retrofit Program and Municipal Financing District Program. If legal barriers are overcome, part of these funds may be used for Property Assessment Clean Energy (PACE)-style financing initiatives (i.e., the program modeled after the Berkeley FIRST program)[9]

  → Department of General Services ($25 million)

  Energy Efficient State Property Revolving Loan Program: The total amount was awarded to DGS through an interagency agreement to retrofit state buildings

  → Energy Conservation Assistance Act 1% Low-Interest Loans Program ($25 million)

  1% Low-Interest Loans for energy conservation: As of March 17, 2010, more than $21.5 million has been approved.

  → Clean Energy Business Financing Program ($30.6 million)

  Low-interest loans to private companies in the clean energy sector

  → Green Jobs Workforce Training Program ($20 million)

[7] U.S. Department of Energy, Recovery and Reinvestment Funding Breakdown, available at http://www.energy.gov/recovery/index.htm

[8] California Energy Commission, California Economic Recovery Energy-Related Programs, available at http://www.energy.ca.gov/recovery/

[9] A PACE (Property Assessment Clean Energy) bond provides financing for energy retrofits (efficiency measures and small renewable energy systems) authorized by commercial and residential property owners who repay their loans over 20 years through higher property taxes via the annual assessment on their property tax bill. PACE bonds can be issued by municipal financing districts or finance companies and the proceeds can be typically used to retrofit both commercial and residential properties. More information: http://www.pacenow.org/ The Berkeley Financing Initiative for Renewable and Solar Technology (FIRST) program recently completed a pilot program to provide financing for residential solar photovoltaic electric systems. More information: http://www.ci.berkeley.ca.us/ContentDisplay.aspx?id=26580.

Green Jobs Workforce Training Program: EDD and ETP have already awarded $26.7 million in grants to 34 regional partnerships, 27 of which received $14.5 million in ARRA funds

→ Program Support & Contracts ($15.4 million)

Auditing, measurement, and evaluation or ARRA contracts and programs

- THE ENERGY EFFICIENCY CONSERVATION BLOCK GRANT PROGRAM (EECBGP), funded for the first time under ARRA, provides funds to units of local and state government, Indian tribes, and territories to develop and implement projects to improve energy efficiency and reduce energy use and fossil fuel emissions in their communities. ARRA will allow innovative communities to demonstrate a variety of sustainable business models that can be replicated across the country. This "Retrofit Ramp-Up" program will pioneer innovative models, including PACE loans, for rolling out energy efficiency to hundreds of thousands of homes and businesses in a variety of communities. The EECBGP is administered by the Office of Weatherization and Intergovernmental Programs (WIP) in the Office of Energy Efficiency and Renewable Energy (EERE) of the U.S. Department of Energy.

- THE ENERGY EFFICIENT APPLIANCE REBATE PROGRAM: The California Appliance Rebate program began on April 22, 2010. Three residential appliance categories were selected to be eligible to receive rebates: clothes washers ($100 rebate), refrigerators ($200 rebate), and room/window air conditioners ($50 rebate). These rebates are in addition to existing rebates offered by California's utilities and appliance manufacturers. To qualify, the appliances must be ENERGY STAR-listed, meet Consortium for Energy Efficiency (CEE) tier standards, and be certified to the Energy Commission as meeting all state and federal appliance efficiency standards.[10]

The CEC also received $3.6 million for Energy Assurance Planning, but we did not include this in our analysis since it is mostly related to energy assurance rather than energy efficiency.

According to our calculations, ARRA will invest almost $1.6 billion in energy efficiency and renewable energy projects in California (see Table A.5). We developed this estimate by selecting ARRA programs specifically focused on energy efficiency and renewable energy (EERE). Our estimate is consistent with recent literature and reports in the field.[11] Most of EERE ARRA funding that came to California went through the federal Department of Energy, however, we also identified relevant programs in the Department of General Services Administration, the Department of Defense, the Department of Veterans Affairs and the Department of Housing and Urban Development. Most of these programs are relatively small. For instance, the ARRA HUD Green Retrofit Program for Multifamily provides grants and loans to make energy and green retrofit investments in multifamily housing projects and to ensure the maintenance and preservation of the property.

When we were unable to find ARRA figures by state, we estimated the amount to be allocated to California by multiplying total program funding by the ratio of total ARRA funds awarded to California from February 17 to

[10] For more information, see: http://www.energy.ca.gov/recovery/energystar.html.

[11] * Goldman C., M. Fuller, E. Stuart, J. Peters, M. McRae, N. Albers, S. Lutzenhiser, and M. Spahic (2010). Energy Efficiency Services Sector: Workforce Size and Expectations for Growth. LBNL-3987E. Retrieved from http://eetd.lbl.gov/ea/emp/reports/lbnl-3987e.pdf.

* U.S. Department of Energy Recovery and Reinvestment Funding Breakdown, available at http://www.energy.gov/recovery/

* California Energy Commission - California Economic Recovery Energy-Related Programs, available at http://www.energy.ca.gov/recovery/

* National Association for State Community Services Programs (NASCSP) – 2008 Weatherization Survey, available at http://www.nascsp.org/Weatherization-Publications/663/WAP-Annual-Funding-Surveys.aspx?iHt=33

December 31, 2009, to total ARRA funds awarded during the same time period (as listed in the webpage recovery.org). This percentage is 10.85. To calculate California's share of ARRA funds awarded to the Department of Defense, we multiplied total Department of Defense ARRA funding by 8.7percent. This percentage is based on ARRA data from a March 2010 DoD's report.[12] The percentage is lower than for the rest of departments because DoD has a relatively smaller presence of military buildings in California compared with other states.

By sector, we classified ARRA programs as shown in Tables A.5 and A.6:

Table A.5 Share of ARRA Spending by Target Sector

ARRA Program	Residential	Commercial	Industrial	Agricultural	Public
ARRA WAP	100%				
ARRA HUD Green Retrofit Program for Multifamily Housing	100%				
ARRA Appliance Rebate Program	100%				
ARRA Building Technologies	50%	50%			
ARRA Industrial Technologies			100%		
ARRA State Energy Program	38%	28%			34%
ARRA EECBG					100%
ARRA Federal Buildings (DoD)					100%
ARRA Federal Buildings (GSA)					100%
ARRA Federal Energy Management Program (DOE)					100%
ARRA Dept of Veterans Affairs					100%

* U.S. Department of Housing and Urban Development, Recovery, available at http://portal.hud.gov/portal/page/portal/HUD/recovery (for HUD ARRA funds)

[12] US Department of Defense, "Department of Defense Information Related to the American Recovery and Reinvestment Act of 2009, DoD Expenditure Plans – March 20, 2010 Report, available at http://www.defense.gov/recovery/

Table A.6 Estimated ARRA Budgets for California by Year and Three-Year (2010-12) Total (in $ millions)

ARRA Program	Total Budget ($ Millions)	CA Agency	EERE	CA Share of Federal	EERE in CA per Year	EERE in CA Total
Department Of Energy					303	907
Administered by a State Agency						
California ARRA Weatherization Assistance Program	186	CSD	100%	100%	62	186
California ARRA State Energy Program	226	CEC	100%	100%	75	226
California ARRA EE Appliance Rebate Program	35	CEC	100%	100%	12	35
California ARRA EE and Conservation Block Grant	49	CEC	100%	100%	16	49
Administered by DOE						
California ARRA EE and Conservation Block Grant	351	-	100%	100%	117	351
ARRA Building Technologies	319	-	100%	11%	12	35
ARRA Industrial Technologies	212	-	100%	11%	8	23
ARRA Federal Energy Management Program	22	-	100%	11%	1	2
General Services Administration					149	448
California ARRA Federal Buildings (GSA)	480	-	100%	100%	149	448
Department Of Defense					111	332
ARRA Dept of Defense Buildings	3,690	-	100%	9%	111	332
Department Of Housing And Urban Development					9	27
ARRA Green Retrofit Program for Multifamily Housing	250	-	100%	11%	9	27
Department Of Veterans Affairs					9	27
ARRA Dept of Veterans Affairs Buildings	1,000	-	25%	11%	9	27
TOTAL EERE ARRA FUNDS IN CALIFORNIA					528	1,581

Source: Author's calculations based on:

* Goldman, C. et al. 2010. Energy Efficiency Services Sector: Workforce Size and Expectations for Growth. Ernest Orlando Lawrence Berkeley National Laboratory (For General Services Admin, Department of Defense and Dept of Veterans Affairs national budgets)

* U.S. Department of Energy Recovery and Reinvestment Funding Breakdown, available at http://www.energy.gov/recovery/ (for DOE budgets administered by DOE)

* California Energy Commission - California Economic Recovery Energy-Related Programs, available at http://www.energy.ca.gov/recovery/ (For DOE budgets administered by State Agency)

* U.S. Department of Housing and Urban Development, Recovery, available at http://portal.hud.gov/portal/page/portal/HUD/recovery (for HUD ARRA funds)

For more detail on the sectoral breakdown of the State Energy Program, see our assumptions in Table A.7 below, based on the share of the budget going to different target sector:

Table A.7 Share of State Energy Program by Target Sector

	Budget (million $)	Residential	Commercial	Public
Energy Efficiency Program				
Municipal Financing Program	$30	75%	25%	
Municipal & Commercial Building Targeted Measure Retrofit Program	$30		50%	50%
California Comprehensive Residential Building Retrofit Program	$50	100%		
Department of General Services State Buildings Retrofit	$25			100%
Energy Conservation Assistance Act 1% Low-Interest Loans Program	$25			100%
Clean Energy Business Financing Program	$30.6		100%	
Green Jobs Workforce Training Program	$20	-	-	-
Program Support and Contracts	$15.4	-	-	-
Clean Energy Business Financing Program TOTAL	$226	38%	28%	34%

II.A.3. HOME STAR

President Obama's proposed HOME STAR energy efficiency rebate program, announced on March 2, 2010, would spur demand for insulation, water heaters and energy audits in the residential market. Obama's March 2010 proposal[13], which had yet to pass through Congress in fall 2010 as these assumptions were finalized, would devote $6 billion for residential retrofits in the US. If we apply the same ratio we used to estimate ARRA funds going to California (10.85%), HOME STAR could potentially bring $651 million dollars for residential retrofits to the Golden State.

On March 25, 2010 the Home Star Energy Retrofit Act of 2010 was introduced in the Senate. Regarding funding and timeframe, the introduced bill reads:

> *Subject to subsection (j), there is authorized to be appropriated to carry out this title $6,000,000,000 for the period of each of fiscal years 2010 through 2012 to remain available until expended.* [14]

Although the bill has been already approved by the House on May 6 2010, it is still pending in Congress (as of July 2010).

[13] White House HomeStar Fact Sheet (March 2010), available at http://www.whitehouse.gov/the-press-office/fact-sheet-homestar-energy-efficiency-retrofit-program

[14] Home Star Energy Retrofit Act of 2010, available at http://www.opencongress.org/bill/111-s3177/text

Table A.8 HOME STAR Rebate Levels

HOME STAR Rebate Level	Description
Silver Star	Under the first level of energy rebates, to be called Silver Star, consumers would be eligible for rebates between $1,000 and $1,500 for a variety of home upgrades, including adding insulation, sealing leaky ducts and replacing water heaters, HVAC units, windows, roofing and doors. There would be a maximum rebate of $3,000 per home
Gold Star	Under the second level, or Gold Star, consumers who get home energy audits and then make changes designed to reduce energy costs by at least 20 percent would be eligible for a $3,000 rebate. Additional rebates would be available for savings above 20 percent

Source: White House HomeStar Fact Sheet (March 2010), available at http://www.whitehouse.gov/the-press-office/fact-sheet-homestar-energy-efficiency-retrofit-program

II.B. SCENARIOS FOR FEDERAL POLICIES

We have defined three scenarios for federal policies:

Table A.9 Scenarios for Federal Policies

	Low Scenario	Medium Scenario	High Scenario
DOE Annual Programs	DOE EERE Annual budgets continue constant until 2020	DOE EERE Annual budgets increase according to CBO projections for 2009 to 2020	EERE DOE Annual budgets increase according to CBO projections for 2009 to 2020
ARRA Programs	75% of ARRA money spent during 2010-2012	100% of ARRA money spent during 2010-2012	100% of ARRA money spent during 2010-2012 and 25% extra during 2013-15
HOME STAR	HOME STAR is not passed	HOME STAR is passed HOME STAR is passed: $3 billion	HOME STAR is passed HOME STAR is passed: $6 billion

For DOE budgets, we looked at two possibilities: a) funds continue constant until 2020 (Low Scenario) and b) funds increase annually according to the Congressional Budget Office (CBO) economic projections for 2009 to 2020[15] (Medium and High Scenario).

For ARRA funds we are more conservative as there have been several problems and delays in the spending of funds awarded to states. For instance, SEP and EECBGP funding decisions were subject to extensive public and contracting processes while WAP spending in California has been delayed due to state budget cuts and employee furloughs. As a result, as of February 16 2010, less than 8 percent of ARRA weatherization funds had been drawn by grantees for weatherization work.[16] NASCSP has noted that states were not allowed to use ARRA weatherization funds for actual production purposes until June 2009 because of restrictions that only allowed them

[15] U.S. Congressional Budget Office CBO Economic Projections for 2009 to 2020, available at http://www.cbo.gov/ftpdocs/108xx/doc10871/AppendixE.shtml

[16] U.S. Department of Energy, Office of Inspector General, Office of Audit Services, Progress in Implementing the Department of Energy's Weatherization Assistance Program Under the American Recovery and Reinvestment Act (OAS-RA-10-4), February 2010, page 2, available at www.ig.energy.gov/OAS-RA-10-04.pdf.

to use these funds for training, hiring and equipment purchases.[17] As a result, according to the DOE Office of Audit Services, only 12 units in California were weatherized as of December 2009 with ARRA funds. Because of the delays in the spending of ARRA funding we have included the possibility that not all funds are spent in our Low Scenario and we have spread ARRA spending into the years 2010, 2011 and 2012 as opposed to 2009, 2010 and 2011. In our Medium Scenario, 100 percent of ARRA funds are spent between 2010 and 2012 and our more optimistic High Scenario assumes the possibility that ARRA funds are extended after 2012 until 2015 with a 25 percent extra of available funding.

Finally, we have included three possible scenarios regarding HomeStar: 1) HomeStar is not passed in the Congress (Low Scenario); 2) HomeStar is passed but only with 50 percent of the proposed $6 billion budget (Medium Scenario); and 3) HomeStar is passed with a $6 billion budget (High Scenario).

II.C. ALLOCATING FEDERAL BUDGETS TO NAICS

We used four different methods to translate federal funding analyzed in previous sections into 4-, 5- or 6-digit NAICS codes.

II.C.1. METHOD 1: WEATHERIZATION AND RESIDENTIAL RETROFITS

We used this method for public funds going to weatherization or commercial/residential retrofits. This category includes weatherization assistance (ARRA and non-ARRA funds), HUD's Green Retrofit Program for Multifamily Housing and HomeStar.

Method 1 is based on a New York State Labor Department study (2009) that identified specific NAICS for weatherization and retrofit activities:[18]

Table A.10 NAICS Codes for Weatherization/Residential Retrofits

NAICS	NAICS Index Entry From NYS Study	NAICS Title
23822	Plumbing, Heating, AC Contractors	Plumbing, Heating, and Air-Conditioning Contractors
23831	Insulation Contractors	Drywall and Insulation Contractors
23835	Window and Door Installation	Finish Carpentry Contractors
23829	Boiler and Pipe Insulation Installation	Other Building Equipment Contractors

Source: New York State Department of Labor, *New York State's Clean Energy Industry: Labor Market and Workforce Intelligence*, May 2009, available at http://www.labor.state.ny.us/workforcenypartners/PDFs/NYS Clean Energy Jobs Report FINAL 05-27-09.pdf

This list corresponds to the list of specialty trades contractors allowed under the CEC's Comprehensive Building Retrofit Program. We added Electrical Contractors as electricians are often needed to install home appliances

[17] National Association for State Community Services Programs, "NASCSP Response to Department of Energy Office of Inspector General Special Report on Weatherization and the American Recovery and Reinvestment Act," February 25, 2010, available at http://www.nascsp.org/Weatherization-News.aspx?id=23

[18] New York State Department of Labor, New York State's Clean Energy Industry: Labor Market and Workforce Intelligence, May 2009, available at http://www.labor.state.ny.us/workforcenypartners/PDFs/NYS%20Clean%20Energy%20Jobs%20Report%20FINAL%2006-09-09.pdf (page 56)

and/or AC units. We then estimated that funds would be distributed among NAICS sectors in the same proportions as in the most recent quarter (Quarter 2, 2009), as reported by the US Department of Labor's Quarterly Census of Employment and Wages (CEW) for total quarterly wages.[19]

Table A.11 Method 1: Allocation Shares by NAICS code for Weatherization and Retrofits

NAICS	NAICS Index Entry From NYS Study	NAICS Title	Total Quarterly Wages (2009)	Allocation Share
23822	Plumbing, Heating, AC Contractors	Plumbing, Heating, and Air-Conditioning Contractors	1,044,235,839	36%
23831	Insulation Contractors	Drywall and Insulation Contractors	485,433,898	17%
23835	Window and Door Installation	Finish Carpentry Contractors	137,651,817	5%
23829	Boiler and Pipe Insulation Installation	Other Building Equipment Contractors	146,529,074	5%
23821	Electrical Contractors*	Electrical Contractors*	1,099,935,094	38%
Total			2,913,785,722	100%

Source: Author's calculations based on 2009 NYS Labor Department study and DOL's Quarterly Census of Employment and Wages (CEW) data

II.C.2. METHOD 2: DEPARTMENT OF ENERGY (DOE) EERE FUNDS

We used Method 2 for DOE programs (including ARRA money going to new or existing DOE programs). Method 2 is based on public data for February 17 – December 31, 2009, provided by the Federal Government on ARRA recipient data.[20] This master database provides extensive information on funds awarded under ARRA. We selected funds distributed by the Department of Energy (Agency Code 8900) and, specifically, those with the TAS (Agency Treasury Account Symbol) number 89-0331, which corresponds to the Energy Efficiency and Renewable Energy Program (EERE). We limited the search to California by selecting only "CA" in the state recipient category.

One of the reporting requirements for ARRA recipients is to provide an "activity code", which can be entered as a 6-digit NAICS code or a NTEE-NPC number. We selected California recipients under the TAS 89-0331 that gave a 6-digit NAICS code. This was done to get a sample of distribution by NAICS code. We also used some selectors in order to limit our sample to energy efficiency and distributed generation funds while excluding electric vehicles and other sectors beyond the scope of this project.[21] We found a sample size of 138 ARRA recipients that followed our criteria. The top reported NAICS codes were the following:

[19] U.S. Department of Labor, Bureau of Labor Statistics, "Quarterly Census of Employment and Wages," available at http://www.bls.gov/cew/home.htm.

[20] US Recovery Accountability and Transparency Board, "Recovery.gov Download Center: Recipient Reported Data" (web site), http://www.recovery.gov/FAQ/Pages/DownLoadCenter.aspx

[21] The following selectors were used to eliminate programs creating jobs outside our EERE scope : IIf([State Recipient CA]![award_description] Like "*fuel*" Or [State Recipient CA]![award_description] Like "*hydrogen*" Or [State Recipient CA]![award_description] Like "*fuel*" Or [State

Table A.12 Allocation Shares by NAICS code for DOE programs

NAICS	NAICS Title	Sum of Award Amount ($)	Allocation Share
541330	Engineering Services	57,026,400	38.7%
926130	Regulation and Administration of Communications, Electric, Gas, and Other Utilities	14,826,299	10.1%
238220	Plumbing, Heating, and Air-Conditioning Contractors	11,347,600	7.7%
541712	Research and Development in the Physical, Engineering, and Life Sciences (except Biotechnology)	10,356,944	7.0%
238210	Electrical Contractors	10,257,600	7.0%
921110	Executive Offices	7,914,900	5.4%
221119	Other Electric Power Generation	6,816,500	4.6%
561210	Facilities Support Services	3,684,800	2.5%
921190	Other General Government Support	3,241,100	2.2%
926110	Administration of General Economic Programs	2,951,200	2.0%
221122	Electric Power Distribution	2,458,511	1.7%
541620	Environmental Consulting Services	2,115,600	1.4%
541611	Administrative Management and General Management Consulting Services	1,738,600	1.2%
236220	Commercial and Institutional Building Construction	1,597,700	1.1%
238990	All Other Specialty Trade Contractors	1,168,800	0.8%
921140	Executive and Legislative Offices, Combined	1,155,100	0.8%
237130	Power and Communication Line and Related Structures Construction	1,031,200	0.7%
Multiple	Other	7,835,325	5.3%
TOTAL (Sample)		147,524,179	100%

Source: Author's calculations based on U.S. Recovery Accountability and Transparency Board, "Recovery.gov

II.C.3. METHOD 2B: ARRA ENERGY EFFICIENCY APPLIANCE REBATE PROGRAM

We used this method for ARRA funds allocated to the Energy Efficiency Appliance Rebate Program in California. Three residential appliance categories are eligible under the California Appliance Rebate program that began on April 22, 2010: clothes washers ($100 rebate), refrigerators ($200 rebate), and room/window air conditioners ($50 rebate). [22] Because these rebates are in addition to existing rebates offered by California's utilities or appliance manufacturers, we are not including participant costs here (they are included under the CPUC appliance program in the next section of this report).

Recipient CA]![award_description] Like "*vehicle*" Or [State Recipient CA]![award_description] Like "*vehicle*" Or [State Recipient CA]![award_description] Like "*weatherization*",1,0)

[22] For more information, see: http://www.energy.ca.gov/recovery/energystar.html.

We assigned 10 percent of the budget to administration and marketing NAICS and the rest to the NAICS category 3352 ("Household Appliance Manufacturing"). For the administration and marketing NAICS we selected the ones identified in the section 3.3.1 of this document, which specifically refer to energy efficiency appliance rebate program. Those are NAICS 551114 ("Corporate, Subsidiary, and Regional Managing Offices"), to capture those workers engaged in managing programs, NAICS 5611 "Office Administrative Services", to reflect the concentration of paper-work related activities involved in administering rebate programs, and NAICS 5418 ("Advertising and Related Services") for marketing and outreach activities.

Table A.13 Allocation Shares by NAICS code for ARRA Energy Efficiency Appliance Rebate Program

NAICS	NAICS Title	Allocation Share
5611	Office Administrative Services	3.3%
551114	Corporate and Regional Managing Offices	3.3%
5418	Advertising and Related Services	3.3%
3352	Household Appliance Manufacturing	90%
	TOTAL	100%

II.C.4. METHOD 3: FEDERAL/STATE/LOCAL BUILDINGS RETROFIT

We used Method 3 for ARRA funds allocated to energy efficiency and renewable energy projects in non-defense public buildings (federal, state or local). This includes the GSA Department Federal Buildings Program, the DOE Federal Energy Management Program and the Department of Veterans Affairs EE Building program.

We used the ARRA database provided by the Federal Government as in Method 2 but, in this case, we selected the TAS number 47-4543 (GSA-General Services Administration-Federal Buildings Fund, Recovery Act), a GSA Dept ARRA program devoted specifically to energy efficiency projects in federal buildings. We did not need to include/exclude keywords in this case because all ARRA funds under this TAS are devoted to energy efficiency improvements. We found a total of 41 entries that reported the following NAICS codes:

Table A.14 Allocation Shares by NAICS codes for ARRA programs

NAICS	NAICS Title	Sum of Award Amount ($)	Allocation Share Sum of Award / Sum of Total Awards
236220	Commercial and Institutional Building Construction	50,311,869	61.8%
541310	Architectural Services	27,775,257	34.1%
333414	Heating Equipment (except Warm Air Furnaces) Manufacturing	1,800,000	2.2%
238210	Electrical Contractors	584,615	0.7%
541330	Engineering Services	299,665	0.4%
541620	Environmental Consulting Services	212,201	0.3%
541611	Administrative Management and General Management Consulting Services	186,585	0.2%
221112	Fossil Fuel Electric Power Generation	98,560	0.1%
541350	Building Inspection Services	61,488	0.1%
238220	Plumbing, Heating, and Air-Conditioning Contractors	55,412	0.1%
541370	Surveying and Mapping (except Geophysical) Services	34,952	0.0%
531390	Other Activities Related to Real Estate	25,185	0.0%
611430	Professional and Management Development Training	6,000	0.0%
531320	Offices of Real Estate Appraisers	4,000	0.0%
TOTAL (Sample)		81,455,789	100%

We assumed that ARRA funds for public sector building retrofit would be distributed among NAICS sectors in these proportions.

II.C.5. METHOD 4: DEPARTMENT OF DEFENSE (DOD) BUILDINGS RETROFIT

We used method 4 for ARRA funds allocated to the Department of Defense for energy efficiency and renewable energy measures in their buildings. We selected the corresponding TAS numbers (Operation and Maintenance) specific to DoD and introduced selectors to capture EE and renewable energy projects.[23]

We obtained 59 entries in California with the following allocation shares by 6-digit NAICS:

[23] SELECTOR: IIf([State Recipient CA]!award_description Like "*Energy*" Or [State Recipient CA]!award_description Like "*efficiency*" Or [State Recipient CA]!award_description Like "*efficient*" Or [State Recipient CA]!award_description Like "*retrofit*" Or [State Recipient CA]!award_description Like "*HVAC*" Or [State Recipient CA]!project_description Like "*Energy*" Or [State Recipient CA]!project_description Like "*efficiency*" Or [State Recipient CA]!project_description Like "*efficient*" Or [State Recipient CA]!project_description Like "*retrofit*" Or [State Recipient CA]!project_description Like "*HVAC*" Or [State Recipient CA]!project_description Like "*solar*" Or [State Recipient CA]!project_description Like "*photovoltaic*" Or [State Recipient CA]!project_description Like "*wind*" ,1,0)

Table A.15 Allocation Shares by NAICS Code for DOD Programs

NAICS	NAICS Title	Sum of Award Amount ($)	Allocation Share Sum of Award / Sum of Total Awards
236220	Commercial and Institutional Building Construction	41,809,209	52.0%
236210	Industrial Building Construction	12,360,878	15.4%
238160	Roofing Contractors	6,804,795	8.5%
221122	Electric Power Distribution	6,551,783	8.1%
238220	Plumbing, Heating, and Air-Conditioning Contractors	5,319,586	6.6%
238210	Electrical Contractors	3,519,091	4.4%
237990	Other Heavy and Civil Engineering Construction	1,314,722	1.6%
238990	All Other Specialty Trade Contractors	1,031,799	1.3%
541330	Engineering Services	1,013,703	1.3%
237110	Water and Sewer Line and Related Structures Construction	460,654	0.6%
238130	Framing Contractors	205,664	0.3%
TOTAL (Sample)		80,391,885	100%

Source: Author's calculations based on U.S. Recovery Accountability and Transparency Board, "Recovery.gov Download Center: Recipient Reported Data" (web site), http://www.recovery.gov/FAQ/Pages/DownLoadCenter.aspx

This allocation was applied directly to DOD building retrofit budgets.

III. UTILITY ENERGY EFFICIENCY PROGRAMS

III.A. PROGRAM DESCRIPTIONS AND BUDGET DATA BY SECTOR

This section describes the energy efficiency programs offered by the state's investor owned utilities (IOUs) and the publically owned utilities (POUs). These include the main three year funding cycle for the Portfolio of Programs, as well as the Low-Income Energy Efficiency (LIEE) programs. As described below in more detail, we obtained a substantial amount of detailed data on the IOU programs due to the fact that the CPUC mandates that each IOU present detailed measure-by-measure proposals at the beginning of each funding cycle. Alternatively, as the POU programs contain relatively sparse programmatic detail, we generally extend the modeling methodology developed for the IOU energy efficiency programs to the POUs.

III.A.1. INVESTOR-OWNED UTILITY (IOU) PORTFOLIO OF PROGRAMS

The largest investment in energy efficiency programs from within the State of California is the Portfolio of Programs (PoP) run by California's four major investor owned utilities (IOUs). The CPUC approves the set of IOU EE programs funded by ratepayers on a three year funding cycle. Each IOU's PoP includes a wide variety of programs and partnerships that cover the primary sectors of utility demand (residential, commercial, industrial, agricultural). Each IOU runs and manages between 10 and 50 individual programs targeted to a specific energy efficiency goal and target sector. Examples include appliance rebate programs, HVAC equipment subsidies, energy audits, and the direct installation of energy efficient appliances and materials (e.g., insulation). Given the wide

variety of programs and the various end-uses stimulated by the programs, we chose to examine each IOUs summary application for the 2010-2012 funding cycle. The total for this cycle comes to $3.1 billion in rate payer dollars, with projected energy savings of 6,965 GWh during the program cycle.[24]

To evaluate the impact of IOU programs on the California labor market, we analyzed a critical quantitative component of each IOUs application called the E3 Calculator, which is a Microsoft Excel based tool that is consistent across all IOUs.[25] The E3 Calculator is a document that each IOU must file with the CPUC that contains detailed budget information allocated to specific measures, which in turn are used to estimate the amount of energy saved per unit of outcome (e.g., per appliance in an appliance rebate program). Each measure is described in a highly detailed manner, but each measure is connected with a corresponding economic or product 'end-use' which we use to link to standard industry classifications (NAICS). The detailed description of our methodology for allocating program measures to NAICS codes is contained in section 3.3.1 below.

III.A.2. WATER ENERGY NEXUS

An area of particular concern among policymakers in the energy efficiency field is the link between energy use and water use. Both resources are scare in California, and efficiency programs focused on either one in isolation may ignore critical interdependencies. For instance, large amounts of water are needed to produce energy at power plants, and significant energy is used to treat and transport water to consumers, particularly in pumping stations that bring water from distance sources to agricultural and urban users. Despite being dependent on each other, energy and water are rarely integrated in policy.

California has been ahead of the curve, though. After the California Energy Commission published its 2005 study on the water-energy nexus, California's Water-Energy Relationship, it became clear that water efficiency should be considered by energy utilities as part of their energy conservation efforts. In this report, the Energy Commission concluded that water-related energy use consumes 19 percent of the state's electricity:[26]

[24] CPUC's Decision approving the 2010 – 2012 Energy Efficiency Portfolios, D09-09-047, dated 10/1/2009. Decision pursuant to application filings 08-07-021, 08-07-022, 08-07-023, and 08-07-031. http://docs.cpuc.ca.gov/PUBLISHED/Graphics/107829.PDF

[25] SCE files available here: http://www.sce.com/AboutSCE/Regulatory/eefilings/proposals/default.htm; PG&E files: http://www.pge.com/about/rates/rebateprogrameval/portfolioapplication/index.shtml; and http://www.sce.com/AboutSCE/Regulatory/eefilings/proposals/default.htm; SDG&E files: http://www.sdge.com/regulatory/A08-07-023.shtml#; SCG files here: http://www.socalgas.com/regulatory/A0807022.shtml (11/23/2009).

[26] California Energy Commission, California's Water-Energy Relationship, 2005, available at http://www.energy.ca.gov/2005publications/CEC-700-2005-011/CEC-700-2005-011-SF.PDF

Other CEC studies on water-related energy:

California Energy Commission, *Assembly Committee on Water, Parks and Wildlife* (page 5), available at www.energy.ca.gov/2007publications/.../CEC-999-2007-008.PDF

California Energy Commission, Integrated Energy Policy Report, 2005, available at http://www.energy.ca.gov/2005_energypolicy/index.html

Table A.16 Water Energy Demand by End User by Sector, 2001

Target Sector	GWh	%
Residential	13,528	28%
Commercial	8,341	17%
Industrial	6,017	13%
Agricultural	7,372	15%
Government (Water Supply and Treatment & Wastewater Treatment)	12,754	26%
WATER ELETRICITY DEMAND	48,012	100%
WATER ELECTRICITY DEMAND	48,012	19%
TOTAL ELECTRICITY DEMAND	250,454	100%

Source: California Energy Commission, *Presentation to the Assembly Committee on Water, Parks and Wildlife*, available at http://www.energy.ca.gov/2007publications/CEC-999-2007-008/CEC-999-2007-008.PDF (page 5)

Meanwhile, the CPUC has also funded an increasing number of studies in recent years to understand more accurately the relationship between water savings and the reduction of energy use. [27] Additionally, the CPUC has approved a number of water-related efficiency programs such as one-year pilot programs for energy utilities through which they will develop partnerships with water agencies to undertake water conservation programs.[28] The period for the pilot programs and studies began January 1, 2008, and ran for 18 months.

Cumulatively, the utilities will spend approximately $6.4 million on water-energy related initiatives. This pilot process will inform later decisions about the incorporation of water conservation efforts in the energy efficiency programs for 2010-2012 and beyond. *Because water-energy pilot programs are included in the IOU energy efficiency portfolio of programs we do not count them separately in our model.*

III.A.3. LIEE AND CARE PROGRAMS

The major public energy programs aimed at low-income ratepayers are LIEE and CARE:

- → LIEE provides no-cost weatherization services to low-income households. Services provided include attic insulation, energy efficient refrigerators, energy efficient furnaces, weather-stripping, caulking, low-flow showerheads, water heater blankets, and door and building envelope repairs, which reduce air infiltration.
- → Low-income customers that are enrolled in the CARE program receive a 20 percent discount on their electric and natural gas bills.

[27] California Public Utilities Commission *CPUC Broadens Its Energy Efficiency Program With Approval of Low Income Energy Efficiency Program Expansion and Water Conservation Pilot Program* (press release), available at http://docs.cpuc.ca.gov/PUBLISHED/NEWS_RELEASE/76880.htm

[28] California Public Utilities Commission, *Order Approving Pilot Water Conservation Programs Within The Energy Utilities' Energy Efficiency Programs*, available at http://docs.cpuc.ca.gov/published/Final_decision/76926.htm

In 2007, the CPUC adopted a programmatic initiative to provide by 2020 all eligible customers the opportunity to participate in Low Income Energy Efficiency (LIEE) programs and to offer those who wish to participate to have all cost-effective energy efficiency measures in their residences. For the 2009-2011 LIEE program cycle, CPUC has approved approximately $3.6 billion for low income programs for the four major investor-owned utilities (IOUs), of which, the Low Income Energy Efficiency (LIEE) program budgets are almost $1 billion for that period. By sector, 100% of LIEE budgets are invested in the residential sector.[29]

Although we note the budget levels for both LIEE and CARE, we will only model the LIEE funds in terms of their impact on the labor market because LIEE directly promotes construction activity as opposed to CARE and other price subsidies initiatives, which are merely a transfer program.

Table A.17 CPUC LIEE and CARE Budgets, 2009-2011

IOU Proposed Budgets 2009-2011				
	LIEE			
Utility	2009	2010	2011	Cycle Total
PG&E	$112,702,000	$152,011,000	$157,625,000	$422,338,000
SCE	$53,594,000	$54,783,000	$56,633,000	$165,010,000
SoCalGas	$40,599,000	$65,849,000	$67,184,000	$173,631,999
SDG&E	$21,000,000	$21,000,000	$20,250,000	$62,250,000
Total	$227,895,000	$293,643,000	$301,691,999	$823,229,999
	CARE			
	2009	2010	2011	Cycle Total
PG&E	$470,011,651	$479,331,337	$489,228,435	$1,438,571,423
SCE	$208,541,000	$213,312,000	$216,885,000	$638,738,000
SoCalGas	$139,132,786	$140,737,280	$142,489,637	$422,359,704
SDG&E	$49,961,816	$51,516,795	$53,064,454	$154,543,065
Total	$867,647,253	$884,897,412	$901,667,526	$2,654,212,192

Adopted Budget Summary 2009-2011				
	LIEE			
Utility	2009	2010	2011	Cycle Total
PG&E	$109,056,366	$151,067,347	$156,789,038	$416,912,752
SCE	$60,242,000	$61,561,082	$63,413,860	$185,216,942
SoCalGas	$49,571,908	$76,872,816	$78,256,269	$204,700,993
SDG&E	$21,184,008	$21,184,009	$20,327,606	$62,695,622
Total	$240,054,283	$310,685,254	$318,786,772	$869,526,309
	CARE			
	2009	2010	2011	Cycle Total
PG&E	$470,314,651	$479,331,337	$489,228,435	$1,438,874,423
SCE	$208,541,000	$213,312,000	$216,885,000	$638,738,000
SoCalGas	$139,132,786	$140,737,280	$142,489,637	$422,359,704
SDG&E	$49,961,816	$51,516,795	$53,064,454	$154,543,065
Total	$ 867,952,262.40	$ 884,899,422.01	$ 901,669,537.33	$ 2,654,515,191.74

Source: California Public Utilities Commission, *2009-11 Low Income Energy Efficiency (LIEE) and California Alternate Rates for Energy (CARE) Applications*, available at http://docs.cpuc.ca.gov/PUBLISHED/AGENDA_DECISION/93393.htm

[29] California Public Utilities Commission, *Decision on Large Investor-Owned Utilities' 2009-11 Low Income Energy Efficiency (LIEE) and California Alternate Rates for Energy (CARE) Applications*, approved November 6, 2008, available at http://docs.cpuc.ca.gov/PUBLISHED/AGENDA_DECISION/93393.htm.

III.A.4. PUBLICLY-OWNED UTILITY (POU) ENERGY EFFICIENCY PROGRAMS

Investor owned utilities (IOUs) provide utility service to 74% of the California's residential and commercial customers, while 26% are served by publicly owned utilities (POUs). While the POUs across the state range from very large entities, such as the Los Angeles Department of Water and Power (LADWP), to very small, rural districts, most all offer a set of energy efficiency programs similar to those offered by the IOUs. Unlike the IOUs, there is no single, consistent data source available for program budgets and descriptions. As mentioned above, we were not able to find detailed measure-by-measure data with which to develop either an exact budget account by year, or a POU specific NAICS distribution. Thus, we made a set of limiting assumptions based on the data that was readily available. To account for the POU energy efficiency spending, we obtained budget information for the two largest POUs (LADWP and SMUD), which together make up nearly half (47 percent) of the POU market.[30] We then scaled these budgets up to the full size of the POU market based on the relative size of LADWP and SMUD's combined POU utility customers. Two caveats about this assumption should be noted here. We recognize that the POU market includes many smaller utility districts located in more rural parts of the state and therefore may not offer programs of the nature offered by LADWP or SMUD. Secondly, some utility districts may not have any energy efficiency programs at all. While these issues are valid, we feel that as no single consistent data source on POU programs exists, it is a reasonable assumption to use the IOU programs as a model (since we have such rich data on them) and two, our extrapolation method from LADWP and SMUD to the overall POU market only involves a relatively small amount of money. Thus any potential upward bias is likely to be small. Below we briefly describe the data sources for SMUD and LADWP EE programs.

- ### SACRAMENTO MUNICIPAL UTILITY DISTRICT (SMUD)

The most detailed data we found was for the FY08-09 budget. The line item called "incentives and rebates," included funding for energy efficiency, services for low income and special needs customers, renewable energy resources and technologies, and research development and demonstration programs. This information was not broken out by utility market sector (e.g. residential, commercial) This total came to $68,436,696.

- ### LOS ANGELES DEPARTMENT OF WATER AND POWER (LADWP)

For the LADWP we also used FY08-09 budget data. Their budgets broke out into residential and non-residential programs. We added the total budgets for these two types of programs together as follows: $41,170,000 plus $29,820,000=$70,990,000.[31]

We then divided the total LADWP and SMUD budget lines up ($70,990,000+ $68,436,696) by their share of the POU market (.47), to obtain an estimate POU Energy Efficiency budget. Based on our reading of the types of rebates and incentives offered by the observable POUs, we decided that the range of programs was, while more limited in scope, broadly similar to the set of programs offered by the IOUs. Thus, because no information was obtained broken out by utility market sector (e.g., commercial versus residential), we used the sector market shares from the IOU as a proxy.

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[30] We estimated the share of the POU market served by LADWP and SMUD by calculating the share of GWhrs generated by each utility relative to the entire POU market. Based on 2007 GWhr data from the CEC, this figure was 46.9%. Data available at: http://www.ecdms.energy.ca.gov/elecbyutil.aspx, accessed May 24th, 2010.

[31] Department of Water and Power, City of Los Angeles, Budget (2008). Rates and Efficiency Division Fiscal Year 2008-09 Proposed Budget June 19, 2008. Retrieved from: http://www.ladwp.com/ladwp/cms/ladwp009302.pdf

The SMUD and LAWDP budgets did not include detailed breakdowns of expenditures by industry, but budget lines for administration were available. The SMUD budget included $4.3 million for administration, and the LADWP budget itemized $3.4 million. We allocated both the administrative funding and the other funding to NAICS codes based on the method described below in the IOU NAICS allocation section (3.3.1).

III.B. SCENARIOS FOR UTILITY ENERGY EFFICIENCY PROGRAMS

III.B.1. SCENARIOS OF IOU PORTFOLIO OF PROGRAM SPENDING

To project IOU PoP spending beyond the 2010-2012 funding cycle, we developed three scenarios based on projected energy savings calculated by the California Energy Commission as part of their report entitled *Incremental Impact of Energy Efficiency Policy Initiatives Relative to the 2009 Integrated Energy Policy Report Adopted Demand Forecast.*[32] This report calculates the incremental energy savings that would stem from future IOU PoP spending according to the assumptions laid out in the CPUC's 2008 Goals Study in terms of additional gigawatt hours (GWh) by year from 2013 through 2020.[33] We feel that this report, conducted by the CEC in conjunction with Itron, is a well recognized source within the state, and that the scenarios as defined were vetted by energy experts, and thus are reasonable for us to adopt as is, rather than attempting to develop our own, based on subjective assessments of future CPUC budgetary actions. Therefore, to estimate future budgets based on projected incremental energy savings, we first took the aggregate annual energy savings from 2010-2012 from the CPUC ruling (2,322 GWh) and calculated a $/GWh savings ratio for the whole program, which is $599,000 per GWh. We then used the GWh figures from the CEC incremental report report from 2013-2020 and added them to the baseline budget figure per year (about $1.39 billion)[34]. To illustrate, for the low scenario, the CEC projects that the IOU programs will provide an incremental additional energy savings of 681 GWh in 2013. So the estimated program budget in 2013 = $1.39B baseline + (681GWh*$599,000\GWr), or $1.798 billion. These figures then get inflated up according to the additional projected energy savings.

Note that we keep the relative target sector shares (residential commercial, etc.) fixed in terms of their budgets. We also hold the share of budgets flowing to admin, marketing, direct implementation constant as well.

[32] Jaske, M. and Kavalec, C. (2009). *Incremental Impacts of Energy Policy Initiatives Relative to the 2009 Integrated Energy Policy Report Adopted Demand Forecast* (CEC-200-2010-001-D), available at http://www.energy.ca.gov/2009_energypolicy/documents/

[33] Note that we only used the projected electricity savings, rather than natural gas savings to project current budget levels into the future. Thus we are implicitly assuming that electricity and gas savings overtime are correlated, or at least that mix of gas/electricity savings does not differ fundamentally from the ratio observed in the current cycle.

[34] Note: we treat all dollars as nominal dollars.

Table A.18 Scenarios for IOU Portfolio of Programs

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
IOU PoP Projected Electricity Savings (GWh) [1]											
Low Case				681	1,333	1,957	2,494	3,053	3,576	4,094	4,609
Mid Case				1,077	2,100	3,073	3,889	4,752	5,539	6,325	7,106
High Case				1,077	2,100	3,073	3,889	4,752	5,539	6,325	7,106
	Estimated IOU PoP Budgets and Induced Demand, 2010-2020										
	ACTUAL BUDGETS ($millions)			PROJECTED BUDGETS ($millions)							
Low Case	1,390	1,390	1,390	1,798	2,188	2,562	2,883	3,218	3,531	3,841	4,150
Mid Case	1,390	1,390	1,390	2,035	2,648	3,230	3,719	4,235	4,707	5,177	5,645
High Case	1,390	1,390	1,390	2,035	2,648	3,230	3,719	4,235	4,707	5,177	5,645
Average annual energy savings over 2010-2012 (GWhrs)[2]								2,322			
Annual budget/induced spending, 2010-2012 cycle[3]								$1,390			
Average $$/GWh ($millions)								$0.599			

Source: (1) California Energy Commission, Jaske and Kavalec (2009); (2) Authors calculation of annual energy savings from 2010-2012 portfolio cycle contained in Table 2-Adopted Goals for the 2010-2012 Program Cycle of CPUC Decision (A.08-07-021), 9/24/2009); (3) Authors calculation of IOU Budgets contained in E3 Calculators (described above). Note that this figure includes induced demand from participant costs.

III.B.2. SCENARIOS FOR LIEE

The CPUC*'s California Long-Term Energy Efficiency Strategic Plan'* establishes that, by 2020, 100 percent of eligible and willing low income customers will have received all cost-effective Low Income Energy Efficiency measures. Because LIEE 2009-2011 budgets aim at meeting 25percent of the objective, there would be a 75 percent of households left for the 2012-2014, 2015-2017 and 2018-2020 cycles (25 percent for each cycle). Therefore we estimate that LIEE budgets will be held constant for the next three budget cycles until 2020.[35] In other words, the low, medium, and high scenarios are equivalent.

III.B.3. SCENARIOS FOR POUS

We scale the POU budgets by the same ratios generated for the IOU programs.

[35] For more information see: CPUC (2008): Decision On Large Investor-Owned Utilities' 2009-11 Low Income Energy Efficiency (LIEE) And California Alternate Rates For Energy (CARE) Applications. Retrieved from: http://docs.cpuc.ca.gov/PUBLISHED/AGENDA_DECISION/93393.htm

III.C. NAICS ALLOCATION OF UTILITY ENERGY EFFICIENCY PROGRAM BUDGET

We used the following methods to translate the utility energy efficiency budgets into 4- or 5- digit NAICS codes.

III.C.1. METHOD 5: IOU ENERGY EFFICIENCY PORTFOLIO OF PROGRAMS

To estimate the dollar amount of policy-induced demand by NAICS sector from the IOUs' Portfolio of Programs we took the following steps.

STEP 1. We obtained the final E3 spreadsheets from each IOU's approved portfolio for the 2010-2012 funding cycle.

STEP 2. Based on information listed on the "Input" table of each E3 spreadsheet we divided the total budget into the following five categories: *1) Administration; 2) Marketing and Outreach; 3) Incentives and Rebates, and 4) Participant Costs, and 5) Activity.* These figures were either listed individually in a given cell in the input spreadsheet, or could be easily calculated from listed figures (e.g., multiplying participant costs per unit by the number of units in each measure). As described below we treated some of these expenditure categories differently with regard to our assumptions about NAICS allocations.

STEP 3. For each of the five budget categories described above we developed a different methodology or rationale for assigning budgeted dollar figures to a given NAICS industry code or set of codes.

- ADMINISTRATION: The NAICS allocation for Administration was relatively uncomplicated. We assigned half of this figure to the NAICS 551114 category "Corporate, Subsidiary, and Regional Managing Offices" to capture those workers engaged in managing programs run by each private IOU, and 50 percent to NAICS 5611 "Office Administrative Services", to reflect the concentration of paper-work related activities involved in administering rebate programs for example.

- MARKETING AND OUTREACH: We assigned the M&O budget to NAICS code 5418 "Advertising and Related Services."

- INCENTIVES AND REBATES AND PARTICIPANT COSTS: The largest share of each IOU's budget is dedicated to direct implementation (DI) of energy efficiency programs, including customer education. Generally, the DI component of the budget is broken down into four distinct types: downstream rebates (to consumers), upstream incentive payments to manufacturers or wholesalers, direct install labor, direct install materials and participant costs. As described above, the set of measures that the IOUs have developed are broad and can be either administered directly by an IOU, by a third party entity such as an implementation contractor, or through partnerships with local governments or non-profits. However, each measure must be listed in the E3 Calculator and the IOU must project the number of "units" or each measure that will be implemented in each year in the funding cycle.

- ECONOMIC ASSUMPTIONS REGARDING REBATES/INCENTIVES: In modeling the economic impact of IOU rebate/incentive programs we decided to include the participant cost of each measure. Because of this, the total estimated induced demand that results from the PoP is significantly higher than the total budgeted amount of $3.1 billion, given that utility customers are contributing their own dollars to implement a given energy efficient measure. For example, SCE offers a measure listed on the E3 Calculator for residential

refrigerators. The gross measure cost per unit is listed as $131.93. We interpreted this figure as the cost differential for purchase a more efficient refrigerator (e.g., Energy Star) compared to a traditional unit. Of this gross cost, $50 is offered by the IOU as a downstream rebate to a consumer who decides to purchase the more efficient unit, when a traditional model is available on the market. The consumer then contributes an additional $81.93 towards the total increased demand of $131.93. Thus when calculating the demand generated by each measure, we assumed that but for the rebate or incentive offered by the IOU, consumers would have otherwise purchased a traditional appliance. We counted the value of the rebate and the value of the participant contribution.

- DETAILED NAICS ASSIGNMENT STEPS: The first step in allocating the direct implementation demand to NAICS codes was to categorize each measure into what we call "Pre-NAICS" categories according to the broad "end use" or each described measure. Specifically, we assigned one of nine pre-NAICSs categories to each of the approximately 150 unique measures listed in the E3 Calculator.[36] This intermediate step was taken for two reasons. First, to reduce the number of assumptions used in assigning NAICS codes to specific measure activities, and second, because we treat rebates and upstream payments differently than directly installed labor or materials. Table A.19 below, provides an example of how we classified individual program measures into pre-NAICS categories, and also shows the incentive figures used to calculate stimulated demand. Note that the gross measure costs refers to the cost associated with each measure, not the gross cost of the particular energy-using equipment. Thus, in the case of an appliance rebate, this refers to the cost associated with purchasing a more efficient appliance compared to a cheaper alternative that uses more energy. Thus it is not the total price of the, say, refrigerator, but the incremental difference between an efficient unit and an older unit.

Next, we calculated the total dollar figure for each direct implementation category by multiplying the number of units proposed and the per unit rebate or subsidy amount (listed above). We then summarized each IOUs demand by pre-NAICS category for each type of DI payment. We were left with five tables containing estimated demand by pre-NAICS category. Each of these five tables was also broken out by four targeted sectors of utility demand: residential, commercial, industrial and agricultural.

For downstream rebates, upstream payments, and their associated participant costs, we assigned to each "pre-NAICS" category *both* a materials-related NAICS code (typically within manufacturing) and, in most cases, a labor related NAICS code. We did this because these types of incentive categories result in customers either adding new equipment (e.g., HVAC systems) or retrofitting existing buildings or equipment (e.g., insulation). To implement some energy efficiency measures (e.g., the installation of a new furnace with updated ductwork), a customer would most likely need to employ the services of a contractor to install and connect the product. However, some IOU programs involve a rebate payment that follows the economic products that a customer would directly consume or install (e.g., CFL bulbs), or have installed by the retailer (e.g., appliance purchases). Therefore, the authors made a simple yes or no judgment for each pre-NAICS category of measures as to whether or not a contractor would likely be involved. Those that were not deemed to involve a contractor were only assigned to a materials NAICS, while those that did were also assigned a labor NAICS. Specific NAICS assignation was based on the authors' judgment of the best match between the measure's description and the standard list of NAICS codes.

[36] These "pre-NAICS" categories are: Appliances, Audits, Consumer Electronics, HVAC, Lighting, Lighting-Customer install, Other EE, Plumbing, Refrigeration Contractors. Note these categories were generated by the authors.

Table A.19 Example of Assignment of PRE-NAICS Category and Direct Installment Funding for Southern California Edison E3 Calculator

Assigned Pre-NAICS Category	Measure Name	Gross Cost ($/unit)	Rebate ($/unit)	Upstream Payments ($/unit)	Direct Install Labor ($/unit)	Direct Install Material ($/unit)	Participant Costs ($/unit)
	RESIDENTIAL						
	DEEMED MEASURES						
Appliances	Appliances						
Appliances	Laundry & Kitchen	585.43	31.06	-	-	-	554.38
Appliances	Refrigerators	131.93	50.00	-	-	-	81.93
Appliances	Appliances Recycling						
Appliances	Refrigerators/Freezers	138.57	50.00	-	88.57	-	-
Appliances	Room A/C						-
Appliances	Other						-
Audits	Residential Audits	40.76	-	-	-	-	40.76
Consumer Electronics	Consumer Electronics						-
Consumer Electronics	Entertainment	34.74	-	17.00	-	-	17.74
Consumer Electronics	Home Office	67.39	-	6.65	-	-	60.75
Consumer Electronics	Other						-
Plumbing	Water Heating						-
Plumbing	Efficiency	83.41	30.00	-	-	-	53.41
Plumbing	Use Reduction	4.45	-	-	-	4.45	-
Plumbing	Pool Pump	1,537.50	244.44	-	85.19	-	1,207.87
Other EE	Residential Other	453.36	429.62	-	-	-	23.74
HVAC	HVAC						-
HVAC	New Room AC	242.72	50.05	-	-	-	192.67
HVAC	New Package, Split System AC, etc.	2,044.20	101.76	507.70	-	-	1,434.74
HVAC	Repair & Maintenance	40.18	0.26	33.26	3.73	2.86	0.07
HVAC	HVAC Ducts	232.37	24.05	28.11	85.86	68.10	26.25
HVAC	HVAC Envelope	11.68	3.94	9.01	-	-	(1.27)
HVAC	HVAC Install - Operation						-
HVAC	HVAC Controls						-
HVAC	New Evap Coolers & Whole House Fans	628.79	83.12	-	-	-	545.67

Source: Southern California Edison, Input tab of E3 Calculator as approved by CPUC Energy Division. Author's assignments of pre-NAICS categories.

Table A.20 below provides an example of the assumptions of which measure category involved a contractor or not and what NAICS code was assigned to each category.[37]

Table A.20 Example of NAICS assignment and contractor involvement assumptions: PGE rebate incentive dollars by utility target sector, 2010-2012

	Author's Assumptions			Rebates by Target Sector			
Pre-NAICS Category	Involves contract or Y/N	Materials NAICS	Labor NAICS	Residential ($)	Commercial ($)	Industrial ($)	Agricultural ($)
Consumer Electronics	No	3341 & 3342	n/a				
Lighting- Customer Installed	No	3351	n/a	890	9,345		
Other Industrial Equipment	No	3332	n/a		1,041,653		
Appliances	No	3352	n/a	26,321,266			
Roofing Contractors	Yes	32412	238160				
Ag-greenhouse	Yes	n/a	2362				484,032
Plumbing	Yes	335228	23822	938,130	858,445		900,986
Insulation	Yes	3279	23831		7,430,004	88,744	3,341
Refrigeration	Yes	3334	23822		10,693,819		6,417,059
Lighting	Yes	3351	23821	11,590,438	56,011,355	1,171,789	1,998,081
HVAC	Yes	3334	238220	41,617,724	103,438,733	65,075,797	26,367,454

Source: E3 Calculators.

For program measures that were deemed to flow to both materials and labor NAICS codes, we estimated the share to each code by calculating the overall split between all direct install materials and direct install labor incentive categories across all four IOUs, as provided by the IOUs' E3 Calculators. This overall IOU-level split was then applied uniformly across all pre-NAICS categories that contained both a labor and materials NAICS. Table A.21 below illustrates this calculation. Overall, 63.9% of direct install incentive dollars went towards labor and 36.1% flowed to materials.

Table A.21 Total Amount of Spending on Direct Install Portions of IOU EE Budgets 2010-2012.

	SCE	PGE	SDGE	SoCalGas	Total IOU	IOU Share
d.iii. Direct Install Labor	$71,583,669	$ 66,232,283	$ 2,968,256.2	$ 7,883,154	$ 148,667,362	**63.9%**
d.iv. Direct Install Materials	$62,076,741	$ 19,590,992	$ 1,306,932	$ 986,498	$ 83,961,162	**36.1%**
Source: E3 Calculators for SCE, SDGE, SoCalGas, Appendix H Proposed Plan 'Summary.xls' for PGE						

[37] Note that this table includes only rebate payments for SCE. This makes up one of five intermediate tables for SCE. These tables are subsequently summed across all IOUs.

- DIRECT INSTALLATION

Directly installed materials and labor were assigned to only one type of NAICS codes.

- ACTIVITY

The final IOU budget category analyzed was listed in the E3 Calculators simply as "Activity". Across all IOUs this category ranged from 0% to 26.1% of the total portfolio budgets. However, there was no immediately obvious way with the E3 calculator files to determine which economic sectors (i.e., pre-NAICS categories or specific NAICS codes) would be stimulated by such spending. After close examination of each IOUs filings and a reading of the CPUC's decision approving the 2010-2012 portfolio cycle, we concluded that this category included a wide variety of technical assistance and customer service activities conducted directly by utility staff members and contractors. Residential energy audits are a prominent example of this non-incentive direct implementation activity, as is continuous energy improvement technical assistance services for large commercial users. These activities clearly involve highly technical, higher skilled services. In addition, some programs involved activities such as rebate processing activities and program promotion, which are more traditional administrative office-based activities. In addition to using the E3 Calculators, we verified the broad type of labor activity in this category by examining a set of internal CPUC budget placemats. Ultimately, we used the following strategy to allocate "Activity" budgets to NAICS codes.

First, we divided up Activity into two categories, observed and unobserved activity. The observed activity consists of specific measures listed in the input spreadsheet of the E3 Calculator for which an energy savings calculation was made, but which contained no per unit figure for any incentive category (rebate, upstream payment, direct install, or participant cost). In these cases we multiplied the gross measure cost of the listed measure by the number of "units" to calculate a total spending amount per measure. Then the measure was matched to a pre-NAICS category as described above. The vast majority of "observed" activity measures that could be directly categorized were energy audits. In this case, we used the NAICS distribution for energy audits as described in section 2.3.1 above (Table A.11).

Next, for the unobserved portions of the activity budget, we made the simplifying assumption based on the CPUC decision that these activities represented a hybrid of traditional IOU program administration and monitoring activities, as well as more sophisticated energy audits and technical assistance (e.g., continuous energy improvement activities in the commercial sector). We then allocated 1/3 of the unobserved activity budget to the same NAICS categories as "Administration," described above, and 2/3 to our energy audits NAICS distribution.

STEP 4. Summarizing Demand by NAICS code and Target Sector

After each separate budget category and incentive type had been assigned to a NAICS code, we summarized the total demand stimulated by the IOU portfolio of programs by utility target sector. The summary is described in Table A.22 below.

Table A.22 Summary of IOU Portfolio by NAICS and Target Sector, 2010-12 Cycle

NAICS	NAICS TITLE	Dollar Total, 2010	Share of Subcategory		Total
Administration					**$ 660,804,456**
5611	Office Administrative Services	$330,402,228.21	50.0%		
551114	Corporate, Subsidiary, and Region	$330,402,228.21	50.0%		
Marketing/Outreach					**$ 212,193,713**
5418	Advertising and Related Services	$ 212,193,713	100.0%		
Unobserved Activity (1)					**$ 610,036,003**
5611	Office Administrative Services	$ 100,655,940	16.5%		
551114	Corporate, Subsidiary, and Region	$ 16,608,230	16.5%		
54133	Engineering Services	$ 6,356,796	38.3%		
54162	Environmental Consulting	$ 274,950	4.3%		
54135	Building Inspection Services	$ 2,509	0.9%		
541690	Other Scientific and Technical C	$ 581	23.2%		
Direct Implementation (Incentives,Rebates, DI, Participant Costs & Obs. Activity)					**$ 2,687,326,340**
NAICS		**Residential**	**Commercial**	**Industrial**	**Agricultural**
2362	Nonresidential Building Constructi	$ -	$ 6,331,162	$ -	$ 2,204,545
3279	Other Nonmetallic Mineral Produc	$ 27,648,228	$ 17,955,048	$ 64,059	$ 2,412
3332	Industrial Machinery Manufacturin	$ -	$ 2,083,305	$ -	$ -
3334	Ventilation, Heating, Air-Conditior	$ 84,088,342	$ 287,999,097	$ 111,606,643	$ 23,668,873
3341	Computer and Peripheral Equipme	$ 14,827,954	$ -	$ -	$ -
3342	Communications Equipment Manu	$ 14,827,954	$ -	$ -	$ -
3351	Electric Lighting Equipment Manuf	$ 166,621,011	$ 168,128,229	$ 1,230,472	$ 1,442,310
3352	Household Appliance Manufacturi	$ 160,875,660	$ 23,623,343	$ -	$ -
23821	Electrical Contractors	$ 86,846,688	$ 265,183,293	$ 2,178,758	$ 6,501,549
23822	Plumbing, Heating, and Air-Condit	$ 143,192,795	$ 453,815,549	$ 195,654,147	$ 46,967,320
23829	Other Building Equipment Contrac	$ 1,155,140	$ 445,780	$ -	$ 449,423
23831	Drywall and Insulation Contractors	$ 54,742,158	$ 35,010,671	$ 436,621	$ 2,637,146
23835	Finish Carpentry Contractors	$ 1,792,975	$ 691,927	$ -	$ 697,581
32412	Asphalt Paving, Roofing, and Satur	$ -	$ 138,919	$ -	$ -
54133	Engineering Services	$ 6,297,093	$ 20,149,320	$ 521,207	$ 24,435,449
54135	Building Inspection Services	$ 150,150	$ 480,447	$ 12,428	$ 582,647
54162	Environmental Consulting Services	$ 711,607	$ 2,276,987	$ 58,899	$ 2,761,344
238160	Roofing Contractors	$ -	$ 245,979	$ -	$ -
238220	Plumbing, Heating, and Air-Condit	$ 53,161,300	$ 84,765,171	$ 2,008,888	$ 6,117
335228	Other Major Household Appliance	$ 17,478,875	$ 6,672,856	$ -	$ 661,900
484210	Used Household and Office Goods	$ 18,599,700	$ -		
541690	Other Scientific and Technical Con	$ 3,809,313	$ 12,188,969	$ 315,295	$ 14,781,786
811310	Commercial and Industrial Machin	$ -	$ 425,524		
Sub Total		$ 856,826,944	$ 1,388,611,577	$ 314,087,418	$ 127,800,401

Source: Author's calculations.

III.C.2. ALLOCATING LIEE BUDGETS TO NAICS

To translate LIEE budgets into NAICS we used the same method for federal weatherization and residential retrofit explained above (Method 1).

IV. CODES AND STANDARDS, BIG BOLD ENERGY EFFICIENCY GOALS AND PACE PROGRAMS

IV.A. PROGRAM DESCRIPTIONS AND BUDGET DATA BY SECTOR

IV.A.1. CODES AND STANDARDS/ TITLE 24

Unlike the other federal and state policies described in this methodology document, the analysis of codes and standards is unique in that the policy itself does not involve a dedicated funding mechanism such as ARRA funds, or rate payer dollars collected by IOUs. Rather, the application of tougher building codes is an explicit government mandate on private sector actors such as developers, contractors, and homeowners to change their behavior, which may result in a shift of final demand towards energy efficient building materials and methods and away from other goods in the economy. Thus, the analysis of job impacts due to changing codes and standards is subject to comparatively greater uncertainty than in those programs where direct budgets could be obtained.

Given this uncertainty we made a series of limiting and simplifying assumptions to develop a best approximation of the impact of more stringent codes and standards on the California labor market. First, we included only building codes and standards in our analysis and ignored standards for other goods, such as appliance standards or consumer electronics standards. The following logic dictates this decision. For an appliance or a television, the application of a higher energy standard on the market does not significantly alter consumer behavior in that consumers will not change their timeframe for the purchase of, for instance, refrigerators or washing machines. However, after the higher energy standards are in place, the consumer will only have a choice among competing products that already meet the standard (i.e., this is not like a rebate that induces a consumer to choose the more efficient product, it is a mandate). Also, appliances and consumer electronics do not typically involve a high degree of labor at the time of purchase or installation.

Second, our analysis of stricter building codes is confined to the broad regulations set at the state level by the California Energy Commission as part of the their update to Title 24. Thus we did not evaluate efforts by some local governments to surpass the standards in Title 24.

Our overall goal in evaluating the impact of building codes and standards was to ascertain the increased level of construction spending needed to meet the new standards. To do this, we needed to estimate three distinct figures: 1) the number of new housing units and commercial square footage added in each year between 2010 and 2020 (i.e., quantity demanded), 2) the increased price of construction associated with meeting the stricter codes (i.e., the price increase), and 3) the long run price elasticity of housing or commercial space. Below we describe the data sources and assumptions used to estimate each of these figures.

1) EXPECTED DEMAND FOR HOUSING AND COMMERCIAL SPACE[38]

The figures for projected new demand for housing and commercial space were obtained from Appendix A of the CEC report *Incremental Impacts of Energy Policy Initiatives Relative to the 2009 Integrated Energy Policy Report Adopted Demand Forecast.*[39] These figures were calculated from the underlying economic and demographic modeling system used to generate the state's energy demand forecast. Specifically, this report estimates that between 2006 and 2020, California will build 2,190,405 new housing units. Since this figure only pertains to the territory covered by the IOUs, we inflated it by the IOU share of the total market (.74), to obtain a statewide figure of 2,960,007 units. Since our analysis is in 2010, instead of 2006, we divided this figure evenly across the 14 years (2006-2020) and came up with annual figures of 211,429 units. A parallel analysis was done for commercial square footage. These figures represent the annual quantity demanded of new housing units and commercial square footage subject to the higher 2008 Title 24 building codes that took effect on Jan 1, 2010.[40]

2) EXPECTED COST DIFFERENTIAL FOR MEETING NEW BUILDING CODES AND STANDARDS.

For this analysis we focused on the incremental costs associated with moving from the 2005 Title 24 standards to the 2008 standards. The CEC estimates that these new standards—which are on average 20% stricter than the 2005 standards—will result in an annual statewide electricity savings of 549 GWhr and natural gas savings of 18 million tons. However, as this revision to Title 24 covers a wide variety of building technologies and methods (e.g., lighting, HVAC systems, building shell insulation, etc.), it is difficult to say with a high degree of certainty what the construction cost differential will be for a given project. Also, there is wide variety on the size and type of housing, and even more variety with regard to commercial space. Thus, for simplicity we used single cost differential figures for single family residential, multifamily residential and commercial new construction averaged across all building types and sizes within these three categories.

The average cost differential figures for residential new construction were obtained from a report by ConSol—a private energy and building construction consulting company—for the California Building Industry Association (CBIA). Specifically these figures are estimated to be $2,170 for single family and $1,553 for multifamily, which represent an average increase of 2 percent.[41] Although ConSol did not prepare a corresponding report for non-residential construction, we adopted the same 2 percent increase and apply it to a statewide average construction cost figure of $175 per square foot.[42] Thus we applied an incremental cost increase of $3.50 per square foot of new commercial construction per year.

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[38] Note that we only include estimates for new construction and do not account for residential retrofits or commercial remodeling. We do this for two reasons. First, we could not find sound estimates of the number of remodels that occur each year (or future projections thereof), nor a consistent estimate of the average cost of a retrofit. Second, since we count major incentive programs for residential retrofit (e.g. HomeStar and LIEE), we risk double counting.

[39] Jaske, M. and Kavalec, C. (2009). Incremental Impacts of Energy Policy Initiatives Relative to the 2009 Integrated Energy Policy Report Adopted Demand Forecast. CEC-200-2010-001-D. Appendix available at http://www.energy.ca.gov/2010publications/CEC-200-2010-001/index.html

[40] California Energy Commission (2008). 2008 Building Energy Efficiency Standards for Residential and Nonresidential Buildings (CEC-400-2008-01-CMF, available at http://www.energy.ca.gov/title24/2008standards/index.html.

[41] "2008 California Energy Code (Title 24) Report, Prepared by ConSol for CBIA, October 22, 2009, p. 2, available at http://www.cbia.org/go/cbia/?LinkServID=574340BE-3751-4F11-83701898C87FC597&showMeta=0.

[42] As noted above, construction cost averages vary widely in the commercial sector, this figure of $175/sq. ft. was taken from RSMeans Construction Cost Data. (accessed at: http://evstudio.info/2009/08/06/cost-per-square-foot-of-commercial-construction-by-region/) This figure represents the estimated cost of a single story office building in Los Angeles. We view this figure as the best available proxy.

It is important to note that these cost figures, derived from a 20 percent energy efficiency increase in building code standards associated with moving from the 2005 to 2008 Title 24, provide the basis for estimating the impact of future code increases and for the Big Bold Energy Efficiency Goals (e.g., zero net energy residential/commercial). In other words, we assumed a linear relationship between ratcheting up building codes and resulting cost increases. Thus for our scenarios (described below) when we assume that say, Title 24 will be increased by another 10 percent in 2014, we also assumed that building costs increase by another 1 percent (i.e., since the 20 percent increase led to a 2 percent current price increase, a 10 percent increase would lead to a 1 percent increase). While the assumption of linearity is problematic, we believe that in the absence of available non-linear models, simplicity and transparency dictate a linear assumption.

3) ASSUMED PRICE ELASTICITY FOR HOUSING AND COMMERCIAL SPACE

Standard economic theory predicts that as the price of a good increases relative to other goods, consumers will typically demand less of that particular good. The amount of demand reduction in the face of a price increase is referred to as the price elasticity of demand, or, specifically, the percent change in quantity demanded for a given percent change in price. Since tougher building codes raise the cost of construction, this is akin to a price increase. As housing costs rise households may demand few units at the higher price. Similarly for commercial space, businesses may choose not to expand or start-up if commercial construction costs rise. Although this concept is straightforward at a theoretical level, economists have a difficult time providing accurate estimates of price elasticities, which leads to a wide range of empirical estimates. For housing Hanushek and Quigley (1980) report price elasticities of between -0.64 and -0.47 for the short run.

However, in the long run, people cannot easily substitute away from housing. Therefore for the purposes of this report we choose a relatively low long-run price elasticity of -0.1. We then used this figure to reduce the annual quantity demanded in response to increased prices associated with each ratcheting up of the building code. For example, since the 2008 Title 24 revisions result in a price increase of 2 percent, we reduced the quantity demanded by 0.2 percent.

IV.A.2. BIG BOLD ENERGY EFFICIENCY STRATEGIES (BBEES)

As part of the Energy Efficiency Strategic Plan, the CPUC established several long term strategies which they term "Big Bold" energy efficiency strategies. These strategies include attaining 100 percent of residential buildings as zero-net energy by 2020, and 100 percent of commercial buildings by 2030. As mentioned above, the opportunity for 100 percent of eligible households to participate in LIEE program is also a Big Bold initiative. However, this goal is not addressed here. Instead, we decided to model the LIEE strategy under the utility program section, as this particular strategy had actual funding behind it. The remaining BBEES (i.e., ZNE) do not specify a direct funding mechanism for their attainment. For simplicity, we assumed that these goals would be met by the private market place. Thus our model approach is similar to that used for codes and standards, except with higher efficiency standards (beyond Title 24) applied to certain percentages of expected residential and commercial new construction.

IV.A.3. PACE PROGRAMS

One of the key policy initiatives to achieve the BBEES objectives mentioned above are municipal energy efficiency programs. Municipal and county energy efficiency and renewable energy programs have become more important and visible in recent years as many cities in California are adopting ambitious climate change and green economic development plans. This poses a unique challenge for data collection, because public funding is often decentralized and dispersed. Furthermore, local governments often administer programs that are financed by external sources, including federal and/or state funding. In order to estimate the different funding sources of energy efficiency and

renewable energy programs at the local level, we reviewed different local programs in California and interviewed key informants. One promising local program to create green jobs in energy efficiency and renewable energy in the distant future is the emerging Property Assessed Clean Energy (PACE) program.

Property Assessed Clean Energy (PACE) programs allows property owners in participant cities to borrow money to pay for energy improvements. The property owner typically pays the borrowed amount through an assessment on the property tax bills over a period of years. One of the first PACE programs, Berkeley FIRST, was developed in 2007 after Berkeley voters endorsed ballot Measure G, which established an aggressive greenhouse gas (GHG) reduction target of 80% by 2050. As part of the effort to reduce emissions, Berkeley city staff developed an innovative program to help Berkeley residents and businesses pay for the high upfront cost of solar installations on private property. The city pays the property owner the initial installation of solar panels and adds an assessment to their property tax assessed value, to be paid off over 20 years. With an average residential solar installation running about $30,000, that amount is about $1,500 a year in extra property taxes. The idea rapidly spread across the U.S – 15 states and many more than 200 governmental jurisdictions have authorized PACE programs over the last 2 years. Berkeley FIRST founder, Cisco de Vries, is also the founder of *Renewable Funding*, currently the nation's leading private provider of PACE financing services. Berkeley was able to pass its PACE program at the local level because it is a charter city.[43] However, after AB 811 was passed in July 21, 2008, all cities and counties in California are authorized to designate areas within which willing property owners could enter into contractual assessments to finance the installation of distributed renewable energy generation or energy efficiency improvements, that are permanently fixed to the property owner's property. Although PACE programs can be used by owners of different properties in the residential, commercial and industrial sectors, our interviews with Renewable Funding confirmed that about 75 percent of PACE programs are residential and about 25 percent take place in the commercial sector.[44]Funding figures for PACE programs can be misleading if not contextualized. The marketing for PACE programs often promotes the total bond financing the city has secured. These figures can be very large, but they are best understood as ceilings, rather than available funding which may be significantly lower. Funding is actually secured on a project-by-project basis. This is because bonds have to be tied to residential properties that will have the work done, and they cannot be identified until an owner applies and is approved. The city of San Francisco has $150 million in commitments. San Diego has $20 million in commitments, with the option to increase to $60 million. Palm Desert has a $7.5 million program with options to increase the amount while Sonoma County's limit is $100 million.

A Renewable Funding spokesperson confirmed that many of these programs are being supplemented with ARRA funding, either from the SEP or EECBG. A statewide program – CaliforniaFIRST – is being rolled out in the summer of 2010. This program is designed to encourage hundreds of cities to set up PACE programs. It serves as a mechanism to achieve economies of scale in financing, marketing and administration. However, it cannot establish PACE districts itself; this has to be done by the city or county. CaliforniaFIRST is supported by $16 million in ARRA funding (through the State Energy Program). This money is being used for different purposes. San Francisco, for instance, is using it to buy down interest rates. One of the most successful PACE programs to date, Sonoma County, which has distributed $20 million in funding, received $2.5 million of ARRA funding. We estimate that about 10 percent of PACE programs comes from ARRA, federal or state sources while; local governments raised the rest via bond financing. In our model, the impact of PACE programs are modeled under ARRA State Energy Program or BBEES and therefore we are not including them as a separate input to avoid the risk of double-counting. Although a promising program, without good data on actual, or even projected, take-up rates of PACE programs, it is not possible to estimate the amount of investment that is likely to occur under PACE. Moreover,

[43] A charter city is a city in which the governing system is defined by the city's own charter document rather than by state, provincial, regional or national laws. As of 2010, 112 of California's 478 cities are charter cities (http://www.cacities.org/index.jsp?zone=locc&previewStory=571)

[44] Renewable Funding Interview in Oakland, CA (May 2010)

as of July 2010, the program is on hold due to objections from the Federal Housing Finance Agency. However, PACE funding could be a significant driver of green jobs in the future, and thus should be included in future analyses.

Table A.23 Funding Figures of existing PACE programs in California (2008-June 2010)

PACE Program	Total Amount of PACE financing	Launched
Berkeley FIRST	$380,000	2008
City of Palm Desert EIP	$7,500,000	2008
Sonoma County SCEIP	$100,000,000	2009
Placer County	$33,000,000	2010
San Francisco GreenFinance	$150,000,000	2010
Yucaipa EIP	$10,000,000	2010
San Diego County PACE	$20,000,000	2010
TOTAL	$320,880,000	

Source: Database for State Incentives in Renewables and Efficiency, available at http://dsireusa.org/incentives/incentive.cfm?Incentive_Code=CA198F&re=1&ee=1

IV.B. SCENARIOS FOR CODES AND STANDARDS AND BBEES

The following tables summarize the scenarios applied to Codes and Standards and the BBEES.

Table A.24 Codes and Standards (Title 24) Scenarios

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Residential Building Codes											
Low Case					10% increase	→	→	→	→	→	→
Mid Case					10% increase	→	→	10% increase	→	→	→
High Case		10% increase	→	→	10% increase	→	→	10% increase	→	→	→
Commercial Building Codes											
Low Case					5% increase	→	→	→	→	→	→
Mid Case					5% increase	→	→	5% increase	→	→	→
High Case		5% increase	→	→	5% increase	→	→	5% increase	→	→	→

Table A.25. Scenarios for CPUC's Big Bold Energy Efficiency Strategies (BBEES)

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
BBEES Tier 2 Residential New Construction											
Low Case		20%	→	→	→	30%	→	→	→	→	60%
Mid Case		30%	→	→	→	60%	→	→	→	→	80%
High Case		40%	→	→	→	90%	→	→	→	→	100%
BBEES Tier 3 Residential New Construction											
Low Case		5%	→	→	→	10%	→	→	→	→	25%
Mid Case		8%	→	→	→	25%	→	→	→	→	60%
High Case		10%	→	→	→	40%	→	→	→	→	90%
BBEES Commercial New Construction											
Low Case		10%	→	→	→	20%	→	→	→	→	40%
Mid Case		20%	→	→	→	25%	→	→	→	→	55%
High Case		30%	→	→	→	50%	→	→	→	→	70%

Source: Jaske and Kavalec (2009), Based on 2008 CPUC Goals Study.

IV.C. NAICS ALLOCATION OF ECONOMIC ACTIVITY RELATED TO CODES AND STANDARDS

Since this activity represents new construction, we allocated to the NAICS 3-digit new construction sector.

V. DISTRIBUTED GENERATION PROGRAMS

V.A. PROGRAM DESCRIPTIONS AND BUDGET DATA BY SECTOR

V.A.1. GO SOLAR CALIFORNIA! PROGRAM

The *Go Solar California!* Program is a joint initiative of the CPUC and the CEC to promote solar energy in California. It combines existing and new solar programs in the state under a single name. The main programs are:

- → California Solar Initiative (managed by the CPUC)
- → New Solar Homes Partnership (managed by the CEC)
- → Publicly-Owned Utilities solar programs (managed by POUs)

Table A.26 Go Solar California! Initiative Program Summary

	California Solar Initiative (CSI)	New Solar Homes Partnership (NSHP)	Publicly-Owned Utilities Programs
Program Authority	California Public Utilities Commission	California Energy Commission	Publicly Owned Utilities
Budget	$2,167 million	$400 million	$784 million
Solar Goals (MW)	1,940 MW	360 MW	700 MW
Scope	All systems in IOU territories except new homes	New homes, IOU territories	All systems in POU territories
Time frame	2007-2016	2007-2016	2008-2016

Source: California Public Utilities Commission, California Solar Initiative website, available at http://www.cpuc.ca.gov/puc/energy/solar/aboutsolar.htm

V.A.2. CALIFORNIA SOLAR INITIATIVE

The CPUC's California Solar Initiative had an initial budget of $2,167 million for the 2007-2016 period.

Table A.27 California Solar Initiative 2007-2016 Initial Budget

Program Category	Budget ($ Million)
General Market Program Subtotal	$1,897
Direct Incentives to Consumers for PV and non-PV technologies	*$1,707*
Program Administration, Marketing & Outreach, Evaluation (10%)	*$190*
Low-Income Programs (10%)	$217
Research, Development, Deployment and Demonstration (RD&D)	$50
San Diego Solar Water Heating Pilot Program	$2.6
Total California Solar Initiative Budget	**$2,167**

Source: Go Solar California website, available at http://www.gosolarcalifornia.org/csi/index.html

The program components of the California Solar Initiative have separate budget and administration plans. All budgets are for 10 years:

- → The Single-family Affordable Solar Homes (SASH) Program will be managed by Grid Alternatives and receives a budget of $108 million.
- → The Multifamily Affordable Solar Housing (MASH) Program is managed by PG&E, SCE and the California Center for Sustainable Energy (in SDG&E territory) and receives a budget of $108 million.
- → The Research, Development, Deployment, and Demonstration (RD&D) Program will have a single statewide Program Manager and a budget of $50 million.
- → The San Diego Solar Hot Water Heating Pilot Program was administered by the California Center for Sustainable Energy (CCSE) and had a budget of $2.6 million with $1.5 million allocated for incentives. The last incentive was given in 2009. This pilot program became the basis of the statewide CSI Thermal Program.

We divided the funding into equal parts by year up to 2016.[45] We excluded the Research, Deployment and Demonstration funds because very few new jobs would be created through it. We also eliminated the San Diego Solar Water Heating project (the last incentive was given in 2009) and included instead the new Solar Water Heating Program (officially known as CSI-Thermal Program).

The CSI-Thermal Program started accepting applications on May 1, 2010, and is expected to run through December 31, 2017. Homeowners may apply for cash rebates of up to $1,875 on the installation of qualifying solar water heating (SWH) systems.[46] To qualify for the rebate, the SWH system must displace the use of natural gas or electricity, and the homeowner must verify that the system was installed after July 15, 2009. $306 million is allocated to incentives, which will be offered to home and business owners that heat water with either electricity or natural gas and are customers of SDG&E, PG&E, Southern California Gas or Southern California Edison. These

[45] We recognize that there could be decreased participation in this program every year after the initial take-up, but since there is no empirical evidence to base this assumption on, we are assuming that funding is allocated equally over time.

[46] Solar thermal is the technology used in solar water heating, a kind of small version of a solar panel. More information on "California Solar Initiative: CSI-Thermal Program", available at http://www.cpuc.ca.gov/puc/energy/solar/swh.htm

utilities will serve as the program administrators, with the California Center for Sustainable Energy administering the program in the SDG&E service territory. The program has a total budget of $368 million.[47]

In order to estimate the total demand generated by DG programs in California we aggregated the total policy budgets and the participant costs. Based on general CSI program data from January 1, 2007 to April 21, 2010 we calculated that the ratio of the average CSI rebate with respect to the total eligible cost of a CSI project is 25.4 percent.[48]

With that percentage we were able to estimate the participant costs for all CSI programs. If we assume 10 percent administrative costs for each program, the remaining 90 percent of each policy budget would go to rebates. For instance, the CSI General Market program, which has a budget of $1.897 billion, will be divided in: $190 million for administration, marketing and evaluation and $1.707 billion for incentives. Because CSI incentives typically pay for 25.4 percent of the total eligible cost of a CSI project, we estimate that this program will generate a total demand of approximately $6.725 billion from 2007 until 2016 ($672.5 million per year assuming a linear allocation of funds by year). The participant costs would be $5.018 billion ($6.725 – $1.707) or $502 million per year.

For the MASH and SASH programs, which received $108 million each, we estimate a total demand of $383 million ($97 million for incentives and $11 million for administrative costs) or $38 million per year.

For the CSI Thermal Program, which received 368 million for 8 years (from 2010 to 2017), we estimate a total demand of $1.304 billion ($331 million for incentives and $37 million for administrative costs) or $163 million per year.

Table A.28 Total Incentives and Eligible Costs of CSI projects (1/1/07 to 4/21/10)

CSI Total Incentive Amount	CSI Total Eligible Cost
$ 690,674,168	$ 2,720,846,551

Source: California Solar Statistics, available at http://www.californiasolarstatistics.ca.gov

We established a distribution of CSI funds by sector using data from the California Solar Statistics database. The four sectors that the database gives are Residential, Commercial, Government and Non-Profit. In order to transform this into our 5-sector categories we broke down commercial projects by NAICS sector.[49] Taking into account only those entries with a NAICS code, we classified those that begin with a 1 as Agriculture, those starting with a 3 as Industrial, those starting with number 9 as Public and the rest as Commercial. Then we added the CSI Non-Profit category to our Commercial category and we arrived to the following breakdown by sector:

[47] California Public Utilities Commission: Decision Establishing the California Solar Initiative Solar Thermal Program to Provide Solar Water Heating Incentives (D. 10-01-022), January 22, 2010, available at http://docs.cpuc.ca.gov/efile/PD/109520.htm (pages 54 and 56)

[48] California Solar Statistics, available at http://www.californiasolarstatistics.ca.gov/

[49] There is a column where companies can enter their NAICS code, although not all of them do it

Table A.29 CSI Breakdown by Sector

CSI	TOTAL INCENTIVE AMOUNT	%	TOTAL ELIGIBLE COST	%	Average %
Residential	237,644,849	34%	1,177,789,825	43%	41%
Commercial (incl. Non-Profit)	251,333,614	36%	791,670,435	29%	31%
Industrial	60,860,549	9%	235,482,017	9%	9%
Agricultural	34,356,819	5%	128,849,089	5%	5%
Government	106,478,337	15%	387,055,185	14%	14%
Total	690,674,168	100%	2,720,846,551	100%	100%

Source: California Solar Statistics, available at http://www.californiasolarstatistics.ca.gov

We estimated the allocation of CSI-Thermal Program expenditures by sector using estimates from the Department of Energy that one million residential and 200,000 commercial solar water-heating systems have been installed in the United States until 2009.[50] That gave us a rough estimate how the expenditures for this initiative will be allocated by sector, that is, residential (83 percent) and commercial (17 percent). For the Solar Thermal initiative we used these sector estimates instead of Table A.29 above.

V.A.3. NEW SOLAR HOMES PARTNERSHIP AND POU SOLAR PROGRAMS

The New Solar Homes Partnership (NSHP) provides financial incentives and other support to home builders, encouraging the construction of new, energy efficient solar homes. The program is managed by the California Energy Commission and has a budget of $400 million for the period between 2007 and 2016.

Table A.30 New Solar Homes Partnership

New Solar Homes Partnership	TOTAL (2007-2016)	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Total budget (In $ Millions)	$400	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0

Source: California Public Utilities Commission, California Solar Initiative - California Public Utilities Commission, Staff Progress Report, October 2009, October 21, 2009, available at http://www.gosolarcalifornia.ca.gov/documents/csi.html

The Public Owned Utilities (POUs) have established a total of $784 million for the period between 2008 and 2016 for solar incentives in POU regions.

[50] U.S. Department of Energy, "Energy Efficiency and Renewable Energy: Building Technologies Program: Commercial Buildings: Solar Water Heating" (web site), available at https://www1.eere.energy.gov/buildings/commercial/water_heating.html (accessed May 8, 2009)

Table A.31 POU SOLAR PROGRAMS

POU Programs	TOTAL (2007-2016)	2008	2009	2010	2011	2012	2013	2014	2015	2016
Total budget (In $ Millions)	$784	87	87	87	87	87	87	87	87	87

Source: California Public Utilities Commission, *California Solar Initiative - California Public Utilities Commission, Staff Progress Report, October 2009*, October 21, 2009, available at http://www.gosolarcalifornia.ca.gov/documents/csi.html

Using the average CSI rebate to total cost ratio (25,4 percent), we were able to estimate a total demand of $1.418 billion for the New Solar Homes Partnership Program ($360 million for incentives and $40 million for administrative costs) and about $2.78 billion for the POU solar programs ($706 for incentives and $78 for administrative costs) for the period between 2008 and 2016. As for IOUs and CEC solar programs, for POU programs, we also calculated year amounts linearly, that is, dividing the total assigned budget between the total number of years and assigning the same amount to each year.

V.A.4. SELF-GENERATION INCENTIVE PROGRAM (SGIP)

The CPUC's Self-Generation Incentive Program (SGIP) provides incentives to businesses and individuals who invest in renewable and non-renewable distributed generation (DG) – defined as generation installed on the customer's side of the utility meter – other than solar energy projects. SB 412 (Stats. of 2009, Chap. 182) authorizes annual collections for SGIP in 2010 and 2011 of not more than the amount authorized for SGIP in 2008 ($83 million). The legislation also extends administration of the program until January 1, 2016, and limits program eligibility to distributed energy resources that the Commission determines, in consultation with the California Air Resources Board, will achieve reductions in greenhouse gas emissions. SB 412 also requires the CPUC to repay unallocated SGIP funds by 2016.[51]

In a phone interview with staff from the CPUC Energy Division, we learned that there is approximately $310 million from past years that will be spent in the period between Jan 1, 2012 and Jan 1, 2016 (see Table A.32 below).[52]

We estimated the portion of SGIP funding dedicated to renewable energy generation (wind turbines, renewable fuel cells and advanced energy storage) by taking the portion of funds used for renewable energy in a SGIP database of projects from the first quarter of 2007 until the fourth quarter of 2009.[53] We excluded advanced gas turbines, internal combustion engines, microturbines and natural gas fuel cells.

[51] California Public Utilities Commission, Decision Adopting Self-Generation Incentive Program Budget for 2010 and 2011 (D.09-12-047), December 24, 2009, available at http://docs.cpuc.ca.gov/PUBLISHED/FINAL_DECISION/111738.htm

[52] Phone interview with Curtis Seymour (CPUC) on Apr 28, 2010.

[53] Center for Sustainable Energy, "SGIP Data and Reports" (web site), available at http://energycenter.org/index.php/incentive-programs/self-generation-incentive-program/sgip-data-a-reports

Table A.32 SGIP Budget (millions of dollars)

SGIP Budget	
2010-11 SGIP Budget ($83 per year)	166
2012-15 SGIP Budget ($310 million carried money)	310
Total 2010-2015 SGIP Budget	476
SGIP Budget % of Wind Turbines, Renewable Fuel Cells and Advanced Energy Storage	54%
2012-2015 SGIP Budget (Wind Turbines, Renewable Fuel Cells and Advanced Energy Storage ONLY)	257

Source: Author's calculations based on interviews with CPUC officials and data from Center for Sustainable Energy, "SGIP Data and Reports" (web site), http://energycenter.org/index.php/incentive-programs/self-generation-incentive-program/sgip-data-a-reports

By sector, most SGIP funded projects happen within the commercial sector[54] so we estimated 100% of SGIP going to the commercial sector. We also calculated that the ratio of the average SGIP rebate with respect to the total eligible cost of the project is higher than for CSI, specifically, 36.5%.[55] Using this average rebate to total cost ratio, we were able to estimate a total demand of $690 million for the SGIP budget between 2010 and 2015 ($231 million for incentives and $26 million for administrative costs) or $115 million per year.

V.A.5. EMERGING RENEWABLES PROGRAM (ERP)

The CEC's Emerging Renewables Program (ERP) provides that a portion of the funds collected from the customers of the three major electric investor-owned utilities be used for statewide public benefit programs, including incentives for non-solar renewable electricity systems. The ERP distributes $65.5 million per year, collected from the ratepayers and held in the Renewable Resource Trust Fund.[56]

The authorization for the public goods charge is set to expire January 1, 2012. The Energy Commission is currently seeking reauthorization of ratepayer funding for ERP. [57]

ERP data is more limited than SGIP. Because of the similarity of the programs and because ERP funding does not break out its budget for different sectors, we estimated that ERP projects also happen mostly in the commercial sector as in the SGIP program. In order to calculate the ratio of the rebate amount to total eligible cost, we also used the SGIP estimations although excluding advanced energy storage (ERP only funds wind turbines and renewable fuel cells). When excluding advanced energy storage, the SGIP ratio equals 33.5 percent, which is the

[54] Phone interview with Curtis Seymour (CPUC) on Apr 28, 2010.

[55] Sum of Total Eligible Cost / Sum of Total Incentive Amount for Wind Turbines, Renewable Fuel Cells, and Advanced Energy Storage for the dataset provided by Center for Sustainable Energy, "SGIP Data and Reports" (web site), available at http://energycenter.org/index.php/incentive-programs/self-generation-incentive-program/sgip-data-a-reports (only for projects starting in January 1, 2007 or after).

[56] Interview and correspondence with James Lee (California Energy Commission).

[57] Interview and correspondence with James Lee (California Energy Commission).

one we used for ERP. Using this average rebate to total cost ratio, we were able to estimate a total demand of $176 million per year for the ERP budget ($59 million for incentives and $7 million for administrative costs per year).

V.B. SCENARIOS FOR DISTRIBUTED GENERATION PROGRAMS

We have defined the following scenarios for distributed generation programs in California:

Table A.33 Scenarios for Distributed Generation Programs

	Low Scenario	Medium Scenario	High Scenario
CSI (CPUC)	Funds continue until 2016 (as currently budgeted)	Funds continue until 2016 and then they stay flat until 2020	Funds continue until 2016 and then they stay flat until 2020
NSHP (CEC)	Funds continue until 2016 (as currently budgeted)	Funds continue until 2016 and then they stay flat until 2020	Funds continue until 2016 and then they stay flat until 2020
POU Solar Programs	To come	To come	To come
SGIP	Funds continue until 2015 (as currently budgeted)	Funds continue until 2015 and then they stay flat until 2020	Funds continue until 2015 and then they stay flat until 2020
ERP	Funds continue until 2011 (as currently budgeted)	Funds continue until 2015 and then they stay flat until 2020	Funds continue until 2015 and then they stay flat until 2020

V.C. DISTRIBUTED GENERATION BUDGETS NAICS ALLOCATION

V.C.1. METHOD 7: CALIFORNIA SOLAR PROGRAMS TO NAICS

We used this method to estimate NAICS codes for funds going to any of the programs of the California Solar Initiative, the New Solar Homes Partnership program and the POUs' solar programs. We estimated that 10 percent of program expenditures would go toward administrative, marketing and evaluation costs (based on information for the CSI program on the *Go Solar California!* website). Excluding this 10 percent meant multiplying the original percentage by a factor of 0.9 (1-0.1). We then divided the remaining costs into different categories based on a 2007 report on solar photovoltaic system costs prepared by Itron for the CPUC:[58]

- → PV modules: 65 percent
- → Inverters: 10 percent
- → Labor and Installation: 25 percent

The readjusted percentages are as follows:

[58] Itron, CPUC Self-Generation Incentive Program: Solar PV Costs and Incentive Factors, February 2007, available at http://www.energycenter.org/uploads/Selfgen_SolarPVCosts_FinalReport.pdf.

Table A.34 Solar Initiatives Percentages (Material, Labor, Admin)

Category	Original %	Admin Factor	CSI Allocation Share
PV Modules + Inverters Costs	75%	0.90	67.5%
Labor and Installation Costs	25%	0.90	22.5%
Administration	100%	0.10	10%

Source: Author's Calculations based on Itron, *CPUC Self-Generation Incentive Program: Solar PV Costs and Incentive Factors*, February 2007 http://www.energycenter.org/uploads/Selfgen_SolarPVCosts_FinalReport.pdf and Go Solar California! website, http://www.gosolarcalifornia.org/csi/index.html

Next, we used the NAICS codes described in a New York State Department of Labor study on the Clean Energy Industry[59] together with our estimated cost percentages to get final CSI allocation shares (see Table A.35 below).

V.C.2. METHOD 8 AND 9: SGIP AND ERP PROGRAMS

We used similar methods for SGIP and ERP funds. Both include wind turbines and renewable fuel cells NAICS codes and for SGIP we included advanced energy storage. We used the SGIP detailed database to calculate the relative portion of funding allocated to wind, renewable cells and advanced energy storage.[60] In the case of SGIP, the ratios were 56 percent for wind, 26 percent for renewable fuel cells and 17 percent for advanced energy storage. In the case of ERP, the ratios were 68 percent for wind and 32 percent for renewable fuel cells. Next, we used the NAICS codes from the New York State Labor Department study together with our estimated cost percentages, to get final wind allocation shares.[61] For renewable fuel cells, we also assigned 10 percent of program funding to administrative costs, based on the CSI program cost structure, and assumed that the remainder would be used for fuel cell materials REVIEW (see http://www.fuelcelltoday.com/events/industry-review). Next, we used NAICS codes for fuel cells from a Green Economy report prepared by the Washington State Department of Community, Trade, and Economic Development,[62] together with our estimated cost percentages, to get final renewable fuel cell allocation shares. For advanced energy storage systems, we assigned 10% of funding to administrative costs and the rest was assign to the NAICS code 335911 (Storage Battery Manufacturing). For more details see Table A.36 and Table A.37 below.

[59] New York State Department of Labor, New York State's Clean Energy Industry: Labor Market and Workforce Intelligence, available at http://www.labor.state.ny.us/workforcenypartners/PDFs/NYS%20Clean%20Energy%20Jobs%20Report%20FINAL%2006-09-09.pdf (page 56)

[60] Center for Sustainable Energy, Statewide Self-Generation Incentive Program Data, available at http://energycenter.org/index.php/incentive-programs/self-generation-incentive-program/sgip-data-a-reports (only for projects starting in January 1, 2007 or after)

[61] New York State Department of Labor, New York State's Clean Energy Industry: Labor Market and Workforce Intelligence , May 2009, available at http://www.labor.state.ny.us/workforcenypartners/PDFs/NYS%20Clean%20Energy%20Jobs%20Report%20FINAL%2006-09-09.pdf (page 56)

[62] Washington State Department of Community, Trade, and Economic Development, E2SHB Implementation Team, "Initial Washington Green Economy Industry List," July 15, 2008.

Table A.35 California Solar Initiative Method

NAICS			Sector	Initial Allocation Share		Final Allocation Share
333414	Solar Heating Systems	Heating Equipment (except Warm Air Furnaces) Manufacturing	Solar Manufacturing	1%	0.675	1%
334413	Solar Cells/Photovoltaic Devices	Semiconductor and Related Device Manufacturing	Solar Manufacturing	91%	0.675	62%
334519	Solarimeters	Other Measuring and Controlling Device Manufacturing	Solar Manufacturing	4%	0.675	3%
335121	Solar Lighting Fixtures (Residential)	Residential Electric Lighting Fixture Manufacturing	Solar Manufacturing	1%	0.675	1%
335122	Solar Lighting Fixtures (Commercial)	Commercial, Industrial, and Institutional Electric Lighting Fixture Manufacturing	Solar Manufacturing	3%	0.675	2%
23816	Solar Reflecting Coating/Roof Application	Roofing Contractors	Solar Installers	14%	0.225	3%
23822	Solar Heating Equipment Installation	Plumbing, Heating, and Air-Conditioning Contractors	Solar Installers	86%	0.225	19%
926130	Regulation and Administration of Communications, Electric, Gas, and Other Utilities		Administration	100%	0.10	10%

Source: Author's calculations based on data from California Solar Statistics (www.californiasolarstatistics.ca.gov/), Center for Sustainable Energy, Statewide Self-Generation Incentive Program Data for projects starting in January 1, 2007 or after (http://energycenter.org/index.php/incentive-programs/self-generation-incentive-program/sgip-data-a-reports), *New York State's Clean Energy Industry: Labor Market and Workforce Intelligence Report* (http://www.labor.state.ny.us/workforcenypartners/PDFs/NYS%20Clean%20Energy%20Jobs%20Report%20FINAL%2006-09-09.pdf (page 56)).

Table A.36 SGIP Method

NAICS	SGIP	Sector					Final Allocation Share
	WIND						
926130	Regulation and Admin of Comm., Electric, Gas, and Other Utilities	Admin/Internal	33%	0.1	3%	56%	2%
5611	Office Administrative Services	Admin/Internal	33%	0.1	3%	56%	2%
551114	Corporate, Subsidiary, and Regional Managing Offices	Admin/Internal	33%	0.1	3%	56%	2%
237130	Power and Communication Line and Related Structures Construction	Labor	100%	0.225	23%	56%	13%
333611	Turbine and Turbine Generator Set Units Manufacturing	Material	100%	0.675	68%	56%	38%
	RENEWABLE FUEL CELLS						
926130	Regulation and Admin of Comm., Electric, Gas, and Other Utilities	Admin/Internal	33%	0.1	3%	26%	1%
5611	Office Administrative Services	Admin/Internal	33%	0.1	3%	26%	1%
551114	Corporate, Subsidiary, and Regional Managing Offices	Admin/Internal	33%	0.1	3%	26%	1%
335999	All Other Miscellaneous Electrical Equipment and Component Manufacturing (incl. Fuel Cells)	Material	100%	0.9	90%	26%	24%
	ADVANCED ENERGY STORAGE						
926130	Regulation and Admin of Comm., Electric, Gas, and Other Utilities	Admin/Internal	33%	0.1	3%	17%	1%
5611	Office Administrative Services	Admin/Internal	33%	0.1	3%	17%	1%
551114	Corporate, Subsidiary, and Regional Managing Offices	Admin/Internal	33%	0.1	3%	17%	1%
335911	Storage Battery Manufacturing	Material	100%	0.9	90%	17%	26%

Source: Author's calculations based on data from Statewide Self-Generation Incentive Program Data for projects starting in January 1, 2007 or after (http://energycenter.org/index.php/incentive-programs/self-generation-incentive-program/sgip-data-a-reports), *New York State's Clean Energy Industry: Labor Market and Workforce Intelligence Report* (http://www.labor.state.ny.us/workforcenypartners/PDFs/NYS%20Clean%20Energy%20Jobs%20Report%20FINAL%2006-09-09.pdf (page 56)). Fuel Cell NAICS codes from *Initial Washington Green Economy Industry List - E2SHB Implementation Team* (July 15, 2008)

Table A.37 ERP Method

NAICS	ERP	Sector					Final Allocation Share
	WIND						
926130	Regulation and Administration of Communications, Electric, Gas, and Other Utilities	Admin/Internal	33%	0.1	3%	68%	2%
5611	Office Administrative Services	Admin/Internal	33%	0.1	3%	68%	2%
551114	Corporate, Subsidiary, and Regional Managing Offices	Admin/Internal	33%	0.1	3%	68%	2%
237130	Power and Communication Line and Related Structures Construction	Labor	100%	0.225	23%	68%	15%
333611	Turbine and Turbine Generator Set Units Manufacturing	Material	100%	0.675	68%	68%	46%
	RENEWABLE FUEL CELLS						
926130	Regulation and Administration of Communications, Electric, Gas, and Other Utilities	Admin/Internal	33%	0.1	3%	32%	1%
5611	Office Administrative Services	Admin/Internal	33%	0.1	3%	32%	1%
551114	Corporate, Subsidiary, and Regional Managing Offices	Admin/Internal	33%	0.1	3%	32%	1%
335999	All Other Miscellaneous Electrical Equipment and Component Manufacturing (incl. Fuel Cells)	Material	100%	0.9	90%	32%	28%
							100%

Source: Author's calculations based on data from Statewide Self-Generation Incentive Program Data for projects starting in January 1, 2007 or after (http://energycenter.org/index.php/incentive-programs/self-generation-incentive-program/sgip-data-a-reports), *New York State's Clean Energy Industry: Labor Market and Workforce Intelligence Report* (http://www.labor.state.ny.us/workforcenypartners/PDFs/NYS%20Clean%20Energy%20Jobs%20Report%20FINAL%2006-09-09.pdf (page 56)). Fuel Cell NAICS codes from *Initial Washington Green Economy Industry List - E2SHB Implementation Team* (July 15, 2008)

VI. DEMAND RESPONSE PROGRAMS AND SMART METERS

VI.A. PROGRAM DESCRIPTIONS AND BUDGET DATA BY SECTOR

VI.A.1. IOU DEMAND RESPONSE PROGRAMS

Demand response is a resource that can allow electricity customers to reduce their electricity usage in a given time period, or shift that usage to another time period, in response to a price signal, a financial incentive, an environmental condition or a reliability signal to an automated direct control switch. Demand response reduces peak time energy usage, and reduces (or at least delays) the need for new generating capacity. The *Long-Term Energy Efficiency Strategic Plan* called for demand response policies to be integrated with California's energy efficiency and demand-side management policies. The CPUC authorizes funding for demand response programs for California's three major electric IOUs in 3-year cycles. The CPUC-approved IOU budgets have a total cost of $350 million over 2009-2011, an average of $117 million per year.[63]

We divided each program category by sector – residential, commercial, industrial, agricultural and public – based on the proportions for each category in the approved programs. We divided those programs that rely on commercial and industrial devices (demand response enabling programs and devices) based on information provided in testimony filed by PG&E in support of their 2009 – 2011 demand response program application.[64] We divided air conditioning cycling programs by sector according to program enrollment information provided in Southern California Edison's testimony.[65] We assumed that the costs of commercial and industrial pricing programs, audits, and R&D would be allocated in the same proportions as commercial and industrial devices, while the costs of evaluation programs would be allocated in the same proportions as marketing programs. For information technology programs, we allocated 10 percent of the costs to the residential sector, and divided the remainder in the same proportions as commercial and industrial devices.

[63] California Public Utilities Commission, *Decision Adopting Demand Response Activities and Budgets for 2009 Through 2011* (D.09-08-027), August 20, 2009, available at http://docs.cpuc.ca.gov/PUBLISHED/FINAL_DECISION/106008.htm.

[64] Pacific Gas & Electric Company, 2009-2011 Demand Response Programs and Budgets, Amended Prepared Testimony, September 19, 2008, available at https://www.pge.com/regulation/DemandResponse2009-2011-Projects/Testimony/PGE/2008/DemandResponse2009-2011-Projects_Test_PGE_20080602-01.pdf.

[65] Southern California Edison, Testimony in Support of Southern California Edison Company's Application for Approval of Demand Response Programs, Goals, and Budgets for 2009-2011 -- Appendices, June 2, 2008, available at http://www3.sce.com/sscc/law/dis/dbattach1e.nsf/0/8825710D007811A8882574660079A633/$FILE/A.08-06-001+SCE+2009-11+DR+App+SCE-02+PUBLIC+Redacted+Version.pdf.

Table A.38 IOU Demand Response Programs by Sector

Sector	DR Programs Estimated $ Amounts	%
Residential	39,054,164	11%
Commercial	82,950,333	24%
Industrial	159,057,453	45%
Agricultural	65,734,783	19%
Government	2,994,101	1%
Total	349,790,834	100%

Source: Pacific Gas & Electric Company, 2009-2011 Demand Response Programs and Budgets, Amended Prepared Testimony, September 19, 2008, available at https://www.pge.com/regulation/DemandResponse2009-2011-Projects/Testimony/PGE/2008/DemandResponse2009-2011-Projects_Test_PGE_20080602-01.pdf; and Southern California Edison, Testimony in Support of Southern California Edison Company's Application for Approval of Demand Response Programs, Goals, and Budgets for 2009-2011 -- Appendices, June 2, 2008, available at http://www3.sce.com/sscc/law/dis/dbattach1e.nsf/0/8825710D007811A8882574660079A633/$FILE/A.08-06-001+SCE+2009-

VI.A.2. IOU SMART METERS

The CPUC has authorized California's four major IOUs to spend a total of $4.94 billion to install advanced metering infrastructure (AMI), including smart meters for all electric and gas customers, over 2006 – 2015.[66] AMI consists of metering and communications infrastructure as well as the related computerized systems and software. Smart meters are capable of two-way information exchange between customers and the utility, allowing customers to have greater control over their energy usage and enabling demand response programs.

We estimated smart meter expenditures by year from the sum of our individual estimates for each IOU. For Southern California Gas, we used the division of costs by year provided in that utility's application to the CPUC. For Southern California Edison, we estimated costs by year from the portion of that utility's meters that will be installed in each year. For the other two utilities, we divided costs by year using the same proportions as those of the sum of Southern California Gas' costs and our estimate of Southern California Edison's costs, in the same years. In each case we shifted costs per year to coincide with the last four years of the period of activity authorized by the appropriate CPUC AMI decision covering that utility.

[66] California Public Utilities Commission, Final Opinion Authorizing Pacific Gas and Electric Company to Deploy Advanced Metering Infrastructure (D.06-07-027), July 20, 2006, available at http://docs.cpuc.ca.gov/word_pdf/FINAL_DECISION/58362.pdf; California Public Utilities Commission, Decision Approving Settlement on Southern California Edison Company Advanced Metering Infrastructure Deployment (D.08-09-039), September 18, 2008, available at http://docs.cpuc.ca.gov/word_pdf/FINAL_DECISION/91154.pdf; California Public Utilities Commission, Decision Approving Settlement on San Diego Gas & Electric Company's Advanced Metering Infrastructure Project (D.07-04-043), April 12, 2007, available at http://docs.cpuc.ca.gov/word_pdf/FINAL_DECISION/66766.pdf; Southern California Gas Decision.

Table A.39 IOUs Smart Meter Budgets in California

Smart Meter Budget (In $ Millions)	2008	2009	2010	2011	2012	2013	2014	2015	2008-2015
Capital	$466	$877	$957	$739	$326	$169	$171	$149	$3,855
O&M	$130	$259	$275	$213	$85	$37	$43	$44	$1,086
TOTAL	$596	$1,136	$1,232	$952	$411	$207	$214	$193	$4,941

Source: California Public Utilities Commission, Final Opinion Authorizing Pacific Gas and Electric Company to Deploy Advanced Metering Infrastructure (D.06-07-027), July 20, 2006, available at http://docs.cpuc.ca.gov/word_pdf/FINAL_DECISION/58362.pdf; California Public Utilities Commission, Decision Approving Settlement on Southern California Edison Company Advanced Metering Infrastructure Deployment (D.08-09-039), September 18, 2008, available at http://docs.cpuc.ca.gov/word_pdf/FINAL_DECISION/91154.pdf; California Public Utilities Commission, Decision Approving Settlement on San Diego Gas & Electric Company's Advanced Metering Infrastructure Project (D.07-04-043), April 12, 2007, available at http://docs.cpuc.ca.gov/word_pdf/FINAL_DECISION/66766.pdf; Southern California Gas Decision

We allocated program costs by sector according to the number of electricity customers in each sector in California, as reported by the U.S. Department of Energy.[67]

Table A.40 Percentage of Smart Meter Customers by Sector

Sector	% Customers (2008)
Residential	87.3 %
Commercial	11.8 %
Industrial	0.4 %
Agricultural	0.1 %
Government	0.4 %
Total	100%

Source: Estimate based on U.S. Department of Energy, Energy Information Agency, Electric Power Annual 2008 -- State Data Tables, January 21, 2010, available at http://www.eia.doe.gov/cneaf/electricity/epa/epa_sprdshts.html. The agricultural and government figures are estimates based on data from 2002, the last year in which customers were reported in an "other" category along with residential, commercial, and industrial.

VI.A.3. POU DEMAND RESPONSE AND SMART METERS

In late 2009, SMUD received a $127.5 million Smart Grid Investment Grant from DOE to implement $308 million worth of smart grid, demand response and EV electrification grid projects until 2013. For the purpose of our study, we selected only the projects specifically related to smart meters and demand response (we included dynamic pricing as a demand response activity), which accounted for $190 million.

[67] U.S. Department of Energy, Energy Information Agency, Electric Power Annual 2008 – State Data Tables, January 21, 2010, available at http://www.eia.doe.gov/cneaf/electricity/epa/epa_sprdshts.html.

Table A.41 SMUD Smart Meter & Demand Response Programs (in $ million)

Project Task	2009 (pre-award)	2010	2011	2012	TOTAL
AMI/Smart Meters	15.6	84.5	26.2	0	126.3
Dynamic Pricing	0	8	4	4	16
Demand Response	0	8.4	16.3	23	47.7
TOTAL	15.6	100.9	46.5	27	190

Source: Jim Parks/California Public Utilities Commission, Smart Grid Implementation at the Sacramento Municipal Utility District -- CPUC Smart Grid Workshop (March 18, 2010), available at www.cpuc.ca.gov/NR/...D534.../CPUCWorkshop31810SMUDParks2.pdf

In November 2009, DOE awarded the Los Angeles Department of Water and Power (LADWP) over $60 million in federal Smart Grid Demonstration funding to "green the grid" by developing, deploying and testing advanced smart grid technologies until 2013.[68] We were not able to find detailed data on how much of these funds would be assigned to smart meters or demand response as in the case of SMUD. Therefore, we assumed a similar distribution of funds as the SMUD smart grid grant (41 percent of the total grant for smart meters, 5 percent for dynamic pricing and 16percent for demand response) and we distributed linearly between 2010 and 2012. We estimated that LADWP alone would spend about $24.7 million for smart meters, $3 million for dynamic pricing and $9.6 million for general DR activities between 2010 and 2013. Combined, both POUs would potentially spend $151 million in smart meters and $76.3 million in demand response and dynamic pricing between 2010 and 2013 (see table below).

Table A.42 Estimated Budgets for Smart Meter and Demand Response (incl. Dynamic Pricing) for SMUD and LADWP (in $ million)

Area	2009 (pre-award)	2010	2011	2012	TOTAL
Smart Meters	15.6	92.7	34.4	8.2	151.0
Dynamic Pricing	0.0	9	5	5	19
Demand Response	0.0	11.6	19.5	26.2	57.3
TOTAL	15.6	113.3	58.9	39.4	227.3

Source: Author's calculations based on Jim Parks/California Public Utilities Commission, *Smart Grid Implementation at the Sacramento Municipal Utility District* -- CPUC Smart Grid Workshop (March 18, 2010), available at *www.cpuc.ca.gov/NR/...D534.../CPUCWorkshop31810SMUDParks2.pdf (for SMUD) and US Department of Energy,* available at http://www.energy.gov/news2009/8305.htm (for LADWP)

VI.B. SCENARIOS FOR DEMAND RESPONSE PROGRAMS AND SMART METERS

[68] U.S. Department of Energy (website), available at http://www.energy.gov/news2009/8305.htm

We have defined the following scenarios for demand response and smart meter programs in California:

Table A.43 Scenarios for IOU's Demand Response and Smart Meters Programs

	Low Scenario	Medium Scenario	High Scenario
Demand Response	Price-responsive annual program funding continues indefinitely at 1/3 of 2009-11 approved level POUs: Funding continues after 2012 at $25 million per year	Price-responsive annual program funding increases by 11% per year through 2017, relative to a baseline of 1/3 of the 2009-11 approved level, then remains constant until 2020	Price-responsive annual program funding increases by 11% per year through 2017, relative to a baseline of 1/3 of the 2009-11 approved level, then by 5 percent per year through 2020
Smart Meters	IOUs: No funding after 2015 POU: No funding after 2013	IOUs: No funding after 2015 POU: No funding after 2013	IOUs: No funding after 2015 POU: No funding after 2013

In the low scenario, demand response program funding would be extended into the future indefinitely at the 2009-2011 approved level ($117 million per year for IOUs). For POUs, demand response funding continues after 2012 at $31 million per year ($5 million for dynamic pricing and $26 for general DR initiatives).[69]

In the medium scenario, price-responsive demand response program funding would increase by 5 percent per year over the 2009-2011 approved level through 2020[70] while emergency-triggered demand response program funding would continue at the 2009-2011 approved level. The costs of other programs are allocated proportionately to price-responsive and emergency-triggered programs. The cost increases in the medium scenario are in proportion to the annual increase in program enrollment that would be needed to reach the State's goal of reducing peak electricity demand by 5 percent (approximately 2,500 MW) through price-responsive measures. This goal was originally established in the second Energy Action Plan, as a target for 2007[71] (there is no long-term goal for emergency-triggered programs). However, for various reasons the price-responsive programs had succeeded only in reducing peak demand by 2.2 percent in 2007,[72] and are projected to do so by only 2.7 percent in 2011.[73] Hence, this scenario relies on aggressive action by state policymakers to remove barriers to demand response programs to meet the goal by 2017, as well as more program funding and the implementation of advanced metering infrastructure, which is being done in part to enable demand response programs. For POU budgets, we assumed that the funding is also increased 11 percent per year for dynamic pricing initiatives through 2017 and then remains constant.

The high scenario reflects continuing development and penetration of demand response programs beyond the state's existing long-term goal for price-responsive measures. Under this scenario, funding for price-responsive programs would increase by 11 percent per year through 2017, then by 5 percent per year through 2020, while funding for emergency-triggered programs would increase by 5 percent per year through 2020 (the total reaching $215 million). For POU budgets, we assumed that dynamic pricing funding is also increased 11 percent per year through 2020. Note that we keep the relative target sector shares (residential, commercial, etc.)

[69] 2012 budget figures for LADWP and SMUD combined

[70] The increment would apply in 2012 for the first time

[71] California Energy Commission and California Public Utilities Commission, "Energy Action Plan II: Implementation Roadmap for Energy Policies," October 2005, available at http://docs.cpuc.ca.gov/published/Report/51604.htm.

[72] A. Faruqui and R. Hledik, The State of Demand Response in California, report of The Brattle Group Prepared for the California Energy Commission (CEC-200-2007-003-D), April 2007, available at http://www.energy.ca.gov/2007publications/CEC-200-2007-003/CEC-200-2007-003-D.PDF.

[73] California Public Utilities Commission, Decision Adopting Demand Response Activities and Budgets for 2009 Through 2011 (D.09-08-027), August 20, 2009, available at http://docs.cpuc.ca.gov/PUBLISHED/FINAL_DECISION/106008.htm.

fixed in terms of their budgets. We also hold the share of budgets flowing to admin, pricing, and technology constant as well and we assumed to POU scenarios are similar to those of IOUs.

Regarding smart meters, because the CPUC has authorized the IOUs to substitute all of their meters by 2015, we do not foresee significant amounts of funding for the installation of smart meters available after that year. Moreover, our analysis considers only jobs created through the installation of smart meters. We did not attempt to estimate job losses to the meter-reading workforce, or job gains due to the need to manage a more complex advanced metering infrastructure. For POUs, we assumed that the funding would not continue after 2013, the year in which both SMUD and LADWP smart grid grants are scheduled to end.

VI.C. DEMAND RESPONSE AND SMART METER BUDGETS AND NAICS

VI.C.1. METHOD 9: DEMAND RESPONSE PROGRAMS

We used method 9 to estimate NAICS codes for funds going to Demand Response programs. Because we had more detailed information on IOUs Demand Response programs, we used the IOU budget to allocate NAICS and then added POU budgets assuming they would follow a similar distribution in job creation. We began by assigning the authorized demand response programs into nine program categories (see Table A44 below). Next, we divided each program category into O&M (operations and maintenance), capital costs, and incentive payments for all three utilities, based on the proportions for each category provided in the 2009 – 2011 demand response program application filed by SDG&E.[74] We used this application because SDG&E provided the most detailed information about O&M, capital costs, and incentive payments.

We assumed that the costs of residential pricing programs would be allocated among these categories in the same proportions as commercial and industrial pricing programs.

[74] San Diego Gas & Electric Company, 2009-2011 Demand Response Application, September 19, 2008, available at http://www.sdge.com/regulatory/A08-06-002.shtml

Table A.44 IOUs Demand Response Programs by Category (2009-2011 Budget)

Category	Estimated $ Budget	O&M	Capital	Incentive
Audits	12,953,326	30%	0%	70%
Commercial & Industrial Devices	104,800,939	30%	0%	70%
Commercial & Industrial Pricing	91,752,440	40%	0%	60%
Evaluation	20,242,822	100%	0%	0%
IT	30,060,420	100%	0%	0%
Marketing	39,639,195	100%	0%	0%
R&D	14,254,271	100%	0%	0%
Residential Devices	5,753,421	40%	60%	0%
Residential Pricing	30,334,000	40%	0%	60%
TOTAL	349,790,834	-	-	-

Source: Author's calculations based on California Public Utilities Commission, Final Opinion Authorizing Pacific Gas and Electric Company to Deploy Advanced Metering Infrastructure (D.06-07-027), July 20, 2006, available at http://docs.cpuc.ca.gov/word_pdf/FINAL_DECISION/58362.pdf; California Public Utilities Commission, Decision Approving Settlement on Southern California Edison Company Advanced Metering Infrastructure Deployment (D.08-09-039), September 18, 2008, available at http://docs.cpuc.ca.gov/word_pdf/FINAL_DECISION/91154.pdf; California Public Utilities Commission, Decision Approving Settlement on San Diego Gas & Electric Company's Advanced Metering Infrastructure Project (D.07-04-043), April 12, 2007, available at http://docs.cpuc.ca.gov/word_pdf/FINAL_DECISION/66766.pdf; Southern California Gas Decision

We reclassified those categories into 5 basic groups in order to calculate the relative weight of each category group in order to assign to different NAICS codes:

Table A.45 Share of IOUs Demand Response Budget by Category (2009-2011 Budget)

Category Group	Estimated $ Budget	Relative Weight
Audits	12,953,326	4%
Marketing	39,639,195	11%
Pricing / Evaluation / IT [1]	172,389,682	49%
R&D	14,254,271	4%
DR Devices	187,367,070	32%
TOTAL ESTIMATED DEMAND	349,790,834	100%

Source: See above

We allocated the new category groups with a relative category weight in the budget (Audits 4 percent; Marketing 11 percent, Pricing / Evaluation / IT 49 percent; R&D 4 percent and Devices 32 percent). Next, we used a combination of methods to calculate NAICS:

- → For Audits, we used NAICS codes from the NYS Labor Department study; for their relative distribution we use the US Department of Labor CEW database.
- → For Marketing, we used the code 5418 (Advertising and Related Services).
- → For Pricing / Evaluation / IT we used the same NAICS code for administrative work used in our estimates for the IOU EE programs.
- → For Research and Development, we used the specific NAICS code "Research and Development in the Physical, Engineering, and Life Sciences (except Biotechnology)."
- → For Devices, we used the CSI estimation of 25 percent labor and 75 percent material. For labor we used "Electrical Contractors" and for materials we used the code "Navigational, Measuring, Electromedical, and Control Instruments Manufacturing."[75]

[75] The U.S. Census defines this NAICS code as "This industry comprises establishments primarily engaged in manufacturing navigational, measuring, electromedical, and control instruments. Examples of products made by these establishments are aeronautical instruments, appliance regulators and controls (except switches), laboratory analytical instruments, navigation and guidance systems, and physical properties testing equipment." (U.S. Census website, available at http://www.census.gov/epcd/ec97/industry/E33451.HTM)

Table A.46. Demand Response Programs NAICS

NAICS	NAICS Code Title	NAICS Code Weight	Category	Relative Category Weight	Final Allocation Share
54133	Engineering Services	57%	Audits	4%	2%
54162	Environmental Consulting	6%	Audits	4%	0%
54135	Building Inspection Services	1%	Audits	4%	0%
541690	Energy Consulting services	35%	Audits	4%	1%
5418	Advertising and Related Services	100%	Marketing	11%	11%
926130	Regulation and Administration of Communications, Electric, Gas, and Other Utilities	33%	Pricing / Evaluation / IT	49%	16%
5611	Office Administrative Services	33%	Pricing / Evaluation / IT	49%	16%
551114	Corporate, Subsidiary, and Regional Managing Offices	33%	Pricing / Evaluation / IT	49%	16%
541712	Research and Development in the Physical, Engineering, and Life Sciences (except Biotechnology)	100%	R&D	4%	4%
33451	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	75%	Devices	32%	24%
23821	Electrical Contractors	25%	Devices	32%	8%

Source: Author's calculations based on California Public Utilities Commission, Final Opinion Authorizing Pacific Gas and Electric Company to Deploy Advanced Metering Infrastructure (D.06-07-027), July 20, 2006, available at http://docs.cpuc.ca.gov/word_pdf/FINAL_DECISION/58362.pdf; California Public Utilities Commission, Decision Approving Settlement on Southern California Edison Company Advanced Metering Infrastructure Deployment (D.08-09-039), September 18, 2008, available at http://docs.cpuc.ca.gov/word_pdf/FINAL_DECISION/91154.pdf; California Public Utilities Commission, Decision Approving Settlement on San Diego Gas & Electric Company's Advanced Metering Infrastructure Project (D.07-04-043), April 12, 2007, available at http://docs.cpuc.ca.gov/word_pdf/FINAL_DECISION/66766.pdf; Southern California Gas Decision; NAICS database, CSI labor/material estimates and IOU's portfolio Admin NAICS estimate

We then assigned this NAICS distribution to the total IOU and POU funds for DR. For IOUs the baseline is the 2009-2011 budget, which equals $350 million or $116 per year. For POUs the baseline is the 2010-2012 demand response and dynamic pricing funds of LADWP and SMUD, which sums up to $63.7 million or $25 million per year. The 2009 figure is $116 million (IOU only) and the 2010 baseline is $141 million per year (IOU and POU combined). Next, we applied the incremental scenarios explained in section 6.2 to project up to 2020.

VI.C.2. METHOD 10: SMART METERS NAICS ALLOCATION

We used method 10 to estimate NAICS codes for funds going to the installation of smart meters. Because we had more detailed information on IOUs Demand Response programs, we used the IOU budget to allocate NAICS and then added POU budgets assuming they would follow a similar distribution in job creation. We began by allocating costs by year, and by O&M and capital

costs (See Table A.47). For Southern California Edison, we took the division into O&M and capital costs from the CPUC decision authorizing that utility's advanced metering infrastructure. For Southern California Gas, we used the division provided in that utility's advanced metering infrastructure application to the CPUC,[76] with the difference between the proposed and approved totals taken from proposed capital costs. We estimated the division into O&M and capital costs for the other two utilities from the sum of these costs for Southern California Edison and Southern California Gas.

We used a combination of methods to calculate NAICS codes for smart meters:

- We estimated that administrative costs would be 10 percent – a similar level as the IOU EE programs. We used the same NAICS code for administrative work that we used in our analysis of IOU EE programs.

- We used the CSI estimation of 25 percent labor and 75 percent material for smart meters. For labor we used "Electrical Contractors" NAICS code and for materials we used the code "Automatic Environmental Control Manufacturing for Residential, Commercial, and Appliance Use"

Table A.47 Smart Meters NAICS Allocation

NAICS	NAICS Code Title	NAICS Code Weight	Category	Relative Category Weight	Final Allocation Share
926130	Regulation and Administration of Communications, Electric, Gas, and Other Utilities	Admin/Internal	33%	0.1	3.3%
5611	Office Administrative Services	Admin/Internal	33%	0.1	3.3%
551114	Corporate, Subsidiary, and Regional Managing Offices	Admin/Internal	33%	0.1	3.3%
23821	Electrical Contractors	Labor	100%	0.225	22.5%
334512	Automatic Environmental Control Manufacturing for Residential, Commercial, and Appliance Use	Material	100%	0.675	67.5%

Source: Author's calculations based on NAICS database, CSI labor/material estimates and IOU's portfolio Admin NAICS estimate

We then assigned this NAICS distribution to the total smart meter funds per year coming from IOUs and POUs. For IOUs, the baseline is the 2009-2011 budget, which equals $350 million or $116 per year. For POUs, the baseline is the 2010-2012 funds of LADWP and SMUD for smart meters, demand response and dynamic pricing which sums up to $63.7 million or $31 million per year. The 2009 figure is $116 million (IOU only) and the 2010 baseline is $141 million per year (IOU and POU combined). Next, we applied the incremental scenarios explained in section 6.2 to project until 2020.

[76] Southern California Gas Company, Application of Southern California Gas Company (U 904-G) for Approval of Advanced Metering Infrastructure, September 29, 2008, available at http://energyadvantagehome.com/regulatory/A0809023.shtml.

Table A.48 IOUs+POUS Smart Meter Budgets in California (in $ Million) - Low Scenario

Smart Meter Budget (In $ Millions)	2009	2010	2011	2012	2013	2014	2015
IOUs	1,136	1,232	952	411	207	214	193
POUs (LADPW + SMUD)	15.6	92.7	34.4	8.2	-	-	-
TOTAL	1,152	1,325	986	419	207	214	193

Source (for IOUs): Author's calculations based on California Public Utilities Commission, Final Opinion Authorizing Pacific Gas and Electric Company to Deploy Advanced Metering Infrastructure (D.06-07-027), July 20, 2006, available at http://docs.cpuc.ca.gov/word_pdf/FINAL_DECISION/58362.pdf; California Public Utilities Commission, Decision Approving Settlement on Southern California Edison Company Advanced Metering Infrastructure Deployment (D.08-09-039), September 18, 2008, available at http://docs.cpuc.ca.gov/word_pdf/FINAL_DECISION/91154.pdf; California Public Utilities Commission, Decision Approving Settlement on San Diego Gas & Electric Company's Advanced Metering Infrastructure Project (D.07-04-043), April 12, 2007, available at http://docs.cpuc.ca.gov/word_pdf/FINAL_DECISION/66766.pdf; Southern California Gas Decision

Source (for POUs): Author's calculations based on Jim Parks/California Public Utilities Commission, *Smart Grid Implementation at the Sacramento Municipal Utility District* – CPUC Smart Grid Workshop (March 18, 2010), available at *www.cpuc.ca.gov/NR/...D534.../CPUCWorkshop31810SMUDParks2.pdf (for SMUD) and US Department of Energy,* available at http://www.energy.gov/news2009/8305.htm (for LADWP)

APPENDIX B:

INCORPORATING THE CALIFORNIA EMPLOYMENT DEVELOPMENT DEPARTMENT AND OTHER GREEN ECONOMY SURVEYS

There is very little reliable data on the industries and the occupations that comprise the green economy (or the energy efficiency sector specifically). The comprehensive employer surveys conducted by the Bureau of Labor Statistics and the Department of Commerce have yet to incorporate systematic questions that help identify energy efficiency employers and workers, so commonly cited sources like the Green O*NET rely on a hodgepodge of interviews and compiled secondary sources to identify green industries and occupations.[77]

However, this study benefitted from being able to incorporate data from three rich, California-unique datasets: the California Community Colleges Centers of Excellence (COE) survey of energy efficiency-related firms; the California Employment Development Department (EDD) survey of green economy firms (including energy efficiency and distributed generation); and the recent U.S. Economic Development Administration report on California's green economy.[78] Our analysis used these three sources to verify our selections of NAICS industries, refine the EDD staffing patterns to include some new green occupations, and translate the job years projected by our study into the numbers of workers needing training. The following details the methodology used for each task.

I. VERIFYING NAICS INDUSTRY SELECTIONS

As detailed in Chapter 3 and Appendix A, we use ten methods to determine which industries will benefit from policy-driven investments in energy efficiency, demand response, and distributed generation (energy efficiency and related) and the proportion of funding they will each receive. In order to verify the appropriateness of our NAICS selections, we checked the list against those found in all three green economy surveys.

First, we compared our list of assigned NAICS to the NAICS of survey respondents in the COE and EDD surveys, to see if our selection of 4-digit energy efficiency and related NAICS corresponded to the survey findings. The COE respondents came from a nearly identical list of NAICS industries, likely due to the COE survey sampling method, which targeted energy efficiency firms. The EDD respondents came from a much broader set of industries – including retail, wholesale, and services – which reflected the broader sampling strategy used in that survey. Because we do not anticipate that energy efficiency and related investment will generate *direct* jobs in these sectors, we did not change the list of industries we assign to.

Another resource to refine the list of NAICS was the list of green economy gazelles in the EDA study. Gazelles are firms with rapid sales growth relative to other firms in the same industry. California's green gazelles include green building firms, manufacturers,

[77] For the Green O*NET, see http://www.onetcenter.org/green.html.

[78] California Community Colleges Centers of Excellence, Understanding the Green Economy in California: A Community College Perspective (2009) available at http://www.coeccc.net/Environmental_Scans/GreenEcon_Scan_SW_09.pdf; For the most recent release of the results from the California 2009 Green Economy Survey, see http://www.labormarketinfo.edd.ca.gov/article.asp?articleid=1229; K. Chapple & M. Hutson, 2010, *Innovating the Green Economy in California Regions* (Berkeley, CA: UC-Berkeley Center for Community Innovation). http://communityinnovation.berkeley.edu/publications.html

wholesalers, and retailers. As with the EDD and COE sources, the wholesale and retail list is not relevant to direct job creation, and the construction and manufacturing NAICS were mostly represented in our list already. The exceptions were niche manufacturers, such as reconstituted wood product manufacturing (NAICS 321219) and glass product manufacturing made of purchased glass (NAICS 327215), which would receive little direct energy efficiency and related funding.

II. REFINING THE EDD STAFFING PATTERNS

As noted in Chapter 3, labor researchers typically rely on the staffing patterns, produced by the Bureau of Labor Statistics and its state counterparts, like the EDD, to determine the distribution of occupations across industries. We use this approach for our analysis as well. However, there are several potential problems with assuming that the occupational distribution in the entire economy is representative of the green economy as well. First, various green economy studies have noted that energy efficiency and related firms may be smaller than traditional firms, perhaps because on average these firms are newer than traditional firms. Thus, they will have fewer administrative, managerial, and technical staff, outsourcing this work to other firms. In the example in Chapter 3, the residential construction firm with four workers is in reality likely to consist solely of laborers working on-site. However, an administrative staff member in another firm will help support that work. Thus, applying the California average staffing patterns to the energy efficiency and related firms, particularly in industries where small firm hiring patterns differ significantly from large firms, may result in a slight over-count of administrative employees and undercount of manual labor.

Another important issue is that the most recent staffing patterns data are from 2008 and are based upon older occupational surveys, thus they do not include any new or emerging occupations. There is considerable debate about whether the energy efficiency and related field has spawned new occupations or simply "enlarged" traditional occupations by requiring new skill sets.[79] Nationally, the U.S. Bureau of Labor Statistics has identified 78 potential new and emerging green occupations in its new Green O*NET. It is possible that some of California's future energy efficiency and related employment will be in these new occupations. However, it is difficult to know how much work will be absorbed by traditional occupations versus spun off into new occupations.

The 2009-2010 California EDD survey results provide some perspective into this issue. That survey asked respondent firms to identify which of 34 new green occupations their workers fit into. Eight of the new green occupations are highly relevant to energy efficiency and related: Building Performance or Retrofitting Specialists, Energy Auditors, Energy Regulation Specialists, Solar PV Panel Installers and Technicians, Solar Thermal Installers and Technicians, Sustainability Planners, Sustainability Program Coordinators/Managers, and Wind Turbine Technicians. Using data summaries provided by the EDD, this analysis was able to determine the share of each of these occupations in NAICS industries at the 3-digit level. That share was applied to all of the 4-digit NAICS within each 3-digit occupational category to provide a crude estimate of the share of these new occupations in each industry. In order to make room within each industry for the new occupation, the share of other occupations was adjusted downward accordingly. It should be noted that even in the most important energy efficiency and related industries, the share of new occupations is very low. For instance, the highest share of any new occupation is Retrofit Specialists in NAICS 2361 Residential Building Construction and 2362 Nonresidential Building Construction, where they make up 1.3 percent of all workers.

III. TRANSLATING JOB-YEARS INTO WORKERS TRAINED

[79] "Job enlarging" is the incorporation of new tasks into existing jobs, which often occurs as new technologies are introduced. Ultimately, as the new technology matures, it becomes more common and even routine. At this point in the life cycle of an occupation, it will spin off new, typically lower-skill occupations – if sufficient labor demand for the skill exists. For more description of this phenomenon, see E.L. Useem, *Low tech education in a high tech world: corporations and classrooms in the new information society* (The Free Press, New York, 2010), and K. Chapple, Networks to Nerdistan: The Role of Labor Market Intermediaries in the Entry-level IT Labor Market, (*International Journal of Urban and Regional Research* 30,3: 548-563, 2006).

The projections methodology produced total numbers of job person-years generated by policy-driven investment in energy efficiency and related programs and policies. Each job person-year creates enough work to keep one person busy for one year. But in reality, most workers will not work at energy efficiency tasks full-time. For instance, an architect might spend 25 percent of her time designing green buildings, and the remainder working on traditional structures. Thus, one job person-year is likely to be allocated to more than one person. If it is an occupation with very little direct energy efficiency work, that job person-year might be divided among many people. For instance, a customer service representative for the utilities may spend only an hour a day discussing energy efficiency, and the rest of her time working on energy safety issues.

The EDD survey asked how many workers did any kind of work in various green economy categories (including energy efficiency and distributed generation), and then how many spent 50 percent or more of their time on EE work (i.e., are full-time). These data are available for each 4-digit industry, for both energy efficiency and distributed generation (as well as the other green economy categories in the EDD survey, such as recycling).

Since this is the only source available that provides this percent time worked calculation, we mined this data source in order to estimate the share of each occupation that will benefit from energy efficiency investment. We did this by making the assumption that the percentage of time worked in energy efficiency in a particular industry (as provided by the EDD survey), was the same as the percentage of time worked by any occupation in that industry. For example, the case of electricians:

Suppose (hypothetically) there are 1000 electrician job person-years according to the projections. Most (90 percent, or 900) work in electrical contracting. Suppose also that the EDD survey data indicates that in the electrical contracting industry, 74 percent of the jobs are 50 percent or more time in energy efficiency. So those 900 person-years would go to 1,216 workers working 74 percent time (900*1/.74). Finally, suppose that the remaining 100 jobs are in residential construction, where only 17 percent of the jobs are 50 percent or more time in energy efficiency. Those jobs would go to 588 workers working 17 percent time (100*1/.17). So 1,000 job person-years translates into 1,804 (1,216 plus 588) needing training.

Thus, for each of the 77 occupations in the study, we determined their distribution across industries. Then, we used the percent full-time workers by industry variable from EDD survey to estimate how much time the occupation would likely spend on energy efficiency and distributed generation in each industry. Totaling up the workers across industries, we obtained the total for each occupation.

APPENDIX C:

E-DRAM MODEL AND RESULTS

We use E-DRAM to evaluate the economy wide effects of the projected policies and programs. The E-DRAM model was recently used to estimate the job impacts of AB32 throughout California. E-DRAM's creator, Dr. Peter Berck, worked with technical staff at the CARB and the CEC to develop a wide range of E-DRAM inputs that best approximate the effect of each measure under AB 32. As a result, the model runs for this project will benefit from the refinements made in the model for ARB. The model code, though not the underlying GAMS programming system, is freely available, and the version of E-DRAM is the one currently in use with ARB (test-standard-edram-2008-10-24.gms).

The purpose of using E-DRAM is to gain a wider appreciation of the economy-wide effects of a set of actions than can be gained with a simple cost benefit analysis. E-DRAM is a computable general equilibrium policy model. Computable general equilibrium models are the most sophisticated macroeconomic models that have been developed in recent years to analyze the impact of major economic policies such as tax policies, trade policies, etc. They are considered a methodological advance beyond simple input-output models used by planning agencies, such as IMPLAN, because they are able to incorporate labor market changes such as in-migration, as well as price changes and their impact on demand and supply. The policy measures incorporated into E-DRAM already include a number of energy efficiency and distributed generation policies, since these are part of the AB 32 set of carbon-reducing policies. As a consequence, the incorporation of expenditures association with additional energy efficiency and demand-side policy measures requires careful attention in order to refine what is already in the model and avoid double counting.

The model is run to evaluate both the policy under consideration by itself and the policy under consideration taken as additional to the measures that were evaluated in E-DRAM for the AB32 draft scoping plan. The policies formulated for this project have been formulated to be additional to those in the scoping plan. So where the same policy is called for at different levels, this project will evaluate the change in the level from that used in the scoping plan to that used in this project. We provided more detailed, updated demand figures for any measure that had been modeled in the original AB 32 impact analysis that was related to energy efficiency, distributed generation, and demand response. In addition we added all the federal energy efficiency funding and policies, including the ARRA funding, which were not modeled as part of the previous AB32 model. The business-as-usual case includes all the investments that would have been made in the absence of this set of energy efficiency and related programs (detailed in Chapter 3).[80]

[80] The following details how we constructed Business As Usual baselines for future years.

In order to run E-DRAM for future years, the model's social accounting table (SAM) must be projected into the future. The base SAM is from measured variables in 2003. First it is updated by multiplying the whole table by the income growth factor. Then the rows and columns of the SAM are further adjusted to account for: 1. Slow growth of refineries relative to income. 2. Decrease in output of extraction of oil and gas. 3.Relatively slower growth of labor, which accounts for increased factor productivity. 4. Increased efficiency of fuels.

The sources for these factors are listed below.

This page will give a more detailed description of what was done to determine the factors for the future years considered. If not indicated, all factors for 2003 are assumed to be 1.

For detailed calculations of each factor, refer to: Factor Sources.xls

1. Personal income growth - INC_GROWTH_FAC(YEARS)

The CA Personal Income growth data and CA Consumer Price Index data is taken from the DOF. The annual percentage change of both is taken, and then the real growth percentage is determined by taking the differences of the percentage changes. The personal income growth factor is determined by taking the real growth multiplied by the factor of the previous year. This is done for years 2004-2020. The remaining years assume a 2.63 percent real growth rate.

E-DRAM is a numeric embodiment of "supply equals demand" in markets for goods and factors of production. The model is used by running a baseline scenario and one or more policy scenarios. These scenarios are then compared. In the current case we expect that the policy will result in additional expenditures in a number of categories (called sectors in the model) including construction and machinery. The model will trace the effects on these expenditures upon expenditures in other sectors and on labor and capital. The model accounts for the percentage of these expenditures that are made within and outside California and the supply of labor and capital. In order to account for the impact of the cost of these investments on the whole economy, the money raised to pay for these expenditures is applied to an appropriate source such as Federal or State fund raising activities or utility rate payers. The model simultaneously takes account of all effects of both the expenditures (i.e., added investment in the energy efficiency sectors) and the revenues needed to fund them. Thus, it accounts for the difference between federal money, which has no strings attached, and state funds, which have opportunity costs that need to be accounted for. The output of the model includes changes in prices, employment, and output, at the sectoral level.

The growth assumptions in E-DRAM come from the California Department of Finance (DOF) projections to 2020, which may not fully take into account the effects of the recession and state fiscal crisis. For the purposes of this analysis, however, we are only looking at the incremental impact of all the energy efficiency and related investments. Thus the growth assumptions behind the base case are not relevant.

Alternatives to using E-DRAM include using other policy models. To the best of our knowledge, there are no other publically available policy models for California. Both the BEAR model and REMI are potentially available. The BEAR model is built on the same data base (Social Accounting Matrix) as E-DRAM and differs significantly in having production technology that represents in general terms the substitutability of energy and other inputs. Though the BEAR model differs from the E-DRAM model in some

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2. Refinery growth - REF_GROWTH_FAC(YEARS)

The factors assume a 0.5 percent growth rate in the refining and gas producing sectors.

3. Oil and gas extraction growth - EXTRACT_GROWTH_FAC(YEARS)

The factors are based on the assumption that the Gas and Oil extraction sector of California will halve its production by 2020 (starting 2003). This is equivalent to a 4% fall in output each year, and continues after 2020 at the same rate.

4. Total population growth - POP_GROWTH_FAC(YEARS)

The California total populations forecast through 2050 are from the DOF. Note that at the moment, the total population forecast is not used. The factor is determined by taking the population growth rate and multiplying by the factor from the previous year.

5. Working population growth (ages 18-64) - WPOP_GROWTH_FAC(YEARS)

The California working population forecast through 2050 are from the DOF. Note that at the moment, the working population (which grows significantly slower) is used to scale JOBS, HH0 and HW0 as those are all depending on the over 18 years old. The factor is determined the same way as the total population growth factors.

6. Natural gas per $ efficiency - GAS_INTENSITY_FAC(YEARS)

7. Electricity per $ efficiency - ELEC_INTENSITY_FAC(YEARS)

8. Fuel per $ efficiency - FUEL_INTENSITY_FAC(YEARS)

The three energy factors are based on UC Davis's Advanced Energy Pathways (AEP) baseline demand scenario reports. Quantity consumed and Gross State Product (GSP) is taken from the AEP summary worksheets and divided to get energy intensity per $ efficiency. The factor is finally determined by taking the ratios of the energy intensity per $ of each year and multiplying by the previous factor. The same is done for all three energy intensities.

Sources: http://hydrogen.its.ucdavis.edu/people/cyang/AEP/AEPbaselinefiles/

Electricity summary_AEPbaseline.xls

Fuel summary_AEPbaseline.xls

Natural gas summary_AEPbaseline.xls

ways, its prediction for the impact of AB 32 was extremely close to that of the E-DRAM model. The BEAR model is proprietary but we expect that using it instead of the E-DRAM would not change our results.

E-DRAM requires the analyst to specify exactly what technology change is desired in the policy; that is what was done for AB32. Energy specialists chose the potential new technologies. It is possible to evaluate the scenarios using input-output type models. IMPLAN has a California model that could be used. The drawback to input output type models is that they do not view the labor market as constraining possible responses to policy, nor do they find the changes in prices that result from policies.

One advantage of using E-DRAM to capture the macro-level employment impacts of energy efficiency and related policies, is that it can account for the jobs created and jobs lost due to the energy savings associated with the entire set of policies. An example may prove helpful here. Take a given EE program that costs the government $1 million to implement. Suppose this program also leads to energy savings valued at $1.25 million, for a Total Resource Cost (TRC) ratio of 1.25. This means that while state tax payers paid $1 million to run the program, energy consumers ended up saving $1.25 million. For E-DRAM, this results in an increase in demand for goods and services that consumers typically purchase (e.g. groceries, health care) and a decrease in demand for energy production and distribution. Since we model the impact of several dozen specific energy efficiency and related programs, many of which involve several hundred individual measures, we were forced to make a simplifying assumption for the value of energy savings to input into E-DRAM. To do this we used data from the one major program for which a careful cost-benefit analysis was done in advance. This was the IOUs' 2010-2012 portfolio of programs. The weighted average TRC across all four IOUs was 1.25. We then applied this figure to all other energy efficiency and related programs. We realize this is a very simple assumption, however, given that most programs need to be proven cost effective (i.e. TRC>=1.00) and without detailed data on energy savings from each program, we believe using the 2010-2012 portfolio of programs figure is a good estimate. The economic activity generated via energy savings drives the positive job growth in unrelated sectors and was responsible for the positive job growth from AB 32.

The limitations of E-DRAM are well documented elsewhere, particularly in response to the ARB model runs.[81] There is some uncertainty around the parameters in E-DRAM, in particular the lack of good trade data for states. Estimated migration rates may prove inaccurate due to changes in the business cycle or policy. Finally, there are of course inherent limitations in predicting the future, as we are unable to anticipate changes in technology in this decade.

I. INCORPORATING E-DRAM RESULTS INTO THE NEEDS ASSESSMENT

The E-DRAM model produced in net employment and output changes across the entire California economy due to the energy efficiency and related policies and AB32 measures. However, to accurately measure the number of jobs for which to measure the number of needed training slots, we needed to reprocess the E-DRAM results and use coefficients from an economic modeling software package to determine the number of d*irect* jobs attributable to the policies. In addition we are also concerned with the number of *indirect and induced* jobs in the directly stimulated industry sectors created by additional rounds of spending in the economy. Below we describe the process of 1) counting the number of indirect and induced jobs in each directly stimulated sector, and 2) how we estimated the number of direct jobs using more detailed information from IMPLAN 3.0.

I.A. PARSING THE INDIRECT JOBS FROM E-DRAM OUTPUT:

The results of the E-DRAM model runs included employment and output expressed in 2010 dollars for four distinct model years 2009, 2010, 2015, and 2020. For each year E-DRAM produced a figure for the "business as usual case," which indicates the amount

[81] Comments on the ARB's Updated Economic Impacts Analysis by the Economic Impacts Subcommittee of the Economic and Allocation Advisory Committee (revised 18 April 2010). Retrieved from: http://climatechange.ca.gov/eaac/documents/eaac_reports/2010-04-19_EAAC_REPORT_Appendix.pdf

of economic activity expected if the energy efficiency and related investments and other AB32 measures were not made. These results were given for a relatively coarse sectoral breakdown (121 total sectors or approximately a 2- or 3-digit NAICS). To determine the number of jobs created by the policies in question, we subtracted the total jobs in each sector from the total jobs in each year's business as usual case. This job figure represented the total jobs created (direct plus indirect and induced) in each sector. Next, we allocated these employment figures to the more detailed NAICS industry sectors using the NAICS-E-DRAM bridge: Specifically, we used the detailed inputs in dollars ($/NAICS) by NAICS to allocate employment in a given E-DRAM sector to each 4 digit NAICS code.

I.B. ESTIMATING DIRECT JOBS USING IMPLAN 3.0 COEFFICIENTS

While E-DRAM has a number of methodological benefits in terms of measuring overall impacts, it uses an industrial structure that is too coarse to measure differential impacts within broad economic sectors. For example, there is only one sector for "construction." Given our detailed policy analysis of demand stimulation at the 4-digit NAICS level, we would lose a lot of information if we used E-DRAM to estimate the number of direct jobs. In addition, even though E-DRAM sorts jobs into within and outside of California, its coarse industry breakdown potentially overstates the number of manufacturing jobs stimulated by certain EE programs. The first step in an economic impact modeling exercise is to determine the amount of demand that is leaked outside of California for each industry, using a factor called a "regional purchasing coefficient," or RPC. This coefficient is calculated on industry-specific trade flows data and measures the proportion of demand for a given industry that is filled from within the state or region. Using RPCs at a more coarse level would result in an inaccurate number of jobs in heavily traded sectors such as manufacturing. For example, we estimate the amount of new demand for appliances generated from appliance rebate programs in dollars. However, very few appliances are actually produced in California. Under E-DRAM's sector aggregation, these dollars would be put in the "machinery" sector. While California does produce a fair amount of machinery, the E-DRAM's sector aggregation would overestimate the jobs in machinery because it would not capture the fact that most appliances are purchased from other regions.

To overcome these two problems, we estimated the number of direct jobs using two pieces of information extracted from the IMPLAN 3.0 software using data from California in 2008. IMPLAN's industry sector aggregation is much closer to the 4-digit NAICS level (especially for manufacturing). Thus we used the output per worker ratio and the industry specific RPCs from IMPLAN to convert our model inputs ($) into direct jobs. Equation 1 summarizes this process.

Direct Jobs (i) = [$ of Demand (i)] X RPC(i) X [Avg. (output($)/Employment) (i)]

Specifically, the number of direct jobs in industry (i), is calculated by multiplying the dollars of new demand by the RPC for that industry. Since the RPC ranges from 1 to 0, where 1 means that 100 percent of the product is produced in California, this "takes off the top" any demand that flows to producers located outside of California. The RPCs were very close to 1 for all the non-manufacturing industries such as construction.[82] After adjusting for this leakage, this product is then multiplied by the average output per job ratio in industry (i), resulting in the number of direct jobs by 4-digit NAICS.

We then subtracted these direct jobs, from the totals produced by E-DRAM to separate the direct and indirect and induced jobs by 4-digit NAICS. These indirect and induced jobs are only those located within California. Because they are not likely to require any specialized energy efficiency training, they were not included in the rest of the Needs Assessment.

I.C. THE RESULTS: TOTAL JOBS ACCORDING TO E-DRAM

[82] However, for many manufacturing industries the RPCs were quite low. For example the RPC for Kitchen Appliances was only 0.07, meaning that California only makes 7 percent of the appliances it demands on the market.

Consumption-related sectors affected by EE-DG-DR investment include retail food, other retail, business services, and construction (Table C.1). Job gains in retail food (182,713 in 2020) dwarf all other sectors. Agriculture and manufacturing sectors – particularly apparel, food, textiles, chemicals, and machinery – also experience significant indirect and induced positive job impacts. The top losers in 2020 are Recreation and Amusement (97,742 jobs), gas stations (28,982 jobs), transportation related to fossil fuels (15,074 jobs), and electric power generation from fossil fuels, nuclear, and other traditional sources (14,837 jobs).

Table C.1 Total Medium Scenario Jobs (Direct, Indirect, and Induced)
by Top E-DRAM Sectors and 2020 Rank

E-DRAM SECTOR	2009	2010	2015	2020
Retail Food	1,481	1,627	78,896	182,713
Agriculture	(439)	(183)	28,051	53,077
Internet and Other Retail	647	37	14,952	33,442
Apparel Manufacturing	204	(242)	14,966	32,982
Business Services	(232)	2,498	17,534	30,153
Specialty Food Manufacturing	63	92	10,188	23,451
Construction	9,176	19,835	19,118	19,212
Textile Manufacturing	211	(36)	7,519	16,554
Miscellaneous Retail	374	(939)	6,350	11,421
Chemical Manufacturing	56	99	3,801	6,514
Machinery Manufacturing	892	1,650	4,171	6,045

APPENDIX D:

JOB CREATION BY INDUSTRY – SEE ATTACHED SPREADSHEET

APPENDIX E:

JOB CREATION BY OCCUPATION – SEE ATTACHED SPREADSHEET

APPENDIX F:

WORKERS NEEDING TRAINING BY METROPOLITAN AREA – SEE ATTACHED SPREADSHEET

APPENDIX G:

METHODOLOGY FOR TRAINING INVENTORY AND SURVEY

Part 2 of this report assesses the state of existing education and job training programs in California related to energy efficiency. The main data gathered for this assessment is a comprehensive inventory of relevant training programs across the state and a survey of a random sample of this inventory. Other qualitative data was gathered on these and other parts of the training system, including the k-12 programs, the utility programs, the employment information systems, and the analysis of strategies specifically geared towards low-income communities, and is described in the text. This appendix describes the development of the inventory, the sampling strategy and protocol development for the survey.

The institutions included in the inventory and survey are apprenticeships, community colleges, 4 year colleges and universities, private industry training programs, community-based organizations (CBOs), regional occupational programs (ROPs) . There were two criteria for inclusion in the inventory (and the sample we drew from it): First, we include training and education programs that train for the most prominent occupations from our job projections, eliminating the general occupations (e.g. accountant). Second, we include training programs that self-identify as training for skills in these sectors. Therefore, we capture both the traditional occupations that are involved in implementing energy efficiency work, as well as the new "specialty" occupations focusing solely on a particular set of energy-related skills. The inventory compiled basic information on training programs, such as the location, length, and skills emphasis of each program, gathered from administrative data and web searches, while the survey entailed in-depth interviews with a sample of training providers across the state.

We identified about 1500 distinct programs, and interviewed 487.[83] We used a cluster-sampling method to produce a random sample of programs to interview by phone, and we oversampled the ones that trained in the most prevalent occupations in our job projections.[84] The sampling strategy focused on established institutions rather than new grant-funded initiatives such as the ARRA-funded programs, although these were captured if they were attached to existing training institutions.

The in-depth phone survey was designed to achieve our main objective of analyzing the workforce development infrastructure in California as a whole, considering the linkages and overlap between major types of training institutions. The interview protocol was based on our combined knowledge of workforce development best practices, and energy efficiency and related job skills and training types. It includes both qualitative and quantitative questions. Each type of institution had a tailored version of the protocol, but all collected information on program structure, content, and connection to career pathways, as well as data on enrollment, graduation, participant demographics and other characteristics.

[83] Quite a few of these program tracks were overseen by one administrator, and therefore they were captured in a single interview. One example of this would be a community college certificate and associates' degree in the same department.

[84] As a result, programs that train for a specific energy efficiency related skill but do not train for a high-demand occupation based on the job projections were not over-sampled as "priority." While it may seem counter-intuitive to not consider a specific "solar" training program as high-priority in a study like this, our intent here was to study training programs based on the labor demand analysis and not hand-pick occupations to study that seem like they would be in high demand because of energy efficiency related policy because they are targeted on specific skills in those skills.

I. DEFINING OCCUPATIONS AND TRAINING PROGRAMS TO INCLUDE IN THE INVENTORY

The focus of this study on energy efficiency and related programs narrows the universe of programs that are relevant for our analysis: we focus only on the pieces of the California workforce development infrastructure that are involved in energy efficiency and related education and training. To identify which these are, we identified programs that fit either of the following two criteria:

Training programs targeting occupations that will see over 200 new jobs by 2020 (in person-years) from our projections of job growth due to energy efficiency and related policies and programs, excluding occupations in manufacturing and administration because they need little or no specific training in energy efficiency and related issues.[85]

Training programs that self-identify as training for energy efficiency or renewable energy, even if their targeted occupation will not see a significant increase in demand.

Thus we focus on a combination of the prominent traditional occupations that will grow as a result of the policies and programs within the scope of this study and the self-identified specialized programs. It should be noted that the specialized occupations such as energy auditor or solar installer did not appear in the list of prominent occupations, because our projections showed much smaller numbers of this specialized occupations. We look at training programs specifically tailored toward a certain occupation (or several), as well as those that offer more introductory or basic job skills training that can be applicable to the occupations of interest. We created lists from data administrative available from institutional or government sources (for community colleges and apprenticeship), web searches, and key informants to help construct and categorize an inventory of relevant programs for each institutional type.

We emphasize job training programs at established institutions and programs within them, rather than new grant-funded initiatives such as those funded by ARRA. We chose to focus on established programs to understand the state's existing sustainable infrastructure. However, programs funded by short-term grants like ARRA were captured if they were attached to sampled training programs.

The structure of each training program is unique because of the roles that each institution plays in the workforce development system, and how they are regulated. Many training programs have multiple sub-programs within them, based on the level of training or the specialization within the training. We call these sub-programs training tracks, defined as a set of courses with a defined entry and exit point. For example, at a 4 year university a bachelor's degree and a master's degree in electrical engineering are counted as separate training tracks. In addition, we count as a separate track each specialty within an apprenticeship or private training program, like a millwright within a carpenter apprenticeship program, or a solar program within a private institution's broader energy efficiency and renewable program. Considering each track as a separate, there are over 1,500 training tracks related to energy efficiency related occupations in the state.

II. DRAWING A RANDOM SAMPLE FOR INCLUSION IN THE SURVEY

Due to the large number of relevant programs in the state, we were unable to interview all of them and had to select a random sample of training programs to interview in more depth. We used a stratified cluster method to maximize the number of programs we interviewed and ensure adequate representation of all key occupations, while still maintaining randomness in selection. The clustering served the purpose of expanding our number of tracks, because we could gather information for all tracks with the interview of one program. The stratification allowed us to interview each institution separately in order to gather institution-specific data when necessary.

[85] See full list in Appendix I.

We also oversampled the programs that train for the occupations that will see the greatest growth in demand by 2020, as forecast by our job growth analysis. This strategy allowed us to obtain better information on these programs, which are likely to be in greatest demand. As a result, we did not sample as many programs that self-identify as energy efficiency or renewable energy training, because most of these did not appear as prominent occupations in our forecast (although they are all listed in the inventory). Frequently, the skills of an energy efficiency-specific occupation are one part of the skill set of a traditional occupation that will see increased demand as a result of energy efficiency policy. Therefore, those skills of the energy efficiency-specific occupation may be in increased demand, but as part of a larger skill set, rather than as a stand-alone occupation. The low number of solar programs interviewed at community colleges, for example, is a result of the fact that solar installer is not projected to be a high-demand job or because skills like solar installation are more often included as one or two courses in a traditional program (such as electrical).

We also excluded the following training programs. We did not interview programs that were so new that they have not yet graduated any trainees. For the community colleges, we only interviewed those programs that lead to a degree or a certificate. This excluded the contract education part of the community college system which is grant or employer funded. While these programs are not sustainable without outside funding, they are over time sometimes adopted into the regular programs of the community colleges. In addition, a fair number of the ARRA funded programs were in the contract education part of the community colleges. Thus some of the energy efficiency programs that tend to be grant funded or new were not captured in our inventory or sample. Where possible, we added qualitative information about these programs.

III. DEVELOPING AN INTERVIEW PROTOCOL

The survey consisted of interviews with program directors, coordinators, and or other knowledgeable program administrators. The research teams developed a common interview protocol based on our combined knowledge of workforce development best practices, and energy efficiency job skills and training types. It includes both qualitative and quantitative questions. Each type of institution had a tailored version of the protocol, but all versions collected information on program structure, content, and connection to career pathways, as well as data on enrollment, graduation and demographic data on participants. The protocol included questions on the following topics:

- → Sectors and occupations for which the training prepares, and specific skills taught
- → Funding sources, and participant costs and/or compensation
- → Entry points and process, including how the number of available slots is determined and application processes/requirements
- → Structure and length of training
- → Credentials available to students
- → Employer involvement in training
- → Process for curriculum development, in general and specific to energy efficiency
- → Partnerships and competition with other training organizations, and career pathways development
- → Wrap-around support services
- → Outcomes and exit points: graduation and job placement rates
- → Demographic profile of students

Researchers conducted interviews both in-person and by phone, depending on feasibility of in-person interviews. These interviews generally followed the guide of the institution-specific protocol, but due to the qualitative nature of many of the questions, expansion and deviation from the initial script was common. The interviews typically lasted 30 minutes to 2 hours.

IV. ANALYZING DATA

Overall response rate was high; 72 percent of those programs contacted were interviewed. Twenty-three percent of programs did not respond to our requests for an interview. Five percent of those contacted refused to participate, for a variety of reasons, including time constraints and or lack of interest or support for the purpose of the research. A small number that we contacted were eliminated from the sample and inventory because we determined that their training did not fall within our scope, or because the program was no longer in existence.

Table G1. Response Analysis[1]

Among sampled programs	
Interview completion rate	72%
Interview refusal rate	5%
Interview non-response rate	23%

Out of the total number of training programs identified in our inventory of California's energy efficiency training programs, which came to around 1500, we were able to interview about 27 percent.

We collected information from our interviews in Excel spreadsheets, and analyzed the quantitative data in Excel, and using STATA software. Qualitative information was analyzed more holistically by each team of researchers.

To achieve our initial research objectives, we structured the analysis of our survey data in two parts:

- → First, an analysis of the different types of training within a singular institution (i.e. Community colleges), and
- → Second, a comparison of the dominant characteristics of each institution in relation to the others, and an analysis of where these institutions (and their sub-types) train along a career pathway.

Some institutions are far more heterogeneous than others, so it is necessary to consider the first level of analysis as well as the second in order to avoid oversimplification of institutions' characteristics. Furthermore, attempting to map out career pathways in different sectors requires an examination of the occupational focus as well as the level of training of different program types and the credentials they offer. All of these qualities can vary considerably both across and within institutions.

V. DATA SOURCES AND SAMPLING FOR EACH INSTITUTION[86]

Apprenticeship

Apprenticeships must be certified and registered with the California Department of Industrial Relations – Division of Apprenticeship Standards (DAS). Most apprenticeships register with both the DAS and the federal Department of Labor (DOL), although some only

[86] We do not include methodological notes on our survey of the utility training programs here. We took a very different approach to these programs because they are much shorter (several hours typically), they serve a different purpose than other training institutions, and we were tasked with making a specific set of recommendations on these programs to the utilities. Information on the utilities' programs is detailed in chapter XX, and incorporated into the analysis of the entire workforce system (Chapter XX) where appropriate.

register with one or the other. Both the DAS and DOL have databases that include basic information on all registered apprenticeships, including trade and basic program completion requirements. We used this data to eliminate apprenticeship programs outside our scope, draw our sample, and gather information on all apprenticeships for the inventory. Apprenticeship programs use the Standard Occupational Code (SOC) system to classify trades.

Community Colleges

Using the publicly available centralized data source of the California Community College system, we identified over 440 for-credit community college programs that provide education and training related to energy efficiency, distributed generation and demand response. Community colleges use a system wide taxonomy of programs (TOP) code that is tied to the SOC system, allowing us to link programs to occupations. We categorized the programs into "traditional community college programs," including architecture, engineering, construction trades, and environmental control technologies (also referred to as heating, ventilation, air conditioning, and refrigeration), and "new/emerging community college programs." Note that some programs, such as renewable energy, were included even though they only cover distributed generation (e.g., photovoltaic installations on customer roofs), as a subcomponent. Other programs, such as "smart-grid" programs were not included, even though these programs cover the technology required for some demand response programs. As stated above, we excluded contract education programs.

V.A. ROPS

While other state funded education systems have some type of centralized data resource outlining all programs offered, ROPs have no such database. In order to identify courses relating to energy efficiency, distributed generation and demand response, we first conducted an internet search of all 74 ROPs in an effort to acquire available course offerings and schedules. Second, we called those ROPs that did not have a website to ask if they provided programs that targeted the occupations of interest. As a result, we identified about 60 ROP organizations in California offering 211 programs relevant to energy efficiency and related careers.

V.B. CBOS

There is also no central organization of CBOs, so we used a variety of methods to search for and identify relevant training programs. Using various available data sources, previous studies, and web research, we identified about 40 programs at CBOs that provide the education and training needed for careers related to energy efficiency. We consulted subject matter and regional experts across California for validation and additional information on programs. We asked respondents about the training programs they offer, how much of a role energy efficiency plays in their curriculum, and how participants are recruited, trained and placed into jobs.

V.C. PRIVATE TRAINING PROGRAMS

Private organizations also do not have a centralized source of information. We used web searching and key informant interviews to help us identify about 200 energy efficiency-related training programs at private organizations. Because of the highly idiosyncratic and disaggregated nature of private training programs, this was an institution for which it was difficult to ascertain whether we had captured the complete inventory. It was particularly problematic to identify each program in traditional occupations, which often did not emphasize their energy efficiency training.

V.D. 4-YEAR UNIVERSITIES

We identified university departments with bachelor's degree or higher degree programs that train professionals to design energy efficient buildings, implement the construction of those buildings, and design policies and procedures that promote energy efficiency, distributed generation, and demand response. We categorized them into four department types: multidisciplinary programs, engineering, architecture, and construction management. From our list of all public and private universities in California with relevant departments, we drew a random sample, by department type, for our interviews. We conducted in-depth, qualitative interviews, by phone, with staff from these departments to learn about the degrees they offer, how curriculum is designed, and how much of a role energy efficiency plays in the curriculum.

APPENDIX H:

CERTIFICATIONS IN KEY OCCUPATIONS OBSERVED IN SURVEY SAMPLE

I. Electrical Systems Certifications

Occupational Category	Certifying Organization	Credential Name	Credential Type	Typical Sector
Community College				
Electrical	Community College	Electrical Construction & Technologies	Educational - AA degree	Residential, Commercial/Public
Electrical	Community College	Electrical Construction & Technologies	Educational Certificate	Residential, Commercial/Public
Renewable Energy/ Energy Efficiency	Community College	Energy Efficiency/Renewable Energy	Educational - AA degree	Residential
Renewable Energy/ Energy Efficiency	Community College	Industrial Technology (Solar/Wind)	Educational - AA degree	Residential
Renewable Energy/ Energy Efficiency	Community College	Auditor	Educational Certificate	Residential
Renewable Energy/ Energy Efficiency	Community College	Solar Energy Technician	Educational Certificate	Residential
Renewable Energy/ Energy Efficiency	Community College	Wind Turbine Technician	Educational Certificate	Residential
Renewable Energy/ Energy Efficiency	Community College	Solar/Wind Certificate of Achievement	Educational Certificate	Residential
Renewable Energy/ Energy Efficiency	North American Board of Certified Energy Practitioners (NABCEP)	Solar Thermal Installer	Occupational Certification	Residential
Renewable Energy/ Energy Efficiency	North American Board of Certified Energy Practitioners (NABCEP)	Solar PV Installer	Occupational Certification	Residential
Joint Apprenticeship Committee				
Electrician	State of CA	Electrician - Inside Wireman	Journey Card	Commercial/Public
Electrician	State of CA	Electrician - Intelligent Transportation Systems	Journey Card	Commercial/Public
Electrician	State of CA	Electrician - Residential Wireman	Journey Card	Residential
Electrician	National Electrical Contractors Association (NECA)	Electrical Project Supervision (EPS I)	Skills Certificate	Commercial/Public
Electrician	Occupational Safety and Health Administration (OSHA)	OSHA 10	Skills Certificate	Commercial/Public
Electrician	American Red Cross/American Heart Association	First Aid/CPR	Skills Certificate	Commercial/Public
Electrician	National Commission for the Certification of Crane Operators (NCCCO)	Mobile Equipment Operation	Skills Certificate	Commercial/Public
Electrician	North American Board of Certified Energy Practitioners (NABCEP)	Solar Thermal Installer	Skills Certificate	Commercial/Public
Electrician	North American Board of Certified Energy Practitioners (NABCEP)	Solar PV Installer	Skills Certificate	Commercial/Public
Electrician	California Department of Public Health	Water Treatment T2	Skills Certificate	Commercial/Public
Electrician	California Department of Public Health	Water Distribution D2	Skills Certificate	Commercial/Public

I. Electrical Systems Certifications (continued)

Occupational Category	Certifying Organization	Credential Name	Credential Type	Typical Sector
Community Based Organization				
Renewable Energy/ Energy Efficiency	California High School Exit Examination (CAHSEE)	HS Diploma/GED (Exit Exam)	Educational - High School	Residential
Renewable Energy/ Energy Efficiency	Occupational Safety & Health Administration (OSHA)	Fork Lift	Skills Certificate	Residential
Renewable Energy/ Energy Efficiency	Department of Motor Vehicles (DMV)	Class B & C Driver's License	License	Residential
Renewable Energy/ Energy Efficiency	Environmental Protection Agency (EPA)	Lead Abatement	Skills Certificate	Residential
Renewable Energy/ Energy Efficiency	California Energy Commission (CEC)	HERS I (Home Energy Rater)	Occupational Certification	Residential
Renewable Energy/ Energy Efficiency	North American Board of Certified Energy Practitioners (NABCEP)	Solar PV Installer	Skills Certfication	Residential
Renewable Energy/ Energy Efficiency	National Center for Construction Education & Research (NCCER)	Core: Introductory Craft Skills	*unknown*	Residential
Renewable Energy/ Energy Efficiency	Training Organization	Certificate of Completion	Self-defined Certificate	Residential
Renewable Energy/ Energy Efficiency	Training Organization	Work Readiness	Self-defined Certificate	Residential
Regional Occupational Program				
Renewable Energy/ Energy Efficiency	Training Organization	Certificate of Completion w/listed competency	Self-defined Certificate	Residential
Private Organization				
Solar	Training Organization	Introduction to Solar	Self-defined Certificate	Residential
Solar	Training Organization	PV Installer	Self-defined Certificate	Residential
Wind	Training Organization	Wind Turbine Technician Training	Self-defined Certificate	Residential

II. HVAC Systems Certifications

Occupational Category	Certifying Organization	Credential Name	Credential Type	Typical Sector
Community College				
Environmental Control Technology (HVAC), Energy Systems Technology	Community College	Energy Management & Climate Policy	Educational - AA	Residential, Commercial/Public
Environmental Control Technology (HVAC), Energy Systems Technology	Community College	Air Conditioning & Refrigeration	Educational - AA	Residential, Commercial/Public
Environmental Control Technology (HVAC), Energy Systems Technology	Community College	Air Conditioning & Refrigeration	Educational Certificate	Residential, Commercial/Public
Environmental Control Technology (HVAC), Energy Systems Technology	Community College	Basic Refrigeration & Control Systems	Educational - AA	Residential, Commercial/Public
Environmental Control Technology (HVAC), Energy Systems Technology	Community College	Advanced Refrigeration	Educational - AA	Residential, Commercial/Public
Environmental Control Technology (HVAC), Energy Systems Technology	Community College	HVACR/HVAC	Educational - AA	Residential, Commercial/Public
Environmental Control Technology (HVAC), Energy Systems Technology	Environmental Protection Agency (EPA)	Refrigerant Recovery (EPA 608, 609)	Skills Certificate	Residential, Commercial/Public
Environmental Control Technology (HVAC), Energy Systems Technology	HVAC Excellence	Technician Certifications	Occupational Certification	Residential, Commercial/Public
Environmental Control Technology (HVAC), Energy Systems Technology	North American Board for Certified Energy Practitioners	Solar Thermal Installer	Occupational Certification	Residential, Commercial/Public
Sheet Metal and Structural Metal	Community College	Sheet Metal and Structural Metal	Educational - AA	Commercial/Public
Sheet Metal and Structural Metal	Community College	Sheet Metal and Structural Metal	Educational Certificate	Commercial/Public
Plumbing, Pipefitting, and Steamfitting	Community College	Plumbing Technologies	Educational Certificate	Residential, Commercial/Public
Joint Apprenticeship Committee				
HVAC Service Tech & Mechanic	State of CA	HVACR Service Tech/Mechanic	Journey Card	Commercial/Public
HVAC Service Tech & Mechanic	*unknown*	Rigging	Skills Certificate	Commercial/Public
HVAC Service Tech & Mechanic	*unknown*	Welding	Skills Certificate	Commercial/Public
HVAC Service Tech & Mechanic	*unknown*	MedGas Certification	Skills Certificate	Commercial/Public
HVAC Service Tech & Mechanic	Environmental Protection Agency (EPA)	Refrigerant Recovery (EPA 608, 609, etc.)	Skills Certificate	Commercial/Public
HVAC Service Tech & Mechanic	State of CA	Apprenticeship Completion	*unknown*	Commercial/Public
Sheet Metal Worker	International Training Institute	Sheet Metal	Educational Certificate	Commercial/Public
Sheet Metal Worker	State of CA	A/C Service Technician - Commerical	Journey Card	Commercial/Public
Sheet Metal Worker	State of CA	A/C Specialist - Residential	Journey Card	Commercial/Public
Sheet Metal Worker	State of CA	Air Balance and Testing - Commercial	Journey Card	Commercial/Public
Sheet Metal Worker	State of CA	Building Trades	Journey Card	Commercial/Public
Sheet Metal Worker	State of CA	Residential	Journey Card	Commercial/Public
Sheet Metal Worker	State of CA	Service Technician	Journey Card	Commercial/Public

II. HVAC Systems Certifications (continued)

Occupational Category	Certifying Organization	Credential Name	Credential Type	Typical Sector
Joint Apprenticeship Committee (continued)				
Sheet Metal Worker	State of CA	Service Technician - Residential	Journey Card	Commercial/Public
Sheet Metal Worker	State of CA	Sheet Metal Apprentice Completion	Journey Card	Commercial/Public
Sheet Metal Worker	Universal Technical Institute	CFC Handling (Refrigerants)	Safety	Commercial/Public
Sheet Metal Worker	North American Technician Excellence (NATE)	Technician Certifications	Occupational Certification	Commercial/Public
Sheet Metal Worker	Testing Adjusting & Balancing Bureau (TABB)	Technician Certifications	Occupational Certification	Commercial/Public
Sheet Metal Worker	Occupational Safety & Health Administration (OSHA)	OSHA 10	Safety	Commercial/Public
Sheet Metal Worker	Occupational Safety & Health Administration (OSHA)	OSHA 30	Safety	Commercial/Public
Sheet Metal Worker	American Red Cross/American Heart Association	CPR/First Aid	Safety	Commercial/Public
Sheet Metal Worker	National Energy Management Institute (NEMI)	Fire Life Safety	Safety	Commercial/Public
Sheet Metal Worker	National Energy Management Institute (NEMI)	Indoor Air Quality	Safety	Commercial/Public
Sheet Metal Worker	Environmental Protection Agency (EPA)	Refrigerant Recovery (EPA 608, 609, etc.)	Safety	Commercial/Public
Sheet Metal Worker	US Green Building Council	Leadership in Environmental Design (LEED)	Occupational Certification	Commercial/Public
Sheet Metal Worker	unknown	Fork Lift	Skills Certificate	Commercial/Public
Sheet Metal Worker	unknown	Fall Protection	Skills Certificate	Commercial/Public
Sheet Metal Worker	unknown	Powder Actuated Tools	Skills Certificate	Commercial/Public
Sheet Metal Worker	unknown	Aerial Lift	Skills Certificate	Commercial/Public
Sheet Metal Worker	unknown	Welding	Skills Certificate	Commercial/Public
Sheet Metal Worker	unknown	Detailing	Skills Certificate	Commercial/Public
Sheet Metal Worker	unknown	Scissor Lift	Skills Certificate	Commercial/Public
Plumber/Pipefitter/Steamfitter	State of CA	Plumber	Journey Card	Commercial/Public
Plumber/Pipefitter/Steamfitter	State of CA	Steamfitter/Pipefitter	Journey Card	Commercial/Public

II. HVAC Systems Certifications (continued)

Occupational Category	Certifying Organization	Credential Name	Credential Type	Typical Sector
Joint Apprenticeship Committee (continued)				
Plumber/Pipefitter/Steamfitter	unknown	Basic Computers	Skills Certificate	Commercial/Public
Plumber/Pipefitter/Steamfitter	unknown	Instrumentation Rigging	Skills Certificate	Commercial/Public
Plumber/Pipefitter/Steamfitter	unknown	MedGas Installation	Skills Certificate	Commercial/Public
Plumber/Pipefitter/Steamfitter	unknown	Foreman	Skills Certificate	Commercial/Public
Plumber/Pipefitter/Steamfitter	United Association of Plumbers & Pipefitters (International Union)	Green Awareness	Skills Certificate?	Commercial/Public
Plumber/Pipefitter/Steamfitter	unknown	Welding	Skills Certificate	Commercial/Public
Plumber/Pipefitter/Steamfitter	unknown	Brazing	Skills Certificate	Commercial/Public
Plumber/Pipefitter/Steamfitter	United Association of Plumbers & Pipefitters (International Union)	UA Certified Valve Repair	Skills Certificate	Commercial/Public
Plumber/Pipefitter/Steamfitter	United Association of Plumbers & Pipefitters (International Union)	UA Foreman Training	Skills Certificate	Commercial/Public
Plumber/Pipefitter/Steamfitter	Environmental Protection Agency (EPA)	Backflow Prevention	Skills Certificate	Commercial/Public
Plumber/Pipefitter/Steamfitter	American Red Cross/American Heart Association	First Aid/CPR	Skills Certificate	Commercial/Public
Plumber/Pipefitter/Steamfitter	Occupational Safety & Health Administration (OSHA)	OSHA 10	Skills Certificate	Commercial/Public
Heat and Frost Insulator	State of CA	Heat and Frost Insulator	Journey Card	Commercial/Public
Heat and Frost Insulator	Occupational Safety & Health Administration (OSHA)	OSHA 10	Skills Certificate	Commercial/Public
Heat and Frost Insulator	American Red Cross/American Heart Association	First Aid/CPR	Skills Certificate	Commercial/Public
Heat and Frost Insulator	unknown	HazMat	Skills Certificate	Commercial/Public
Unilateral Apprenticeship Committee				
Plumber	State of CA	Plumber	Journey Card	Commercial/Public
Private Organization				
HVAC	EPA	Refrigerant Recovery (EPA 608, 609, etc.)	Skills Certificate	Residential

III. Building Envelope Systems Certifications

Occupational Category	Certifying Organization	Credential Name	Credential Type	Typical Sector
Community College				
Carpentry	Community College	Carpentry	Educational Certificate	Residential, Commercial/Public
Carpentry	Community College	Carpentry	Educational - AA	Residential, Commercial/Public
Carpentry	Environmental Protection Agency (EPA)	Lead Abatement	Skills Certification	Residential, Commercial/Public
Construction Crafts Technology	Community College	Construction Technology	Educational Certificate	Residential
Construction Crafts Technology	Community College	Construction Management	Educational Certificate	Residential
Construction Crafts Technology	Community College	Building Inspection	Educational Certificate	Residential
Construction Crafts Technology	Community College	Construction Management	Educational - AA	Residential
Construction Crafts Technology	Community College	Construction Technology	Educational - AA	Residential
Construction Crafts Technology	Community College	Building Inspection	Educational - AA	Residential
Construction Crafts Technology	Community College	Industrial Technology	Educational - AA	Residential
Renewable Energy & Energy Efficiency	Community College	Energy Efficiency/Renewable Energy	Educational - AA	Residential
Renewable Energy & Energy Efficiency	Community College	Home Building Performance	Educational - AA	Residential
Renewable Energy & Energy Efficiency	Community College	Auditor	Educational Certificate	Residential
Renewable Energy & Energy Efficiency	Community College	Environmental Study	Educational Certificate	Residential
Renewable Energy & Energy Efficiency	Community College	Construction Home Building Performance	Educational Certificate	Residential
Green Building & Energy Systems Technology	Community College	Green Building & Energy Systems Technology	Educational - AA	Residential
Green Building & Energy Systems Technology	Community College	Building Performance & Energy Assessment	Educational Certificate	Residential
Green Building & Energy Systems Technology	Building Performance Institute (BPI)	Building Analyst	Occupational Certification	Residential
Green Building & Energy Systems Technology	Building Performance Institute (BPI)	Envelope	Occupational Certification	Residential

III. Building Envelope Systems Certifications (continued)

Occupational Category	Certifying Organization	Credential Name	Credential Type	Typical Sector
Joint Apprenticeship Committee				
Roofer/ Waterproofer	State of CA	Roofer/Waterproofer	Journey Card	Commercial/Public
Roofer/ Waterproofer	National Roofing Contractors' Association (NRCA)	Certified Roofing Torch Applicator (CERTA)	Skills Certification	Commercial/Public
Carpenter	State of CA	Carpenter - Acoustical Installer	Journey Card	Commercial/Public
Carpenter	State of CA	Carpenter - Cabinet Maker	Journey Card	Commercial/Public
Carpenter	State of CA	Carpenter - Carpenter	Journey Card	Commercial/Public
Carpenter	State of CA	Carpenter - Drywall/Lather	Journey Card	Commercial/Public
Carpenter	State of CA	Carpenter - Floorlayer	Journey Card	Commercial/Public
Carpenter	State of CA	Carpenter - Hardwood Floor Installer	Journey Card	Commercial/Public
Carpenter	State of CA	Carpenter - Insulation Installer	Journey Card	Commercial/Public
Carpenter	State of CA	Carpenter - Millwright	Journey Card	Commercial/Public
Carpenter	State of CA	Carpenter - Modular Furnishings Installer	Journey Card	Commercial/Public
Carpenter	State of CA	Carpenter - Pile Driver	Journey Card	Commercial/Public
Carpenter	State of CA	Carpenter - Plasterer	Journey Card	Commercial/Public
Carpenter	State of CA	Carpenter - Shingler	Journey Card	Commercial/Public
Carpenter	State of CA	Carpenter - Terrazzo Finisher	Journey Card	Commercial/Public
Carpenter	State of CA	Carpenter - Terrazzo Worker	Journey Card	Commercial/Public
Carpenter	American Red Cross/American Heart Association	First Aid/CPR	Skills Certification	Commercial/Public
Carpenter	Occupational Safety & Health Administration (OSHA)	OSHA 10	Skills Certification	Commercial/Public
Carpenter	*unknown*	Powder Actuated Tools	Skills Certification	Commercial/Public
Carpenter	American Welding Society	AWS Welding - Structural	Skills Certification	Commercial/Public
Carpenter	American Welding Society	AWS Welding - Light Gage	Skills Certification	Commercial/Public
Carpenter	*unknown*	Aerial Lift	Skills Certification	Commercial/Public
Carpenter	*unknown*	Industrial Powered Lift Truck	Skills Certification	Commercial/Public
Carpenter	*unknown*	Scaffold Erection	Skills Certification	Commercial/Public
Carpenter	*unknown*	Confined Space Worker	Skills Certification	Commercial/Public
Carpenter	*unknown*	Best Practices in Healthcare Construction	Skills Certification	Commercial/Public
Carpenter	Building Performance Institute (BPI)	Building Analyst, etc.	Occupational Certification	Commercial/Public
Laborer	State of CA	Laborer	Journey Card	Commercial/Public

III. Building Envelope Systems Certifications (continued)

Occupational Category	Certifying Organization	Credential Name	Credential Type	Typical Sector
Unilateral Apprenticeship Committee				
Laborer	State of CA	Laborer	Journey Card	Commercial/Public
Community Based Organization				
Construction	California High School Exit Examination (CAHSEE)	HS Diploma/GED	Educational - High School	Commercial/Public
Construction	Self-certified by organization	Certificate of Completion	Educational Certificate	Commercial/Public
Construction	Occupational Safety & Health Administration (OSHA)	OSHA 10	Skills Certification	Commercial/Public
Construction	American Red Cross/American Heart Association	First Aid/CPR	Skills Certification	Commercial/Public
Construction	*unknown*	Flagging	Skills Certification	Commercial/Public
Construction	*unknown*	Traffic Control	Skills Certification	Commercial/Public
Construction	*unknown*	Scaffold User	Skills Certification	Commercial/Public
Construction	National Center for Construction Education & Research (NCCER)	Core: Introductory Craft Skills	Skills Certification	Commercial/Public
Construction	Home Builders' Institute	Pre-Apprenticeship Certificate Training (PACT)	Skills Certification	Commercial/Public
Construction	Training Organization	Environmental Training Certificate	Self-defined Certificate	Commercial/Public
Construction	Training Organization	Work Readiness/Life Skills Certificate	Self-defined Certificate	Commercial/Public
Construction	Training Organization	Computer Applications	Self-defined Certificate	Commercial/Public
Renewable Energy/ Energy Efficiency	California High School Exit Examination (CAHSEE)	HS Diploma/GED (Exit Exam)	Educational - High School	Residential
Renewable Energy/ Energy Efficiency	*unknown*	Fork Lift	Skills Certification	Residential
Renewable Energy/ Energy Efficiency	Department of Motor Vehicles (DMV)	Class B & C Driver's License	Skills Certification	Residential
Renewable Energy/ Energy Efficiency	Environmental Protection Agency (EPA)	Lead Abatement	Skills Certfication	Residential
Renewable Energy/ Energy Efficiency	California Energy Commission (CEC)	HERS I (Home Energy Rater)	Occupational Certification	Residential
Renewable Energy/ Energy Efficiency	National Center for Construction Education & Research (NCCER)	Core: Introductory Craft Skills	Skills Certfication	Residential
Renewable Energy/ Energy Efficiency	California Community Services Department (CSD)	Weatherization Training - Certificate of Accomplishment	Skills Certficate	Residential
Renewable Energy/ Energy Efficiency	Training Organization	Certificate of Completion	Self-defined Certificate	Residential
Renewable Energy/ Energy Efficiency	Training Organization	Work Readiness	Self-defined Certificate	Residential
Renewable Energy/ Energy Efficiency	Roots of Success	Environmental Literacy	Self-defined Certificate	Residential

III. Building Envelope Systems Certifications (continued)

Occupational Category	Certifying Organization	Credential Name	Credential Type	Typical Sector
ROP				
Building Trades and Construction	Training Organization	Certificate of Completion	Self-defined Certificate	Residential
Building Trades and Construction	Building Performance Institute	Residential Building Envelope Whole House Air Leakage Control Installer	Occupational Certification	Residential
Building Trades and Construction	Environmental Protection Agency	Refrigerant Recovery/Handling	Skills Certification	Residential
Building Trades and Construction	American Welding Society	Arc Welding	Skills Certification	Residential
Building Trades and Construction	American Welding Society	Structural Welding	Skills Certification	Residential
Building Trades and Construction	National Center for Construction Education & Research (NCCER)	Core: Introductory Craft Skills	Skills Certification	Residential
Renewable Energy/Energy Efficiency	Training Organization	Certificate of Completion	Self-defined Certificate	Residential
Building Trades and Construction (Green Construction)	Training Organization	Certificate of Completion	Self-defined Certificate	Residential
Private				
Retrofit Installer	Building Performance Institute	Air-sealing and Insulation Technician	Occupational Certification	Residential
Retrofit Installer	Building Performance Institute	Envelope Specialist	Occupational Certification	Residential
HERS Rater	California Energy Commission (CEC)	HERS I (Home Energy Rater)	Occupational Certification	Residential
HERS Rater	Building Performance Institute	Air-sealing and Insulation Technician	Occupational Certification	Residential
HERS Rater	California Home Energy Efficiency Rating Services (CHEERS)	CHEERS Core Class	Occupational Certification	Residential
HERS Rater	RESNET	Home Energy Survey Professional (HESP)	Occupational Certification	Residential
Auditor/ Performance Analyst	Building Performance Institute	BPI Building Analyst	Occupational Certification	Residential
Auditor/ Performance Analyst	Building Performance Institute	BPI Envelope Specialist	Occupational Certification	Residential
Auditor/ Performance Analyst	RESNET	Home Energy Survey Professional (HESP)	Occupational Certification	Residential
Auditor/ Performance Analyst	National Energy and Sustainability Institute	Home Energy Audit Certification	unknown	Residential

APPENDIX I:

INVENTORY OF CALIFORNIA WE&T PROGRAMS IN THE ENERGY EFFICIENCY AND RELATED SECTORS – SEE ATTACHED SPREADSHEET

APPENDIX J:

EMPLOYMENT INFORMATION SYSTEMS SURVEYS

I. METHODOLOGY AND APPROACH

The approach for the EIS analysis consisted of six main steps: 1) conducting a literature review and subject matter expert interviews with a focus on labor exchanges, 2) defining the scope of employment information systems to be addressed and the key attributes of interest, 3) preparing of a resource inventory of EIS providers, 4) developing an interview protocol and contacting EIS providers, 5) interviewing a sample of EIS administrators and preparing survey data, 6) reporting results based on resource inventory and survey data, and 7) developing recommendations and qualifications for the development of a WE&T web portal through a collaborative process.

I.A. EIS PROVIDER INVENTORY

The initial list of EIS providers was compiled through an online search for organizations focusing on employment, workforce, and the labor marketplace. The study team conducted a review of professional literature on the topic of labor exchanges and internet job portals and held interviews with subject matter experts. The literature review and the preliminary interviews informed the development of a working definition of EIS and assisted in the compilation of a larger list of EIS organizations. The criteria for inclusion were, at a minimum, the inclusion of a job search and job post function in the EIS operations.

The preliminary research suggested that the majority of labor market exchanges related to energy efficiency, distributed generation, and the broadly defined "green" area were limited in their functionality and focused primarily on job posting. Very few were found to incorporate other elements of labor exchange facilitation, such as career awareness and exploration tools, training needs matching services, etc. To fully understand what an EIS can potentially offer to both a job seeker and an employer, the decision was made to separately identify and document so called "full-service" EIS that do focus on a variety of industries rather than on the one limited to energy efficiency and the green economy in general. The assumption was that the review of these EIS would produce promising practices in online labor market exchanges that are transferrable across industries.

Thus, the following two lists were produced for the inventory and sampling purposes:

- → EIS related to energy efficiency, distributed generation and broadly defined "green" industries that focus primarily on job matching function (labeled as "green job boards" for the purposes of this report)
- → Labor exchange systems that operate in a variety of industries and offer a variety of services to labor market participants, not limited to job matching functions (labeled as "full-service EIS")

I.B. DATA COLLECTION

To obtain additional information on specific EIS, data were collected from a sample of EIS providers using phone interviews. The research team utilized a purposeful sampling strategy to document variations between different EIS within each category (green job boards and full-service EIS), and highlight important common patterns. To ensure

a thorough investigation of EIS models and best practices, we included organizations in the state of California as well as those in other states.

An interview protocol was developed for each category studied. The green job board protocol included both qualitative open-ended questions and structured inquiries, necessary for further categorization of findings (see Section III). The full-service EIS protocol consisted of primarily qualitative questions focused on capturing the variety and depth of potential services offered and identification of successful practices (see Section IV). The respondents were asked about what services and information they provide to job seekers to assist in successful job matching, what services they provide to employers to ensure successful job filling, what education and skills their job seekers possess, and whether or not and how they incorporate energy efficiency and renewable energy related information.

A total of 69 EIS providers were contacted, of which 47 were job boards and 22 were full-service EIS administrators. The contacts were done using available e-mail addresses. As a general rule, phone numbers were not available. A total of 18 EIS administrators were interviewed during the months of September – October 2010. The interviews were conducted by members of the research team following the developed protocols. Through the interviews, information was gathered from 11 of the 47 job boards (23 percent) and 7 of the 22 full-service EIS providers (32 percent). Appendix J.1 provides a listing of the EIS providers which were contacted for an interview. Appendix K shows the inventory listing of information on all EIS included in the study.

There are a number of possible explanations for the low response rates, especially among administrators of green job boards. First, the majority of green job boards are very new and do not provide reliable contact information on their web pages. In many cases, a web-based email contact form is the only method of contact provided. Multiple attempts to contact job boards using this method did not prove successful. Second, many job boards were unwilling to participate for various reasons. One green job board expressed concern that any information provided could be potentially used to create a competitor in the field. Yet another green job board reluctantly agreed to participate but would not provide responses for the majority of questions asked. Third, some job banks contacted were no longer in existence. These challenges point to the nascent nature of many green job boards and the immaturity of the business practices in this field.

I.C. DATA ANALYSIS

Based on the interviews conducted, the features of existing employment information systems were documented. While attempts were made to secure interviews with all types of EIS providers, those most willing to participate were government sponsored One-Stop centers and niche green job boards. As a result, the findings of this report are skewed toward these two groups and are not representative of all labor market exchange services. With additional resources, other methods could be considered for increasing the response rates and the types of employment information systems interviewed expanded. Specifically, necessary steps for a representative study would include a larger group of researchers to make initial outreach attempts to identified EIS, purchasing a commercial database of businesses that run EIS with accurate contact information, and employing a variety of outreach methods, such as an email or online survey.

The analysis of the data collected allowed the research team to confirm a broad range of EIS models, and outline the practices that prove to work successfully in labor market exchanges. The information was organized by key research questions, with a synthesis of critical success factors, challenges, and job matching effectiveness topics. Three case studies and a list of promising practices are also included as part of this study.

II. EIS INTERVIEWED

II.A. JOB BOARDS:

Clean Techies

Efficiency First

EHS Careers

Energy Central Jobs

Energy Jobs Portal

Green Career Central

Green Jobs

Green Job Spider

Idealist.Org

Job Central

Sustainable Business: Green Dream Jobs

II.B. FULL SERVICE EIS:

Center for Sustainable Energy; Green Career Network

Employ Florida Marketplace

iSEEK Energy

Los Angeles Urban League

NOVA North Valley

SETA

Workforce Florida

III. JOB BOARD INTERVIEW PROTOCOL

III.A. JOB BOARD INTERVIEW GUIDE:

1. Name of the organization:_____
2. Website_____
3. Contact Name_____
4. Contact Email_____
5. Contact Phone_____
6. Which of the following would best describe your Employment Information System?
    a. web portal
    b. online job board
    c. online job search engine
    d. staffed employment center with physical location(s)
    e. information center
    f. other. Please specify_____

7. Connecting employers and job seekers is:
    a. the primary goal of your center/portal/website.
    b. one of the important goals, but not the primary one.
    c. an additional service to your users, but not one of your goals.

8. What is the primary purpose of your Employment Information System (EIS)?*Qualitative*_____

9. What industry focus does your EIS have? Check all that apply.
    a. Not industry-specific--include all industries.
    b. Energy and utilities
    c. Industries with "green" or environmental focus
    d. Renewable energy and energy efficiency
    e. Other_____

10. What geographic area do you serve?

11. What are the staffing and budgetary needs required to successfully operate your service? _____

12. What is the size of your service? (by # of job postings) _____

13. How is your service advertised? _____

14. How often and how is content updated?_____

15. Are job postings
    a. Location-dependent
    b. Mobile
16. How many years has this organization been providing employment matching services?
    a. In general: _____
    b. In the current format (e.g. website/portal/etc.):_____

17. How is your EIS service funded?
    a. Federal/State/Local Government
    b. Grants. _____
    c. Private investment (for profit)
    d. Private funding (non-profit). If applicable, please specify the sources:_____
    e. Self funded

18. Who is the intended target audience for your employment matching services?

    Example: professionals, blue collar, unemployed, etc

    _____

19. Do you partner with any agencies/organizations for:
    a. Job board_____
    b. Labor Market Info_____
    c. Education or Training services/programs_____
    d. Occupation information_____
    e. Any other service offering?

III.B. JOB SEEKER INFORMATION:

20. What services do you offer for job seekers?

21. What are the costs associated with these services?

22. What is the education level of job seekers?
    a. No high school or GED
    b. H.S. diploma
    c. Associates
    d. Bachelors
    e. Masters
    f. Doctorate

23. What is the skill level of your audience?
    a. Low skill
    b. Average skill

c. High skill

24. What is the age level of job seekers?
    a. younger than 18
    b. 18-24
    c. 25-35
    d. 35-54
    e. 55 and older

25. What is the ethnicity of job seekers
    a. White/Caucasian
    b. Latino
    c. African American
    d. Asian
    e. Pacific Islander
    f. Other

26. What is the income level of job seekers?
    a. less than $10,000
    b. 10-30K
    c. 30-60
    d. greater than 60,000

27. Would you say the job seekers that use your site are
    a. currently employed
    b. currently unemployed

28. Do you offer job placement services for any special audiences?
    a. Veterans
    b. Immigrants
    c. Displaced workers
    d. Ex-offenders
    e. Disabled workers
    f. Other

29. Do you verify credential/licensing information provided by job seekers?

III.C. EMPLOYER INFORMATION:

30. What services do you offer for employers?

31. What are the prices associated with these services?

32. What is the size of employers using your site?
    a. small (<100)
    b. medium (100-500)
    c. large (>500)

33. What industry are employers members of?

III.D. OUTCOMES:

34. What matching algorithm do you use? _____

35. What is the success rate of employer – job seeker matches? _____

36. Do you receive employer/job seeker feedback? If yes, how? _____

37. Can you talk about any challenges you face in matching job seekers to employers? Any specific to Renewable Energy/Energy Efficiency?_____

38. Can you talk about any successes you have experienced? _____

39. Is there any other information you would like to share with me about job seeker/employer matching? _____

40. Can you recommend any other green job boards I should be aware of?

IV. FULL-SERVICE EIS INTERVIEW PROTOCOL

IV.A. FULL SERVICE EIS INTERVIEW GUIDE

Name of organization _____

Contact Name _____

Contact email _____

Contact phone # _____

Website _____

1. Would you please provide a brief history of your EIS, for how long has it been participating in the workforce arena?

2. What is the primary goal of your EIS?

3. Is your EIS:
   a. Physical location
   b. On-line service

4. What geographic area do you serve?_____

5. Who is your target audience?
   a. Students
   b. Parents
   c. Educators
   d. Intermediaries
   e. Employers
   f. Job seekers
   g. Other? _____

6. Does your EIS offer any services/information for special audiences? Please describe _____

7. What services/information do you provide for your target audience? Please explain_____

8. Do you partner with any organizations/agencies for any of the following? If yes, please name partner and explain relationship:
   a. Job boards
   b. Labor Market information
   c. Training/program information
   d. Any other service? Please explain _____

9. Are there fees associated with the service/s you offer? If so, please explain _____

10. How is your EIS funded?
    a. Government Funds
    b. Private Funds
    c. Public Funds
    d. Other _____

11. How is your EIS advertised? _____

12. What are your staffing and budgetary needs for successful implementation of your services?_____

13. How and how often is your program content updated?_____

14. Do you have an industry focus? If so, please explain. _____

15. Has your EIS incorporated Energy Efficiency or Renewable Energy into its practices? If so, please describe how? _____

16. Can you talk about any operational challenges you face? _____

17. Can you talk about any successes or accomplishments of your EIS? _____

18. How do you see your EIS developing in the future? New programs/services?_____

19. Is there any additional information that you would like to share with me about your organization that we haven't yet covered? _____

20. Do you know of any other EIS that you think I should be aware of? In or outside of California? _____

APPENDIX K:

EMPLOYMENT INFORMATION SYSTEMS INVENTORY – SEE ATTACHED SPREADSHEET

APPENDIX L:

INVENTORY OF K-12 ENERGY EFFICIENCY EDUCATION -- SEE ATTACHED SPREADSHEET

APPENDIX M:

LIST OF INTERVIEWEES FOR THE NEEDS ASSESSMENT – SEE ATTACHED SPREADSHEET

APPENDIX N:

WORKFORCE STRATEGIES, ENERGY EFFICIENCY, AND GREEN JOBS SUMMIT, DECEMBER 2010 -- SEE ATTACHED DOCUMENT [APPENDIX N_SUMMIT PROGRAM.PDF]

On December 8th, 2010 the Donald Vial Center on Employment in the Green Economy, the California Public Utilities Commission, and the UC Berkeley Center for Labor Research and Education sponsored a one-day summit focused on green jobs and workforce development in California. The summit, called "Workforce Strategies, Energy Efficiency, and Green Jobs: A summit to discuss needs, challenges, and opportunities in California," was funded by California utility ratepayers under the auspices of the California Public Utilities Commission.

The summit provided an opportunity to disseminate the findings of the California Workforce Education and Training Needs Assessment, and to offer a forum for discussion and advancement of the workforce strategy recommendations that emerged from the study. The summit offered guidance about workforce strategies to clean energy policymakers, program managers, and others working to meet California's goals for energy use and workforce education and training. The day's events were organized around the presentation of results, illustration of best practices, and discussion of changes needed.

Over 250 people attended the event held at the UC Berkeley Clark Kerr Center. Participants came from all regions of the state and many parts of the country representing a diversity of viewpoints and networks. Participants represented many different members of the clean energy and workforce development communities including:

- Policymakers in state government agencies, and the legislature responsible for energy, education, and workforce training policies;
- Utilities, local government agencies, educators and others designing and implementing workforce education and training programs for energy efficiency and related skills;
- Trade associations and employer and labor organizations directly involved in the energy efficiency and related sectors; and
- Policymakers and practitioners in state and local workforce education and training arenas, including WIBs, apprenticeship programs, community colleges, non-governmental agencies, etc.

Table N.1 presents a summary of the summit participants:

Table N.1 Participants in the Energy Efficiency Workforce Summit

Clean Energy Community	Workforce Development Community
Academic (UC): 5 Academic (other): 1 Business: 48 Community Organizations: 17 Funders: 1 Government: 25 Labor: 0 Press: 1 No affiliation: 2	Academic (UC): 14 Academic (other): 16 Business: 11 Community Organizations: 26 Funders: 2 Government: 39 Labor: 39 No affiliation: 3
TOTAL: 102 people	TOTAL: 147 people