

**California Energy Commission**  
**STAFF REPORT**

**COMPREHENSIVE ENERGY  
EFFICIENCY PROGRAM FOR  
EXISTING BUILDINGS  
SCOPING REPORT**



CALIFORNIA  
ENERGY COMMISSION

Edmund G. Brown Jr., Governor

AUGUST 2012  
CEC-400-2012-015

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## ABSTRACT

This scoping report document is the first of two documents that will collectively serve as the foundation and roadmap for implementing the Comprehensive Energy Efficiency Program for Existing Buildings as required by Assembly Bill 758 (Skinner, Chapter 470, Statutes 2009). This report introduces the background to the AB 758 program, explores the market characterization and potential program targets, and analyzes eight market components. These market components include financing, workforce development, residential and nonresidential ratings and assessments, energy upgrade programs, compliance and enforcement, marketing education, and outreach, and data. The report also investigates preliminary results from the California Energy Commission/American Recovery and Reinvestment Act investments in the existing building energy efficiency upgrade industry. The report finds that major needs exist within each sector to achieve the energy efficiency targets stated by the California Public Utilities Commission and the Energy Commission in the *Long Term Energy Efficiency Strategic Plan*. Programs must be aimed at specific target markets and communicated with an emphasis on resonant messages and trusted messengers to find the most purchase with the marketplace. The report also finds that AB 758 program implementation must be carried out along with key agency and industry stakeholders to ensure the program design will work in the marketplace. This report will be followed by public workshops to gain stakeholder input; public comment will be incorporated into a draft action plan.

**Keywords:** zero net energy, renewable energy, Long Term Energy Efficiency Strategic Plan, ARRA, green workforce, data, compliance and enforcement, HERS, whole house, whole building, time of sale, RECO, CECO, loan loss reserve, BPI, HPwES, EPS, HEScore

Brook, Martha, Christine Collopy, Devorah Eden, Todd Ferris, Chris Graillat, Helen Lam, Samuel Lerman, Rebecca Menten, Bill Pennington, Justin Regnier, Keith Roberts, Jenny Wu. 2012. *Comprehensive Energy Efficiency Program for Existing Buildings Scoping Report*. California Energy Commission, Efficiency and Renewable Energy Division. Publication number: CEC-400-2012-015.

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## Executive Summary

Assembly Bill (AB) 758 (Skinner, Chapter 470, Statutes 2009) institutes a comprehensive program to improve the energy efficiency of existing buildings. Effective implementation of AB 758 is fundamentally important to California's energy policy: there is no realistic path to achieving the state's aggressive energy efficiency targets and carbon emissions goals without accomplishing large-scale improvements to the existing building stock.

### California's Energy Upgrade Project

California has long been a leader in improving building efficiency, both at the time of construction and upon a major remodel or equipment replacement. As a result of building codes and appliance standards, utility programs, training for the energy efficiency design compliance and enforcement communities, public outreach, and other means, California's per capita energy use has remained roughly flat since 1980 compared to the national trend, which has been on an increasing trajectory. The jointly-adopted California Public Utilities Commission (CPUC) and California Energy Commission (CEC or Energy Commission) *Long Term Energy Efficiency Strategic Plan (Strategic Plan)* notes that "California's building and appliance standards have saved consumers more than \$56 billion in electricity and natural gas costs since 1978 and averted building 15 large power plants."

At the same time, existing buildings represent a particular set of challenges, in that the building stock itself is very diverse and each building occupant is unique. Many energy efficiency upgrades involve invasive procedures to a building's shell and systems, sometimes displacing the occupants or requiring multiple interruptions. Cash resources are often limited, and accessible financing is needed to enable investment. As a result, penetration rates for building upgrade programs currently fall far short of state targets<sup>1</sup>.

The American Recovery and Reinvestment Act (ARRA) funding provided an influx of capital needed to develop and kick-start crucial components of the market; however, project pipelines need to expand considerably. A capable and committed contractor community, a sufficiently aware population of building owners, and simple access to affordable capital are fundamental requirements for achieving scale in the state's building upgrade activity. Most fundamentally, it is important to recognize that 1) upgrade projects will be scoped, priced, sold and built primarily by contractors, using a variety of business models that should be expected and encouraged to evolve, and 2) these projects will be delivered to customers who seek to satisfy a wide range of motivations and who are subject to various specific constraints.

Through its direction for AB 758 Program initiatives the Energy Commission will seek to characterize and shape the most critical elements needed for enabling this marketplace to grow

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<sup>1</sup> The California Long Term Energy Efficiency Strategic Plan states a target of 30 percent reduction in existing home energy purchases of 75 percent of all existing homes by 2020. This would be 9.75 million homes, or 1.2 million homes / year. The current whole house retrofit program has accomplished roughly 1,000 upgrades / year.

and thrive, with the goal of achieving cost-effective upgrades of the widest possible range of California's buildings. To facilitate success, state efforts should encourage innovation in the building upgrade industry while ensuring that it is subject to clear expectations for quality, transparency and accountability.

The legislation itself provides thoughtful direction for approaching the building upgrade challenge. It acknowledges the multifaceted nature of such an undertaking, and calls on the Energy Commission to develop a program that addresses the many underpinnings of successful energy upgrades. In addition, the statute directs the Energy Commission to work with key stakeholders to accomplish the program goals. While the Energy Commission is identified as the primary implementing agency, AB 758 establishes specific roles for the CPUC, the investor owned utilities (IOUs), and the publicly owned utilities (POUs). The Energy Commission is called upon to consult with the Department of Real Estate, the Department of Housing and Community Development, and to coordinate workforce development efforts with the California Workforce Investment Board, the Employment Training Panel, and California Community Colleges. The statute also calls on the Energy Commission to consult with a large group of industry stakeholders, with the expectation that the Energy Commission will hold at least three public hearings on the program in geographically diverse regions throughout the state.

### **Importance of Effective Program Design and Partnerships**

Given the complex nature of building upgrades, the relationship of the benefits to the costs must be compelling enough to motivate a property owner to take action. The overall value proposition—the multiple benefits, energy-related and otherwise, compared to the costs to the customer, including transaction costs—must be such that contractors can make a compelling case to their potential customers for the appropriate upgrades. For each market sector, indeed for each customer, this value proposition will be different. A recurring theme throughout the Scoping Report is the importance of including program components accessible to and tailored for diverse target audiences.

In a pragmatic and structural sense, it is contractors who must drive the retrofit marketplace; they must have the tools and program support to do so effectively and efficiently. At the same time, they and other actors—financing entities, training and technical assistance providers, raters, quality assurance (QA) agents, program administrators, utilities, local governments and state agencies—must be aligned and committed to the best interests of the upgrade customer. For the upgrade enterprise to be sustainable, true partnership must exist between these various actors until a scale is achieved at which the market can function with limited, targeted program support. Certainly the costs of upgrades must decline as contractors and their offerings mature; in parallel, the effort needed for contractors to comply with program requirements should be as modest as possible at the outset and should decline through time.

## **Specific Program Components Identified in AB 758**

This report examines the major program components from a high level, and generalizes findings across residential and non-residential buildings, where appropriate.

### Investing in Energy Efficiency (Financing)

Financing is an important component of an energy upgrade program, in order to enable deeper investments in existing properties. The recession that accelerated in 2008 has greatly hampered access to capital across all market sectors. Several marketplace needs are identified to increase investment in energy efficiency. Financial products need to be designed for ease of access wherever possible, taking into consideration the impact of financing terms on the consumer value proposition. Lower interest rate and longer term lending would facilitate investment and thus increase project flow, perhaps resulting in deeper upgrades. Improved project data collection and sharing would properly support this effort: enhanced access to project characteristics and outcomes would improve evaluation efforts and likely facilitate robust access to the secondary capital markets. Greater project flow would allow proper market segmentation and the development of more targeted financial products. The split incentive, in which the owner does not pay utility bills and therefore has no incentive to invest in improving the efficiency of the property, is a clear market barrier. To improve market awareness, the presence and value of energy improvements should be integrated with the real estate valuation process.

### Workforce Development

A well-qualified workforce is a crucial component of a successful program. Experienced and knowledgeable workers are essential to effectively and reliably delivering high-quality upgrades; that quality guarantees long lasting savings and builds consumer confidence. The recession has hit the construction industry particularly hard. The Energy Commission and other entities across the state (Workforce Investment Boards, Employment Training Panel, Employment Development Department, California's Community Colleges) have been investing in green workforce development. We know that for both contractors and trainees to benefit, workforce efforts must match marketplace needs in terms of scale, content, location, accessibility and cost; they should be well aligned with the local and regional markets they support, and the contracting industry should actively participate in assessing workforce needs so that training can focus on bridging existing skill gaps. Apprenticeship approaches could be very appropriate and effective in the upgrade context, but have not yet been widely employed.

### Energy Assessments and Ratings

Energy assessments and ratings are key components of the AB 758 program. These two activities can each determine and communicate the anticipated energy performance of a property and its opportunities for improvement. An assessment determines the specific opportunities in a particular building, in order to define an appropriate project scope. Ratings

are used to compare the efficiency of one building to others based on standard assumptions of occupant behavior.

### *Residential Assessments and Ratings*

A well-conceived and appropriately comprehensive assessment is a cornerstone of the home performance approach. The applicable diagnosis of building shell, systems, and occupant needs enables both the generation of a project scope and much-needed customer education. A variety of assessment tools exist in the marketplace, and a number of contractors have created proprietary assessment tools in-house for use in their project sales and development processes. Energy use estimates from building energy modeling software can be helpful during assessment and project scoping, if utilized by qualified personnel.<sup>2</sup> For quality control purposes, there is a need for some standardization of testing protocols and reporting methods, and also of training and certification. The Energy Commission has a strong interest in encouraging innovation in this arena, without relaxing expectations of installation quality, contractor accountability, or program oversight and evaluation.

The Building Performance Institute (BPI) has established an assessment approach that has gained traction in the marketplace. BPI has developed a system of training and contractor certification, which has been used as a standard for participation in many of the state's residential whole building performance programs. BPI-certified professionals utilize a performance approach to test and diagnose a home and its systems in order to define an appropriate work scope, and to monitor and verify the expected improvements as the job is completed.

Another product made possible by a rigorous assessment is a home's relative energy performance rating. The California Home Energy Ratings System (HERS), administered by the Energy Commission, is the only recognized home rating system in the state. AB 758 calls upon the Energy Commission to evaluate the effectiveness of the HERS system in achieving the legislation's goals. In developing a rating, a HERS rater delivers a comprehensive, whole-building assessment to the property owner, involving an array of testing and diagnoses that is roughly comparable to that which would be done through the BPI process. Widespread delivery of ratings would provide important information to prospective home buyers and the real estate market generally. For ratings to be effective, they need to be available at specific trigger points, such as the sale of a property, and should be supported by an infrastructure for valuing the energy improvements of a property.

As currently conceived, the HERS program results in an asset rating allowing comparison of the energy performance of a home, independent of its occupants. To the individual customer considering an upgrade project, a rating may or may not be desirable. A customer replacing a broken furnace or water heater may not see the value of a rating at that particular point in time. On the other hand, some contractors leverage HERS as a useful, state-sanctioned tool to engage the customer and educate them on the benefits of home performance. In any case, to ensure

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<sup>2</sup> Examples are: EnergyPro, Home Energy Saver, HEED

consistency and avoid customer confusion, software tools supporting ratings and assessments of existing homes should produce generally comparable results. In particular, tools used in home assessments for the purposes of efficiency upgrades should calibrate to actual energy bills; it is the Energy Commission's intention to invest in HERS-approved tools to accomplish this. Additionally, there is a need to move the application of whole building multifamily assessments and ratings from pilot phase to statewide availability.

#### *Non-Residential Ratings and Assessments*

Energy performance ratings have evolved differently for residential and commercial buildings, both in California and the nation. While residential ratings have been "asset"-based, focusing on the energy performance of homes that is not behavior-dependent and therefore appropriate within a property appraisal, commercial building ratings in the U.S. have focused on the actual energy usage of buildings. There are obvious benefits to both approaches, so much so that recent commercial building rating development efforts in the U.S. and California focus on providing a commercial building asset rating approach to complement the well-known ENERGY STAR Portfolio Manager energy-use rating. California will soon have the opportunity to employ both energy use and asset ratings of commercial buildings, in the hope that their availability will lead to increased demand for energy efficient buildings through rating disclosures, and thus stimulate the execution of projects to improve building energy performance.

Commercial energy assessments tend to be much more time and labor intensive than their residential counterparts (depending on the size of the building) due to the increase in size and complexity of the lighting controls and mechanical systems in the building. Currently, there is no one methodology utilized for commercial whole building energy assessments. More typically, energy assessments for large scale facilities occur in phases, where an initial investigative audit is performed to screen out buildings with low potential for savings and more comprehensive investment grade audits are subsequently performed to prepare a project proposal for consideration. Often, the ASHRAE level I-III protocols are relied upon to deliver these progressive assessments.

Existing building commissioning (EBCx) includes an energy assessment, which focuses on the system-wide performance of the mechanical equipment in a building and makes recommendations for improvements to the facility. The EBCx process does not stop at the audit report, but continues past installation of the measures and often includes post-installation testing of the equipment and training of the building maintenance staff to ensure persistent savings.

If disclosure policies are to be part of the AB 758 program, it is important that the Energy Commission and other implementing agencies coordinate with stakeholders to develop new policies through a collaborative approach. Other states are implementing policies for periodic disclosure, independent from property transfer. In addition, robust and inexpensive tools are needed to screen for potential energy efficiency opportunities to streamline program delivery and bring down costs. Similarly, cost-effective audits and/or EBCx investigations need to be

encouraged as mechanisms to deliver whole building approaches in the commercial market. The Smart Grid infrastructure, where energy use data is available at small time steps, is one tool that should be leveraged to achieve these economies for both assessments and ratings.

### Energy Upgrade Programs

Ratepayer-funded energy efficiency incentive programs are the major source of funding for energy efficiency in the state. The CPUC, IOUs and select POU's are providing whole building programs, but these programs have encountered challenges. For the residential sector, the limited pool of approved tools can slow the sales process and introduce unhelpful complexity. Program structure has produced tension between QA processes and the need for streamlined program flow; and arms-length QA program design misses critical opportunities for feedback to contractors. Finally, the existing IOU whole building upgrade programs are far from the cost effectiveness requirements of the CPUC, constraining the ability of these programs to scale in the near term. Existing cost-effectiveness methodologies give no weight to non-energy benefits such as health, safety, comfort, and productivity, which tend to be among the most important motivating points for property owners.<sup>3</sup>

Significant lessons are being gleaned from the ARRA experiences and compared with emerging CPUC-sponsored evaluation, monitoring, and verification reports on IOU programs. These lessons, coupled with stakeholder feedback, particularly from the contractor community, will assist the Energy Commission in developing recommendations for improved program designs and other market-supporting initiatives. For the commercial and multifamily sectors, there is not yet a whole building approach, though the CPUC 2013-14 Energy Efficiency Portfolio Guidance Decision (*Guidance Decision*) does encourage the IOUs to develop programs to fill this gap.<sup>4</sup>

Utility ratepayers both fund and participate in the building upgrade endeavor, and thus are crucial stakeholders. Therefore, the CPUC, IOUs, POU's and their boards are necessarily close partners with the Energy Commission in implementing AB 758. AB 758-inspired initiatives and timelines must align with the respective planning and implementation cycles at the CPUC and utilities. Achieving alignment while preserving any possible flexibility moving forward will require continuous communication and coordination between the agencies.

### Compliance and Enforcement

Building standards are a crucial component of California's energy policy, which relies on them to deliver projected savings, ensure safe and healthy homes, and mitigate the impacts to peak load associated with construction and installation defects. However, compliance levels, especially for alterations and upgrades to existing buildings, are difficult to assess, in part resulting from the lack of coordinated data collection across a large group of players. Ensuring compliance with existing codes and standards is also very difficult in that there are many

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<sup>3</sup> MIG. *Energy Upgrade California Market Research Report*, p. 9, July 30, 2010.

<sup>4</sup> D. 12-05-015. Available at: <http://www.cpuc.ca.gov/puc/>

trigger points at which the standards apply, and each actor – from contractors to local building official to utility program representatives – has a part to play.

We do know that the rate of pulling permits is very low for alterations to existing buildings, such as HVAC change-outs. There is a need to increase the pulling of permits and to simplify compliance with the existing standards. Education and outreach around the standards needs to be customized and targeted to the specific implementing roles (e.g., building officials, contractors, etc.).

### Marketing, Education and Outreach (ME&O)

Marketing, Education and Outreach is a very important component of any program, but it is particularly important for one that seeks to motivate behavior change over time. The value of energy efficiency must be communicated in relevant, targeted messages that motivate property owners to take action. The Energy Commission, CPUC, local governments, and stakeholders partnered through the ARRA program efforts to develop a single brand and statewide message for the residential whole house upgrade program; this approach sought to minimize market confusion that could have occurred through competing messages and brands. The CPUC voted in the *Guidance Decision* to extend the Energy Upgrade California brand as the single umbrella brand for residential and small commercial energy programs.<sup>5</sup> AB 758 can provide a platform for collaboration among the CEC, CPUC and its ME&O team, the POUs and regional partners across the state to explore successful strategies and improve awareness, understanding, and demand for energy efficiency improvements.

The AB 758 comprehensive retrofit program will require the support of a well-researched and well developed marketing, education and outreach plan. This plan should articulate how particular program approaches are designed to reach the intended customer segments. Also, there is a need to leverage trusted messengers to communicate the value of the program. ME&O should support workforce development by communicating the value of trained, certified professionals and generating demand for these workers. The ME&O plan should consider and support innovative approaches that gain traction, particularly those identified as successful in the ARRA programs. Finally, and perhaps most importantly, there is a need to communicate the value and importance of ME&O efforts to accomplishing program goals and building consumer demand for energy efficiency.

### Data

The market succeeds when data is available not only to inform program design and evaluation efforts, but also to enable contractors, investors, entrepreneurs and other essential market actors in their business decisions. California has been investing in energy efficiency for more than three decades, but the data available to market decision makers for financial risk analysis, energy upgrade opportunity evaluations, and other types of market analyses is lacking. The CPUC, the IOUs and the Energy Commission all collect valuable data related to building performance, but this data is not managed in a consolidated location, and generally is not

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<sup>5</sup> California Public Utilities Commission. Decision 12-05-015, p. 13. May 10<sup>th</sup>, 2012.

available for public consumption, even through anonymous formats that protect personal information. Most important, the market decision makers who will ultimately implement effective efficiency upgrade projects across our state do not have access to this market data, even for projects for which public and ratepayer funds have been provided. The Energy Commission is developing a data warehouse to hold information from multiple sources related to the Energy Upgrade California ARRA program efforts, but this only resolves a small portion of the problem, and primarily from the program analysis and evaluation perspective. The CPUC has similarly directed the IOUs to develop a database to contain project information related to projects that are financed through IOU programs, with the intention of supporting secondary market financing efforts.

## **Role of the California Public Utilities Commission and Publicly Owned Utilities in AB 758**

### CPUC

The Energy Commission is directed to coordinate with the CPUC and to avoid duplication of existing CPUC proceedings. The statute also calls out specific roles for the CPUC related to financing. AB 758 directed the CPUC, by March 1, 2010, to open a new proceeding or amend an existing proceeding to “investigate the ability of electrical corporations and gas corporations to provide various energy efficiency financing options to their customers...” for the purposes of implementing the AB 758 program. Also, AB 758 directs the CPUC to report to the Legislature an assessment of each IOU’s implementation of the AB 758 comprehensive program. In addition to the direct statutory responsibilities of the CPUC, the Energy Commission recognizes the considerable investment the CPUC oversees in energy efficiency through the use of ratepayer funds. For the 2010-2012 funding cycle, the total investment in energy efficiency equaled \$3.1 billion, or \$1 billion per year.

The IOUs have historically offered rebate programs that provide an incentive for the incremental cost of a specific, more efficient technology over another. Pre-determined, set rebates are available for homeowners who wish to replace a failing water heater with a more efficient model, or for agricultural customers who change out motors for a premium, efficient motor. In 2008, the CPUC and the CEC jointly adopted the *Strategic Plan*; this document was updated in 2011. The *Strategic Plan* recognizes the IOU programs have tended to “‘buy’ load reductions in easy, well packaged measures with limited market impacts.” The *Strategic Plan* further notes “there has been little incentive for utilities to engage in measures with a longer-term orientation – those very measures which produce meaningful market transformation<sup>6</sup>.”

The CPUC has been working with the IOUs to introduce programs that provide incentives for these longer-term projects. In Decision 09-09-047, approving the IOU applications for the 2010-2012 timeframe, the CPUC called upon the IOUs to develop and implement the first performance based incentive program for the residential sector, known as the Whole House Performance Program (WHPP). The introduction of this new program occurred simultaneous

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6 CPUC. *Long Term Energy Efficiency Strategic Plan*, p.4. 2011. Available online at: <http://www.cpuc.ca.gov/PUC/energy/Efficiency/eesp/> (August 8, 2012.)

to the deployment of millions of dollars of ARRA funding. The Energy Commission, the CPUC, IOUs, POU, and local government partners saw the opportunities inherent in collaborating to provide a maximum investment in an emerging residential whole building upgrade program. The results and experiences from the past two years of ARRA programs provide substantial anecdotal evidence as to what is working well and what needs further improvement in the residential building performance program design. These experiences have been identified throughout this scoping report. Still, there is a clear need for publically accessible hard data on projects, market performance and temporal trends.

The collaboration between the CPUC and the CEC over the course of the ARRA funding has laid important groundwork for ongoing AB 758 program efforts. CPUC and CEC staffs have established a close working relationship over AB 758. Given the significant investment that the CPUC makes in delivering energy efficiency financing and upgrade incentives, it is likely many of the program approaches identified in the Action Plan will rely upon CPUC and IOU implementation, particularly in the near term when AB 758 is characterized by voluntary program approaches and market infrastructure development.

### POUs

California's 41 publicly owned utilities operate across a very diverse set of regions, but just two of the POU hold 64 percent of the total POU market share of reported energy savings: Sacramento Municipal Utility District (SMUD), 37 percent of total, and Los Angeles Department of Water and Power (LADWP), 28 percent of total. POU do not report to the CPUC, but rather are governed by locally elected boards. This puts them in a unique position to respond directly to the particular needs of their communities. In 2006, AB 2021 was signed into law requiring the locally owned utilities in California to identify achievable energy efficiency potential on three year cycles and establish targets for capturing this potential. AB 2021 further required the POU to report on these programs to the Energy Commission. AB 758 reiterates this requirement, directing the POU to "be responsible for implementing an energy efficiency program that recognizes the intent of the Legislature to encourage energy savings and greenhouse gas emissions reductions in existing residential and non-residential buildings, while taking into consideration the effect of the program on rates, reliability, and financial resources<sup>7</sup>." The POU must report to the Energy Commission on the status of program implementation as well as net energy savings from improvements installed in accordance with the AB 758 program.

POU are not accountable to a state agency but rather directly to the local governing bodies; calling upon POU to implement the AB 758 program will require a collaborative approach with local government partners. The Energy Commission worked with local governments through the ARRA funded programs, and recognizes the diverse set of realities that these POU face.

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<sup>7</sup> California Public Resources Code, Section 385.2 (a)

## **Conclusion**

Developing markets for energy efficiency in existing buildings will require a long-term, concerted effort among myriad stakeholders. The Energy Commission intends to implement the AB 758 program in three phases. The first phase focuses on scoping and planning for the program. The second phase will focus on voluntary approaches, partnership building, and market development, and will begin in 2013. The third phase of the program will focus on potential regulation setting and is envisioned for 2015 and beyond. The Scoping Report represents the first attempt to characterize the market needs and identify barriers to accomplishing the goals of the legislation. During the Fall of 2012, the Energy Commission will conduct workshops to gather stakeholder input to identify potential approaches to addressing the needs and overcoming barriers the identified in the Scoping Report. The workshop process will be followed by the release of a draft action plan for public comment. Further workshops throughout the State will provide additional opportunities for input. The resulting Action Plan will serve as the initial road map for the AB 758 program.

# CHAPTER 1: Background

California has long been a leader in supporting energy-efficient buildings through building codes, utility programs, training for the design and enforcement communities, public outreach, and other means. This has contributed to California's per capita energy use remaining flat since 1980 while the national trend has been on an increasing trajectory.

Starting with the *Energy Action Plan* in 2003,<sup>8</sup> several adopted policy documents list energy efficiency as first in the "loading order" for utilities' plans to meet growing energy demand. The *Strategic Plan* (adopted 2008, updated 2011) sets specific targets for long-term accomplishments of utility programs, identifies some of the persistent barriers they have faced, and outlines a broad policy framework for reducing or eliminating the barriers and meeting the goals.

With an economy twice as large as any other state<sup>9</sup> and more than two-thirds the size of France or the United Kingdom (UK), California is also one of the world's largest emitters of greenhouse gases (GHG). There are many reasons to believe that California may be particularly vulnerable to the negative effects of climate change, including the state's reliance on an adequate snow pack for hydroelectric generation and agricultural and municipal water. In 2006, the Legislature passed the Global Warming Solutions Act (AB 32 – Núñez, Chapter 488, Statutes 2006), which tasked the California Air Resources Board (ARB) to work with industry, other state agencies, and the public to reverse the increase of GHG emissions back to 1990 levels. Much of ARB's policy work has been closely coordinated with the Energy Commission and the CPUC, in recognition that energy efficiency is the most cost-effective option for addressing GHG emissions.<sup>10</sup>

To a large extent, the efforts in energy efficiency fostered by the Energy Commission, CPUC, and California's utilities have been focused on newly constructed buildings through codes and standards, design assistance and rebates. Utility programs have offered rebates for single energy efficiency measures for existing buildings and, in the most recent utility program cycle, rebates for whole house energy upgrades. The relatively low incremental cost of higher efficiency options installed during construction has made new construction an obvious place to focus building science, code, and program attention. However, in the very best year for the

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8 *Energy Action Plan*. Adopted by Energy Commission, CPUC, and Consumer Power and Conservation Financing Authority (no longer exists), on May 8, 2003.

9 [http://www.lao.ca.gov/reports/2011/calfacts/calfacts\\_010511.aspx#zzee\\_link\\_2\\_1294170707](http://www.lao.ca.gov/reports/2011/calfacts/calfacts_010511.aspx#zzee_link_2_1294170707).

10 Climate change is a "fundamental consideration in future energy planning, with a coordinated implementation plan for state energy policies and a reiterated commitment to the loading order described in the first EAP." *CPUC Energy Efficiency and Conservation Programs Progress Report to the Legislature*, July 2009.

construction industry during the past two decades, less than 2 percent of the homes existing at the end of the year were built that year. It was clear to legislators in 2009 that the state would have to increase its focus on existing buildings if it was to meet the state's energy efficiency and climate change goals. AB 758 was introduced and passed in 2009 to explore and address this mostly untapped opportunity. AB 758 directs the Energy Commission to "establish a regulatory proceeding to develop a comprehensive program to achieve greater energy savings in the state's existing residential and nonresidential building stock."

California's nearly 35-year history with building and appliance standards along with efficiency programs has created resources that have, to some degree, been transferable from newly constructed buildings to retrofit and renovation work. Roughly 15 years ago, new construction programs started emphasizing performance improvements over incentives for adopting specific technologies (prescriptive rebates), which helps designers and owners understand how their buildings work as systems. Over the last 10 years, retrofit programs have provided that same lesson. In 1999, the state Building Energy Efficiency Standards began relying on certified third parties (HERS Raters) to verify the performance of certain measures in residential buildings. The range of measures expanded over time as did the body of trained, certified Raters. With the adoption of HERS Whole House (HERS II) regulations, this body of expertise was able to help expand performance-based programs for existing homes.

In 2008, the "Great Recession" hit, changing the building landscape in some important ways. First, housing construction collapsed from more than 200,000 units per year to a low in 2009 of just 36,000. The ARRA provided an infusion of funding for energy efficiency efforts through state programs, local and regional programs, workforce training organizations, financing entities, and code compliance bodies. These influences resulted in a significant increase in residential energy efficiency remodeling activity informed by professional energy assessments, and provided a considerable learning opportunity. In the commercial sector, the ARRA energy efficiency efforts resulted in the cost-effective deployment of advanced lighting, HVAC and refrigeration control technologies that yielded significant energy savings in existing buildings. At the same time, in California and across the nation, ARRA-supported building upgrade initiatives were conceived with the understanding that Property-Assessed Clean Energy (PACE) financing would be a core resource for property owners to obtain attractive capital for their upgrade projects. Early in EUC program development, when PACE suffered a critical setback due to skepticism and intransigence on the part of the Federal Housing Finance Agency (FHFA), the near-term goals that had been set for EUC became that much more challenging.

Energy efficiency is a crucial element of California's economy. The billions of dollars the state's building and appliance standards and energy efficiency programs have saved consumers annually is a reliable resource that can be expanded – unlike traditional energy resources that are depleted when extracted, and at lower cost than most renewable generation sources. Dollars not spent on energy are dollars that foster other economic activity. Additionally, the state's economy benefits from investment in energy efficiency and clean energy generation; while state unemployment in total rose during the recession, there was job growth in the "green

economy<sup>11</sup>.” More venture capital dollars for energy efficiency and clean energy come to (or stay in) California than any other state.

AB 758 institutes a comprehensive program to improve the energy efficiency of existing buildings. A major driver in accomplishing this mandate and achieving the aggressive energy efficiency targets of state agencies is instigating “market transformation” in the energy efficiency industry. The CPUC defines market transformation as “long-lasting, sustainable changes in the structure or functioning of a market achieved by reducing barriers to the adoption of energy efficiency measures to the point where continuation of the same publicly-funded intervention is no longer appropriate in that specific market. Market transformation includes promoting one set of efficient technologies, processes or building design approaches until they are adopted into codes and standards (or otherwise substantially adopted by the market), while also moving forward to bring the next generation of even more efficient technologies, processes or design solutions to the market<sup>12</sup>”

AB 758 acknowledges the multifaceted nature of such an undertaking and calls on the Energy Commission to develop a program that addresses the many underpinnings of a successful energy upgrade. In addition, the statute directs the Energy Commission to work with key stakeholders, including other state agencies, to accomplish the program. While the Energy Commission is identified as the key implementer, AB 758 establishes specific roles for the CPUC, the IOUs, and the POU. The Energy Commission is called upon to consult with the Department of Real Estate and the Department of Housing and Community Development, and to coordinate workforce development efforts with the Workforce Investment Board, the Employment Training Panel, and the California Community Colleges. The statute also calls on the Energy Commission to consult with a large group of industry stakeholders, with the expectation that the Energy Commission will hold at least three public hearings on the program in geographically diverse regions throughout the state.

## **AB 758 Implementation**

The Energy Commission intends to accomplish AB 758 implementation in three phases.

### **Phase I: Infrastructure Development and Implementation Plan**

In 2009, the same year AB 758 was signed into law, President Barack Obama signed the American Recovery and Reinvestment Act, bringing millions of dollars into California to

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<sup>11</sup> The ‘green economy’ is a term used by the Employment Development Department to convey economic functions which generate and store renewable energy, recycle existing materials, involve energy efficient product manufacturing, distribution, construction, installation, and maintenance, education, compliance, and awareness, or natural and sustainable products and manufacturing. More information is available at: <http://www.labormarketinfo.edd.ca.gov/contentpub/GreenDigest/Californias-Draft-Definition-Green-Industries.pdf> (August 21, 2012).

<sup>12</sup> D. 09-09-047 at 88-89.

promote energy efficiency and renewable energy. Seeing the opportunities as they related to the objectives of AB 758, the Energy Commission committed a significant portion of ARRA funding to piloting energy efficiency upgrade programs. These pilots are now winding down, and information related to the approaches that were tried and the initial lessons learned are covered in Chapter 6 of this report.

Simultaneous to ARRA, Energy Commission staff has been working to assess the existing state of the energy efficiency market and determine what major barriers and needs exist that should be addressed through the *AB 758 Action Plan*. For the past two years, the Energy Commission has been gathering relevant lessons learned from ARRA, researching market conditions, and working with technical support consultants to develop an understanding of the market. This *Scoping Report* is the result of this overall research effort and is intended to be a high-level summary of major gaps and needs in the marketplace. This report will be vetted at public workshops, and the Energy Commission will utilize public comment received at the workshops and subsequently into an *AB 758 Action Plan*.

One part of this effort involved working with consultants to gather expert views and opinions on a specific set of questions. The results of the conversations with these industry experts informed the overall research process, and will be released in conjunction with the overall *AB 758 Action Plan* development process. The *Action Plan* will define major goals and strategies of the AB 758 program, articulate solutions for addressing needs identified in the *Scoping Report*, and develop a road map for implementation of the program.

## **Phase II: Market Development and Partnerships**

Phase II of the program will involve implementation of the near-term activities identified in the *Action Plan*, including any necessary market development to support energy efficiency programs (for example, tools, workforce development, additional market analysis, etc.) A major activity in this phase will be identifying industry and agency partners and defining and developing collaborative relationships.

## **Phase III: Statewide Ratings and Upgrades Requirements**

This third phase of the program will help transition voluntary program approaches and market maturity into regulations when and where identified as appropriate to accomplish the goals of the AB 758 program.

## **Role of the California Public Utilities Commission and Publicly Owned Utilities in AB 758**

### **CPUC**

While the Energy Commission is directed to coordinate with the CPUC and to avoid duplication of existing CPUC proceedings, the statute also calls out specific roles for the CPUC related to financing. AB 758 directs the CPUC, by March 1, 2010, to open a new proceeding or amend an existing proceeding to “investigate the ability of electrical corporations and gas corporations to provide various energy efficiency financing options to their customers...” for

implementing the AB 758 program. Also, AB 758 directs the CPUC to report to the Legislature an assessment of each IOU's implementation of the AB 758 comprehensive program. In addition to the direct statutory responsibilities of the CPUC, the Energy Commission recognizes the considerable investment the CPUC oversees in energy efficiency through the use of ratepayer funds. For the 2010-2012 funding cycle, the total investment in energy efficiency equaled \$3.1 billion, or \$1 billion per year.

The CPUC has historically offered rebate programs that provide an incentive for the incremental cost of a specific, more efficient technology over another. Predetermined, set rebates are available for homeowners who wish to replace a failing water heater with a more efficient model, or for agricultural customers who change out motors for more efficient motors. In 2008, the CPUC and the Energy Commission jointly adopted the *Strategic Plan*; this document has since been updated (2011). The *Strategic Plan* recognizes that the IOU programs have tended to "buy" load reductions in easy, well packaged measures with limited market impacts." The *Strategic Plan* further notes that "there has been little incentive for utilities to engage in measures with a longer-term orientation – those very measures which produce meaningful market transformation."<sup>13</sup>

The CPUC has been working to introduce programs that provide incentives for these longer-term projects. In Decision 09-09-047, approving the IOU applications for the 2010-2012 timeframe, the CPUC called upon the IOUs to develop and implement the first performance-based incentive program for the residential sector, known as the WHPP. The introduction of this new program occurred simultaneous to the deployment of millions of dollars of ARRA funding. The Energy Commission, the CPUC, IOUs, POUs and local government partners saw the opportunities inherent in collaborating to provide a maximum investment in an emerging residential whole building program. The results and experiences from the past two years of ARRA programs provide rich, anecdotal evidence as to what is working well and what needs further improvement in the residential building performance program design. These experiences are called upon throughout this document.

The collaboration between the CPUC and the Energy Commission over the course of the ARRA funding has laid important groundwork for ongoing AB 758 program efforts. CPUC and Energy Commission staffs have established a close working relationship over AB 758. Given the significant investment that the CPUC makes in energy efficiency financing, it is likely many of the program approaches identified in the *Action Plan* will rely upon CPUC and IOU implementation, particularly in the near term when AB 758 is characterized by voluntary program approaches and market infrastructure development.

## **POUs**

California's 41 publicly owned utilities operate across a very diverse set of regions. Two of the POUs hold 64 percent of the total POU market share – SMUD (37 percent of total) and LADWP (28 percent of total). POUs do not report to the CPUC but rather are governed by locally elected

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13 CPUC. *Long Term Energy Efficiency Strategic Plan*, p.4. 2011. Available online at: <http://www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/eesp/> (August 8, 2012.)

boards. This governance puts them in a unique position to respond more readily to the particular needs of their communities. In 2006, AB 2021 (Levine, Chapter 734, Statutes 2006) was signed into law, requiring the locally owned utilities in California to establish achievable energy efficiency potential on three-year cycles and establish targets for capturing this potential. AB 2021 further required the POU's to report on these programs to the Energy Commission. AB 758 reiterates this requirement, directing the POU's to "be responsible for implementing an energy efficiency program that recognizes the intent of the Legislature to encourage energy savings and greenhouse gas emissions reductions in existing residential and nonresidential buildings, while taking into consideration the effect of the program on rates, reliability, and financial resources."<sup>14</sup> The POU's are expected to report to the Energy Commission on the status of program implementation as well as net energy savings from improvements installed in accordance with the AB 758 program.

As POU's are not accountable to a state agency but rather directly to their local governing bodies, calling upon POU's to implement the AB 758 program will require a collaborative approach with local government partners. The Energy Commission gained experiences working with local governments through the ARRA-funded programs but will need to recognize the diverse set of realities that these POU's face.

## **Market Characterization**

A fundamental piece of market transformation is designing a program to specifically address a target market sector. To understand how best to address efficiency in existing buildings, the Energy Commission must first endeavor to gain an understanding of existing building stock. Overall, California's efficiency policies have contributed to a steady per capita rate of energy consumption since the 1980s<sup>15</sup>. However, factors such as growth in the building stock and the increasing use of consumer electronics contribute to an increased energy demand overall.

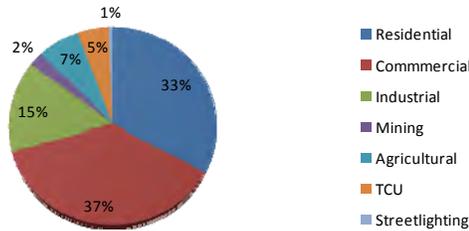
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<sup>14</sup> California Public Resources Code, Section 385.2 (a).

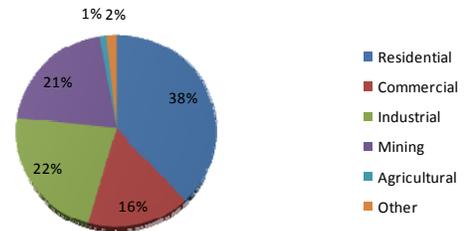
<sup>15</sup> Kandel, Adrienne, Sheridan, Margaret, and McAuliffe, Patrick. *A Comparison of Per Capita Electricity Consumption in the United State and California*. Available online at: <http://www.energy.ca.gov/2009publications/CEC-200-2009-015/CEC-200-2009-015.PDF> (August 13, 2012).

**Figure 1: Energy Consumption and Peak Demand in California by Sector**

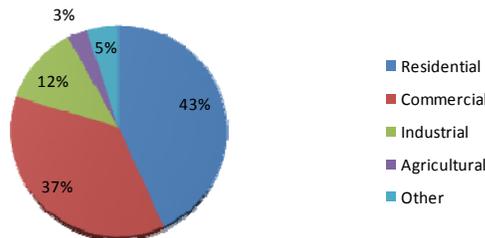
**2012 Electricity Consumption by Sector**



**2012 Natural Gas Consumption by Sector**



**2012 Coincident Peak Demand by Sector**



Source: California Energy Demand 2008-2018 Staff Revised Forecast, pp. 37, 41, 218.

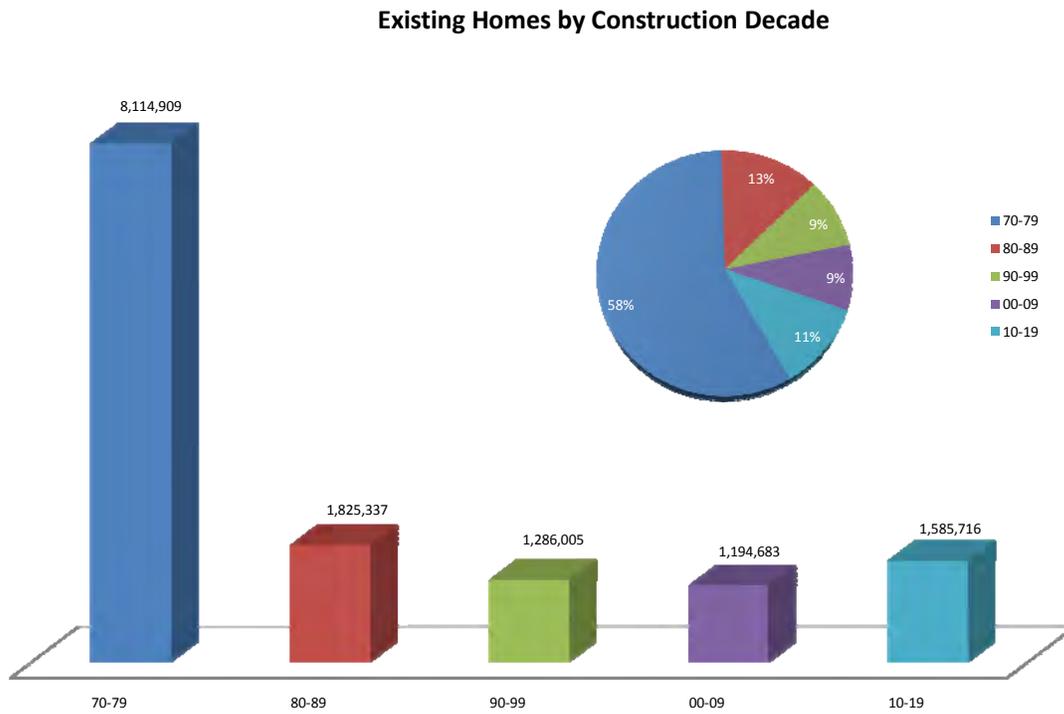
In the figure above, the residential and commercial sectors account for nearly even thirds of total electricity consumption in the state, while the residential sector dominates natural gas consumption. Similarly, the residential and commercial sectors share 80 percent of the state’s peak electricity demand.

## Residential Market Characterization

If California is to meet its energy efficiency goals for 2025, it will need to consider the substantial contributions of older buildings. California’s existing residential building stock is dominated by pre-code buildings, and this reality is expected to persist well into the next decade. There is substantial potential for improvement in energy performance (Figure 2) in existing buildings. Energy Commission projections estimate that in 2022 58 percent of all homes will have been built before 1980, when California energy standards in building construction came into effect, and 71 percent of all homes will have been built before 1990. In addition to the clear need to target the opportunity present in older homes, a look at the energy use attributed to space conditioning in homes by vintage shows that there is still an opportunity to reap great

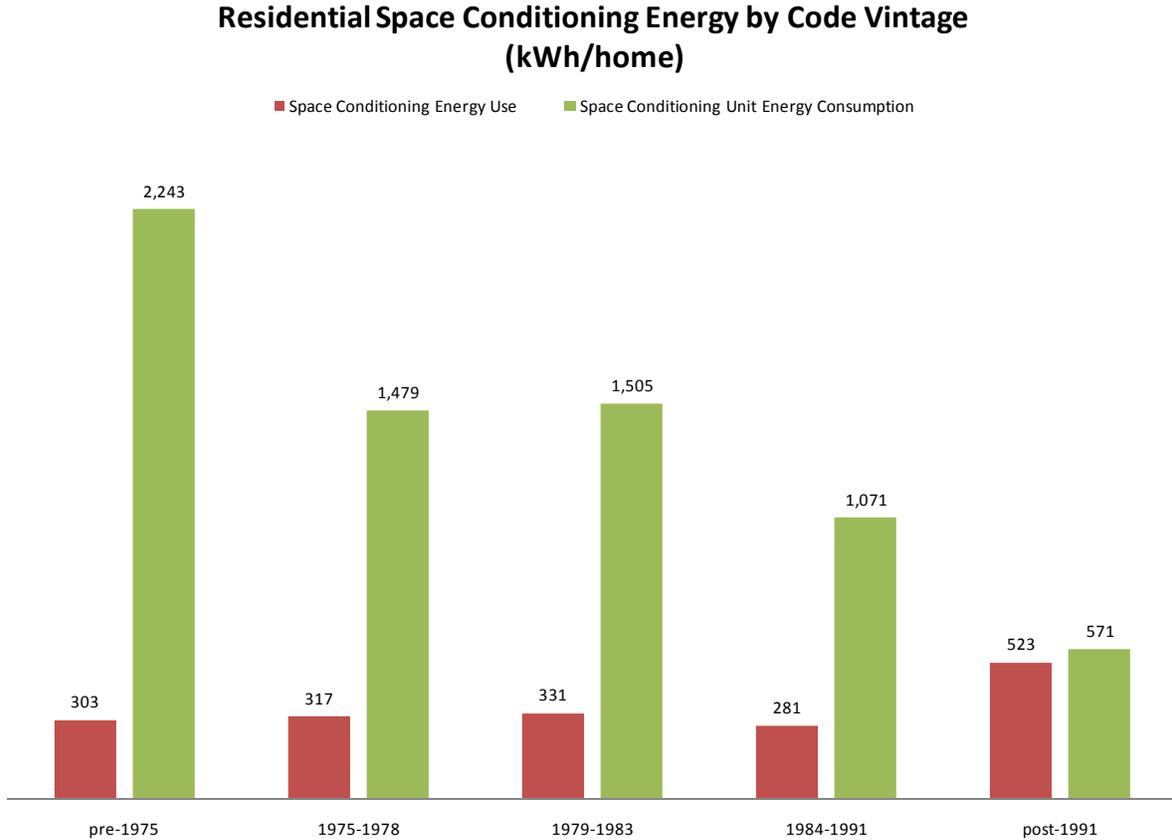
energy savings in some “newer” homes. Figure 3 illustrates that even though older homes’ heating and cooling equipment is less efficient (having higher unit energy consumption values), more energy is used to heat and cool newer homes than older homes. This is due in part to the fact that more new homes have air conditioning systems than older homes. Another contributing factor is that occupants in older homes cannot always afford to operate their inefficient space conditioning systems, so they live with less comfortable indoor conditions.

**Figure 2: Distribution of California’s Housing Stock by Building Vintage (Decade).**



Source: California Energy Commission

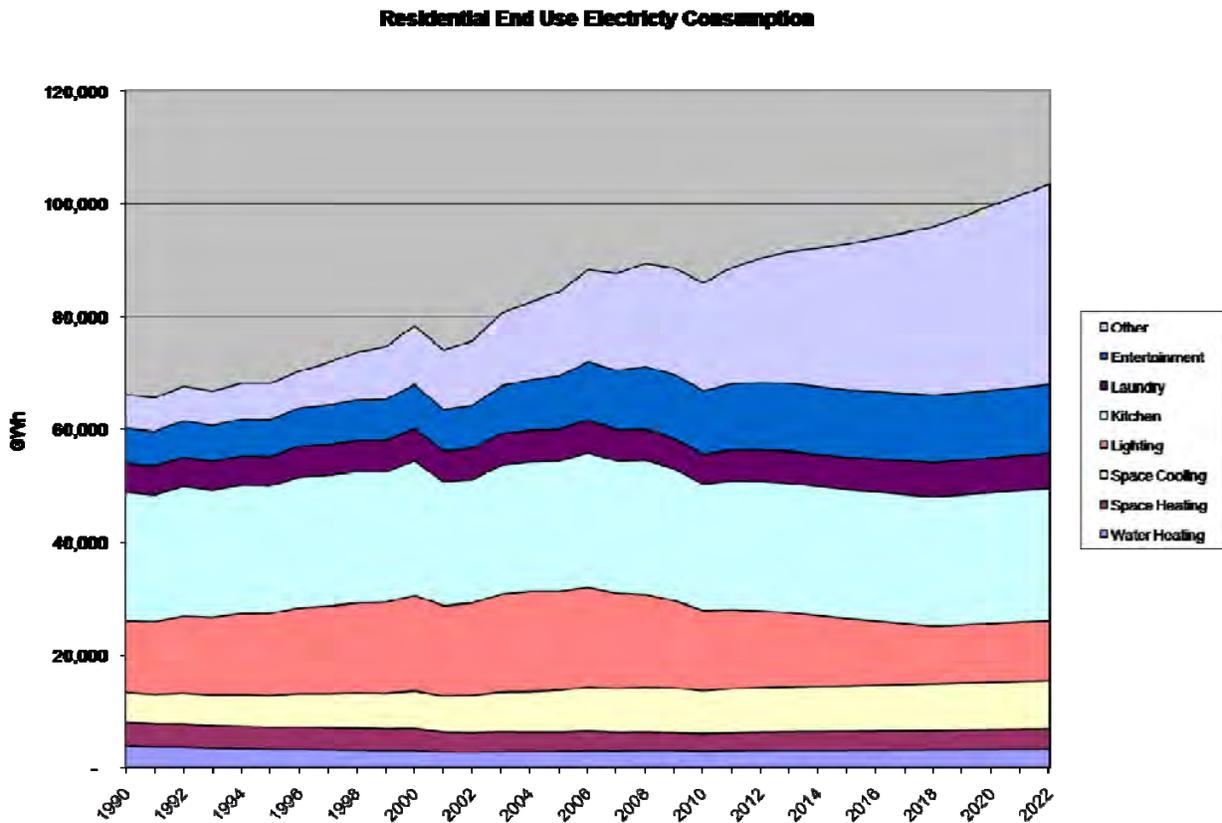
**Figure 3: Residential Space Conditioning by Energy Code Vintage.**



Source: California Energy Commission

Determining where energy is being consumed in the residential sector is also important in designing an effective program. Generally, the electrical loads associated with the kitchen contribute most to the electricity demand in residential dwellings (Figure 4). Plug loads, however, represent the fastest growing category of electricity consumption in residential buildings (see “Other” in Figure 4).

Figure 4. Residential Electricity Consumption by End Use.



Source: California Energy Commission.

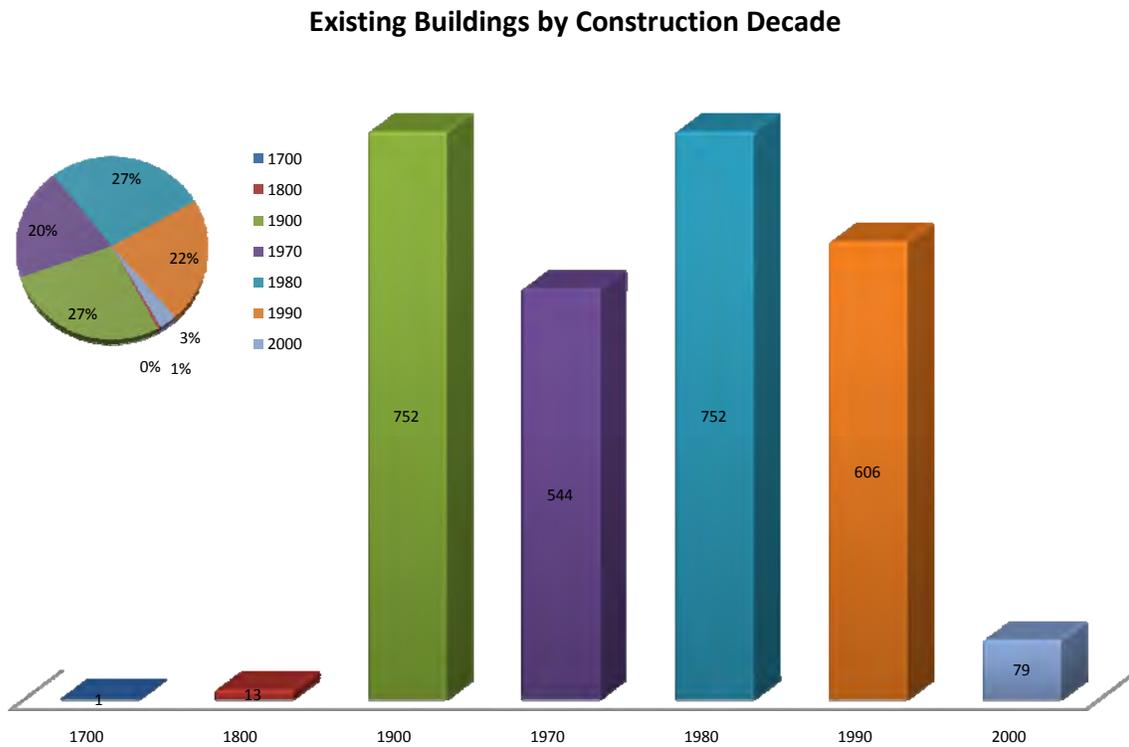
### Nonresidential Market Characterization

Similar to the residential sector, the nonresidential sector is dominated by buildings that predate California’s energy code for new construction; Energy Commission projections indicate that, by 2022, nearly 50 percent of buildings will be pre-1970 and 74 percent pre-1990 (Figure 5). Within the nonresidential sector, there is a great variety of building types, and each contains a different profile of energy consumption. Energy consumption is greatest in the miscellaneous building category<sup>16</sup>, which may speak to the difficulty of categorizing buildings more than it is helpful for efficiency program design. However, it is helpful to acknowledge that the retail sector is the next largest, both in number of buildings and their aggregate electricity consumption, and that the electricity use in the retail sector is more than five times larger than the next largest electricity consuming sectors, large offices and healthcare. (Figure 6 – first chart). The second chart in Figure 6 examines the difference between the electricity use from equipment and systems expected to be transferred with commercial property, called “assets” here, and the electricity used in buildings by equipment that is more typically dependent on the

<sup>16</sup> The Energy Commission intends to dive further into available market data to attempt to distinguish the types of buildings in the miscellaneous category, and the associated energy consumption for the *Action Plan*.

specific operations of a particular building, such as miscellaneous plug loads (called “operational” here). Finally, Figure 7 looks at how much each category of electricity using equipment and devices contribute to the overall electricity consumption of the entire commercial sector, and how much each of these “end uses” is expected to change over time. The relatively constant growth rates across all end uses in the future years of Figure 7 implies that the majority of electricity growth in the commercial sector is expected to come from additions to the existing building stock rather than the increasing energy intensity of each end use.

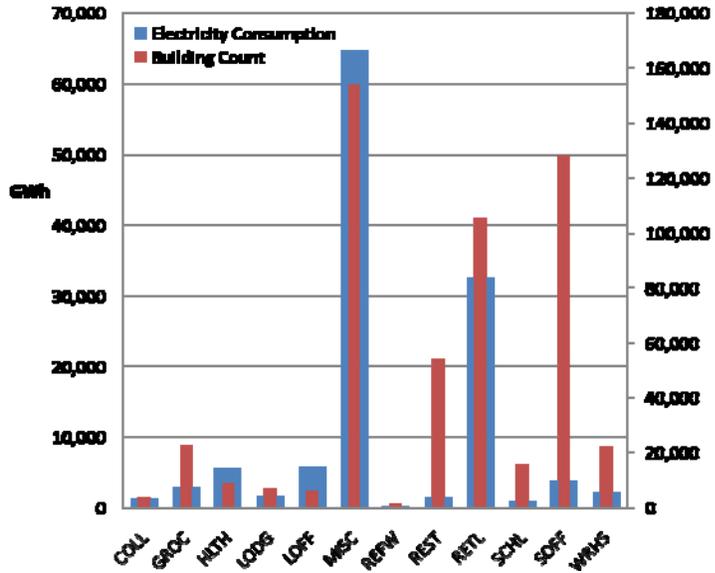
**Figure 5: Distribution of California’s Commercial Building Stock by Vintage**



Source: California Energy Use Survey (CEUS) data. This data is a sample of commercial buildings and not necessarily representative of the total market sector.

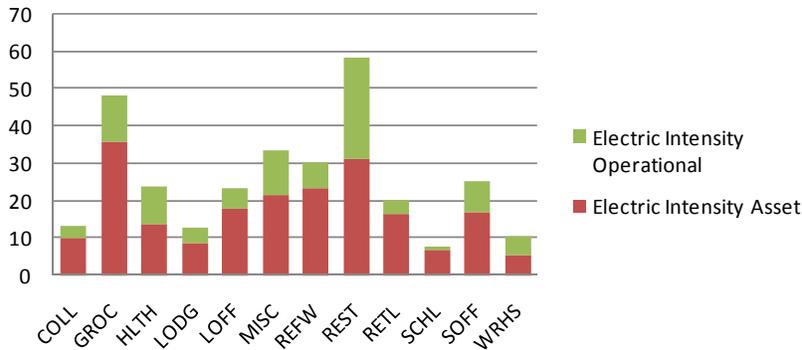
Figure 6: Electricity Consumption, Count, and Intensity by Nonresidential Building Type.

### Electricity Consumption and Count by Building Type



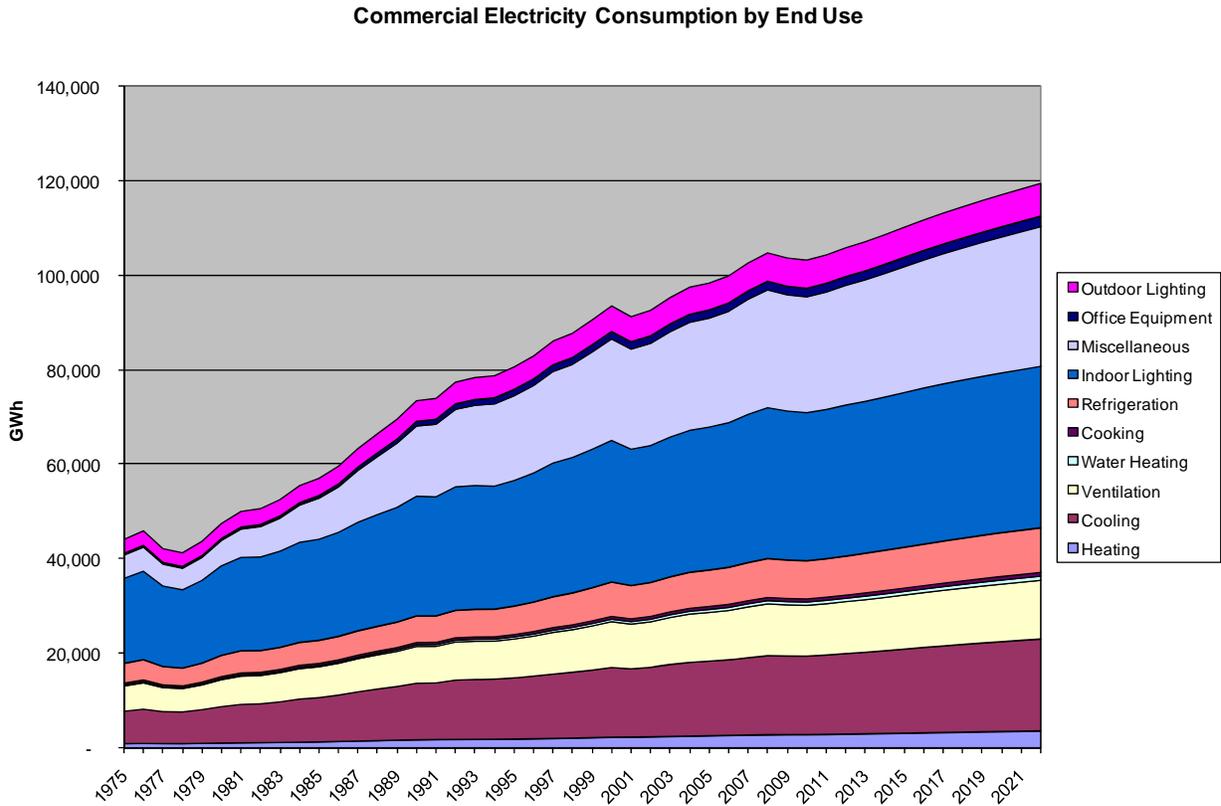
Legend	
COLL	College
GROC	Grocery
HLTH	Health
LODG	Lodging
LOFF	Large Offices
MISC	Miscellaneous
REFW	Refrigerated Warehouse
REST	Restaurant
RETL	Retail
SCHL	School
SOFF	Small Offices
WRHS	Warehouse

### Electricity Intensity by Non-Residential Building Type (Kwh/ft<sup>2</sup>)



Source: Commercial Energy Use Survey (CEUS) data. This data is a sample of commercial buildings and not necessarily representative of the total market sector.

**Figure 7: Commercial Electricity Consumption by End Use.**



Source: California Energy Commission

## Program Goals

The AB 758 statute defines the intention of the program as “achiev[ing] greater efficiency in the states existing residential and nonresidential building stock.”<sup>17</sup> The statute also directs the Energy Commission to consider “the amount of annual and peak energy savings, greenhouse gas emissions reductions, and project customer utility bill savings that will accrue from the program.”<sup>18</sup>

Selecting a quantifiable goal for the AB 758 program is important for multiple reasons. At the simplest level, a quantifiable goal serves as a metric against which to gauge program progress. At a more fundamental level, however, the goal that is chosen will drive program design. The State of California has multiple targets that could be used to serve as the one, quantifiable target for the AB 758 program. Figure 1 and Figure 2 explore the potential impact different existing state targets would have on electricity consumption in California. Using the forecast data from

<sup>17</sup> California Public Resources Code, Section 25943, (a) (1). 2012.

<sup>18</sup> California Public Resources Code Section 25943, (a) (2) (c). 2012.

the Energy Commission's electricity supply analysis office, these charts then overlay different state targets to examine the effect these targets would have on projected consumption.

Figure 8 and Figure 9 demonstrate that existing state targets are not consistent. Some appear unrealistically aggressive, such as achieving zero net energy levels of energy efficiency in half of all commercial buildings by 2030, while others seem overly conservative, like the current estimates of economic potential for savings from IOU efficiency programs. The figures also explore different potential program approaches. One target, 25 percent of buildings decreasing electricity use by 75 percent by 2030, assumes deep reductions can be accomplished in a smaller portion of the total building stock. This projection would rely upon achieving deep savings in fewer buildings. This can be compared to the effect of achieving 30 percent energy reductions in 75 percent of the total building stock by 2030. This scenario in the residential sector would be akin to achieving 75 percent penetration of the existing WHPP operated by the IOUs<sup>19</sup>. However, given that after two years of operation the program has achieved 2,624 upgrades, this would require a significant increase in the scale of this program<sup>20</sup>.

These scenarios should also be considered with the market sector characterization in mind. For example, the greatest electrical load contribution in the commercial sector is from lighting and plug load programs (Figure 7). Designing a program for the commercial sector that targets improvements in these categories could accomplish something close to the 30 percent reduction in 75 percent buildings goal modeled in Figure 9; such a program may focus on small offices, retail, and the miscellaneous sector, which account for the greatest number of commercial buildings (Figure 6). However, such a program design would largely rely on improvements in plug load, which are hard to guarantee from one building occupant to the next, or even over time. Such a program design may involve using the smart grid infrastructure to guarantee persistent savings. Alternatively, designing a program that aims to achieve deep savings in a smaller number of buildings might choose to focus on large offices and hospitals, the largest energy-using building types. Given that neither scenario achieves the greenhouse gas reduction goals of AB 32, both program approaches may be necessary (Figure 9).

The Energy Commission will present these scenarios and the implications of selecting one target over another at public workshops following the publication of the *Scoping Report*. Stakeholders and the public are invited to submit public comment on the proposed scenarios. With the release of the draft *Action Plan*, the Energy Commission will propose a quantifiable metric for the AB 758 program and discuss the implications of this target on the design and implementation of the program. There will be further opportunity for comment on the selection of and rationale for program targets at that time.

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19 Preliminary results from the IOU evaluations of the WHPP indicate participating customers achieve on average 30 percent savings in their homes.

20 Whole House Process Evaluation – PG&E\_SCE Interim Report 5-1-12.pdf.

## Residential Electricity Consumption with Efficiency Scenarios (GWh)

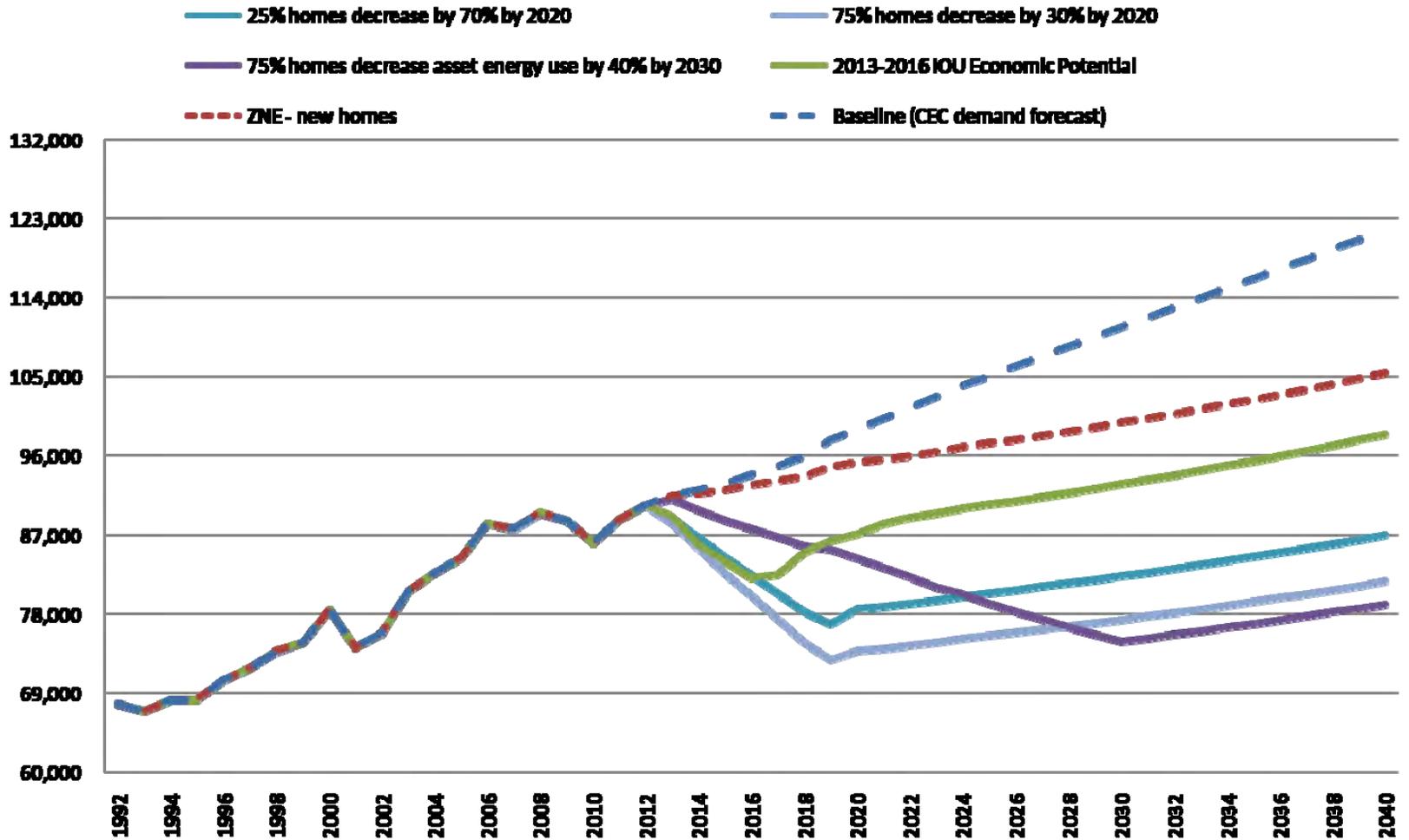


Figure 8: Residential Electricity Consumption Scenarios. This chart shows the potential impact different existing and proposed efficiency targets could have on overall consumption in the state.

## Commercial Electricity Consumption with Efficiency Scenarios (GWH)

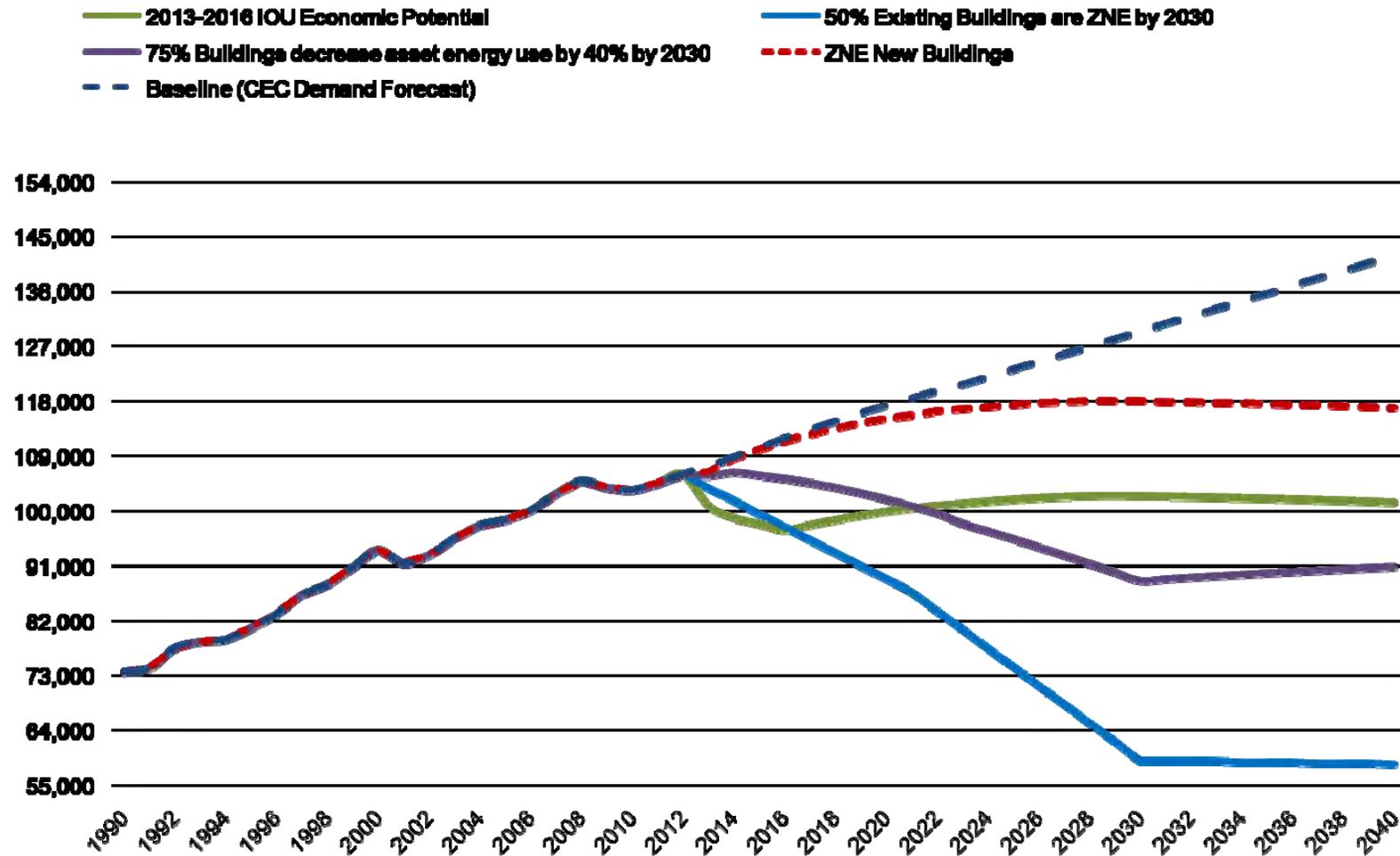


Figure 9: Commercial Electricity Consumption Scenarios. This chart shows the potential impact different existing and proposed efficiency targets could have on overall consumption in the state.

## **Purpose**

This report outlines the critical issues that need to be addressed to systematically obtain deeper levels of energy savings in California's existing buildings and highlights many of the options for addressing them. The needs and options discussed in this report are a result of the rich history California has with developing building and appliance standards, implementing and evaluating energy efficiency programs, fostering professional building auditing and performance modeling, and engaging in a wide range of other building science activities. This report does not provide determinant solutions to the needs that are identified, instead offering a set of possible options. It identifies some of the risks and challenges associated with pursuing certain options, as well as with not meeting certain needs.

This report is meant to inform interested parties about what the Energy Commission believes those critical needs to be and invites stakeholders to consider ways that they can be met so that the state will realize its energy policy goals. Dialogue and deliberation will undoubtedly bring to the surface more options and even refinement of the needs. The Energy Commission has primary responsibility for AB 758 implementation, but several other agencies as well as myriad stakeholders play essential roles in the marketplace for existing building upgrades. In particular, the contracting community will be the primary agent for selling and installing the projects that add up to success. Under the guidance of AB 758, the Energy Commission desires and expects to encourage strong growth in the building performance arena that is both customer- and contractor-focused and sufficiently structured to ensure the necessary transparency and accountability. Stakeholders are encouraged to join the dialogue and help the Energy Commission in this effort.

## CHAPTER 2: Investing in Energy Efficiency

The role of financing in promoting uptake of energy upgrades has gained significant attention in recent years. For the residential sector, lack of access to financing is one of the primary barriers to scaling up energy upgrades in homes. The “first cost barrier, or the difficulty in procuring the necessary capital to pay for an upgrade at the time of the project, is a well-documented challenge for the residential and small commercial sector. For the larger commercial and institutional buildings, financing may be available, but financial products are often not ideally suited to the specific needs of energy projects, and/or the value proposition for energy efficiency is not compelling enough to motivate owners to action. Whether it is a homeowner with dwindling access to a home equity line of credit, a small commercial entity with limited cash flow, or a large developer with a portfolio of deferred maintenance, access to financing is a key driver in every sector. AB 758 has called out financing specifically as a component of the state’s energy efficiency approach<sup>21</sup>. In a different economic climate, the majority of financial assistance provided to encourage property owners to adopt energy efficiency came in the form of rebates or incentives. With the current economy in California, the emphasis has been shifting toward more financing solutions as a way both to increase the reach of programs to a broader set of participants, and reduce the overall cost to ratepayers and the public in general for savings achieved. The following section briefly summarizes the status of the energy investment marketplace, identifies significant needs, and in some cases reviews potential solutions to those needs.

### California Public Utilities Commission’s Role in Energy Efficiency Financing

AB 758 carves out a specific role for the California Public Utilities Commission in relation to financing, stating that, by March 2010, the CPUC should open a new proceeding to “investigate the ability of electrical corporations and gas corporations to provide various energy efficiency financing options to their consumers for the purposes of implementing the program.”<sup>22</sup> In addition to the direction provided by AB 758, the CPUC received considerable stakeholder input as part of the *Strategic Plan* process to consider offering financial products to support the energy upgrade industry<sup>23</sup>. Simultaneous to the development of AB 758, the CPUC responded to stakeholder input in the consideration of the 2010-2012 efficiency portfolio. Decision 09-09-047, the CPUC decision approving the 2010-2012 IOU efficiency programs, directed staff to investigate potential financial products, oversee development of a report that would

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21 Public Resources Code §25943 (a) (2).

22 Public Resources Code §381.2 (July 23, 2012).

23 Harcourt Brown & Carey Inc. *Energy Efficiency Financing in California: Needs and Gaps*, p.6. July 8, 2011.

recommend specific products or strategies, and hold a series of workshops to consult with stakeholders and industry leaders<sup>24</sup>.

The CPUC commissioned a consultant report under Decision 09-09-047 to analyze the state of the energy efficiency financing industry and the potential role for the utilities in this landscape. The resulting report, *Energy Efficiency Financing in California: Needs and Gaps (HBC Report)*, released in July 2011, is used as a foundational document to this chapter and is cited throughout. The CPUC followed up on the report with a series of workshops in February 2012, the purpose of which was to define further how the utilities might offer financial support to ratepayers through the Energy Efficiency proceedings. In May 2012, the CPUC adopted a *Guidance Decision* with specific direction for the utilities to invest in energy efficiency financing at a level of \$200 million over a two-year period<sup>25</sup>. More on this *Guidance Decision* is found below in the market status section. The Energy Commission is engaged with CPUC on joint activities to advance financing solutions for California, including recent collaborations on the California Alternative Energy and Advanced Transportation Financing Authority (CAEATFA)'s Clean Energy Upgrade program. The CPUC's direction on financing strategies for IOU ratepayer investments has been incorporated into this report, and the Energy Commission and CPUC will continue this high degree of collaboration throughout the AB 758 program planning and implementation process.

## **Market Status**

The repercussions of the 2008 housing market collapse have been damaging to the energy investment sector. House values have dropped dramatically across the country, leaving many homeowners with limited or even negative equity in their homes. Access to credit across sectors was affected as lenders became increasingly risk-averse. Additionally, those who have access to traditional means of financing have been reluctant to borrow with increasing concerns over job security and dwindling cash reserves. The commercial sector saw a similar collapse in market pricing, with prices dropping around 36 percent between 2007 and 2011, and throughout 2010, 25 to 30 percent of sales were "distressed," meaning they were sold below market value or sold in a rush to avoid foreclosure or other financial problems. Since 2011 sales prices have been increasing and the percentage of distressed properties has been falling, although the situation is still a long way from the peak in 2007<sup>26</sup>.

Energy upgrades have in the past largely been financed through traditional financial instruments. Usually offered through banks, lending instruments are typically either secured or unsecured. A home mortgage is a familiar example of secured lending, where the bank records a lien against the property to protect against default on the loan. Other forms of secured lending include equity lending, such as a home equity line of credit, fixture filings which are recorded on the deed of the property, and property assessed clean energy financial products.

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24 CPUC Decision 09-09-047, pp. 272-293.

25 CPUC Decision 12-05-015, p. 3, 2012.

26 Data from CoStar Composite Price Indices, available at <http://www.costar.com/ccrsi/index.aspx>.

Secured lending typically offers longer terms and lower interest rates (up to 30-year terms and 6 percent interest) than unsecured lending (3- to 7-year terms with 13 percent - 17 percent interest or higher) but often requires more time and complexity to access<sup>27</sup>. The most predominant form of unsecured lending is credit card debt, which typically offers very high interest rates and very short terms. However, many financial institutions also offer unsecured lending instruments similar to auto loans.

Lending products specific to energy efficiency have popped up in both the secured and unsecured categories on a limited scale: the “Average Joe” or typical business has not likely heard of them, though energy efficiency contractors and other experts are able to describe them at length. Secured energy lending products include energy efficiency mortgages (EEMs) and PACE products. EEMs, limited to the single-family residential sector, are offered both through public and private lenders, although the Fannie Mae, Federal Housing Administration (FHA), and U.S. Department of Veterans Affairs (VA) EEMs have been on the market for the most years. An EEM allows a financial institution to extend the debt-to-income ratio of the borrower, thereby increasing the lending capacity to cover energy efficiency improvements incorporated at the time of sale. While EEMs have been around for a long time, they have limited uptake – likely a product of the large amount of paperwork associated with executing an EEM<sup>28</sup>, although this could be addressed with the involvement of trained and experienced lenders and real estate agents. For commercial properties there are no specific products termed “energy efficiency loans” from private lenders, although ARRA funds have been used in some states for short-term programs aimed at commercial properties. In the absence of specific financial products for energy efficiency, some private lenders such as Wells Fargo have been promoting their record “environmental loans and investments,” which includes energy efficiency investments<sup>29</sup>.

One of the biggest challenges for private lenders who are interested in creating loan products for energy efficiency upgrades is that there are no established underwriting standards, which has two effects: First, risk analysis is challenging due to a lack of statistical data on the performance of energy efficiency upgrades, and second, the lack of standardization makes it difficult for the primary lender to package multiple loans to sell onto a secondary market. The U.S. Department of Energy (US DOE) is taking steps to address the data issue, through development of a Building Performance Database that comprise cost/benefit data and tools to support implementation of a wide range of energy efficiency measures in commercial and residential buildings.

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27 Features of financing provided in the Harcourt Brown and Carey, Inc report to the CPUC. *Energy Efficiency Financing in California: Needs and Gaps*, p.22. July 8, 2011.

28 <http://www1.eere.energy.gov/wip/solutioncenter/financialproducts/m/energyefficientmortgages.html>.

29 For an example, see Wells Fargo’s *Environmental Finance Report*, April 2012, at [https://www.wellsfargo.com/downloads/pdf/about/csr/reports/environmental\\_finance\\_report.pdf](https://www.wellsfargo.com/downloads/pdf/about/csr/reports/environmental_finance_report.pdf).

PACE financing is a new concept first pioneered in the cities of Berkeley and Palm Desert, beginning in 2008. These programs use existing local government authority to secure financing by placing priority liens on private property. Local governments have been using this authority to allow property owners to opt into the program and receive financing for energy improvements that will be tied to the property. The governments can either offer the capital themselves through Treasury reserves or bond financing or can assist private financial institutions and property owners who have negotiated a deal themselves by placing the lien and administering repayment on their behalf (known as the "open-market" PACE model).

The PACE lien is considered very secure in that it has priority over all other encumbrances on a property, including the mortgage<sup>30</sup>. This is a feature that has caused concern in the banking industry, however. In July 2010, the FHFA issued a statement that effectively halted residential PACE programs across the country<sup>31</sup>. In the wake of this decision, California's Attorney General Jerry Brown filed suit against the FHFA, claiming that the FHFA statement constituted illegal rulemaking. The United States District Court for Northern California ruled in favor of California's Attorney General and ordered the FHFA to undergo a formal rulemaking process to uphold the July 6, 2010, statement. The FHFA initially released an Order of Proposed Rulemaking in January 2012, which received more than 1 million public comments. The FHFA has since released a Proposed Rule, which is in the public comment phase. While the legal challenges have resulted in a nearly complete halt of PACE residential programs (Sonoma County, California is the only PACE program in the country still serving residential customers.), the challenges do not apply to commercial buildings. Commercial PACE programs are popping up across the country, with five in California alone<sup>32</sup>.

One unsecured product of note is the Geo Smart Loan product, which is offered through the Energy and Gas Institute of America and available for single-family homes. While the product is initially offered at 16 percent interest, many contractors buy down the interest rate out of pocket to offer their customers a lower APR. This product has significant uptake in the residential contracting community<sup>33</sup>.

One market barrier for commercial building owners in obtaining financing for energy efficiency projects is that it typically adds debt to the balance sheet, thereby affecting asset value and cash flow. Any financing options that are "off balance sheet" (i.e. the loan does not show up on the

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30 In the event of foreclosure, a priority lien is paid off before all other encumbrances, including the mortgage.

31 The Federal Housing Financing Authority (FHFA) regulates Freddie Mac, Fannie Mae, and the 12 Federal Home Loan Banks in the country, which collectively provide \$5.9 trillion in funding. The statement issued by the FHFA can be found at: <http://www.fhfa.gov/webfiles/15884/PACESTMT7610.pdf> (July 26, 2012).

32 Commercial PACE programs are available in Placer County, Sonoma County, City/County of San Francisco, Los Angeles County, and the City of Sacramento.

33 <http://www.egia.org/desktopdefault.aspx?tabid=661>.

company balance sheet) are therefore more attractive. The closest match to this in the current financing marketplace is provided by the energy service companies, or ESCOs.

These entities provide energy efficiency and/or renewable energy investments through service contracts, with a number of different financing arrangements. Under one contracting arrangement, the ESCO provides the upfront capital in exchange for a monthly fee negotiated through a contract – the debt is therefore off-balance sheet. This has proven especially popular in the public sector. (About 80 percent of ESCO projects are for the public sector.) Adoption for commercial real estate owners has been low, however, primarily because the ESCO overhead costs for energy auditing, project management and so forth mean that larger projects are preferred, and these projects tend to have longer payback periods (often 10-20 years). For many commercial real estate owners, this is far longer than they will own a property.

An emerging financing option is to use the utility infrastructure and establish repayment mechanisms through utility bills. The financing could potentially be tied to the meter<sup>34</sup>, and therefore transferable with the property, and may include mandatory utility shut-off clauses as a consequence of nonpayment. This possibility is being implemented in a few states across the country, including on a limited scale for commercial buildings only in California. The California Public Utilities Commission *Guidance Decision* includes a substantial investment – \$200 million over two years – in energy financing, including continuation of On Bill Finance (OBF), a variation of On-Bill Repayment,<sup>35</sup> and credit enhancements. IOUs implemented \$60 million in On Bill Finance loans to commercial customers in 2010-2012, under direction from the CPUC; IOU OBF programs are expected to provide up to \$120 million in financing in 2013-14.

Energy leases are one way to avoid upfront payment costs and streamline project delivery. In an energy lease model, a company would retain ownership of the equipment and lease the equipment to the property owner, often on a monthly fee basis. While this model is most frequently used for solar energy, this is also a common structure in the ESCO market. Some businesses are finding ways to incorporate energy efficiency upgrades into a renewable energy lease project scope to provide more comprehensive services to their customers. These approaches can be quite attractive. If they are structured correctly, they can offer off-balance sheet financing options, and many include the project technical assistance, providing energy efficiency as a service, rather than a complex undertaking.

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34 Financing “tied to the meter” means that the debt is not attached to the borrower but to the meter infrastructure. As a borrower vacates the property, the new occupant would assume the debt obligations.

35 The CPUC *Guidance Decision* varies from what has been implemented to date and across the state in that the utilities would not be the sole entities providing the capital for the improvements (the majority of capital would be provided by financial institutions), but would rather primarily be providing access to the meter as a means of security and repayment. This is noted by the term “On-Bill Repayment,” as opposed to On-Bill Financing. The CPUC decision does not include On Bill Repayment to single-family residential customers but does authorize the creation of credit enhancement programs for residential customers. OBR is a directed option for the multi-family pilot, but the IOUs may alternatively propose a tariff-based energy efficiency reimbursement mechanism that may require legislation to implement.

## Subsidized Financing

The government has traditionally bolstered private financing with a number of creative enhancement strategies. The recent influx of federal funds through the ARRA and the nationwide halt of residential PACE programs invigorated a fresh round of innovation in these strategies.

Loan insurance and loan guarantees are mechanisms intended to lower interest rates or provide capital to credit-challenged borrowers by decreasing lender risk. Loan insurance typically involves borrowers purchasing third-party insurance for loans (often from government agencies) that will offer pay for some or all of the losses a lender will incur on a loan or portfolio of loans in the event of borrower default. The FHA's mortgage insurance program is a typical example of a loan insurance program. Loan guarantees involve a third party (typically a government agency) offering to assume a debt if a borrower defaults. Loan guarantees can involve some entity making a guarantee, either to the lender (for example, that consistent loan payments will be secured) or to the borrower (for example, that monthly energy savings will be more than debt servicing). One product available to single-family property owners is the U.S. Department of Housing and Urban Development's (HUD) Title 1 pilot program product known as PowerSaver. This product can be unsecured below \$7,500, though HUD requires the product to be secured by either a mortgage or deed of trust for loans of up to \$25,000. While the financing is offered through a private financial institution (in this case, specific preselected partners), HUD insures the lender against losses of up to 90 percent of the loan value.

One ARRA-funded program that achieved strong participation rates in California offered below-market interest rates (BMIR) using federal funds as loan principal. The Moderate Income Sustainable Technology (MIST) program administered by the California Rural Homes Municipal Financing Authority (CRHMFA) Homebuyers Fund (CHF) offers zero to 3 percent interest over 30-year terms for consumers in participating counties. The program targets moderate-income individuals pursuing deep energy retrofits. The CHF program has been wildly successful, accomplishing 1,043 retrofits for a total portfolio of \$26.6 million in one year. While it is unclear that this model is financially sustainable without considerable subsidy, it does demonstrate market potential at the right terms.

Interest rate buydowns (IRBDs) are similar to BMIRs, but in these scenarios the government or another entity will pay a financial institution a sum of money to bring the interest rate down for consumers. In these arrangements, the private financial institution is guaranteed the rate of investment desired, and the borrower can appreciate a lower interest rate. While IRBDs are a familiar concept for both government and private financial institutions, they do require a subsidy for which there is no return<sup>36</sup>.

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<sup>36</sup> A BMIR operates as a revolving loan fund, and therefore interest payments are returned to the lender. IRBD represent a lump sum paid to offset the interest rate, and therefore no revenue is anticipated to offset the expense.

Another popular strategy in California has been the emergence of loan loss reserve (LLR) or debt service reserve fund (DSRF) mechanisms. Currently being piloted in several regions in California<sup>37</sup> for both residential and commercial programs, these credit enhancement funds seek to lower risk (and hence interest rate) on an investment by offering to cover losses on either a specific loan or a portfolio of loans<sup>38</sup>. While terms vary considerably from program to program (and in some cases, sector to sector<sup>39</sup>), these strategies have the potential to leverage private sector investment – sometimes at ratios of 20:1. CAEATFA has recently approved guidelines for a residential energy efficiency-lending program where they will secure private financial investments with a 10 percent to 15 percent LLR; this program, termed the Clean Energy Upgrade Financing Program, began enrolling financial institutions in July 2012.

The institutional market, including state and local governments, universities, schools, hospitals, and other governmental or pseudo governmental entities, is often characterized by deferred maintenance and a general lack of energy expertise. The institutional sector traditionally has had access to financing mechanisms through bonding, but lacked the expertise necessary to identify and pursue energy improvements. For this reason, the ESCO market has had success in attracting institutional customers and has adapted to serve this sector primarily<sup>40</sup>. In some cases, institutional entities lack the upfront capital necessary to investigate and develop a complicated transaction to support bonding. In others, particularly governing bodies that are subject to voter approval for bond authority, securing the revenue necessary to finance capital improvements to government buildings can be a hard sell.

## Multifamily

Market-rate multifamily housing<sup>41</sup> presents a unique challenge in financing energy efficiency retrofits. While market rate multifamily properties are clearly part of the residential sector, market-rate multifamily construction and permanent lending is a specialized type of commercial lending. Lenders focus heavily on net operating income, estimated expenses, loan-to-value ratios, and other commercial lending metrics to determine the credit worthiness of a proposed or existing multifamily housing project. Owners tend to focus heavily on maintaining market position, often through enhancing curb appeal and common area amenities, to maintain

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37 The Counties of Los Angeles and Santa Barbara as well as the City of San Diego are piloting loan loss reserve mechanisms in residential lending programs, and the City / County of San Francisco and City of Los Angeles are piloting loan loss reserves to compliment their commercial PACE programs. Each of these programs offers slightly different terms.

38 A debt service reserve fund functions similar to a LLR, but rather than covering an entire loss in the event of default, a DSRF will cover the delinquencies in payments.

39 LLR offerings in the income qualified multifamily sector can sometimes range up to 40 percent or even in some extreme cases nearly 90 percent – blurring the lines between LLRs and loan insurance or loan guarantees.

40 HBC Report, p. 36.

41 “Market-rate” multifamily properties are those that offer rent without subsidy, compared to affordable multifamily properties.

the property as a profit-generating asset. As a result, this sector can present a vexing case of the split incentive issue. Unless owners can recoup in-unit energy efficiency improvements through rent increases or they simply have to make such improvements just to maintain market position, there is little incentive for owners to make them. Given the more transient nature of renters (as opposed to homeowners), the wear on multifamily housing eventually brings about a decline in the market position, and the project’s market rents erode. At some point an owner must make a business investment decision to continue to invest in or sell every market-rate multifamily property. As a result, there is a robust business within a subsector of the affordable housing development community that focuses on converting market rate multifamily housing to affordable multifamily housing.

In response to the complex challenges in addressing the energy efficiency retrofit needs (especially the in unit energy efficiency needs) of multifamily housing, the IOUs’ offer multi-family energy efficiency rebate programs, a multifamily Energy Upgrade California pilot, audit service, and other resources to their customers. However, persistent barriers, such as the landlord-tenant split-incentive problem, remain. The CPUC has adopted a two-phased approach to addressing the low income multifamily sector in a Final Decision<sup>42</sup> in the Energy Savings Assistance Program proceeding.

Affordable multifamily housing development is a complex, specialized area of residential development. Financing an affordable multifamily housing project can involve multiple resources from multiple levels of government funneled through multiple programs. The table below shows the financing for Fireside, a rehabilitation (retrofit) project in Marin County that provides a real-world example of how extreme and complex the financing mix for affordable housing projects can become:

**Table 1: Financing for Fireside, a multifamily community in Marin County.**

Construction Financing		Permanent Financing	
Source	Amount	Source	Amount
CalHFA	\$12,165,000	CalHFA First Loan	\$1,350,000
Marin Co. Housing Trust Fund	\$1,400,000	CalHFA Second	\$250,000
Marin Co./CalHFA Help	\$1,050,000	Marin Co. Housing Trust Fund	\$1,400,000
Marin Co. HOME	\$1,610,000	Marin Co. HOME	\$1,610,000
Marin Co. CDBG	\$194,478	Marin Co. CDBG	\$194,478
AHP	\$500,000	AHP	\$500,000
McKinney SHP	\$610,000	McKinney SHP	\$610,000
Foundation Grants	\$420,000	Marin Community Foundation	\$1,600,000
Deferred Costs	\$688,275	Foundation Grants	\$420,000
Deferred Developer Fee	\$300,330	HCD MHP	\$4,882,222
Investor Equity	\$846,170	Deferred Developer Fee	\$300,330
		Investor Equity	\$8,267,224

<sup>42</sup> D. 12-08-044. Available at <http://www.cpuc.ca.gov/puc>

**TOTAL**

**\$21,384,254.00**

Source: California Tax Credit Allocation Committee Staff Report, Project # CA-2006-918, December 13, 2006.

Multiple financing sources are layered together to reduce the required debt payments for a project. Therefore, the payments are low enough that the project can be maintained with substantial rent limits/restrictions that will typically be in place throughout the life of the project. In the above example, from top to bottom, the permanent financing structure for the project included a California Housing Finance Agency tax-exempt bond financed first loan, and second taxable bond financed loan; three separate sources of “soft” funding provided by Marin County<sup>43</sup>; the Affordable Housing Program’s the McKinney Supportive Housing Program; foundation grants; the California Housing and Community Development Agency’s Multifamily Housing Program; developer contributions; and Low Income Housing Tax Credit investor equity.

The complex financing structure of many affordable housing projects, and the requirements of specific funding resources, result in affordable housing projects continuously revolving through the cycle of investment/rehabilitation and decay. Much of the affordable housing built in California during the past 15 years involves Low Income Housing Tax Credits (LIHTCs). The federal LIHTCs are credits that investors in affordable multifamily housing can take annually for a minimum of 10 years. (LIHTCs can be used by investors for up to 15 years.) The federal LIHTC program requires a minimum 15- year affordability period. The California LIHTC program requires a 55-year affordability period and places a regulatory agreement on title tied to the land. Essentially affordable housing in California 1) gets built, 2) runs down over a period of 12 to 15 years, 3) changes hands when investors use up their tax credits and the project is recapitalized (typically through the LIHTC) and rehabilitated as part of the change in ownership, and 4) runs down over the following 12-15 years, and 5) repeat 3 and 4 ad infinitum. While affordable housing units are often modestly rehabbed at turnover, major rehabilitation efforts are often disruptive to tenants and project cash flows, so even affordable housing built without LIHTC follows a similar life cycle. The affordable housing life cycle presents affordable housing energy efficiency programs with an obvious trigger point at 3. Energy efficiency finance programs that rely on debt inserted at other points in the cycle will struggle to find uptake as they are attempting to insert additional debt into a complex business arrangement. Energy efficiency programs that rely on granted or free services, such as the Energy Savings Assistance Program (ESAP) and Weatherization Assistance Program (WAP), can encounter issues related to other policy dissonance between those programs and the requirements of affordable housing finance programs, but they do not face the daunting challenge of inserting additional debt into an existing, complicated finance and ownership structure.

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<sup>43</sup> “Soft” (as opposed to “hard”) funding or financing or debt can be grants but often are public agency loans with below-market interest rates and repayment requirements that are generous and taken from what often referred to as “residual receipts.” These residual receipts fund leftover hard debt, operating expenses, and perhaps one or more other subordinate funding resources have been paid.

The same resources that finance the rehabilitation of market-rate multifamily housing projects converting to affordable multifamily housing, or existing affordable multifamily housing projects undergoing substantial rehabilitation and refinancing, can finance substantial energy efficiency improvements. The mechanisms for achieving this are found in the regulatory requirements of those federal, state, and local affordable housing finance programs. Finally, like market-rate multifamily housing, affordable housing projects face the split incentives issue. However, due to the legal definition of “affordable” housing and the regulatory structures in place, affordable housing owners are more capable of overcoming this barrier than market rate affordable housing owners and developers<sup>44</sup>.

## Rebates and Incentives

Traditionally, the majority of financial assistance has come in the form of rebates and incentives. California has a mature business model, in which the investor-owned utilities are directed by law to reduce demand as the primary strategy for meeting energy needs in the state. The CPUC, as explained elsewhere in this document, has been shifting focus from a single-measure approach – such as lighting and appliance change outs – to adopting a whole-building model that acknowledges the house as a system. Such a shift demands that incentives move away from widget-based rebates and toward a performance approach where incentives are paid based on improvement over some baseline energy performance. The shift toward whole-building approaches has been piloted and subsequently rolled out at the state level in all IOU territory in California for the single-family residential sector. After more than a year of program experience, the IOUs are learning from early implementation and adjusting their programs through the 2013-2014 application cycle. While the IOUs have introduced programs in the single-family sector and are gaining significant experience, the multifamily sector lags considerably. However, the IOUs are expected to introduce a strategy for achieving deeper retrofits in the multifamily sector in the 2013-2014 application cycle, as directed by the CPUC *Guidance Decision*<sup>45</sup>.

For the commercial sector, some programs exist to encourage a more comprehensive analysis of a whole building operation, such as existing building commissioning and calculated incentive programs that allow flexibility to couple groups of measures and pay based on performance improvements. However, these programs are not being used to develop a comprehensive package of operational and retrofit opportunities that can be incorporated into an owner’s long-term energy efficiency upgrade strategy; furthermore, market penetration for these programs is very low. In response to the CPUC’s *Guidance Decision*, the California IOUs are proposing a “Whole Building demonstration” in the Statewide Commercial Program Implementation Plan (PIP). This demonstration will be used to evaluate more comprehensive approaches to energy efficiency upgrades and to measuring savings impacts. An industry workshop organized by the

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44 The Energy Commission created and maintains the California Utility Allowance Calculator (<http://www.gosolarcalifornia.ca.gov/affordable/cuac/index.php>), which can directly help affordable housing developers overcome the split incentive issue.

45 CPUC Decision 12-05-015, p. 21. May, 2012.

California Commissioning Collaborative and hosted by Pacific Gas and Electric Co. (PG&E) in May 2012 was a major driver for this initiative<sup>46</sup>.

### Financing in the CPUC *Guidance Decision*

While this new whole building model recognizes the complexity of building science and the interaction of different energy measures, it also drives the market toward deeper, more comprehensive building retrofits and creates an even more pressing demand for financing models that are well adapted to these types of projects. As noted above, the CPUC has been investigating expanding the use of ratepayer funds for financing since D. 09-09-047, and in the *Guidance Decision* proposed a suite of new financing options. These financing strategies rely on the approach of leveraging private investment capital with ratepayer funds. One statewide pilot is an On-Bill Repayment (OBR) program, which would have the utilities facilitating private transactions secured by the meter and repaid through current utility billing systems for nonresidential and multifamily customers<sup>47</sup>. In addition to rolling out the OBR program, the *Guidance Decision* continues funding for the current On Bill Financing program and provides direction to the IOUs to continue support for successful ARRA financing programs. The *Guidance Decision* also includes a portfolio of credit enhancements available for small business and residential customers. These credit enhancements would sweeten the deal for consumers and are targeted to support greater investments in energy efficiency. A homeowner looking to finance a furnace replacement, for example, could be offered a more attractive interest rate if willing to expand the project to include building envelope measures and/or duct sealing.

Outside of utility rebates, another incentive available to commercial and multifamily building owners is a federal tax deduction covered under Internal Revenue Code Section 179(d). This allows for an immediate depreciation deduction of up to \$1.80 per square foot for commercial buildings that achieve a 50 percent reduction in total energy and power costs, relative to the ASHRAE 90.1 building standard<sup>48</sup>. Documentation requirements are onerous, though<sup>49</sup>, favoring owners with large portfolios who may have energy managers and tax professionals on staff. In addition, eligibility requirements mean that real estate investment trusts (REITs)

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46 Workshop Summary Report available at [http://www.cacx.org/meetings/meetings/2012-05-03/Whole Building Workshop Summary Report v2.pdf](http://www.cacx.org/meetings/meetings/2012-05-03/Whole_Building_Workshop_Summary_Report_v2.pdf)

47 A central component of OBR financing is the ability of the utility to shut off energy service to the borrower in the event of nonpayment, creating security for the financier. The shutoff provisions of on-bill repayment are subject to debate, and thus far the IOUs and ratepayer advocates have protested against extending shut-off provisions to residential consumers. The *Guidance Decision* avoids directing the IOUs to provide OBR for single family residential customers while the legality of these provisions is being worked out.

48 Available at [www.ashrae.org](http://www.ashrae.org)

49 The success of federal tax incentives introduced through the 2005 Energy Policy Act, including 179D, is summarized in the report *Energy Efficiency Tax Incentives, 2005-2011: How Have They Performed?* Available at <http://aceee.org/files/pdf/white-paper/Tax%20incentive%20white%20paper.pdf>.

typically cannot take advantage of 179(d) tax deductions. In 2011 President Obama's Better Buildings Initiative called on Congress to redesign 179(d) to improve market adoption among commercial and multifamily properties.<sup>50</sup> Draft revised language indicates a plan to increase the maximum deduction from \$1.80 to \$4.00 per square foot, adding terminology to allow greater access by REITs, and adding requirements around savings modeling approach rather than requiring conformance to ASHRAE 90.1.

## Market Needs

Financing is a crucial component of an energy upgrade market transformation effort. The HBC report on financing indicates that investment at roughly \$4 billion/year would be necessary to meet energy goals stated in the *Strategic Plan*; however, the current level of energy efficiency investment in California is about one-half that amount<sup>51</sup>. Scale in the marketplace cannot be reached unless well-designed financial products are available to overcome first cost barriers and motivate property owners to action. These products need to be streamlined, convenient, and easy to integrate into an upgrade project. In addition, the split incentive problem needs to be addressed, and market perception of the value of energy efficiency needs to be made more visible through property valuation methods. Public involvement in this area could support the development of financial products that speak to existing gaps and needs in the marketplace. A preliminary assessment of these needs and potential solutions to address them are offered below.

### Targeted, Sector-Specific Financial Products

While the introduction of new financing products to the marketplace is important, so are the design, coordination, and communication of these products. To avoid consumer confusion and ensure maximum uptake, financial products need to be developed with the specific market sector in mind. The financing product ideally suited to support an emergency residential HVAC change out is going to have different characteristics than a financing product to support a deep rehab of a million-square-foot commercial building. These products need to be designed and targeted sector by sector and, in many cases, could be developed to address a specific trigger point<sup>52</sup>. Ideally, these products would be well coordinated with the programs they support. This would ensure streamlined quality assurance and quality control mechanisms, consistent requirements across programs, and support from available rebates and incentives to reduce the loan principal. Fundamentally, these products should also be designed with consideration to the value proposition. A property owner is not going to take action and incur debt unless the inherent benefits of the project are well understood – especially in today's

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50 More details at: <http://www.whitehouse.gov/the-press-office/2011/02/03/president-obama-s-plan-win-future-making-american-businesses-more-energy>.

51 Harcourt Brown & Carey Inc. *Energy Efficiency Financing in California: Needs and Gaps*, p.4. July 8, 2011.

52 "Trigger points" are key decision-making points that influence a property owner's willingness to invest in energy efficiency. This could be a furnace failure in winter, tenant turnover in a commercial or multifamily property, or major rehabilitation on an income-qualified development.

market, which is characterized by risk aversion. Program design could consider the specific barriers that need to be overcome and elevate the benefits of the project relative to the costs and risks.

### More Attractive Terms Well-Suited to Comprehensive Upgrades

Currently, the rates and terms offered for traditional financial products are not well suited to energy lending, particularly in the residential and small commercial sectors. While terms can be influenced by the deal structure in some cases (for example, the credit risk of the borrower or the security of the loan), there are certain systemic factors that influence the terms of energy loans.

#### *Scale*

Currently, energy lending is offered by very few entities. While the ARRA funding has brought a number of credit unions to the table, these entities are limited in their ability to scale up<sup>53</sup>. To reach scale, the large financial institutions with significant capacity for lending need to be brought to the table. Additionally, the presence of a healthy secondary market for energy loans will ensure that the large financial institutions will have an off-ramp for the loans they originate, helping to revolve capital.

#### *Risk Evaluation*

One reason for the to-date tepid interest of large financial institutions is that there is not yet a good understanding of the performance of energy loans, in this case meaning a borrower's ability to meet the debt obligation. When a financial institution develops the loan terms, there is a risk evaluation period where the loan being contemplated is compared to similar known loans. While some existing loan products such as home equity lines of credit, utility bill payment history, and unsecured credit cards could offer imperfect comparisons, a common theme among financial institutions is that they lack the necessary comparative data to effectively assess risk of energy loans<sup>54</sup>.

#### *Underwriting Criteria*

Energy loans have specific characteristics that set them apart from traditional lending. Investing in energy upgrades is one of the few types of projects that create the potential for monetary savings, potentially enhancing the borrowers' ability to meet their debt servicing obligations. Existing underwriting criteria – with a few notable exceptions, such as energy efficiency mortgages – do not acknowledge this unique characteristic. Additionally, the underwriting for energy lending lacks standardization, increasing the time and complexity of accomplishing transactions.

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53 Credit unions often seek to hold their entire portfolio of loans, as opposed to larger financial institutions that will often bundle loans and sell them as investment instruments on the secondary market.

54 The claim that there is insufficient data available to evaluate energy loans was repeated throughout the CPUC finance workshops in February 2012.

## Split-Incentive Leasing Structures Need to Be removed as Market Barriers for Residential and Commercial Rental Properties

For a property owner who does not pay utility bills, and a tenant who doesn't own a property, the motivation to invest in energy efficiency upgrades is understandably low. Considering that rented properties comprise about 50 percent of all commercial properties<sup>55</sup> and 42 percent of residential properties<sup>56</sup>, this is a major barrier to improved energy efficiency statewide.

The needs relating to the split incentive problem are twofold: first, leasing arrangements need to allow for sharing of the direct cost savings that arise from upgrades, and second, the owner's investment in energy efficiency upgrades needs to be recognized at the time of property valuation. The CPUC's *Guidance Decision* acknowledges this barrier and directs the IOUs to propose program strategies to address it in their 2013-2014 portfolios for the multifamily sector<sup>57</sup>.

## Energy Improvements Are Not Integrated Into Real Estate and Appraisal Evaluation Methods

While some efforts have begun to incorporate information on so-called "green" properties, there is currently little standardization in this area. For example, what constitutes a "green" property has not been defined. This category may include energy performance of the building, energy amenities such as renewable energy generation, and whether a property has received a rating or certification, including the Leadership on Environment and Energy Design, Build It Green (BIG), or other certifications. This information is either not at all included in Multiple Listing Service (MLS) listing or is included haphazardly, and the presentation of this information varies wildly throughout the real estate industry.

Some activity has begun in this area:

- The Appraisal Institute of America recently released an addendum to its technical training manuals that addresses how to evaluate and incorporate energy efficiency and other environmental improvements into a home evaluation<sup>58</sup>.
- In 2011, the DOE signed a memorandum of understanding (MOU) with the Appraisal Foundation that establishes a partnership to ensure that appraisers nationwide have the information, practical guidelines, and professional resources they need to evaluate energy performance when conducting commercial building appraisals<sup>59</sup>.

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<sup>55</sup> *Harcourt Brown & Carey Report*, p. 46.

<sup>56</sup> CPUC. *Long Term Energy Efficiency Strategic Plan*, page 7, 2008.

<sup>57</sup> CPUC Decision 12-05-015, p 189.

<sup>58</sup> Appraisal Institute of America. *AI Reports: New Form Residential Green and Energy Efficient Addendum*. Online at: [http://www.appraisalinstitute.org/education/green\\_energy\\_addendum.aspx](http://www.appraisalinstitute.org/education/green_energy_addendum.aspx) (May 2012)

<sup>59</sup> More details at [http://apps1.eere.energy.gov/news/progress\\_alerts.cfm/pa\\_id=548](http://apps1.eere.energy.gov/news/progress_alerts.cfm/pa_id=548).

- The National Association of Realtors has introduced a “green MLS” toolkit that assists real estate professionals in “greening” MLS listings. However, there is, as of yet, little adoption and little standardization in these movements.
- In 2011, an ASTM standard for defining building energy use at time of sale was released, with the goal of creating greater transparency in commercial buildings’ energy use<sup>60</sup>.

### *Unconvincing Value Proposition*

Access to financing and incentives is not the only market barrier to improved energy efficiency. While the benefits of energy upgrades are relatively easy to demonstrate, the value proposition for many commercial property owners is not sufficient to spur energy efficiency projects, even if they have access to capital. A report <sup>61</sup> commissioned by the CPUC summarized the key market barriers:

- About 50 percent of commercial properties are leased <sup>62</sup>, and the predominant leasing arrangement is “triple net,” resulting in tenants bearing all energy costs. This leads to a “split incentive” situation, whereby the owner would be responsible for energy efficiency upgrades in the building even though it would be the tenants who receive the direct energy cost reductions. (Note: this split incentive is also a barrier for residential rental situations.) Model “green lease” templates exist, but adoption is thought to be very low at present.
- Property owners prioritize investments in their core business activities, especially if it encumbers debt, with a lesser priority placed on energy efficiency investments.
- Managing an energy efficiency project requires resources and expertise that many firms do not have; this is thought to be more pronounced for smaller commercial properties and the institutional sector.
- For a property owner, progressive increase in asset value is a primary goal. It is encouraging that there is a growing body of research linking increased energy efficiency with increased asset value, but as yet there are no standardized practices for incorporating energy efficiency into the valuation of a specific building.

### Options for Addressing Needs

#### *Subsidy to Decrease Interest Rate*

Certain well-designed subsidy programs could target the specific concerns of financial institutions and help bring down interest rates. For example, risk is a primary driver in

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60 Details at <http://www.astm.org/Standards/E2797.htm>.

61 Harcourt Brown & Carey (2011), “Energy Efficiency Financing in California – Needs and Gaps” Full text available at [http://www.harcourtbrown.com/wp-content/uploads/CPUC\\_FinancingReport\\_HBC\\_Jul8v2.pdf](http://www.harcourtbrown.com/wp-content/uploads/CPUC_FinancingReport_HBC_Jul8v2.pdf)

62 Based on Johnson Controls survey of commercial properties, 2009.

determining the appropriate interest rate for a transaction. To offset the risk concerns, public dollars could be offered as junior capital in loan loss reserve structures, and would be second in line for repayment to 'senior capital' in the event of a loan default. These funds would cover some percentage of losses on a portfolio of loans. Other similar strategies could include loan insurance and subordinated capital. Loan insurance covers loss on a loan or portfolio of loans and can be particularly useful in high-risk markets where there is a compelling public desire to provide financing options (for example, in a major affordable housing rehab project). Subordinated capital structures are similar to loan loss reserve structures. In these arrangements, public capital could be contributed to the deal and would be the "last in line" to receive repayment in the event of a default. These strategies, as noted above in this document, are being piloted in several jurisdictions across California. However, it is unclear how the pilots would translate to larger programs, though the experiences of the emerging CAEATFA Clean Energy Upgrade Financing program will offer some learning opportunities. Interest rate buydowns are another option for lowering interest rate. Programs that have employed interest rate buydowns have boosted participation, but at high cost. Neither loan loss reserves nor interest rate buydowns offer the same possibility of sustainability that a revolving loan fund would, but they do potentially "kick start" the market by bringing early adopters in the door and helping to generate "buzz" about the program. This should be contrasted against the high investment required to fund a revolving loan fund; public dollars can potentially offer much larger investment possibility by leveraging against private capital in credit enhancement structures such as loan loss reserves. A risk in this assumption is the fact that many large financial institutions have requested high coverage in loan loss reserve programs, with some requests ranging up to 90 percent loss coverage in income-qualified program settings.

#### *Coordinated Data Collection Effort to Create Better Understanding of Energy Loan Performance*

Access to data on the performance of energy loans could help better inform the financial community of the actual risks associated with these types of products. Some programs exist that have amassed a relatively large pool of loans, such as the Commonwealth of Pennsylvania Keystone HELP program and the Sonoma County Energy Independence Program (both around \$50 million). Though this effort may be somewhat hampered by distinctions between programs and the history of data available, these data pools could be enhanced with information on new programs rolling out. To ensure that the data collection effort has the greatest possible effect on the financial community, such an effort could be coordinated with stakeholders from the financial industry and could involve standard data collection procedures that could be incorporated into existing and emerging program designs, such as the CAEATFA program and the potential IOU financing programs.

A common database that links energy savings data (using standard forms of measurement) to loan performance could be created to promote a better understanding of loan performance. The CPUC *Guidance Decision* directs the IOUs to facilitate a working group that will explore data issues and determine which information would support investment in this market. In tandem, the decision directs the IOUs to develop a standardized database and to make certain non-personal information available through this database. The *Guidance Decision* directs the IOUs to collect the following information:

- Customer type
- Host site characteristics
- Utility payment history
- Borrower credit scores and energy project repayment histories
- Energy project performance data (by building or customer, not only by measure)
- Billing impacts comparing pre-installation and post-installation utility bills.<sup>63</sup>

Access to this information may support the credit agencies' rating analyses of when considering securitization of energy loans for entry into the secondary marketplace.

#### *Support of a Secondary Market to Facilitate Scale*

As stated above, one issue to scaling up energy lending is the lack of a secondary market to purchase loans. Without the ability to sell a portfolio of loans, small programs cannot revolve the capital, and large financial institutions will likely remain uninterested. Public agencies could help facilitate a secondary market by offering subsidy to support the transactions, similar to loan loss reserve mechanisms, and by supporting standardized data collection and underwriting criteria. Standardized underwriting criteria would help ensure that loans have similar enough terms to be aggregated, and a loan loss reserve would attract investment by decreasing risk.

There is a national effort to support a secondary market by developing an "aggregator" entity. This entity would develop underwriting criteria and establish specific terms for loans. Program partners at the local level would then originate loans with the assurance that the aggregator would purchase them. The aggregator in turn would bundle loans and place them on the private market. This effort, termed the Warehouse for Energy Efficiency Lending, or WHEEL, is a partnership between Citibank, the Energy Programs Consortium, and AFC First. While it is unclear that the terms (close to 10 percent interest) would be attractive to California, the program has potential to standardize underwriting and create scale in the marketplace.

Another interesting component of the WHEEL program is the partnership structure among nonprofits, financial institutions, and government. Nonprofit organizations have been shown to be mission-oriented partners who can make transactions easier without adding significantly to the cost of the financing.

#### *Refine and Enhance Existing Tools to Support Underwriting*

One barrier to developing an energy loan is a poor understanding by potential financial players of the anticipated performance of the proposed project. To support underwriting, which better matches energy transactions, existing datasets and tools that are used for evaluating potential energy savings should be refined to incorporate actual performance data based on a statistically valid dataset.

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<sup>63</sup> CPUC Decision 12-05-015, p. 135.

### *Support Efforts to Implement Energy Rating and Labeling*

There are many benefits of including energy performance in the appraisal process. For one, presenting the energy performance of a property can be a powerful outreach tool to consumers, helping to ensure that energy assets are considered at the time of purchase, sale, or rental. Additionally, evaluating and incorporating the value added to a property as a result of the energy improvements can help encourage a higher sale price, helping the property owner recuperate some of the project investment.

Communicating the value of energy benefits may also support a property owner's decision to "go green" in instances where they might be little other incentive, for example in split incentive situations – particularly if supported by outreach, education, and marketing strategies. Finally, financial institutions may be leery of extending debt-to-income ratios on the basis of energy savings, or including energy savings when evaluating monthly cash flow, and having a standardized system for evaluating and including such information could help with this process.

### *Develop or Enhance Tools to Support Project Evaluation*

As noted above, particularly in the institutional sector, one of the main barriers to implementing improvements is a lack of energy field expertise. Often maintenance staffs with little experience in energy or engineering are expected to identify and evaluate different opportunities. Providing or enhancing software support tools or programmatic assistance to these professionals can help them to identify and package potential energy improvement projects.

In addition, many decision makers currently use cost analysis metrics that undersell the long-term benefits of many energy projects. The de facto standard metric for evaluating projects is simple payback (project cost/project savings). While simple payback is an easily understood and applied metric, it is not one that is well-suited for projects that yield ongoing savings. In the case of a short-term tenant or a business with uncertain long-term prospects, a criterion that favors quick payback can be appropriate but won't deliver deep energy savings. Unfortunately, it is common for a project with extremely high savings to be passed over in favor of a different project that pays back the initial investment more quickly but has lower savings, even when quick payback isn't needed.

Some sophisticated organizations with good long-term prospects have adopted criteria that reflect the true value of projects, such as net present value (NPV). There is a need to educate decision makers on the appropriate criteria for their situations and the tools available to evaluate projects. In addition to existing tools, there is a need to develop legal and financial vehicles that address short-term cash flow needs while achieving the deep energy savings necessary to achieve California's zero net energy goals.

## CHAPTER 3: Workforce Development

Alignment of workforce training, standards, and certification with state policy is necessary to ensure that the workforce has the capacity, skills, and knowledge required to meet California's energy efficiency policy goals. The clean economy sector, which includes onsite renewable energy production as well as energy efficiency, is not only growing, it is perceived as a resilient sector that offers opportunities and good wages to low- and middle-skilled workers<sup>64</sup>. California leads the nation in clean energy investments,<sup>65</sup> and through judiciously crafted energy efficiency policies and strategic partnerships with state and local government, education, and industry, the state can catalyze the creation of well-paying jobs for California's workers and the expansion of quality, credential-based training to ensure high standards are met for energy efficiency measures in support of AB 758.

### Market Status

#### Workforce Availability

Recent workforce studies indicate that the majority of jobs required for clean occupations, including energy efficiency work, are in "mature segments" of the economy, such as the traditional construction trades<sup>66</sup>. However, a number of relatively new clean energy occupations, including building raters, energy auditors, and commissioning agents, are gaining a foothold and are expected to grow. An increased focus on energy efficiency and onsite renewable energy through state mandates, utility rebate and upgrade programs, and growing ratepayer demand will promote this growth. Two-thirds of directly related jobs are expected to be in the construction trades; 17 percent are in the fields of architecture, engineering, management, and administration; the remaining 16 percent are in manufacturing, advertising, office administration, and other industries. A 2011 California Workforce Education & Training Needs Assessment predicted that increased labor demand through 2020 could be met by workers who are currently unemployed or underemployed (although skills upgrade training would still be required)<sup>67</sup>.

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64 Brookings Institute. *Sizing the Green Economy: A National and Regional Green Jobs Assessment* (2011) <http://www.brookings.edu/research/reports/2011/07/13-clean-economy>.

Next 10, 2012 *Many Shades of Green* (2012) <http://next10.org/2012-many-shades-green-california%E2%80%99s-shift-cleaner-more-productive-economy>.

65 Clean Tech Group (2010). *Global Clean Technology Venture Investment Increases 65 Percent in 1H 2010 Finds Cleantech Group and Deloitte*. <http://cleantech.com/about/pressreleases/Q2-2010-release.cfm>

66 Don Vial Labor Center, *California Workforce, Education and Training Needs Assessment for Energy Efficiency, Distributed Generation, and Demand Response* (2011) [http://www.irl.berkeley.edu/vial/publications/WET\\_Part1.pdf](http://www.irl.berkeley.edu/vial/publications/WET_Part1.pdf).

67 Ibid., 28.

For the solar market sector, a Community Colleges Centers of Excellence report<sup>68</sup> has indicated that there are currently 50,000 workers in California in this field and that an additional 18,000 to 24,000 will be required over the next three years. The report breaks down the existing and projected staff requirements based on several job types (for example, installer, designer) and state regions (for example, Bay Area, Southern California). This type of tool, if available for the green job sectors associated with AB 758 programs and priorities, would be useful in helping to determine potential scheduling of AB 758 implementation.

California has been hard hit by the recent recession, suffering some of the highest unemployment rates in the country. The construction trades were the hardest hit. To get people back to work and to foster a skilled labor pool ready to perform the work required by energy projects funded by ARRA, the Energy Commission designated a portion of funding from the State Energy Program (SEP) ARRA projects to develop the Clean Energy Workforce Training Program (CEWTP). This program, which was the largest program of its type in the nation, offered retraining and up skilling in clean energy occupations to incumbent, unemployed, and underemployed workers – primarily construction workers – and basic skills training for new workforce entrants. Training was provided to 8,200 individuals throughout the state by partnerships of local workforce investment boards and community colleges as well as by small businesses, labor organizations, and trade associations seeking to become more competitive in the clean energy marketplace.

CEWTP and other training programs funded with ARRA dollars, such as the Energy Smart Jobs program described below, not only have provided many trainees for present energy efficiency occupations, they can represent starting points or replicable models for future, sustainable, energy-related training. As California advances toward meeting the goals of AB 758, energy-efficient practices and technologies will become standard practice. Workers will need additional training in lighting, HVAC, refrigeration, and other areas to remain competitive in the marketplace.

The 2011 California Workforce, Education and Training Needs Assessment advised balancing the cost of additional training with the cost of upgrades. If training is too extensive and labor costs increase, building owners may not embrace upgrades, particularly for residential and small commercial work, where savings are not as dramatic as in large-scale commercial buildings. In addition, employers may be less willing to fill many stable, benefited positions if labor costs are too high. Paradoxically, residential work may be most in need of standardized, quality training<sup>69</sup>.

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68 Centers of Excellence, *Solar Industry & Occupations: Distributed and Utility-Scale Generation Southern California, Central Valley, South Central Coast, and the Bay Area*, February 2012

69 Don Vial Labor Center, *California Workforce, Education and Training Needs Assessment for Energy Efficiency, Distributed Generation, and Demand Response*, p, 112. (2011)  
[http://www.irl.berkeley.edu/vial/publications/WET\\_Part1.pdf](http://www.irl.berkeley.edu/vial/publications/WET_Part1.pdf).

The most successful workforce training programs have strong industry support and involvement to ensure that training meets industry needs. These programs employ sector strategies, which bring all players to the table – such as training providers, industry, economic development, labor and community organizations, and local government. The partners work together to develop coordinated workforce and economic strategies that align resources with regional industry needs. The Energy Commission partnered with the California Workforce Investment Board (CWIB) to fund the development of regional industry cluster plans. CWIB also funded the State Energy Sector Partnership Grant with ARRA dollars to enable CEWTP grantees to develop regional, clean energy, industry-specific approaches to workforce needs implemented by employer-driven partnerships of key stakeholders. These efforts can guide future workforce development strategies under AB 758.

### *Training, Standards, and Certification*

Training programs funded through ARRA stimulus dollars, such as CEWTP, were designed to provide high-quality, standardized training aligned with nationally recognized certifications. For example, training was available through several CEWTP local programs for Leadership in Energy and Environmental Design (LEED) “Accredited Professional” (AP) designation and certification as a Building Analyst Professional through the BPI. Training providers should assess these programs and develop measures of success for such certifications to verify that they are meeting intended goals and industry needs and improving work standards. Measuring the success of these programs and their outcomes can also help to determine whether training is coordinated with and helping to achieve goals established by AB 758 and the Energy Commission’s most recent building standards.

Venues for training the workforce range from career technical education in high school, to short-term or career training programs in the community colleges, degreed programs at universities, and apprenticeships through labor organizations and professional continuing education programs. Additional training may be provided by utilities, nonprofit and for-profit entities, and career technical education, such as regional occupation programs (ROPs). Community colleges are responding to the need for technician-level programs for efficiency occupations, while universities are expanding options for energy-related and sustainability degrees.

The following programs are just a few examples of certifications related to energy efficiency occupations and efforts to standardize training. These certifications are key to ensuring the workforce is well-prepared to perform quality installations of energy efficiency measures and adheres to high standards of performance.

**Job Task Analyses** are being developed jointly by the US DOE and the National Renewable Energy Lab (NREL) to formalize the skills required for six key energy-related occupations: commercial building energy auditor, commercial building energy modeler, commission/retro-commissioning authority, energy/sustainability managers, facility managers, and operating engineers/building technicians. These analyses can guide the alignment of the goals and curriculum of training programs for these occupations nationwide.

**California Lighting Controls Training Program (CALCTP)** is a 40-hour skills upgrade training and certification program for experienced (“journeymen”) electricians, designed to ensure proper installation for advanced lighting controls systems. The program was co-developed by utilities, the International Brotherhood of Electrical Workers (IBEW)/National Electrical Contractors Association (NECA), the Energy Commission, the community college system, UC Davis Lighting Technology Center, and the National Electrical Manufacturers’ Association. It focuses on rigorous standards and quality installations to ensure energy efficiency savings are maximized.

**Building Performance Institute** offers nationally recognized technical standards and certifications for the residential contractor workforce. It fills a gap for standardizing training for residential performance contracting, which seeks quality installation of whole building energy upgrades and consumer acceptance. Examples of certificates offered are building analyst, envelope professional, and heating professional. In addition, BPI has collaborated with DOE to develop certifications for four energy upgrade professional designations: energy auditor, retrofit installer, crew leader, and quality control inspector.

**ASHRAE** is a long-established, national standard-setting organization focused on establishing consistency in workforce training and quality work. ASHRAE/ACCA<sup>70</sup> 180 Quality Maintenance Standard is an example of a standard that has been integrated into a utility incentive program in California<sup>71</sup>. This standard formalizes HVAC inspection and maintenance procedures and provides a basis for benchmarking to measure resulting energy savings. Other ASHRAE standards relevant to energy efficiency upgrades include:

- ASHRAE 90.1: Energy-Efficient Building Design
- ANSI/ASHRAE 100-2006: Energy Conservation in Existing Buildings
- ASHRAE Guideline 0.2: Existing Building Commissioning
- ASHRAE Procedures for Commercial Building Energy Audits

There are multiple certification options for commissioning providers, some of which are focused on the commissioning process and others that focus more on technological expertise. There are also variations in requirements for actual commissioning project experience<sup>72</sup>.

The following three programs provide examples of training programs that focus on standardized, quality training tailored to industry needs:

**PowerPathway** is a PG&E training program using a sector strategy approach and is offered in collaboration with community colleges, the public workforce development system, unions, and

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70 Air Conditioning Contractors of America.

71 For an example, information on PG&E’s Commercial HVAC Quality Maintenance Program can be found at <https://www.commercialhvacqm.com/>.

72 A summary of the various commissioning certification programs can be found at [http://www.cacx.org/resources/provider\\_cert.html](http://www.cacx.org/resources/provider_cert.html).

four-year universities. PowerPathway initially focused on utility workers but has since expanded, now covering energy efficiency occupations, such as HVAC installation. The program provides career training provided through educational partners preparing candidates for jobs in the energy and utility industry. In addition to line worker training, programs are available for hydro-electrician, welder, account manager, and power engineer, as just a few examples.

*College of the Desert's Utility-Scale Solar Energy Program* was funded through CEWTP. It targets unemployed, underemployed, and incumbent workers. The program was developed using a sector strategy approach, establishing partnerships with local labor organizations, other area community colleges, workforce and economic development agencies, and industry partners to tailor training to meet the needs of the utility-scale solar power plants in the state's desert region. The program is also associated with a career partnership academy program at Desert Hot Springs High School.

**EnergySmart Jobs** was an ARRA-funded program. The Energy Commission partnered with PECI and the California Conservation Corps to train corps members to identify specific efficiency upgrade measures for grocery stores and to subsequently inspect installed measures. It is an example of hands-on, efficiency-related training for entry-level workers that can serve as a gateway to higher level training or full-time employment in energy-related careers.

**RichmondBUILD Pre-Apprenticeship Construction and Green Jobs Training Academy** offers basic skills training for residential and nonresidential construction jobs. The program was developed as a public/private partnership to develop hands-on skills in high-wage construction and renewable energy fields for Richmond residents and as a strategy for providing alternatives to avoid violence in the community.

The examples provided above can inform the Energy Commission as it proceeds with an action plan for AB 758. These programs represent various successful approaches for developing quality, well-coordinated, and sustainable training programs. These programs can be used as models for programs that support the achievement of high levels of energy efficiency in residential and commercial buildings.

### **Driving Demand and Forecasting Workforce Needs**

In addition to requirements under AB 758, regulations and policies that drive workforce development and demand for energy efficiency upgrades include building codes, such as the Title 24 Building Energy Efficiency Standards and the California Green Building Standards Code, as well as regulatory requirements, such as commercial benchmarking stipulated by the Commercial Use Energy Disclosure Program (AB 1103).

Utility rebate and financing programs and public works projects also drive demand for a well-trained workforce. These programs may further standardization of work by establishing requirements for participating contractors, for example, Energy Upgrade California, which requires BPI certification for contractors to perform upgrades under Energy Upgrade California. Important goals of the Energy Upgrade California program, designed as a pilot for AB 758, are to drive consumer demand to increase the volume of

energy efficiency upgrades. The program also works to ensure high quality standards for installments by establishing training requirements for contractors participating in the program and strong quality assurance components for work completed.

The CPUC developed workforce, education, and training goals as part of the *Strategic Plan*. The overarching vision is to have a trained workforce ready by 2020 to advance demand-side management businesses, policy, research and development, and education outlined in the plan and mandated by AB 32. Jobs will include energy-efficient and distributed energy engineering, construction, maintenance, program design and implementation, and financial analysis.

To accomplish this vision, the plan calls for establishing energy efficiency education and training at all levels of California's educational system. The plan also calls for ensuring that minority, low-income, and disadvantaged Californians fully participate in these programs. Strategic partnerships with state labor and education agencies, trade and labor associations, educational and training organizations, nonprofit organizations, and industry must be formed to advance these goals.

The ARB created the *Climate Change Scoping Plan*<sup>73</sup> for implementing AB 32, which calls for creating a skilled workforce by: (1) strengthening career technical education in high schools; (2) ensuring an adequate pipeline of skilled workers by expanding education and training programs that are linked with postsecondary training such as apprenticeship programs, vocational training, and colleges or universities; and (3) cultivating university research and training programs to ensure that they produce the next generation of clean-tech engineers, scientists, and business leaders.

## **Market Needs**

### **Stackable Credentials Offered by Key Training Programs**

Training and education should be offered in a sequence of certifications or credentials that can be accumulated over time to increase an individual's qualifications and allow one to move up a career ladder to higher-paying jobs. A stackable credential framework is one that creates career pathway models within industries with high unmet needs for skills. The section above on training, standards, and certification provides examples of well-aligned training, such as the PowerPathway program. Programs such as this should be greater in number, and there is still a strong need for better definition of the career/training path, standardization of training programs statewide, and articulation of training programs from high school through college, apprenticeships, and industry certifications.

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73 California Air Resources Board, *Climate Change Scoping Plan* (2008)  
[http://www.arb.ca.gov/cc/scopingplan/document/adopted\\_scoping\\_plan.pdf](http://www.arb.ca.gov/cc/scopingplan/document/adopted_scoping_plan.pdf).

### *Options for Addressing Need*

The Energy Commission can collaborate with the CPUC's Workforce, Education & Training Task Force, the California Community College Chancellor's Office, the Department of Education, labor organizations, and other stakeholders to review the various training options and create recommendations for repairing disconnects with existing efforts/programs. For example, CALCTP is a good model of standardized, certificated training, but it is intended for licensed electricians. What is the training progression for electricians to get to this point? How can this program be part of a series of stackable credentials for electricians?

The Energy Commission can collaborate with other state agencies to create a state-level "stackable credentials" education and training framework for different occupations that integrates and coordinates basic education, occupational training, and postsecondary degree and certificate programs from high school on.

### *Challenges/Barriers/Risks*

Given the vast array of training and certification venues/options, creating consistency within a statewide framework will be important. The challenge is to create a comprehensive strategy with timely and relevant career pathway models.

### **Support Ongoing Alignment in Workforce Planning**

The statewide energy efficiency program will drive an increased need for training and retraining of existing construction trades people and expansion of workforce capacity in newer, specialized roles. It is critical to align program plans with data-driven state and local workforce development strategies, both in terms of workforce volume and in meeting the required quality standards.

### *Options for Addressing Need*

The Energy Commission currently does not have a comprehensive workforce plan. It should consider creating a commission wide strategy for energy-related workforce development that is coordinated with the CPUC's efforts and other state labor agencies' plans. As part of its plan, it should consider working with the existing workforce and economic development agencies at the state and local levels to develop data-driven sector strategies for anticipated energy-related occupations, such as building raters, energy auditors, solar and HVAC installers. Through these partnerships, the Energy Commission can reach out to the workforce and communicate that focusing training programs on performing quality work is essential to the programs' success.

In fostering training programs, the Energy Commission should consider ancillary occupations, such as real estate agents, who can understand and promote the value of energy-efficient homes to buyers, financial officers, and appraisers, who will factor energy efficiency into financing packages and property valuations. These occupations can also serve as the front line for public education and outreach campaigns.

Efforts should also be undertaken to create stronger alignment between research and development for emerging technologies entering the market and forecasting of future workforce skill development. The Energy Commission should more closely link the efforts of its Public Interest Energy Research Division and its Energy Efficiency and Renewable Energy Division as well as the Emerging Technologies Program administered by the investor owned utilities under the auspices of the CPUC. CALCTP is an excellent example of a training program designed around a proven new technology in the marketplace.

Finally, outreach should be conducted to the public and to industry so consumers and employers alike understand the value of standardized, certificated training in producing a workforce capable of performing high-quality work that will achieve the highest levels of energy efficiency. Such certification can greatly improve customers' confidence in contractors overall.

### *Challenges/Barriers/Risks*

Timing workforce training with market demand can prove challenging. A best-case scenario would provide workers with just-in-time training as demand peaks. The lack of a qualified workforce can delay initiatives and programs while oversupply can lead to disillusionment from workers who have invested time and money into training. In addition, consistent employment is difficult to achieve for workers in the building industry, who are subject to seasonal and economy-driven ebb and flow. Lessons in capacity building and statewide partnerships can be learned from the CEWTP program to advise future workforce development efforts.

### **Define Quality Standards for Energy Efficiency Work**

Standards are critical in creating consistency of training programs and work products. However, it can be difficult to persuade building owners that higher up-front costs due to quality installations will result in greater savings for the long term. In the nonresidential sector, there is currently no prevailing standard for certification for whole building work. With time, marketing, education and outreach, market recognition of quality installations will induce building owners and operators and contractors to ensure workers are trained to meet high quality standards.

### *Options for Addressing Need*

State energy policies can incorporate workforce requirements to drive demand for higher quality training. One example is to tie efficiency programs to formal standards of work, such as the ASHRAE/ACCA 180 standard, which is at the core of several utility rebate programs, including Energy Upgrade California. The Energy Commission can collaborate with the CPUC and IOUs to include more certification requirements for utility programs and Energy Upgrade California. The Energy Commission can also work with state and local governments and public institutions to clearly define quality standards for all public works projects.

In addition, training programs can use the CALCTP model to build programs addressing other skill sets, such as energy auditing, building rating, installing sub-metering/monitoring controls and installing HVAC controls.

### *Challenges/Barriers/Risks*

Requiring high standards and certification offers clear benefits, but the commitment to develop a comprehensive training strategy and curricula for energy-related occupations requires funding and time. Currently multiple certifications exist for certain professions, such as commissioning agents. Regulators need to determine whether to identify the “best” certification for these professions or to make available multiple options.

Another challenge is that contractors are currently not required to accrue continuing education credits; rather the state policy is “licensing for life.” There is no professional incentive to take ongoing training classes to upgrade skills. Changing this situation and requiring annual training may take years.

### **Promote the Long-Term Value of Certifications**

A number of high-quality certifications are currently available for energy-related occupations, and others may arise from the AB 758 statewide energy efficiency program. Requiring certifications for energy-related work can be useful for creating market value and demand for these credentials. As mentioned, the status quo for contractor licensing does not encourage ongoing education.

### *Options for Addressing Need*

The Energy Commission can work with its federal, state, and local partners to identify the most value-added certifications for contractors and other energy-related occupations and determine policies that can promote their adoption, such as requiring certifications for any state and utility programs. These agencies can work with its state partners, the community colleges, and other training providers to identify the most useful certifications and ensure that any new certification programs are consistent with state and local policy requirements, are developed with industry input, do not impose an unnecessary financial burden on workers, and reflect the attainment of a sufficient level of knowledge, skills, and experience.

The Energy Commission can work with contractors, the Contractors State License Board (CSLB), and other appropriate partners to consider requirements for contractors to recertify periodically and to tie that recertification to accumulation of continuing education credits.

### *Challenges/Barriers/Risks*

Periodic recertification will require funding for the state to monitor. In addition, requiring recertification will be met with resistance from contractors. They may not be able to afford the time and money to take additional training, nor will they want to face the risk of failing to pass recertification, which may jeopardize their jobs. Finally, certification in itself does not guarantee quality work.

### **Address Skill Gaps**

Incumbent workers may lack the necessary skills to perform certain energy-related jobs or tasks. Training programs may need to be updated so these workers can be up-skilled. In addition, energy efficiency measures may not reach their full potential if building operators do not know how to properly operate and maintain systems.

### *Options for Addressing Need*

Statewide training should be reviewed to ensure it meets the most current DOE training standards and is consistent with DOE's energy retrofit guidelines for residential and commercial buildings. Alternatives that provide adequate hands-on training and field experience, such as apprenticeships for growing and nontraditional occupations, should be explored. For example, the state could consider collaborating with state agencies and labor organizations to pilot an apprenticeship program for energy auditors. In addition, the success of CALCTP can be built upon through similar training programs to address skills gaps for mid-career workers in other occupations. This program can also be built into a stackable credential structure.

Consideration should also be made for educating homeowners and building owners and operators. For example, outreach to inform ratepayers of the skills and education contractors should possess will give them better tools to select qualified contractors.

Researching the role of training (for example, building operator certification training) should also be undertaken to investigate skills gaps for building operators who manage automation controls and participate in commissioning projects.

Training should also be developed for commercial energy raters for Building Energy Asset Rating System (BEARS). The scale of this need depends on the policies that will require these ratings.

Finally, contractors and other service providers should be training in sales techniques so they can adequately inform their customers of the value of energy efficiency measures.

### *Challenges/Barriers/Risks*

A comprehensive workforce development strategy must be implemented in stages, with an immediate plan for meeting the most important training needs in the short term. This strategy must be continually reassessed to ensure that gaps are addressed on an ongoing basis, as needs will change over time.

# **CHAPTER 4:**

## **Energy Assessments and Ratings – Residential Buildings**

### **The Role of Energy Assessments and Ratings in Achieving California Energy Policy Goals**

The development of effective and appropriate energy assessment and rating services in California is a key component of AB 758's comprehensive energy efficiency program for existing buildings. The legislation anticipates that the Energy Commission will establish requirements for home energy ratings and energy assessments to ensure that program criteria are met. The legislation defines energy assessment as the determination of an energy user's energy consumption level, relative efficiency compared to other users, and opportunities to achieve greater efficiency or improve energy resource use. The bill calls for the Energy Commission to determine the most effective way to report energy assessment results and corresponding energy efficiency improvements to the building owner, including prioritizing the identified energy efficiency improvements and the cost-effectiveness of those identified improvements.

The Energy Commission is expected to determine the appropriateness of the California HERS program to support the goals of AB 758, and whether there are sufficient numbers of HERS certified raters available to meet the needs of the program. This chapter separately addresses energy assessments, and energy ratings. Each will be covered in its own section including history, market status, and key issues that need to be addressed before full roll-out of AB 758 programs can be achieved successfully and sustainably.

### **Energy Assessments**

Energy assessments play a pivotal role in achieving the state's goals for high percentage savings through whole-house, "house-as-system" upgrades in all of California's homes. These goals are founded on the concept that each home represents a unique opportunity to save energy, given that different energy features or defects were built in at the time that the home was constructed, different energy efficiency upgrades have already been made in the home, and major energy consuming equipment are at a different point in their useful life. Since the opportunity for making energy efficiency improvements is different for each home, conducting effective and efficient energy assessments is critically important to understand and prioritize the potential upgrades that can be made, and gain homeowner buy-in to make upgrades to realize energy bill reductions as well as important comfort, indoor air quality, health improvement, noise reduction, and other non-energy benefits.

### **Market Status of Residential Energy Assessment Programs**

Whole-house energy upgrade programs are rapidly developing all over the country. These programs pursue the program theory and goals of Home Performance with ENERGY STAR, with an eye to alignment with the Building Performance Institute's standards and certification/accreditation that are founded on the conduct of energy assessments.

### *Home Performance With ENERGY STAR*

Home Performance with ENERGY STAR, administered by the US DOE, offers house-as-a-system upgrades to homeowners. Programs are conducted around the country, managed by a local sponsor (could be a utility, or state or local energy agency) that recruits home improvement contractors who are qualified to perform comprehensive home energy assessments. The energy assessment addresses opportunities for improvement of heating and cooling systems, building envelope features, and other energy-related equipment and features of the home, including safety testing of gas appliances. Based on this assessment, participating contractors offer solutions to fix comfort problems and reduce energy bills. The whole-house energy assessment is performed by contractors, trained in building science, to make a visual and diagnostic inspection of all of the home's thermal and mechanical systems.

Based on the assessment, the homeowner receives a comprehensive list of recommended improvements and a cost estimate to complete the recommended work. In installing the recommended improvements selected by the homeowner, the contractors follow industry best practices. Participating contractors perform diagnostic testing at the completion of the work to verify that the installations have improved home performance and that safety standards are met. Diagnostic testing includes measuring air infiltration and duct leakage and evaluating combustion safety. The homeowner receives a report summarizing the improvements completed, test results, and estimated energy savings.

It is the job of the sponsors to monitor the quality of the work performed by all participating contractors. This quality assurance includes:

- Reporting by the participating contractor
- A job review to ensure program compliance and provide feedback to the contractor
- The ability for customers to provide feedback to the sponsor
- Onsite inspection of a sample of the jobs completed
- A conflict resolution process to respond to and resolve customer complaints
- Recordkeeping and tracking of the results of onsite inspections, customer feedback and corrective actions.

### *Building Performance Institute Standards and Certification Programs*

BPI has developed standards to guide energy assessments, including a strong emphasis on combustion safety. It offers certification for individual building energy professionals who focus on the house as a whole. The certification process requires the candidate to pass a written exam and field tests. Certified individuals are required to participate in continuing education programs to keep up to date with the industry. BPI standards are a requirement for whole house programs around the country, including Energy Upgrade California and programs conducted by the New York State Energy Research and Development Authority (NYSERDA) and Energy Trust of Oregon.

BPI also administers an accreditation program for contracting companies that commit to conducting whole house performance contracting as a business. The BPI accreditation program includes a Quality Assurance component that includes customer surveys, customer telephone

interviews, file review, and field verifications. Certified individuals working for BPI-accredited contractor firms are required to participate in continuing education programs.

### *California Efforts*

The *Strategic Plan*, developed by the CPUC in 2008 with policy collaboration by the Energy Commission, established ambitious goals to transform home improvement markets to apply whole-house energy solutions to existing homes. These initiatives were to reach all existing homes and maximize their energy efficiency through delivery of cost-effective energy efficiency upgrades. The plan envisioned moving away from a “widget”-based approach to a “whole-house” approach founded on comprehensive energy assessments. In 2010 the Energy Commission allocated a major portion of its ARRA funding to pursuing whole-house energy upgrades. The Energy Commission sought the delivery of regional programs based on Home Performance with ENERGY STAR approaches with projects delivered by the emerging building performance contractor industry in California, certified and accredited by BPI. The regional programs were expected to collaborate with utility whole-house programs to maximize results. Under the statewide Energy Upgrade California program and brand, extensive energy assessments were conducted under the direction of performance contractors.

## **Energy Ratings**

An energy rating assigns a numerical “score” to a building to assess and rate its level of energy efficiency. (Some rating systems rate energy consumption rather than efficiency.) Energy ratings enable the energy efficiency levels to be compared either between homes or for the same home before and after energy efficiency upgrades. Ratings apply to both existing and newly constructed buildings.

Ratings can be a powerful tool to communicate the energy assets of a property and can educate and motivate consumers to take action on an upgrade project. In California, the California HERS Program establishes procedures for the only legal energy rating that can be provided for a home. By statute raters in California must also provide energy assessments, including energy bill savings estimates and recommendations for improvements. Under the California HERS Program, energy ratings require the onsite inspection and diagnostic testing, and analysis of the energy efficiency of the existing home, similar to energy assessments. There are other rating systems that operate in other parts of the country and around the world that can provide example approaches for consideration for improving the California Home Energy Rating System Program.

Two different kinds of energy ratings have been established in Europe and other parts of the United States, asset ratings and energy use ratings. (Energy use ratings are sometimes called *operational ratings*.) An asset rating rates the energy efficiency of the physical features of the home, taking into account the features of the building envelope (that is, walls, ceiling/roof, windows, insulation, air tightness) and permanent energy-using equipment (for example, HVAC equipment, ductwork, water heating systems, lighting systems). The goal is to rate the home, not the occupants, so the rating is established based on standard assumptions about how homes are expected to be operated. This is similar in concept to a “miles per gallon” (MPG)

rating for a car. The California HERS Program establishes asset ratings, as does US DOE's Home Energy Score, Oregon's Energy Performance Score, and other home rating systems.

Energy use rating systems have also been established in other parts of the nation and world, particularly for nonresidential buildings. An energy use rating simply reports the actual energy use of the building over a period divided by the square footage of the building. Often energy use ratings are organized for particular categories of buildings, such as office buildings or retail buildings, to enable a comparison that is more likely to be meaningful. An energy use rating not only is affected by the physical features of the building, but strongly depends on how the current occupant of the building is operating the building. (This is the source of the often-used term *operational rating*.)

Asset ratings are particularly useful for consideration about valuing property, either in monetary terms or in terms of its expected utility or performance with respect to a financial transaction (sale, lease, financing). Energy use ratings can be useful for giving building owners or operators' feedback on their building or their operational practices. Energy use ratings allow for benchmarking of an owner's building and operational practices against the norm for the same category of buildings, and allow for a longitudinal comparison over time to track the effect of operational changes or building improvements on energy use per square foot. In Europe, the public disclosure of both asset ratings and energy use ratings is obligatory.

## Market Status of Residential Energy Rating Programs

In recent years, building rating systems have begun to proliferate throughout the United States and the world mostly as voluntary tools. However, policy makers increasingly view them as a way to label and promote more efficient buildings. This has been driven by the concept that ratings help create property value for energy efficiency and can be useful as a sales tool or for motivating competition, leading to actions to improve efficiency.

Since the approval of CalCERTS to serve as a California Whole House Rating Provider in 2010, more than 3,500 whole house test-in (pre-energy upgrade) and 1,490 test-out (post-energy upgrade) ratings have been completed for California homes.

## California Home Energy Rating System Program

Public Resources Code Section 25942 requires the Energy Commission to establish the California HERS Program to certify home energy rating services in California. The statute requires that ratings be based on a single statewide rating scale and include estimates of potential utility bill savings and recommendations on cost-effective measures to improve energy efficiency. The statute requires the Energy Commission to develop training, certification, and quality assurance procedures for Raters; database and reporting requirements; and labeling procedures. The statute prescribes that once the Energy Commission adopts the California Home Energy Rating System through regulation, no home energy rating services may be performed in the state unless the services have been certified by the Energy Commission to be in conformity with the program criteria adopted by the Energy Commission. The program goal is to provide reliable information to differentiate the energy efficiency levels among California homes and to guide investment in cost-effective home energy efficiency measures.

The Energy Commission implemented the HERS Program regulations in two phases. Phase I was adopted in 1999 to establish procedures for certifying home energy raters to provide field verification and diagnostic testing for showing compliance with the Building Energy Efficiency Standards (Title 24, Part 6). The regulations established the framework for HERS Providers to train, certify, and provide oversight for HERS Raters.

Phase II of the HERS Program was adopted through a regulatory process conducted in 2007 and 2008, going into effect as California law in September 2009. Phase II expanded the program to include whole-house energy ratings of existing and newly constructed homes. The Phase II regulations complied with statutory requirements by establishing the California HERS Index as the single statewide rating scale, and procedures for labeling, estimating utility bill savings, and providing upgrade recommendations. The whole-house regulations and the HERS Technical Manual (HTM) established methods for determining cost-effectiveness of energy efficiency measures and the development of recommendations for energy efficiency improvements. The procedures call for utility bill analysis, including comparison of actual energy use of the home to simulation estimates with procedures for normalizing weather differences, and identification of non-energy benefits resulting from upgrade projects, such as comfort, indoor air quality, noise reduction, and health and safety for the homeowner.

#### *Rating Programs Outside of California*

Development of rating programs in other states has expanded over the past several years. The Residential Energy Services Network (RESNET) revised its HERS Index in 2006 and has worked to improve its programs and procedures. The California HERS Program is recognized by RESNET as the state-administered HERS program, and there are substantial similarities. For example, both programs provide asset ratings on a scale that sets a score of 100 for a building code-compliant home (2008 California Energy Code for California and the International Energy Conservation Code [national model code] for RESNET) and a score of zero for zero net energy homes.

**Energy Trust of Oregon/EPS** – The Energy Trust of Oregon introduced Energy Performance Score (EPS) in newly constructed homes in 2008 and piloted the program for existing homes in 2009. The Energy Trust rating is merely the estimated millions of British thermal units (MBtus) of the homes, using a site energy conversion. The Energy Trust of Oregon and several partners developed the EPS in 2008. The results of the pilot indicated that existing home modeling software tended to over-predict energy use. The first software used for EPS programs was developed by Earth Advantage Institute (EAI) for the Energy Trust of Oregon. At its foundation, EPS uses the Simple energy analysis program developed by Michael Blasnik. Simple is designed to require only a limited number of inputs to reduce the time required for data capture and simulation. Energy Trust of Oregon also has used other software in EPS programs it has piloted. EAI has also conducted rating programs in other parts of the country, using further updated versions of the Simple program.

**Home Energy Score** – The Lawrence Berkeley National Laboratory developed the Home Energy Score (HEScore) rating tool for the US DOE. It was created basically as a screening tool “to provide a rapid low-cost opportunity assessment of a home's fixed energy systems and provide the home owner with general feedback on the systems that potentially need more

detailed attention from certified home performance diagnostics and weatherization professionals.”<sup>74</sup> Pilot programs were implemented in nine states in 2010-2011. These programs were used to estimate delivery costs, improve modeling algorithms, assess the need for diagnostics in formulating a score, and gauge homeowner interest and understanding.

The individual providing the assessments for HEScore must be a BPI-certified Building Analyst or a RESNET Rater and have passed the U.S. DOE’s online test of the information and training offered by the DOE on HEScore. Raters are required to collect about 40 data points to determine the home’s rating. The energy rating uses a 1 to 10 score based on a source energy conversion of energy estimated by an asset rating simulation. DOE will be conducting further pilots of its revised HEScore in 2012-13, which was changed substantially in response to feedback from the original pilots.

### Independent HERS Raters and Building Performance Contractors

HERS Ratings have traditionally been performed by independent raters, who have no financial interest in the work that is completed by builders or contractors who make the energy efficiency improvements. This is consistent with other market motivations for independent home assessments. HERS Raters are required by HUD and secondary lenders to be independent of the contractor when providing a whole-house energy assessment and rating for qualifying for energy efficiency financing. Also, persons involved in home inspections, including energy inspections for providing information to sellers, buyers, real estate agents, and appraisers in the real estate transaction process, are required to be independent of the contractors providing improvements to address inspection findings. Also, homeowners often value the evaluation of the energy efficiency of their home and the potential for its improvement provided by a person who is independent of the contractor who will provide those improvements.

On the other hand, home performance contractors who are trained and experienced in making whole-house energy assessments, recommending energy efficiency improvements, and installing those improvements offer the ability for homeowners to obtain a full-service, one-stop approach to upgrade projects, maintaining continuity and ongoing access to a single entity from the beginning to the end of a project. This can lead to a highly efficient process from a timing and consumer convenience perspective, particularly with the introduction of the contractor-driven IOU Whole House rebate program.

The home performance contractor also can be particularly knowledgeable of the circumstances and constraints involved in the completion of energy efficiency improvements in specific homes, including the reasonable cost for those improvements.

In expanding the Phase I California HERS Program to establish the legal requirements for whole-house ratings, the Energy Commission adopted a dual-path approach for completion of whole-house HERS Ratings to address market needs. The “Independent Rater” path provides

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<sup>74</sup> LBNL, *The Home Energy Scoring Tool for Asset Rating*

Online at: <https://sites.google.com/a/lbl.gov/hes-public/home-energy-scoring-tool>

an independent third-party whole-house rating to the homeowner, whereas the “Building Performance Contractor” (BPC) path allows a certified building performance contractor/Rater to conduct the whole-house rating and perform the recommended energy efficiency improvements on the home.

In establishing the BPC path to completing ratings, the Energy Commission endeavored to align this approach with BPI standards, certifications, accreditation, and higher levels of quality assurance. BPI raters are required to hold BPI Building Analyst and Building Envelope certifications; these certifications will satisfy the certification requirements for BPI contracting firm accreditation.

### Comparison of Simulations to Actual Energy Usage

In developing the whole-house HERS Rating calculation approaches, the Energy Commission intended to establish an asset rating system as a means to compare the physical characteristics (assets) across homes, while holding constant other factors (such as operating assumptions and plug loads) that affect energy consumption. The California HERS Index is based on this asset rating approach.

The Energy Commission recognized that building simulations using standardized operating assumptions can only make estimates of the energy use that will occur in any particular home with varying weather patterns, occupancy use patterns, and information about features that affect the building’s energy consumption. The Energy Commission recognized that in making recommendations to homeowners, and determinations of the cost-effectiveness of their investments, raters should compare the simulations against actual energy usage. Energy Commission-approved rating software must provide an Energy Consumption Analysis Report that compares the raw actual energy usage, the weather-normalized energy usage, and the usage estimated by the simulation. Data is expected to be presented in terms of energy usage for electricity, energy usage for natural gas, and energy cost; the energy cost estimated for the simulation is expected to be based on the actual energy bill tariff that is input into the software.

At the time that the Energy Commission was developing the whole-house rating program, the Energy Commission was not able to find a public domain protocol for calibrating simulations to the actual energy usage in energy bills, which could be provided to raters for their use. Raters are to provide the Energy Consumption Analysis Report to the homeowner. When there is more than a 30 percent variation between the normalized energy usage, raters must determine if there may be reasons that would explain the variation, such as intermittent occupancy, different thermostat settings, different hot water consumption patterns, miscellaneous electricity consumption differences, or shading from trees or adjacent buildings. When there is more than a 30 percent variation, raters are encouraged to interview the occupants to determine if there are lifestyle differences that would explain the variation. Whenever there is more than a 30 percent variation, raters should take that variation into account in making recommendations for upgrades. The Energy Commission recognizes that improvements are needed to this method to provide more guidance for calibration.

Home performance contractors have gained experience in assessing homes with the simulation model through the Energy Upgrade California whole-house programs. Some of these

contractors have raised concerns with the practice of basing energy saving estimates and recommendations for homeowner investment in improvements on an asset-based approach with fixed assumptions about occupant behavior. While asset ratings for the home must standardize assumptions, the Energy Commission agrees that simulation results should be calibrated to actual energy usage to help homeowners understand how their investment will likely affect their energy use if their occupant behavior remains the same after improvements are installed.

## California Energy Policy Drivers for Making Energy Calculations

In establishing building energy performance approaches, the Energy Commission has endeavored to develop and approve calculation tools that achieve the following energy policy drivers:

- Climate-specific design and installation;
- Electricity system reliability, accounting for electricity system generation, transmission and distribution losses, with an emphasis on avoidance of peak and critical peak demand;
- Correction and avoidance of construction and installation defects.

### *Climate-Specific Design and Installation*

California has by far the widest variation of climate of any state in the United States. In fact, the climate variations in the state include examples of all but the most extreme climates found in other states, from the coast to central valleys, to desert climates and the high Sierras. It is important that calculation software and tools encourage energy efficiency improvements to be made that are dialed in to these climate variations. California's building energy efficiency standards and the HERS program place careful attention on promoting building energy efficiency investment decisions that address this climate diversity; the HERS Index is designed to benchmark ratings to climate-appropriate building energy efficiency measures and levels.

### *Electricity System Reliability and Peak Demand*

The Energy Commission is directed by the Warren-Alquist Act to conduct energy efficiency programs that contribute to the reliability of the state's electric system. Most California homes use more than one fuel to provide heating, cooling, water heating, lighting and other energy services. To address the relative efficiency of those homes, whether determining percentage savings or establishing a HERS Rating or meeting the building energy efficiency standards energy budget, the use of those fuels need to be converted into common units, British Thermal Units (BTUs). If one disregards the effect of home's electricity use on the utility system and disregards the inefficiencies in the generation, transmission, and distribution system, one would use a "site energy conversion." This would ignore the efficiency losses resulting from generation, transmission, and distribution, which can translate to as much as two-thirds of the energy consumed due to the home. Because electric utilities must be compensated for these generations, transmission, and distribution losses through energy bills, using site energy conversion, which leaves out those major losses, will give homeowners investment signals that deviate from what their energy bills would show to be in their best interests.

To account for the actual energy consumed due to the home's energy measures, the Energy Commission rejected the use of site energy conversion, using source energy conversion instead beginning in 1978. Stimulated by the electricity crisis of 2000-01 and the threat of blackouts as a result of unreliable and extremely expensive electricity supplies, the Energy Commission in collaboration with the IOUs developed for the building energy efficiency standards update adopted in 2003, the time dependent valuation (TDV) approach to energy conversion. TDV conversion accounts for the seasonal and time-of-day variation of the cost to supply energy on an hourly, year-around basis. In so doing it moves away from the idea that a kilowatt hour (kWh) is worth the same value every hour of the year, that a kWh saved by saving furnace fan energy in the middle of the night in the winter is worth the same as a kWh saved in the middle of a critical peak event in the middle of a summer heat wave. The TDV conversion method aligns building assessment practice with upcoming real-time pricing initiatives made possible by the installation of smart meters by all of the utilities. Using the TDV conversion method provides contractors and consumers with percentage savings information that is most closely aligned with utility and societal costs, enabling their investment decisions to be aligned with electric system reliability and peak demand responsiveness.

#### *Correction and Avoidance of Construction and Installation Defects*

Beginning in the mid-1990s, the Energy Commission has focused strong attention on the problem that many energy-using features and equipment are commonly installed with defects, and these defects can be avoided by careful attention to diagnostic testing, installation protocols, and quality installation. These measures include duct and air handler air sealing, location and insulation; proper air conditioner installation, including refrigerant charge, airflow, fan watt draw, sizing, and high Energy Efficiency Ratio (EER) coil installation; building envelope air sealing and insulation quality; and proper PV system installation. Based on California field research and analysis, the Energy Commission has determined typical defect conditions and developed calculation approaches for the energy use resulting from those typical defects as well as from the correction of those defects. The Energy Commission's building energy efficiency standards and whole-house HERS program incorporate these calculations to address both uncorrected and corrected defects in approved software. In this manner the state encourages the correction of these defects and rewards builders and contractors who practice quality installation practices. Performance contractors, trained in BPI standards and the Energy Commission's protocols, should correct these common defects during the normal course of business and be able to easily differentiate their high-quality work through energy savings saved through that process.

#### **California Whole-House Rating Pilots in ARRA-Funded Programs**

Conducting ratings was a key component of the Energy Commission ARRA-funded whole-house upgrade programs. The Energy Commission sought regional programs that would explore ways that HERS Ratings could be provided, either through the independent rater or building performance contractor paths established by the California HERS Program. Different approaches were piloted in different regionally based ARRA programs.

The original intent of the ARRA programs was to pilot ways to accomplish whole-house upgrades, based on the Home Performance with ENERGY STAR model, and aligning with BPI

Standards and certification/accreditation. A secondary objective was integrating HERS whole house ratings into the market and the upgrade process. The ARRA programs were intended to coordinate with and leverage the IOU whole house programs. Given the central role performance contractors played in delivering the IOU program, and the initial delay in the rollout of the HERS whole-house program, an interim performance approach was adopted with the EnergyPro software available for energy simulations, which allowed performance contractors to use the EnergyPro tool to provide the baseline assessments necessary for the IOU programs. The HERS whole house program was launched partway through the course of IOU, Energy Commission, and local government ARRA program rollout; at that time, work began in earnest to explore business models or program design that would accommodate raters. The Energy Upgrade California utility program administrators (four IOUs and SMUD) reported more than 3,700 assessments completed on homes since the start of the Energy Upgrade California Whole-House program, resulting in major energy improvements and rebates to California homeowners. However, the vast majority of the energy assessments in the Energy Upgrade California whole house programs were conducted by performance contractors.

The IOU-administered Energy Upgrade California programs have been, appropriately, performance contractor-centric programs where performance contractors are ultimately responsible for delivering whole-house energy efficiency upgrade projects that meet program requirements for valid and effective assessments, program-compliant and effective building simulation modeling, and quality-installed upgrades that pass the program's quality assurance reviews. Performance contractors have served as the primary interface with the homeowner, encouraging the homeowner to invest in as deep upgrades as possible, taking advantage of the incentives and financing that was available through the range of Energy Upgrade California programs in each county.

From the outset of the Energy Upgrade California programs, there have been challenges in taking advantage of the skills and availability of HERS Raters to contribute to delivery of the services expected by the program. For one thing, the IOU programs required combustion safety testing to be performed by a certified BPI Building Analyst. While the assessment that a HERS Rater performs is similar in many respects to the assessment a performance contractor would perform, unless a HERS Rater also holds a BPI Building Analyst certification that qualifies him to complete combustion safety testing, performance contractors would be required to perform this testing. Also, home performance contractors were reluctant to use a HERS Rater assessment (particularly from a HERS Rater they had not previously worked with) in developing a scope of work for a project. One reason for this is that it is a challenge for HERS Raters to develop reasonable project cost estimates that are acceptable for contractors to deliver the project. But in some cases, increasingly as the program continued, HERS Rater capabilities were brought to bear to increase the delivery of successful projects. HERS Raters were used to do energy assessments, including combustion safety testing for those raters who also held a BPI Building Analyst certification, building simulation analysis and project documentation. Some performance contractors found this use of HERS Raters to be a good business decision, expanding the capabilities of their firms to deliver quality installation of upgrades, while off-loading tasks for which their employees have less experience or equipment.

In some cases HERS Raters were the first point of contact for homeowners. The raters completed initial energy assessments and successfully brought leads for projects back to the Energy Upgrade California program for performance contractors to act upon. This approach had only limited success, partially because the HERS Raters had incomplete knowledge and information with which to complete the energy assessments or information about the Energy Upgrade California program and the expectations on the performance contractors.

#### *Sacramento Municipal Utility District*

The SMUD High Performance Program for single-family homes operated a performance incentive program very similar to those operated by the IOU whole-house programs with incentives available for upgrade projects applied for and conducted by performance contractors. SMUD offered an option for homeowners to receive partial payment of the cost of energy assessments and ratings of their existing homes by an independent HERS Rater instead of by a performance contractor. A substantial number of homeowners chose this option.

However, homeowners tended to be unaware that to get the substantial energy upgrade incentives offered by the program, energy assessment information would have to be provided by a performance contractor for upgrade measures recommended and installed by the contractor. Homeowners found it confusing to be offered an option for a HERS Rater to do the energy assessment and then be obligated to go through a different entity, the performance contractor, to qualify for upgrade incentives.

Also, at the start of the program, HERS Raters were relatively uninformed of the workings of the SMUD program, the need to coordinate closely with a performance contractor to help homeowners qualify for incentives, and things they could do in their energy assessment to provide measure recommendations that were compatible with what performance contractors likely would recommend. At the start of the program, HERS Raters were not including combustion testing in their energy assessments and were not aware of the need for them to be BPI Building Analyst-certified so as to add combustion testing to their energy assessment work. Since combustion testing by a BPI-certified Building Analyst was required by the program, this led to performance contractors having to repeat at least a portion of the energy assessment effort that was done by the HERS Rater.

Homeowners were frustrated that their original choice for an independent HERS Rater to do the energy assessments led to an unexpected need and time commitment on their part to later also choose a performance contractor who needed to repeat some of the assessment work and who recommended different measures than those recommended by the HERS Rater. Many homeowners approached the HERS Rater energy assessment as a way to obtain information about the energy efficiency of their home and identify upgrade measures that they could pursue at a later date. Others, who were confused by the unexpected need to re-engage with a performance contractor and work through the process to reconcile HERS Rater and contractor findings and recommendations, were not willing to follow through to get to the point of doing upgrades.

Based on homeowner feedback and confusion at the outset of the program, SMUD actively worked to provide HERS Raters and performance contractors information and discussion

forums to work through the coordination necessary to achieve projects that would lead to completed upgrades. As the program progressed, there was substantial improvement in HERS Raters' and performance contractors' success in working together.

However, SMUD was not able to undo the frustration that homeowners experienced with what they unexpectedly were required to do because they opted for an independent HERS Rating/energy assessment at the outset. Over the whole program, homeowners were substantially less likely to take action during the program period to complete upgrades when they started with an independent HERS Rating than with a performance contractor (conversion rate of 44 percent starting with performance contractors, 7 percent starting with HERS Raters).

#### *City of Fresno*

The city of Fresno program (operating in the San Joaquin Valley counties of Fresno, Kings, Kern, and Tulare) was developed in response to public demand for objective energy assessments, to identify existing home energy efficiency and options for upgrades, conducted by independent parties from the contractor who ultimately would complete the work. The Fresno program provided subsidized energy assessments and HERS Ratings to more than 800 homeowners. Homeowners participating in the program were encouraged to contact participating performance contractors to make the upgrades but were free to act upon recommendations individually as they could afford upgrades. Roughly 37 percent of participating homeowners took some action or plan to take action to make upgrades, though not necessarily "whole house" upgrades.

#### *County of San Diego*

The San Diego County single-family whole-house program provided incentives for partial payment of energy assessments and test-in and test-out ratings completed in conjunction with whole-house upgrades. The county encouraged and promoted the coordination of HERS Raters and performance contractors working together to deliver upgrade projects.

#### *County of Sonoma*

Sonoma County offered no-cost energy assessments and/or ratings to be provided by either a HERS Rater or a BPI Building Analyst. The county encouraged the coordination of HERS Raters and performance contractors working together to deliver upgrade projects, many of which could be financed through the Sonoma County PACE program.

#### *CHF*

The CHRMFA Homebuyers Fund MIST program provided incentives for energy assessments and ratings by independent HERS Raters and required ratings at test-out to qualify whole-house upgrade projects for low-interest loans. The program actively encouraged the coordination of HERS Raters and performance contractors to deliver upgrade projects. The program completed more than 1,043 projects, all of which received a test-out rating.

#### *Local Government Commission*

The Local Government Commission (LGC), operating statewide, provided incentives for test-in and test-out ratings completed along with whole-house upgrade projects. As the LGC rebate

program rolled out much later than many of the programs mentioned above, there was an opportunity to glean early “lessons learned” and develop an approach that attempted to speak to the challenges in the marketplace. Recognizing the kinds of difficulties that SMUD had experienced encouraging coordination of HERS Raters and participating contractors, LGC provided Web-based explanations of roles, led rater and performance contractor coordination meetings, and provided information for how performance contractors could take advantage of rater capabilities in completing upgrade projects that qualify for IOU whole-house program incentives. The LGC contract paid rebates for 697 test-in and 157 test-out ratings.

## Multifamily Energy Assessments and HERS Ratings

Multifamily buildings create major opportunities and challenges for achievement of whole-building energy efficiency upgrades. The energy systems of multifamily buildings can be complex, having occupancy and equipment that are a mix of those seen in both nonresidential buildings and single-family homes. Buildings are often a combination of common areas provided with nonresidential-type equipment and central HVAC and water heating systems, and dwelling units that may have be served by either central systems or equipment for each dwelling unit. Energy bills for the common area are paid by the building owner; energy bills for the dwelling units can be either paid by the building owner or by the tenants. Multifamily buildings can offer either market rate or affordable housing. Affordable housing projects are even more challenging, as they often involve coordination with many energy services providers and can involve complex and layered ownership and financing structures.

With ARRA funding the Energy Commission placed priority on pursuing multifamily whole-building upgrades in pilot programs in contracts with San Diego County (Heschong Mahone Group [HMG], administrator), SMUD, HMG, administrator), Association of Bay Area Governments (stopwaste.org, administrator) and San Francisco Mayor’s Office of Housing (Enterprise Community Partners, co-administrator). These programs were operated in coordination with the Home Energy Retrofit Coordinating Committee (HERCC) subcommittee on multifamily, providing support for development of program delivery approaches and energy audit/assessment approaches and protocols. The San Diego County program endeavored to pilot approaches and solutions that could be extended to a statewide IOU multifamily whole-building program that could be administered in each IOU service area.

The California HERCC subcommittee on multifamily recommends that energy assessments in multifamily buildings be provided by independent energy analysts/HERS Raters<sup>75</sup>. Rather than the single-family model, where homeowners often do not have established relationships with contractors and all work can be performed by one home performance contract, multifamily building owners often have established relationships with a range of specialty contractors licensed to address the separate systems and equipment that are being upgraded. The energy

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<sup>75</sup> *Improving California’s Multifamily Buildings: Opportunities and Recommendations for Green Retrofit and Rehab Programs*. Findings of the Multifamily Subcommittee of the California Home Energy Retrofit Coordinating Committee; p. 21. April, 2011. Available online at: [http://www.builditgreen.org/files/Admin/HERCC/MF\\_HERCC\\_report\\_10152010.pdf](http://www.builditgreen.org/files/Admin/HERCC/MF_HERCC_report_10152010.pdf) (August 7, 2012).

analyst or HERS Rater can add value to multifamily projects by coordinating all energy aspects of the project across these multiple entities.

Cost containment for completing energy assessments is very challenging because a reasonable per-dwelling unit cost becomes unaffordable when applied to large developments/campuses with many dwelling units. Conducting energy assessments on a reasonable-sized sampling of dwelling units is important, in addition to assessment of the separate equipment and systems for common areas. Pilot programs endeavored to establish combustion testing protocols that could be applied affordably, made difficult by the potential for cross-communication of combustion products among multiple dwelling units, making testing, and investigation hard to accomplish.

Whole-house ratings under the California HERS Program are authorized for use for low-rise residential (three stories and fewer) buildings, including multi-family buildings. High-rise multi-family buildings are not covered. To expand to cover high-rise multifamily buildings and to better address central HVAC and water heating systems that often are used even in low-rise multifamily buildings, simulation software needs to be improved. A major issue of the HERCC multifamily subcommittee was developing modeling improvements for more complete and effective coverage of the range of equipment and systems that apply to complex multifamily buildings.

## **Market Needs**

### **Property Valuation for Energy Efficiency**

One of the most important unrealized market opportunities is the systematic recognition of energy efficiency in the property valuation appraisal process. Energy efficiency upgrades provide great benefits to homeowners. In contrast to other real improvements that provide visual or convenience amenities to the home, energy efficiency upgrades lower energy bills, creating the potential when upgrades are financed to produce positive cash flow opportunities with reductions in energy bills exceeding and paying for the monthly costs of financing. Often the savings are durable, extending beyond the term of the financing, saving energy for future owners of the home after the cost of the improvement is paid off. But on top of this unique aspect of energy efficiency upgrades is being able to pay for it themselves, these upgrades are often valued by homeowners more for their non-energy benefits than for their energy savings. Energy efficiency upgrades improve the quality of life for homeowners who experience them, improving comfort, improving air quality, creating a more healthy home, and reducing noise, and dust and dirt intrusion.

If these benefits were systematically recognized in property valuation, the cost of the investment in the upgrades could be partially or totally refunded at the point that the home is sold. This would create a residual value for the improvements that logically would be considered when the cost effectiveness of improvements is evaluated, leading to deeper improvements being able to be shown to be cost effective. If the energy savings and non-energy benefits of energy efficiency were systematically recognized for income properties, rents for tenants would be able to be raised, and the property value could recognize increased rents, lower operating costs and increased profits.

To achieve the inclusion of energy efficiency in property valuation calls for systematic, reliable, and objective rating of the energy efficiency of residential buildings in early in the sales process, as in through the multiple listing process, in the appraisal process and in the process for qualifying residential buildings for financing. Utility bills for the current owner or tenant(s) in the building, or energy use ratings (aka operational ratings) can be useful for providing information to these transactions, but they are insufficient for supporting property valuation increases because they are as much or more dependent on potentially, highly varying occupant behavior as they are on the building assets. Asset ratings provided by a well-functioning California HERS Program can serve to achieve this systematic process.

For asset ratings to be realized, multiple listing services and the appraisal industry must accept and incorporate energy efficiency rating and upgrade measure information in a systematic and ongoing manner.

### Trigger Events for Home Energy Ratings

To affect property valuation, rents, and financing, whole-house ratings should be available at the point that these transactions occur. Ratings don't necessarily have to happen at the same time as these transactions, if they have been completed before the transactions. These transactions have the potential to motivate and enable the completion of upgrades, increasing the demand for upgrades. Immediately prior to these transactions would be an excellent point for building owners to obtain energy assessments and make investments in upgrades that would be reflected in ratings that increase the desirability of the property for resale or rental or financing. From the seller's vantage point, ratings would best be completed before the point of listing to enhance and differentiate the property compared to other buildings that the buyer may consider.

These transactions also could be an excellent time for the party to the transaction who is not the building owner to consider the current energy efficiency of the building and energy efficiency upgrades that would be suitable for the building. If ratings were available at the point of listing, which not only identify the current rating of the building, but the opportunity for upgrades to be made that would reduce energy bills and deliver other non-energy benefits, buyers, renters, and lenders could consider that information when deciding among the properties they are choosing from, and when deciding whether upgrades could be included in new financing for the building.

In considering whether energy assessments, ratings and upgrades are made leading up to or in conjunction with these financial transactions, care must be taken as directed by AB 758 to not unreasonably or unnecessarily affect the home purchasing process or the ability of individuals to rent housing. Approaches would need to be developed to accomplish this direction.

These financial transactions are not the only logical point where whole-house ratings could be completed. Completing ratings at the time that the house/multifamily building is being otherwise upgraded could be an efficient and logical point for rating the upgraded homes. Energy efficiency upgrades could be made at the same time as other improvements are being made, lowering transactions costs and enabling deeper upgrades. This could be in conjunction with alterations for which the building department requires a building permit. Attention

would need to be made to make the rating process as seamless and non-disruptive to the rest of the project as possible.

Completion of post upgrade ratings could also be appropriate for upgrade projects that are recruited for participation in ongoing whole-house incentives programs, although it is critical that such ratings don't affect the ability of contractors to sell homeowners on the upgrades by increasing the number of "touches" (times that the homeowner has to be off work to let workers in or be contacted about the project) or by causing confusion about the involvement of multiple people in getting the project done. One way to address the potential problem of increased touches would be for the whole-house incentive program to build the rating into the program's QA process by avoiding QA visits by relying on the rating instead. Under this approach, the program would have to be convinced of the reliability of the rating for QA purposes.

Finally, ratings and energy assessments could be made at specific time increments in the life of a house/multifamily building. This would enable ratings and assessments to be made away from financial transactions or other home improvement projects, avoiding the rating/assessments being disruptive or inconvenient to those transactions and projects where there is little opportunity to accomplish energy upgrades (perhaps where available capital and time is fully devoted already to other aspects of the transaction/project). On the other hand, getting ratings and assessments done away from financial transactions or other alteration, remodeling, renovation, or upgrade projects could be perceived to be the most intrusive of all approaches if homeowners are fully occupied with other matters and have little interest or opportunity to make upgrades.

### Calibration of Simulations and Actual Energy Use in Energy Assessments and Ratings

Energy assessments, made independent from or along with whole-house ratings, should consider the actual energy use of homeowners in developing recommendations for energy efficiency upgrades in which homeowners will be asked to invest. This is consistent with the expectations that the Energy Commission adopted for the *HERS Technical Manual*. Ideally, building energy simulations would be modified systematically to approximate the bills as a tool for dialing in the upgrades under consideration for recommendation to fit the energy using behavior of the homeowner. Care should be made in developing the systematic process for this simulation modification to choose among the many possible simulation assumptions that could be made to result in valid model changes that fit the actual physical and occupant conditions, and to do so in a manner that is efficient and without adding substantial time for the process.

In November 2011, BPI adopted BPI Standard 2400-S, *Standardized Qualification of Whole House Energy Saving Estimates*, which provides detailed procedures for making comparisons of building energy use simulations and actual energy use. This new standard should be considered as a potential protocol for making these comparisons and identifying when modeling adjustments are needed to dial in recommendations resulting from energy assessments.

Non-energy benefits resulting from a whole-house upgrade project are as important, or more important, to homeowners than achieving the energy bill reductions possible from the upgrade.

This is particularly true where the existing energy efficiency conditions of the home are deficient. Occupants in this situation may be curtailing energy consumption because the services and benefits of a well-functioning, energy-efficient home cannot be accomplished without exceeding the household budget available for energy bills. Once those deficiencies are corrected, the benefits of an energy-efficient home may be much more feasible within a reasonable energy bill budget.

Caution should be taken when considering the appropriateness of assuming the existing occupant behavior for the home before the energy upgrade when making decisions about the investment of public funds for upgrades. The lifetime of the energy efficiency upgrades in a home can be very long, exceeding the time when the home is occupied by the existing or even multiple successive occupants. Since occupant behavior across owners and tenants of the home will vary greatly, public investment of funds should consider standard occupant behavior for the population served by the program rather than only the specific behavior of the current occupant. This could lead to the use of standard occupant assumptions that are much more efficient to administer than attempting to dial in the occupant assumptions for each individual home/residential building served by the program.

Also, this would avoid perverse, potentially unfair use of public funds to support or deny support for particular energy efficiency measures in individual homes, strictly as a function of the current behavior of the occupant or the current household budget available for energy bills. For example, current occupants who are curtailing energy use to stay within the household budget for energy bills or who are particularly miserly in the use of energy could be denied public funds to make particular energy efficiency measures, which, based on that current use, do not appear cost-effective. At the opposite end of the spectrum, current occupants who are wasteful in their energy use or are affluent enough to pay the energy bills that result from inefficient features and occupant behavior could be rewarded with public funds to make energy efficiency upgrades, which are cost-effective based on their current behavior.

Making these support/denial decisions for public investments for measures in the home, based on the current occupant behavior, would be particularly inappropriate for measures that will have long-lasting public benefits with useful lives that exceed the duration the current occupant behavior is likely to last. BPI Standard 2400 recognizes this potential problem. It says in Annex D, "This standard, while adequate as a standalone procedure, is intended to be flexible to allow for a particular energy efficiency program or sponsor to substitute values for acceptance criteria, input constraints, and/or standardized operating conditions as appropriate. This will enable the standard to meet the needs of a variety of supporting energy efficiency tax credit programs, state and national efficiency programs, and utility programs."

### *Non-Energy Benefits*

The non-energy benefits of a whole-house upgrade project are at least as important, if not more important to homeowners, as is the cost-effectiveness of candidate upgrades. How these are identified, assessed, and supported will fundamentally affect the value proposition for the customer and consequently the ability of building performance contractors and ESCOs to sell deep upgrade projects.

## Alternative Software for Energy Assessments

In its experience with building performance software, the Energy Commission has placed full attention on developing standardized and accurate algorithms based on building science principles to model the energy use required to meet technical comfort standards in buildings, particularly in relatively energy-efficient, newly constructed buildings. The intention for this work has been to provide consistent software that would equitably assign energy efficiency credit for tradeoff measures for showing compliance with the building energy efficiency standards.

That body of experience has addressed the need for systematically consistent software that would avoid the gaming of showing compliance with the Title 24 standards that would arise from unsubstantiated or unreliable changes to building operational assumptions, potentially in combination with favorable treatment of particular technologies or measures from software users who would obtain economic advantage. Basically, the goal of this long experience has been to set up a fair and level playing field for alternative energy efficiency measures to be able to compete equitably for use in buildings subject to building energy efficiency performance standards, in a modeling regime intended to deliver expected comfort in this relatively efficient population of buildings. In extending this experience to whole-house rating of existing homes, the Energy Commission thoroughly reviewed standard modeling approaches recommended by NREL and issues in modeling of homes with very low levels of energy efficiency.

In its experience with approval of building performance software, the Energy Commission has not focused extensive attention on the software user's experience. Compliance software is used by energy consultants, mechanical contractors, and other professional analysts/designers who have extensive experience with the software as the result of in-depth training and repeated use. Reports from such software only need to inform residential builders of what energy efficiency measures are needed to comply, third-party HERS Raters of what measures they need to diagnostically test and field verify, and building department inspectors of what measures are needed to comply and should be covered in compliance inspections.

To a large extent the user interface for compliance software has been left up to the software developer, who must respond to the expressed needs of their user customers, with limited involvement of the Energy Commission in improving that user interface. Energy Commission attention has not focused on the design of software user interfaces for emergent home performance contractors, some of whom have had very limited building simulation software experience and who at least early in the IOU Energy Upgrade California programs received little or no training on the software. Energy Commission attention has not focused on software that would provide highly improved homeowner reports that would promote rapid sales of energy efficiency upgrade projects.

From the Energy Commission's perspective, alternative building simulation software, designed to make home performance contractor use as simple and effective as possible and to facilitate homeowner acceptance of energy efficiency upgrade projects, would be desirable as long as that software guides the selection of energy efficiency measures that is satisfactorily consistent across software programs and enables contractors and homeowners to make measure selections that support statewide energy policy and system reliability goals.

In the recent CPUC *Guidance Decision* the CPUC directed consideration of the approval of alternative building simulation software for use with IOU Energy Upgrade California programs. CPUC staff and the IOUs were directed to consider relevant findings and activities on building energy rating and labeling systems occurring as part of the AB 758 program development process. The decision directed that the following criteria be considered for approving additional software:

- Should be required to meet national NREL BESTEST and/or RESNET standards
- Include standardized data reporting requirements to ensure that each approved software calculates energy savings in a manner consistent with other software in the program
- Support, but not require, integration of code compliance features within the energy modeling software
- Should allow reflection of the occupants' actual energy usage, that is, should not rely solely on averages.

The Energy Commission will actively participate in the consideration of these criteria and work with the CPUC, IOUs, and other stakeholders to achieve a workable balance of usability and accuracy. The Energy Commission has required meeting the NREL BESTEST for basic building envelope measures for both whole-house ratings and for the Interim Performance Approach. Standardized data reporting requirements that accomplish electronic reporting of project data in an XML or similar format is important. Energy Commission staff also believes that approved software programs should be compared against each other to ensure satisfactory consistency of energy savings for measures that are incented by the IOU Energy Upgrade California programs. Energy Commission staff agrees that measures that support and encourage the correction and avoidance of construction and installation defects should be included, although such measures do not necessarily have to be universally supported by all software approved for the IOU Energy Upgrade California programs. Staff also agrees that the software should allow for comparison of simulations to actual energy use and provide a means to calibrate the simulations to that actual energy use. Staff would encourage consideration of BPI Standard 2400 as a possible approach for such calibration.

#### **Potential Establishment of a California HERS Lite Option**

One potential way to improve the usability of whole-house rating software, reducing both the time involved in data collection at the home and data entry into the software, would be to focus on ways to simplify the user interface to reduce the number of required inputs. Some possibilities used by other software is the use of a simplified wizard that allows very little information about wall areas and orientations to be entered to generate a simulation model of the home using generic building geometry and orientation, and to allow the use of a HERS Lite option based on default inputs for the typical condition of measures requiring diagnostic testing, such as blower door and duct blaster testing.

These types of approaches have been used by the US DOE in developing its Home Energy Score home energy rating system. US DOE has worked to identify the minimum number of building simulation data inputs necessary to differentiate the energy efficiency of homes to establish a

home energy rating (asset rating). Home Energy Score establishes a rating based on a 10-point scale, comparing individual homes to simulations of the population of homes with a range of energy efficiency features in climate zones established by DOE. HEScore uses a source energy conversion to BTUs to establish the rating. HEScore defaults the inputs for features that BPI Standards and best practices call to be diagnostically tested. (The latest version of the HEScore software allows blower door test results to be entered for building air leakage but not duct blaster results or other diagnostically tested factors.)

Some public interest has been expressed in the potential piloting and use of Home Energy Score in California. A first hurdle for that would be the statutory requirement for no home energy rating services to be performed in the state unless the services have been certified by the Energy Commission to conform with the California Home Energy Rating System program criteria adopted by the Energy Commission. The statute also requires home energy ratings in the state to use the single, statewide scale established by the Energy Commission. It may be possible to overcome these hurdles by integration of a California version of Home Energy Score into the California HERS Program as a HERS “lite” option.

Home Energy Score was not designed to pursue the California energy policy drivers discussed earlier in this chapter. It is not clear to what extent Home Energy Score would encourage climate-specific design and installation of energy efficiency measures in a manner comparable to existing building energy efficiency standards and HERS Rating calculation tools. California has carefully established climate-specific building energy efficiency standards that establish benchmarks for proper measure selection in each of California’s diverse climates. The California HERS Index establishes a rating that is set with respect to the Title 24 benchmarks that have been adopted by the Energy Commission. (California HERS Index is set using the 2008 Building Energy Efficiency Standards as a fixed reference.) In contrast the Home Energy Score rating system does not recognize California building standards as a reference, but uses a small number of energy efficiency scenarios chosen by DOE to establish the low and high points on the 10 point scale (the energy efficiency scenarios that DOE used for setting the low and high points on the scale do not vary by climate).

In the original version of Home Energy Score, Energy Commission staff was very concerned with the use by DOE of a small number of climates in California, with the widely varying California climates predominantly represented by only two climate regions defined by DOE. That version of Home Energy Score also was calculating scores based on a comparison to actual energy use data across these DOE climate regions, which encompass multiple actual California climates. The result was that the score received for a home was strongly a function of the climate it was in, outweighing the energy efficiency features that were installed. In response to Energy Commission staff comments, DOE established a much larger number of climate regions for analyzing homes, and changed the comparison to building simulations rather than actual energy use to establish a true asset rating approach.

Home Energy Score was also not designed to use a BTU conversion method that focuses strongly on electric system reliability with an emphasis on the avoidance of peak and critical peak demand. Home Energy Score does not recognize the time-dependent valuation approach that the California uses for its Title 24 standards and reach standards throughout the state,

implemented through IOU new construction programs, green building standards programs, and local government green and energy ordinances, as well as in the California Whole House Rating program. Home Energy Score does use a source energy conversion to BTUs, which is a marked improvement over site energy conversion. The second-best, source energy conversion approach, however, still uses an approach that equates energy savings at off-peak times in the middle of the winter with energy savings at on-peak and even critical peak times in the middle of summer heat waves, when the electricity system is most vulnerable to rolling blackouts and the cost of electricity supply soars.

Home Energy Score was also not designed to encourage correction and avoidance of construction and installation defects. HEScore does not recognize the diagnostic testing protocols and energy calculation methods that the Energy Commission has developed to capture the effect of standard practices that result in these defects, and to provide energy savings credit for the efforts of contractors, particularly performance contractors endeavoring to meet BPI standards and Home Performance with ENERGY STAR style quality work, to install energy efficiency features with quality, supported by diagnostic testing and attention to detail. Home Energy Score defaults all measure inputs that California encourages to be measured through diagnostic testing, except for an allowance to opt to use blower door testing results for envelope leakage.

Energy Commission staff is in dialogue with the DOE staff, who are developing and refining Home Energy Score. This dialogue aims to enable Energy Commission staff to better understand the technical basis of Home Energy Score and the extent to which the differences in the HEScore system deviate from outcomes consistent with California energy policy goals for calculations and ratings.

### **Role of Performance Contractors and Raters in Delivering Energy Assessments and Ratings**

In the absence of a financial transaction that creates an opportunity for improving market information of a residential building's energy efficiency through disclosure of a home energy rating of a home, homeowners may have little motivation (other than having a means to compare their home to others) to request a home energy rating. Homeowners who are living in their current home and don't anticipate selling it in the near future, renting it out, or acquiring other financing of it may not be likely candidates for volunteering for a home energy rating. Many such homeowners may be extremely important candidates for energy assessments and potentially may be motivated to invest in deep energy efficiency upgrades.

These homeowners, who presently appear to represent the large majority of homes that make up the target audience for achieving deep upgrades, are likely to be well-served by a strong home performance contractor industry, with contractors who are skilled in performing whole-house energy assessments, explaining the desirability of such upgrades to homeowners, including the resulting non-energy benefits as well as energy bill savings, encouraging the sale of the upgrades to those homeowners, and completing quality installation of the upgrades so that the benefits are realized. In this case no home energy rating necessarily needs to be provided, particularly if no regulatory obligation is in place to cause home energy ratings to be completed.

As discussed, independent home energy raters could provide a valuable service to performance contractors to perform all or specific aspects of the energy assessment for such homes. Also, independent HERS Raters who market their services to such homeowners could perform energy assessments and provide HERS Ratings of the existing conditions of the home and provide projected ratings for potential energy upgrades. HERS Raters who participate in the market in this manner would be essentially “developing leads” for performance contractors, expanding the total number of upgrades completed in the state as a result of their efforts.

It is important that independent HERS Raters providing services in either of these modes “do no harm” in delivering their services. Such HERS Raters should perform their services with high quality and in a manner that is not disruptive to the performance contractor completing the sale and delivering deep energy efficiency upgrades.

Independent HERS Raters performing such services need to be highly skilled. They need to well understand the goals, practices and standards of the home performance contracting industry and prepare themselves to satisfy those goals and standards in their own work. They should understand the BPI Standards for Building Analysts, including combustion testing, and be credentialed and able to deliver consistent with those Standards. Independent HERS Raters who are working directly with homeowners must also be knowledgeable regarding all of the benefits arising from whole-house upgrades and should be able to deliver cost estimates that are reasonable for the given project. Doing so may be extremely difficult without experience in the contracting industry.

Although it is not a necessity that HERS Ratings be performed along with the completion of whole house improvements, it may be an important opportunity to do so. Delivering the HERS Rating in conjunction with the upgrade could be the least disruptive process for the homeowner, and lower transaction costs compared to having the rating done at a later date. This opportunity could be served through contractors who are certified under the California HERS Program as BPC companies with the ability to have BPC raters complete ratings on the work that the BPC companies complete. Alternatively, Independent HERS Raters could be called out at the end of the project to provide a HERS Rating along with the test-out phase of the project.

The Energy Commission views it as highly important that the delivery of energy assessments by HERS Raters or home performance contractors, and the delivery of HERS Ratings at test-out, be well-aligned and consistent with the goals, practices and standards of the home performance contracting industry. The work completed by HERS Raters in providing their services should be perceived as a value added by homeowners and performance contractors and should be designed and delivered to not be disruptive to accomplishing deep energy efficiency upgrades. The Energy Commission has endeavored to align the delivery of HERS Ratings with BPI Standards through the creation of the Building Performance Contractor path and believes that alignment should extend further to better prepare Independent HERS Raters for delivery of value-added services that expand the ability of California to attain deep upgrades.

## Moving Whole Building Multifamily Programs From Pilots to Standard Practice

The ARRA-funded programs in California piloted whole-building, performance-based approaches for multifamily buildings. The subcontractor teams administering these programs worked together with other stakeholders on the HERCC multifamily subcommittee to develop building simulation software improvements, energy assessment and report protocols, and cost-effectiveness and actual energy use comparison procedures. This work was designed to develop specific recommendations for improving the California HERS Program to more effectively address multifamily buildings, including expansion to include high-rise multifamily buildings. These pilots were designed to be foundational for a statewide whole building performance program for multifamily buildings.

For multifamily, affordable housing programs, coordination is strongly needed with the CPUC/IOU- and Community Services and Development (CSD) -administered weatherization programs. The goal should be to maximize the energy savings and the delivery of services to low-income participants through joining forces and collaborating to overcome differences in program rules. Barriers arise with needing to determine income eligibility of individual tenants when the whole building project is represented by opportunities with common spaces, central HVAC and water heating systems, and building envelope improvements for all of the dwelling units in the building, including those occupied by moderate-income tenants. Also, individual programs have limitations on which measures are eligible, and energy assessments are expected to be made for each program; measures that are eligible and recommended by the assessments of each program become baselines for determining cost effectiveness and recommendations for the remaining measures addressable through a whole-building performance program. Strategies for coordinating energy assessments and sharing of attribution of savings are critically needed.

Delivering energy assessments for a large number of dwelling units in multiple building campuses is a costly matter that needs further development and a focus on cost reduction. Particularly difficult is completion of combustion safety testing on a large number of dwelling units. Protocols for doing combustion testing in a safe but affordable manner are critical.

Strong success has been made on development of energy assessment protocols, building simulation, building screening, and data collection and actual energy use evaluation tools. All of these need to be brought forward into statewide programs and expansion of California HERS Program approaches.

## CHAPTER 5:

# Nonresidential Buildings: From Ratings to Retrofits

While there are many ways in which building owners can improve the energy efficiency of their buildings, industry best practice starts by assessing current energy performance through rating/benchmarking, followed by a holistic assessment of improvement opportunities. Many policy makers nationwide have introduced a new step to this process: disclosure of rating information. This chapter covers each of these fundamental steps in maximizing energy efficiency improvements for nonresidential buildings. Each step is summarized briefly below:

A rating is a quantified metric established to enable the comparison of the energy consumption and/or efficiency of buildings. Ratings can be classified as either an *energy use* rating or an *asset* rating; these two types of rating systems will be defined and discussed in detail later in this chapter. Benchmarking is another practice that has been used for many years for comparing building energy use either to peers or to a historical baseline.

Disclosure is the process of notifying parties of the rating that a building has received. The trigger point for requiring disclosure, and to whom the rating needs to be disclosed, varies depending on the specific policy. Rating disclosure programs can facilitate the market's valuation of energy efficiency within property financial transactions, such as leases and purchases, and seek to create public awareness of building energy use in the contexts of best practice property management and environmental stewardship.

An energy audit is a systematic approach to gathering information on a building with a structured method for problem-solving and decision-making. The primary goals of an energy audit are to determine and quantify how the building energy systems are performing, provide suggestions as to how that performance can be improved, and quantify the costs and benefits for the building owner<sup>76</sup>.

Existing building commissioning (also known as EBCx, retro commissioning, or RCx) is a systematic process for evaluating the functionality and operation of a building's systems and addressing the issues found, to meet the building owner's performance requirements. The data gathering and analysis portions of EBCx can be very similar to those in a detailed audit.

This chapter identifies how building ratings and disclosure, energy audits, and EBCx investigations are currently incorporated into the nonresidential market, what the perceived market needs are, and discusses possibilities for addressing these needs.

### Market Status

It is encouraging to note the countless examples of best practice steps to improve and value energy efficiency in existing buildings; The question is less about what is technically possible,

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<sup>76</sup> ASHRAE publication, *Procedures for Commercial Building Energy Audits, 2nd Edition*, 2011.

and more about how best practice can become business as usual for the majority of building owners. Market status around ratings, disclosure, and building assessments is summarized below.

## Rating Systems

Every nonresidential building is unique. Hence, if building owners want to assess the energy efficiency of their buildings, simply measuring energy use and comparing to other buildings' energy use will not allow for an "apples-to-apples" comparison. A building rating attempts to overcome this problem by accounting for expected variations in operational parameters, such that a building's energy use and/or levels of energy efficiency can be judged within a relative performance metric. Building ratings serve multiple purposes:

- Provide a metric for determining the relative energy efficiency of a given building
- Provide a means for communicating the benefits of improved energy efficiency
- Allow for long-term tracking of energy efficiency

Ratings fall into two general categories: energy use ratings (also known as "operational" ratings) based on actual energy use, and asset ratings based on the potential efficiency of the building's permanent energy-consuming assets.

### *Energy Use Ratings*

The key inputs required for an energy use rating are a building's actual energy use data (at least 12 months worth), along with a limited set of building-specific data, for example, size, type, address, occupancy percentage, and hours of operation. This data is analyzed and compared to a dataset that contains similar types of buildings, and a relative rating is determined.

By far the most recognized energy use rating tool in the United States is the Environmental Protection Agency's (EPA) ENERGY STAR Portfolio Manager, which provides a rating between 1 (least efficient) and 100 (most efficient) for buildings. The rating is "statistical," meaning that a given building's rating will indicate the percentile in which it lies relative to its peers. For example, a rating of 65 means that a building is more efficient than 64 percent of its peers. The underlying dataset used for comparison is the DOE's 2003 Commercial Buildings Energy Consumption Survey<sup>77</sup>. As of mid-2011, 230,000 buildings nationwide were benchmarked using Portfolio Manager, representing 24 billion square feet; of this total, 2,194 million square feet are in California, making it the state with the largest total floor area covered<sup>78</sup>. Obtaining a score of 75 or above qualifies a building for an ENERGY STAR plaque. A prerequisite for applying for the plaque is that the score be verified by a certified professional engineer (PE).

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<sup>77</sup> See <http://www.eia.gov/consumption/commercial/> for more details

<sup>78</sup> ENERGY STAR *Snapshot*, Fall 2011

Policy makers' selection of ENERGY STAR Portfolio Manager for disclosure legislation (covered later in this chapter) will likely bolster its position as the dominant energy use rating. In California, the CPUC has helped to promote ENERGY STAR by requiring utilities to benchmark properties through their programs<sup>79</sup>; as of 2011, almost 5,000 properties were reported to have been benchmarked as a result of this requirement, although there have been reported challenges such as matching meters to buildings, identifying building types and square footage, and customer privacy concerns<sup>80</sup>. Further reinforcement will likely come from the ever-growing body of research<sup>81</sup> that links higher ENERGY STAR ratings with higher property values.

ENERGY STAR Portfolio Manager requires some training, but it is free of charge, easy to understand, requires little effort to collect the required data, and is based on a fairly comprehensive national dataset. (Some have argued that the peer sample size for certain building types does not allow for robust statistical analysis.) The main drawback of Portfolio Manager is that its 5,000 square feet minimum size threshold, coupled with some building types being excluded, result in more than 50 percent of California's floor space being ineligible for a rating.

CBEURT (California Building Energy Use Rating Tool, pronounced "C-Burt") is being developed by the Energy Commission to complement Portfolio Manager. With both tools, the California building market can compare a building's energy use to both the national building stock and to other California buildings. CBEURT is designed to overcome the main drawback of Portfolio Manager and to provide a more comprehensive peer group database for California buildings. Features of CBEURT include:

- The ability to rate buildings smaller than 5,000 square feet
- Rating metrics are designed to complement California's Zero Net Energy (ZNE) goals, that is, a zero rating is zero net energy, and a 100 on the scale is energy use equivalent to the median California building of the type being rated.
- Ratings are possible for buildings with multiple occupancies.;
- The data source is the California End Use Survey (CEUS) (2003)<sup>82</sup>, not CBECS.
- California climate data is used to normalize the energy use data.

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79 Refer to CPUC Decision 09-09-047.

80 Statewide Benchmarking Process Evaluation, *Volume 1: REPORT*; April 2012; NMR Group

81 An example is Eichholtz, Piet, Nils Kok, and John M. Quigley. Working Paper No. W10-003: The Economics of Green Building. Web. April 2011. In this paper, "green" buildings are considered to be those that have either a LEED certification or are certified for energy efficiency by the US EPA's Energy Star Program. Other examples can be found at <http://www.buildingrating.org/content/efficiency-property-value>

82 Itron, Inc., *California Commercial End-Use Survey*. March 2006. Data based on a survey of 2,800 commercial properties in California, as opposed to CBECS, which is based on a national dataset of 5,215 buildings.

CBEURT is intended to be offered as both a Microsoft Excel® spreadsheet and as a Web-based energy rating tool and is planned for release in the first quarter of 2013.

ASHRAE's Building EQ (bEQ) "In Operation" rating provides a building with an A+ (most efficient) to F (least efficient) rating, based on actual energy use. ASHRAE bEQ was released in 2012 and, like Portfolio Manager, is based on the CBECS database. Beyond the differences in how the rating is communicated, bEQ also differs from Portfolio Manager in that it is not free, and there is a more structured assessment process required to obtain a rating. A bEQ rating can be provided only by a certified building energy assessment professional, it includes an ASHRAE Level I Audit, and it requires a \$500 registration payment to ASHRAE. In addition, the bEQ energy assessment includes highlighting potential energy conservation measures, although they do not directly contribute to the rating itself. It is too soon to evaluate the market impact of the bEQ rating.

NABERS, the National Australian Built Environment Rating System, is a performance-based rating system for existing buildings. The main outputs of NABERS are ratings between one and six stars for both energy and water use. The rating, covering offices, hotels, retail, schools, hospitals, and homes, is tailored for use by building owners, managers, and building occupants. Depending upon who is seeking a rating and the scope of its influence, NABERS will require a different set of inputs, for example, building occupants can report on the performance aspects relating to the elements under *their* control. The NABERS rating system has been featured in mandatory disclosure legislation since 2010.

The link between energy use ratings and property value has been reported several times. (See earlier note.) This link would suggest that energy use ratings are a valuable element for property transactions, but technically there is one major limitation of energy use ratings in this context. Energy use is strongly influenced by operational factors, occupancy, hours of use, and so forth. These are factors that may change significantly when a new owner takes on a property, thus reducing the relevance of the prior owner's energy use rating. This limitation is one of the major factors behind the drive to develop asset ratings.

### *Asset Ratings*

Asset ratings are somewhat analogous to an MPG rating for a car, in that they express a measure of performance *potential* as opposed to measuring how a vehicle has performed for an actual owner. There are two noteworthy differences, however:

- Asset ratings are determined through building energy modeling, whereas an MPG rating is the result of a standardized road test.
- While an MPG rating can be used to compare the relative efficiency of cars across vehicle classes, asset ratings are generally only comparable for buildings of the same type.

In the context of an asset rating, an "asset" can be defined as anything that affects energy use that is typically left in place when a property is sold. For example, insulation, HVAC equipment, lighting systems and windows are assets, whereas photocopiers, occupants, and refrigerators are not. An asset rating determines a rating based on all assets performing

optimally, with all other input factors being based on default assumptions. The principal benefit of an asset rating is that it allows a potential buyer to compare multiple properties, even when those properties are being operated very differently from each other. A secondary benefit is that a building owner considering an energy efficiency upgrade can determine the rating that would be achieved as a result of making the improvement.

Asset ratings have been implemented in multiple European countries as a result of the European Energy Performance of Buildings Directive<sup>83</sup>. Ratings are based on an A (most efficient) to G (least efficient) rating with some variations between countries. In the United Kingdom, an A rating represents zero net energy use, and an average property would gain a rating of D or E. (The rating scale is linear.)

In the United States, DOE and the State of California are each developing an asset rating system, and Massachusetts Department of Energy Resources is completing research to support the future development of an asset rating program.

California's BEARS is entering a pilot phase to evaluate the practicality, robustness, and cost of the process. The system will rate a building on a linear (not statistical) scale between 0 and 250, with zero representing net zero energy use and 100 representing a code-based benchmark. The rating represents the ratio of the rated building's energy use to a code-based benchmark. For example, if the rated building as modeled uses 30 percent more energy than the code-based benchmark, then its rating will be 130.

DOE's asset rating is also in the pilot phase, and specifications have not yet been publicly released. (Various design-related options have been reported and released for public discussion.) One way in which it is expected to be different from BEARS is that DOE is expected to use source energy<sup>84</sup> as the main energy metric, whereas BEARS will use the TDV<sup>85</sup> of energy. DOE's asset rating scale is expected to be similar to ENERGY STAR Portfolio Manager, where 100 is best and 1 is worst in terms of relative energy efficiency. Another key difference expected is that DOE's asset rating will include an assessment of potential improvement opportunities.

Cost is perhaps the greatest challenge for asset rating development. A comprehensive site assessment combined with simulation modeling can cost more than \$10,000. An asset rating needs to significantly reduce that cost while still being technically robust. Innovative approaches to field data collection may be explored as a way of limiting costs, such as thermal

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83 Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the Energy Performance of Buildings. Available at <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32010L0031:EN:NOT>.

84 Source energy is a metric that encompasses all the energy used in delivering energy to a site, including power generation and transmission and distribution losses, as opposed to "site energy" which includes only the energy used at the building (that is, the amount of energy that appears on the utility bill)

85 Time-dependent valuation is based on the cost for utilities to provide energy, which can vary based on time of day/week/year. More details at <http://www.energy.ca.gov/title24/2005standards/archive/rulemaking/documents/tdv/index.html>.

imaging technology or determining building envelope parameters from digital photos or Google Maps, iPad applications, and so forth.

Beyond the technical challenges of asset rating development, there will likely be significant market challenges. ENERGY STAR Portfolio Manager has been around for a decade and has high market recognition in certain submarkets, such as Class A buildings. As asset ratings enter the market, the key questions to answer will be: What is an asset rating? How is it different from Portfolio Manager? Why is another rating needed?

### Disclosure of Ratings

Policies that require disclosure of building ratings are becoming more popular nationwide. The primary driver for these policies is to increase visibility of energy performance, which in turn is expected to create greater value around energy efficiency. While ratings and disclosure of ratings do not directly save energy, these are activities that are expected to create long-term market transformation.

The European Union developed the Energy Performance of Buildings Directive in 2002, which outlined ratings (energy use and asset ratings) and disclosure guidelines. In the United States, California was the first to enact disclosure legislation (AB 1103), and policies are in place or proposed in three states and six cities<sup>86</sup>.

Many of the national disclosure policies share common features, with the main variables being:

- **Disclosure trigger:** Some policies, like California's AB 1103, require disclosure at time of sale, lease or finance; others require disclosure on a date-certain timeline.
- **Building size threshold:** All disclosure policies have a minimum building size threshold, ranging from 5,000 square feet to 50,000 square feet. In addition, some policies include multifamily properties, and some do not.
- **Parties to disclosure:** Disclosure may be to a potential buyer/lessee/lender, to the state or local government, or public. To date, public disclosure of ratings has only been required of public buildings. **Additional requirements:** Some policies incorporate an energy audit requirement in addition to a rating.

#### *EU's Energy Performance of Buildings Directive (EPBD)*

The EPBD is a set of 14 articles developed in 2002 that provide strategic direction to the 27 countries of the European Union. The articles of concern require all public buildings, 500 square meters or larger (about 5,000 square feet) to benchmark their energy performance and post the result in the building. In addition, policies are in place regarding time-of-sale

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<sup>86</sup> [www.buildingrating.org](http://www.buildingrating.org) is a comprehensive website covering national and international disclosure policies. U.S. policies are detailed at [http://www.buildingrating.org/sites/default/files/documents/Commercial\\_Benchmarking\\_Policy\\_Matrix.pdf](http://www.buildingrating.org/sites/default/files/documents/Commercial_Benchmarking_Policy_Matrix.pdf).

disclosure for commercial properties. The EPBD was revised in 2010 to include all buildings that are “frequently visited by the public,”<sup>87</sup> and in 2015, buildings greater than 250 square meter will require certification. Certification is required at least once every 10 years and must be provided by a certified independent expert. Implementation of disclosure by the 27 countries is widely variable. Some countries have been requiring some type of disclosure for years (England and Wales), whereas many countries are only just starting to implement this directive.

### *California Assembly Bill 1103*

AB 1103<sup>88</sup> requires disclosure of a building’s ENERGY STAR score at time of sale, lease, or refinance for buildings larger than 5,000 square feet. The regulation, effective January 1, 2013, will require that disclosure is made to the potential buyers, lessees, or lenders. The policy, originally proposed in 2007, has experienced some delays in implementation, with multitenant properties being a considerable challenge. In cases where tenants are sub-metered and pay their own energy bills (a common situation), owners cannot force their tenants to disclose their energy use, and so they cannot obtain the data necessary to create a whole-building energy use rating. This challenge has been overcome by enabling utilities to provide combined whole-building data to building owners in multitenant situations; this provides the owner with the data to develop the rating but preserves confidentiality of each tenant’s individual energy use data.

### *San Francisco’s Existing Commercial Buildings Energy Performance Ordinance*

San Francisco’s Existing Commercial Buildings Energy Performance Ordinance<sup>89</sup> (“San Francisco Ordinance”), implemented in 2011, goes beyond the requirements of AB 1103 (table 2.)

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87 Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings, Article 13, sub-article 2.

88 More details at <http://www.energy.ca.gov/ab1103/>.

89 More details at <http://www.sfenvironment.org/energy/energy-efficiency/commercial-and-multifamily-properties/existing-commercial-buildings-energy-performance-ordinance>.

	AB 1103	San Francisco Ordinance
Implementation	1/1/2013	10/1/2011
Size Threshold	5,000 square feet	Initially 50,000square feet then second phase 10,000 square feet
Disclosure Trigger	Time of sale	Date-certain, with first phase deadline of 10/1/2011
Parties to disclosure	Buyer/Lessee/Lender	Phase 1: to the city Phase 2: public (starting 4/1/4012)
Audit Requirements	None	At least once every 5 years ASHRAE Level 1 or 2 audit, depending on building size

The San Francisco Ordinance was developed in partnership with a taskforce comprising a broad cross-section of industry stakeholders<sup>90</sup>.

*Voluntary Disclosure Programs*

In addition to mandatory rating disclosure policies, there are also examples of voluntary disclosure programs. Examples include:

**Seattle 2030 District:**<sup>91</sup> Motivated by the recently passed Seattle Energy Disclosure Ordinance<sup>92</sup>, downtown property owners and managers are sharing utility data to create the Seattle 2030 District. Usually considered proprietary data, property owners are working together to develop a baseline of district wide energy use and strive collectively to meet the 2030 Challenge (energy use 50 percent or less than the national average energy use). The Seattle 2030 District intends to go beyond just the data gathering and reporting required by the ordinance. The committee has

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90 Further details can be found in the *Final Report and Recommendations of the Mayor’s Task Force on Existing Buildings*. Available at [http://www.imt.org/files/FileUpload/files/Benchmark/sf\\_existing\\_commercial\\_buildings\\_task\\_force\\_report.pdf](http://www.imt.org/files/FileUpload/files/Benchmark/sf_existing_commercial_buildings_task_force_report.pdf).

91 <http://buildingconnections.seattle.gov/2010/06/30/442/>.

92 Details at <http://www.seattle.gov/environment/benchmarking.htm>.

begun to collect and analyze data to define current baselines and reduction targets for energy, water, and vehicle miles traveled. Concurrently, the committee is exploring best practices for energy efficiency improvements as well as incentive and financing plans to implement improvements.

**Greenprint:**<sup>93</sup> Greenprint Foundation, a worldwide alliance of leading real estate owners, investors, financial institutions, and other stakeholders committed to reducing carbon emissions across the global property industry, announced that its Greenprint Global Cities Office Index has been accepted as a Clinton Global Initiative (CGI) Commitment to Action as of September 2011. The Global Cities Office Index is Greenprint's commitment to develop a series of global cities office indices for benchmarking environmental performance of the investment sector of the built environment.

### Initial Investigations for Efficiency Opportunities

A major factor in determining potential opportunities for improving nonresidential properties is risk management. The cost of assessing a property should ideally match the magnitude of the savings, so an initial low-cost screening can be a valuable tool for avoiding high-cost energy audits for properties with low savings potential. Screening can also help portfolio owners to prioritize properties for more detailed assessments.

#### *Energy Data Analysis*

Without even visiting a property, analysis of its energy use data can provide some indication of current performance and potential. Monthly energy use data can be analyzed to estimate the portion of energy devoted to heating, cooling, and base loads. FirstView is a tool that the New Buildings Institute is developing that analyzes energy use data in this way, compares demand with ambient temperature, and develops an "energy signature" for a property. A building's energy signature can provide some pointers toward potential energy savings. For example, observing relatively high gas use when ambient temperature is high can indicate that the heating system is operating when it is not needed.

The availability of energy use data at a higher resolution is becoming more prevalent through smart meters. Smart meters, also known as interval meters and collectively as the Advanced Metering Infrastructure (AMI), provide data at intervals of one hour or even less and can give a much more detailed insight into a building's energy use characteristics. Engineering analysis of interval data is a common part of an EBCx project, but now automated tools are appearing that have the potential to make such analysis commonplace. FirstFuel is one such tool, with a patent-pending analysis engine that is claimed to be able to separate energy data into end uses and to identify potential improvement opportunities. The benefits of this type of analysis are twofold: First, it can help portfolio owners or even utilities to identify properties that the greatest improvement potential. Second, it can help to focus efforts for an on-site assessment in the areas where problems appear to be greatest.

While automated energy analysis software tools show great promise, market penetration is currently low. A key factor is thought to be that the software doesn't directly save energy, so

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93 [http://www.greenprintfoundation.org/News/Clinton\\_Global\\_Initiative.aspx](http://www.greenprintfoundation.org/News/Clinton_Global_Initiative.aspx).

payback is hard to calculate for an owner. For the same reason, these tools have not yet become established through utility programs. An additional barrier is that there are a high number of tools available and no established specifications. Therefore, it is hard for owners and utilities to know if they are backing a winning product or one that will become obsolete.

### *Use of Benchmarks*

Benchmarking is useful in prioritizing areas of focus among a portfolio of properties. It is natural that greater priority should be placed on improving properties that are least efficient, although there are caveats: benchmarking does not identify where the most *cost-effective* improvements can be made, and there is no reason why a building with a good benchmark cannot reap significant savings. Beyond prioritization, ratings can also be integrated into a project proposal, that is, expected ratings *after* upgrades can be included in the proposal, so that an owner can factor in the value of the higher rating alongside the direct energy savings benefits from the project.

Benchmarking based on energy use ratings can identify buildings that could benefit from physical upgrades as well as operations and maintenance (O&M) improvements. If energy use data are available for multiple end uses, there is even greater potential to identify specific areas of opportunity. ENERGY STAR Portfolio Manager is useful for performing whole-building benchmarking analyses, but not all buildings are eligible for a rating. In such cases, manual benchmarking can be performed through identifying similar building types for comparison. In Minnesota, for example, the B3 benchmarking tool was developed for public buildings as they are not well-represented within ENERGY STAR Portfolio Manager.

Asset ratings can be employed to identify buildings where potential for physical upgrades exists and can indicate specific equipment that falls farthest below benchmark standards, such as current building code. When using asset ratings, it is important to separately assess equipment operation, as the rating process deliberately ignores operational characteristics to understand the performance of a building's permanent energy assets.

### *On-Site screening*

Beyond energy data analysis, a second level of opportunity assessment will typically require a site visit from a specialist. At this point, the full extent of opportunities is still unknown, so it is helpful to get a general indication without the need for a detailed and expensive investigation. An ASHRAE Level I audit (see next section) incorporates energy data analysis with a brief site visit; some utility EBCx programs provide a similar level of screening prior to customer commitment. The California Commissioning Collaborative recently completed development of the Facility Operations Assessment, a walkthrough and reporting process for indicating the extent of operational opportunities<sup>94</sup>. This process is somewhat similar to the ASHRAE Level 1 audit, although the site walkthrough checklist and reporting templates are prescribed in more detail than for the ASHRAE audit.

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<sup>94</sup> Facility Operations Assessment description and toolkit is available at <http://www.cacx.org/resources/rcxtools/foa/>.

## Energy Audits and EBCx Investigations

The most common framework for describing the work performed in an energy audit has been established by ASHRAE<sup>95</sup>, which has developed guidelines for Level I, II, and III audits that progressively increase in depth and cost.

ASHRAE is updating Standard 100-2006<sup>96</sup>. Standard 100 defines a process for auditing and upgrading the energy efficiency of existing buildings to meet specific energy use targets. This standard defines the responsibilities of the building owners, energy auditors, and local building officials when upgrading the energy efficiency of a building.

EBCx includes an investigation that is somewhat similar in depth to an ASHRAE Level II audit. A key difference is that the EBCx process does not end until improvements have been implemented and verified (and sometimes can even extend beyond that point to conduct ongoing commissioning, such as through continuous performance monitoring). EBCx also includes development of a plan for persistence of benefits related to the measures implemented as part of the EBCx process.

The commissioning process is not defined under any specific standard, although there are multiple examples of best practice guidelines. There are also multiple certification programs nationwide<sup>97</sup>. ASHRAE Guideline 0.2 and 1.2 (in progress) are two of several guidance documents that are attempting to define the scope of EBCx.

### *Description of Audit Types*

Energy audits are well-established processes that have been honed over the decades. Summaries of the three types of ASHRAE audits follow:

#### **ASHRAE Level I Audit – Walk-Through Analysis/Preliminary Audit**

The Level I audit is often called a “walk-through audit” and involves brief interviews with site operating personnel, a review of the facility’s utility bills and other operating data, and a walk-through of the building. The ASHRAE Level I audit is geared toward the identification of the potential for energy improvements, understanding the general building configuration, and defining the type and nature of energy systems. The audit should result in a preliminary, high-level, energy-use analysis for the entire facility and a short report detailing the findings, which may include identifying a variety of recognizable efficiency opportunities. Usually this report does not provide detailed recommendations with cost/benefit information, except for very visible projects or operational faults. Preliminary recommendations with rough associated costs and benefits are typically included in an ASHRAE Level I audit report.

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95 ASHRAE publication, *Procedures for Commercial Building Energy Audits, 2nd Edition*, 2011.

96 BSR/ASHRAE/IES Standard 100-2006R; *Proposed Revision of Standard 100-2006, Energy Efficiency in Existing Buildings; First Public Review Draft* (May 2012).

97 The California Commissioning Collaborative has a summary of certification programs, available at [http://www.cacx.org/resources/provider\\_cert.html](http://www.cacx.org/resources/provider_cert.html).

## **ASHRAE Level II Audit – Energy Survey and Analysis**

A Level II audit evaluates the building energy systems in detail to define a variety of potential energy-efficiency improvements. This should include the building envelope, lighting, HVAC, domestic hot water (DHW), plug loads, and compressed air and process uses (for manufacturing, service, or processing facilities). This study starts with a detailed analysis of energy consumption to quantify base loads, seasonal variation, and effective energy costs. From there, the study should include an evaluation of lighting, air quality, temperature, ventilation, humidity, and other conditions that may affect energy performance and occupant comfort. The process also includes detailed discussions with the building owners, managers, and occupants to explore potential problem areas and to clarify financial and nonfinancial goals.

The Level II audit should result in a clear and concise report and briefing with the owner and management team describing a variety of energy efficiency measures including no- and low-cost measures, modifications to system controls and building automation, operational changes, and potential capital upgrades. The findings should include costs and savings information, as well as a means for the owner to evaluate the energy conservation measures (ECMs) and decide how to proceed with implementation.

## **ASHRAE Level III Audit – Detailed Analysis of Capital-Intensive Modifications**

Some of the system upgrades or retrofits revealed by the Level II audit may require significant investments of capital, personnel, and other limited resources. Before making this level of investment, the owner will want to have a more thorough and detailed understanding of the benefits, costs, and performance expectations. This is the purpose of the “investment-grade” Level III ASHRAE audit. There may be only a few capital-intensive energy efficiency measures exposed by the Level II audit, or there may be dozens for larger facilities. In most cases, since this cannot be clearly determined or accurately estimated in advance, the recommendation and scope definition for a Level III audit usually is an outcome of the Level II process.

The ASHRAE Level III audit often includes (but doesn’t specifically require) a building simulation calibrated to actual energy use. The ASHRAE Level III audit involves more detailed data collection over the course of weeks or months. Data loggers typically will be placed temporarily (at least two weeks is typical) to monitor the operation of pumps and motors, temperatures of affected spaces, lighting levels, switching behavior, and other factors. Once system-specific data have been input into the building simulation, the energy use predicted by the simulation is cross-checked to actual use, to validate the accuracy of the simulation.

Once calibrated, the simulation can be used to model the potential energy impacts of various proposed system improvements; combining that process with construction-grade cost estimating supports informed investment decisions<sup>98</sup>.

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<sup>98</sup> <http://microgridenergy.com/the-difference-between-ashrae-level-1-2-3-energy-audits/>.

## Description of EBCx Investigations

An EBCx investigation<sup>99</sup> can resemble an ASHRAE Level II audit, in that it involves the collection of energy and system data, an evaluation of opportunities, and a determination of costs and energy savings for those opportunities. The main difference between an EBCx investigation and an ASHRAE Level II audit is that the EBCx process includes implementation and verification of ECMs, update of O&M manuals, training of operations staff, plans for maintaining persistence of benefits, and in some cases an ongoing monitoring period after the project ends to ensure that improvements persist.

It is commonly stated that the main difference between audits and EBCx is that audits look at retrofit opportunities and EBCx focuses only on O&M improvements. In practice, this distinction is more due to a specific owner's scope requirements – both processes can cover retrofits and O&M improvements.

In California, EBCx has been established in utility programs for almost a decade, under the titles “Building Tune-Up,” “Monitoring-Based Commissioning,” or “Retrocommissioning.” These programs have not implemented best practice commissioning because they have been primarily focused on O&M energy savings and due to budget limitations. A best practice EBCx process works to meet the owner's current facility requirements, whatever they may be, through identifying and implementing facility improvement measures. In addition to energy benefits, these measures can yield non-energy benefits such as improved occupant comfort and extended equipment life. The utility EBCx programs, while they include a limited investigation budget, have reaped significant savings (between 5 percent and 15 percent, typically) and have honed their program processes over successive program cycles to improve cost-effectiveness.

One of the key challenges for utility programs is that significant investment is required to investigate a building (budget is typically \$0.10 per square foot, paid by the utility) before a detailed understanding of savings potential is known. There is a risk in this case that eventual savings will not justify the investigation cost. Utilities have reduced this risk by requiring that owners implement ECMs that have a simple payback of less than one year. Measurement and Verification (M&V) is another challenge. EBCx is a whole-building optimization process, but utility programs require each ECM to be calculated and verified separately, which can lead to lengthy cycles of review. Two standardized savings calculation tools – “BOA” and “C-BOA” – have been developed to reduce the calculation review time and cost<sup>100</sup>. Whole-building approaches to M&V using energy use data are being explored as an alternative; this was the

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99 For more information on EBCx, The Building Commissioning Association has developed a best practice guideline, available free at <https://netforum.avectra.com/temp/ClientImages/BCA/b352902a-e491-4609-80ef-dc1bf6c8f6af.pdf>

100 BOA stands for *Building Optimization Analysis*, and C-BOA stands for *Custom Building Optimization Analysis*. Both spreadsheet tools are available for free download at [http://www.cacx.org/resources/rcxtools/spreadsheet\\_tools.html](http://www.cacx.org/resources/rcxtools/spreadsheet_tools.html).

subject of a stakeholder workshop in May 2012 organized by the California Commissioning Collaborative<sup>101</sup>.

The Continuous Optimization Program run by BC Hydro (Canada) is an example of an innovative approach to EBCx that is proving successful. The two features offered by BC Hydro that have not been implemented in California are (a) the use of an advanced energy information system (EIS) to measure savings at the whole building level and to track persistence of savings, and (b) the provision of a remote energy manager/coach to work with building staff. These features, fully subsidized by the utility, have been instrumental in gaining rapid uptake – as of October 2011, the program had enrolled 117 customers, representing 468 sites. No projects have yet been completed, but the first 75 investigations showed an average expected savings of 11.5 percent.

Outside of utility EBCx programs, there is little data to quantify the volume of EBCx projects happening in California or nationally. While it is thought that EBCx has enjoyed steady growth over the last decade, there is little to suggest that it is normal practice, let alone that it is performed every 3-5 years as is typically recommended<sup>102</sup>. For this reason, the continued support from utilities is vital for the continued growth of EBCx practice and to further hone the EBCx process. The application of advanced software tools – such as advanced EIS and automated fault detection and diagnostics (FDD) – within EBCx program frameworks shows great promise for automating M&V, uncovering additional savings, and providing greater assurance that savings will persist. Beyond these technical benefits, the software could also be a useful recruitment tool for building owners needing better energy management<sup>103</sup>.

Similar to EBCx, there is little data on the volume of ASHRAE energy audits performed. It is thought that they are often incorporated as part of ESCO projects, which are predominantly applied within the public sector (About 80 percent of ESCO projects are public sector.) Within utility programs, energy audits are uncommon. Multiple utilities have “nonresidential audit” programs, but formal ASHRAE audits are restricted to customers with high demand (>200kW), of which there are relatively few. (Smaller customers receive online or phone audits typically.) Policies such as the San Francisco Ordinance<sup>104</sup> may lead to a larger volume of ASHRAE audits in future and may provide a resource for tracking the volume and quality of audits performed.

Performing an energy audit or EBCx is a complex process if carried through to upgrade, monitoring, and verification, typically involving capital outlays, the hiring of consultants and contractors, and time-consuming consultation with financiers and utilities. Some of the greatest

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101 Workshop summary report available at [http://www.cacx.org/meetings/meetings/2012-05-03/Whole\\_Building\\_Workshop\\_Summary\\_Report\\_v2.pdf](http://www.cacx.org/meetings/meetings/2012-05-03/Whole_Building_Workshop_Summary_Report_v2.pdf).

102 The State of California has shown leadership in this area, through executive orders that require commissioning for state buildings.

103 Application of advanced software tools in programs was part of the CCC workshop referenced in note 69 above.

104 Ibid at note 13.

barriers to the implementation of audits/EBCx revolve around the time and expertise required to realize the benefits of these processes. For owners to determine the consultants who can provide results in a cost-effective and timely manner is labor-intensive. One limiting factor to market uptake of these processes is the time cost for company personnel to get up to speed and execute their first successful project.

In addition, the knowledge level for larger organizations is deeper and generally more capable of dealing with the complexities of an upgrade process compared to typical small business owners, thus tending to cause small businesses to not participate in energy audit and upgrade programs.

## Redesign Tools

With the plethora of options available for improving energy efficiency, it is understandable that owners often find it challenging to know where to start and how to select an approach that fits their long-term needs. It is common that large owners will develop relationships with trusted specialists who can advise them on the available options and help plan for successful projects. For smaller owners with fewer resources, it is more difficult. There is no shortage of advice available through electronic newsletters, websites, webinars, and so forth, but it remains a challenge to digest the volume of information and to integrate all this information into a successful project plan. The DOE is developing Advanced Energy Retrofit Guides to help owners in their project planning. Several guides for different building types have been released to date<sup>105</sup>, and others are to follow. These guides outline a range of efficiency improvement options with typical cost/benefit data, covering O&M ECMs, retrofit ECMs, and deep retrofit packages of ECMs.

The term “deep retrofit” (sometimes called “deep renovation”) refers to an integrated process whereby a comprehensive package of ECMs is implemented in a building, likely including major envelope upgrades. A deep retrofit project can result in energy savings beyond 50 percent, taking a comprehensive approach means that load-reduction strategies such as envelope enhancements (for example, efficient windows and shading, lighting upgrades) can be paired with downsizing of HVAC equipment. Deep retrofit projects are not common, but there are several case studies, research reports, and guides that are leading the way<sup>106</sup>. Rocky Mountain Institute’s “Retrofit Depot<sup>107</sup>” is a valuable Web-based resource with news, case studies, and guidance on deep retrofits, targeted at owner-occupiers, investors, tenants, and service providers.

Employing advanced technology for all types of building assessment, whether high-level screening or detailed assessment, has potential to improve the quality of outcomes and reduce costs. Infrared camera technology, streamlined modeling tools, energy modeling algorithms, and so forth can automate traditionally manual processes and even provide completely new

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105 <http://www.ashrae.org/standards-research--technology/advanced-energy-design-guides>.

106 New Buildings Institute is a useful resource for deep retrofits, at [www.newbuildings.org](http://www.newbuildings.org).

107 [http://www.rmi.org/retrofit\\_depot](http://www.rmi.org/retrofit_depot).

insights into building performance and potential. A host of options are available, although typically market penetration is slow due to (a) challenges for utilities in assessing such a wide range of technology options for consideration in rebate programs, (b) conservatism among service providers, and (c) potential confusion caused by vendors' bold claims coupled with their reticence to disclose details of how their products actually work. These factors are all present in current efforts to promote EIS software.

## Market Needs

### Trusted Rating Systems That Are Valued by the Nonresidential Market

Market needs for an energy use rating system are largely met by the ENERGY STAR Portfolio Manager tool – it is free, easy to understand, and has high market recognition. The only major market need is to make the tool applicable to properties under 5,000 square feet, as this encompasses a high proportion of commercial floor space. Beyond that, an updated CBECs survey (the most current dataset is from 2003) should provide more up-to-date benchmarks while bolstering sample sizes for some building types; A CBECs update is expected in 2014, which will cover 2012 energy use data<sup>108</sup>.

Beyond needs for the energy use rating tool itself, the key market need is for building rating to become standard practice. Based on published literature, market penetration for energy use ratings in the office sector (especially Class A) and the public sector appears high, but beyond that it is hard to determine penetration rates. The San Francisco Ordinance, AB 1103, and efforts by California utilities will continue to push for wider implementation of energy use ratings. Additional market “pull” is needed.

Asset ratings have not yet been implemented in California or elsewhere in the United States. The critical market needs are to understand the value of asset ratings and to be able to distinguish between the purpose of an asset rating and an energy use rating. Beyond that, knowing that an asset rating will not be free, there needs to be sufficient value inherent in the rating itself, through its use as a project planning tool and/or because a higher asset rating correlates to higher property value. A critical foundational market need is for stakeholders to have confidence in the rating as a measure of a building's energy efficiency – there are two key elements here:

- **Technical specifications:** The rating must be accepted as a reliable measure of a building's energy efficiency.
- **Quality assurance:** The rating process and the workforce implementing the rating needs to be consistent across all buildings rated.

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108 Refer to <http://www.eia.gov/consumption/commercial/> for more details.

## A Collaborative Approach to Developing Disclosure Policies

The key need regarding disclosure policy for nonresidential buildings is that it cause minimal or no disruption to normal business practice. In the context of a property transaction (the trigger for AB 1103 disclosure, for example), this would mean that owners consider any additional cost to be worthwhile, and that there is no disruption to the sales process or timing.

Among building owners it is natural to expect resistance to a “naming and shaming” approach that requires public disclosure of ratings. To implement such a policy would disrupt normal business practice for properties with a low rating, as they may quickly become uncompetitive.

Given that disclosure of ratings is still a new practice, there is a general market need for collaboration – this can help to ensure that building owners appreciate the long-term societal benefits attached to such policies, and that they feel they have a hand in shaping such policies. It is vital that a broad cross-section of property owners is represented, as different market segments will have differing needs and viewpoints.

From the policy makers’ perspective, a major need is to maximize and track compliance with limited resources. Employing a host of “enforcers” and resorting to legal challenges over noncompliance are undesirable uses of public funds. Beyond tracking compliance, it is also important to track long-term improvements in energy efficiency statewide.

## Robust and Inexpensive Tools to Screen for Energy Efficiency Opportunities

The key market need around initial investigations is that they provide the maximum output for the minimum cost. “Maximum output” would mean that the investigation provides an indication of potential for savings with high confidence, perhaps even pinpointing specific opportunities. “Minimum cost” relates to the actual total cost, rather than simply minimizing building owner cost through the use of utility program rebates.

Market needs around initial investigations generally fall into two categories:

- **Programmatic needs:** To maximize a program’s cost-effectiveness, a high-level, low-cost screening tool is valuable for prioritizing sites for investigation.
- **Building-specific needs:** Given that every nonresidential building is essentially unique, an initial investigation needs to be based as much as possible on data specific to that building. For example, an investigation finding such as *“adding lighting controls will typically save 2 percent of energy costs with a simple payback of four years”* is of limited use.

Another need that applies to both programs and building owners is the integration of investigations within a broader framework. The outputs of the investigation need to direct owners to the next step in the process, whether it be contacting a utility representative about specific programs or contacting a service provider for a bid or a more detailed energy audit.

## Cost-Effective Energy Audits and EBCx Investigations as a Foundation for Whole-Building Approaches to Energy Efficiency

For both energy audits and EBCx investigations, there is a well-trained (and often certified) workforce available to perform high-quality work. It can be argued that there is a need for unification of the various certifications, guidelines, and standards around EBCx, but while this

would be highly challenging, a far easier option would be to educate owners about the options available to them.

The greatest need around energy audits and EBCx investigations is simply to complete more of them; the benefits of both are widely acknowledged, but market penetration is relatively low. In the context of California's long term energy savings goals, a whole-building approach to energy efficiency is critical, and energy audits or EBCx are the fundamental starting point for any whole building approach.

Making the EBCx process more cost-effective, particularly within utility programs, could be a major factor to increase market penetration. Areas to reduce costs include reducing the effort required to collect building performance data, reducing the on-site labor required for investigation, and reducing the cost and increasing the confidence in the M&V requirements.

A commonly raised need is for a cost-effective whole building approach for smaller commercial properties (that is, smaller than 100,000 square feet). Typical EBCx best practice is not cost-effective for smaller properties for two principal reasons: Energy savings for a smaller building will be less than for a large building, and smaller buildings tend not to have central digital controls. (These are important for data collection and implementing control strategies.) There are some exceptions: Labs, grocery stores, and data centers, while typically smaller than 100,000 square feet, can have high energy use and central controls, but there are still no established EBCx programs for these subsectors.

In the context of meeting California's energy efficiency goals, another need for audits and EBCx investigations is to integrate identification of demand response opportunities. Control systems are central to audits/EBCx and to demand response, but to date there is no established program approach that combines them.

## **Options for Addressing Needs**

### **Rating Systems and Disclosure Policy**

The Institute for Market Transformation is the foremost authority in the United States with regard to ratings and disclosure policy, and its report *Building Energy Transparency: A framework for Implementing U.S. Commercial Energy Rating & Disclosure Policy*<sup>109</sup> is a comprehensive resource for understanding market needs and keys to success. This report, which focuses more on energy use ratings than asset ratings, informed many of the options and recommendations listed below.

#### *A Comprehensive and Collaborative Approach to Implementation*

The mayor of San Francisco's cross-functional taskforce on existing buildings played a role in shaping the San Francisco Ordinance.– Lessons learned from this task force approach could be useful in developing statewide rating systems and disclosure policies. Whether through a task force or other means, it could be beneficial to contact building owners directly and leverage and

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109 Available at [http://www.buildingrating.org/sites/default/files/documents/IMT-Building\\_Energy\\_Transparency\\_Report.pdf](http://www.buildingrating.org/sites/default/files/documents/IMT-Building_Energy_Transparency_Report.pdf).

educate local businesses to develop programs and to support outreach. Identifying industry partners such as the Building Owners and Managers Association (BOMA), the Commercial Real Estate Development Association (NAIOP), and the California Business Properties Association (CBPA) can have a major effect on market acceptance of statewide energy efficiency policies. Statewide collaborative efforts can underpin a comprehensive outreach program and a media campaign to educate building owners and promote energy efficiency.

### *Robust Rating Systems That Are Trusted by the Market*

To demonstrate the robustness of rating systems to the nonresidential buildings market, a series of case studies could form part of an outreach campaign. Case studies could highlight examples where owners took their buildings from a low to a high rating through a sequence of upgrades, for example. Collaborating and co-branding with industry organizations (for example, BOMA, NAIOP, and CBPA) would enhance the credibility of such case studies.

### *Quality-Assured Rating Processes*

Quality assurance and quality control are obtained through a combination of strategies. The rating process should be transparent and well-documented. Where possible, rating systems should minimize or preferably avoid any subjective inputs (in other words, dependent on the experience and judgment of the rater). Beyond that, several options exist that can contribute to high quality rating programs:

- **Training programs for raters:** A consistent level of teaching is recommended for raters, and perhaps a central “train the trainer” program. Such programs should be aligned with estimates of market demand to ensure a pool of raters that will meet market and programmatic needs.
- **Rater certification:** Similar to the HERS whole-house rating system, a certification program can reinforce the value of training for raters and provide confidence among building owners in the qualification of raters and expected quality level. Certification also provides for a worst case scenario whereby certification can be revoked if raters do not meet the required standards in practice.
- **Independent verification of ratings:** Third-party verification of ratings is a form of quality control that can provide further confidence in ratings for owners and policy makers. The additional cost should be considered carefully against the potential benefits. It is preferable to build quality into the process (QA) before incurring the additional cost of quality control measures.

Additional suggestions that may enhance quality assurance include requiring signatures on rating certificates and, if ratings are to be published, publishing the input values. (This would discourage entering false data inputs that inappropriately enhance a building’s rating.)

### *Maximize Benefits of Rating Systems*

In addition to receiving a rating, market “pull” could be enhanced by adding features or integrating the rating with other programs. Establishing data exchange protocols to promote data sharing between application tools (between a rating tool and a redesign tool, or between an assessment tool and a rating tool, for example) can reduce costs and improve data integrity.

Integrating rating systems and redesign processes into energy upgrade programs can facilitate the identification of retrofit packages that are optimized for the subject building. Designing rating systems to include an application programming interface (aka “API”) can enable the market to deliver innovative benchmarking, performance monitoring, EIS, and other tools that include the ability to calculate performance ratings.

#### *Reinforce the Connection Between Higher Ratings and Higher Property Value*

A number of recent reports have documented a link between higher ENERGY STAR scores and higher property values. Initially these reports were academic in nature, but more recently there have been reports released that were cosponsored by major property owners and managers. More research is needed, especially considering a broader spectrum of property types beyond Class A offices, as well as outreach programs to develop a common and consistent understanding of this link. Integrating rating into the property appraisal process would further reinforce the connection between ratings and property value and could lead to ratings becoming a standard data point on a property listing. (AB 1103 may be a catalyst for this.) This in turn could lead to existing real estate databases, such as CoStar, incorporating performance ratings, resulting in correlations between rating level and property value that are determined from a much richer set of empirical data.

#### *Phased Approach to Rating System Introduction and Disclosure*

With any new rating system or disclosure legislation, a phased approach can ease market adoption. Implementation phases should consider, at a minimum, the following areas:

- **Cost:** Starting with voluntary programs, rebates may be offered to cover the cost of ratings. As market transformation takes place, these rebates can be reduced.
- **Building size/type:** A phased approach is being employed by many regulators, starting with larger buildings (which are fewer in number but encompass a high proportion of floor space), and moving to smaller buildings over time. It is also common to require public disclosure for public buildings before moving to commercial properties, to demonstrate leadership and to establish administrative processes. There is no prior example of phasing disclosure legislation based on market sectors (for example, office, hotel, grocery store).

#### *Establish a Central Tracking Database for Ratings*

The goal of AB 758 is to improve energy efficiency in California, and in doing so to create high-quality jobs in the state. Data inputs for ratings, as well as the ratings themselves, are critical for tracking the success of AB 758 and for tailoring specific program approaches. Web-based rating tools can make centralized data warehousing easier and create a picture of nonresidential building energy performance in California that is larger and that has a greater depth of detail than anything in existence. A deeper understanding of the equipment and performance of California’s building stock can help target utility programs toward the systems most in need of upgrade, on a regional level, and in parallel track the performance improvements of the building stock. DOE has established the Standard Energy Efficiency Data (SEED) Platform for states and cities to use in each of their rating disclosure programs. SEED is in beta testing by

select cities and states and shows promise to significantly reduce the costs of implementing rating disclosure programs.

## **Building Assessments, Energy Audits, and EBCx**

### *Energy Audits and EBCx to Become a Foundational Component of Utility Upgrade Programs*

Energy audits and EBCx have the potential not only to provide direct project savings, but to promote longer term improvements (in other words, for future implementation of ECMs that didn't initially get installed), and to educate building owners, managers, and operators on building performance issues. As such, it may be worth reconsidering the accepted methods of determining program cost-effectiveness evaluation to include these indirect impacts. If Energy Upgrade California is expanded to cover nonresidential properties, energy audits and EBCx could become pivotal to its success in promoting whole-building upgrades.

### *Innovative Building Assessment Protocols to Open up the Smaller Commercial Market*

Whether for a high-level screening or a detailed investigation, there are a variety of technology options available to streamline the process. This streamlining would benefit larger building owners and, more importantly, create programmatic opportunities in the smaller commercial sector. Perhaps the most critical focus area is EIS software that can use hourly energy use data from smart meters to identify areas of opportunity and perform project M&V. Other areas of potential include infrared camera technology, wireless monitoring, and automated auditing tools. To be successful in the smaller commercial market segments, technology options should be accompanied by support for building owners with limited project management resources.

### *Outreach and Education Program*

Further outreach and education should promote energy audits and EBCx, including providing guidance around how to manage both the audit/EBCx process and how to successfully manage the subsequent implementation of improvements. This would include education on what to expect from the process, the various options and how to choose between them, how to select an auditor/EBCx provider, and how to establish operational practices that will allow the savings to persist over time.

## CHAPTER 6: Energy Efficiency Upgrade Programs

Achieving energy efficiency improvements in existing building stock is the primary motivation behind the AB 758 legislation. Energy upgrade programs will be the key tool to accomplish this objective. Energy efficiency upgrade programs are either voluntary programs that seek to incentivize or otherwise encourage action, or mandatory programs that establish regulations to accomplish specific objectives. With a few notable exceptions, most energy upgrade programs in California (as elsewhere in the nation) are voluntary. The majority of voluntary energy efficiency upgrade programs in the State of California are administered by the IOUs, under the direction of the CPUC. Other programs are administered through a combination of federal, municipally or publicly owned utilities and local government programs.

### Market Status

#### Voluntary Programs

##### *Publicly Owned Utilities Voluntary Programs*

There were 41 POUs in 2011 that accounted for 25 percent of the annual electricity sales in California. Of these, LADWP and SMUD accounted for 64 percent of the POU market share, and “The Big 15” (see Table 4) accounted for 96 percent of POU market share.

**Regulatory Background:** Senate Bill (SB) 1037 (Kehoe, Chapter 366, Statutes of 2005) required the POUs to use cost-effective energy efficiency as the preferred first energy source when procuring new resources and to report annually on their energy efficiency activities to their customers and to the Energy Commission.

AB 2021 required POUs to estimate potentially achievable cost-effective energy efficiency at least once every three years and to establish annual energy efficiency improvement targets using a 10-year rolling estimate. Additionally, each POU must have its savings claims evaluated independently. POUs must report annually on these additional activities to their customers and to the Energy Commission, and the Energy Commission is to report on POU activities in the *Integrated Energy Policy Report (IEPR)*.

AB 758 required POUs to implement an energy efficiency program that recognizes the Legislature’s intent to encourage energy savings and greenhouse gas emission reductions in existing residential and nonresidential buildings. POU’s are to include the status of their efforts in the annual report that is required under SB 1037.

##### *Market Status*

The history of POU energy efficiency programs has been a “bottoms-up” process in California, started by pioneering POUs and only beginning to coalesce in the last 10 to 15 years. The SMUD first demand-side management program was started back in 1976, when peak summer load reduction programs debuted. Since then other POUs have added programs important to their operations and customers. SMUD now offers more than 20 programs to its customers, and

the 41 POU together offer more than 450 programs, generally funded by the Public Goods Charge (PGC).

AB 1037 and AB 2021 have done much to help coordinate the efforts of the POU, including the development of a coordinated annual report. This report produced since 2006 by the California Municipal Utilities Association (CMUA) each March is intended to inform the POU customers and the Energy Commission. This annual report has allowed the Energy Commission to compare and contrast the efforts of the POU and the IOUs and to help make suggested improvements to each<sup>110</sup>.

The PGC was first mandated for POU in 1998 and has been set at a minimum of 2.85 percent of annual sales. The PGC consists of four components: energy efficiency, renewable investment, electricity related research and development, and low-income assistance. The annual report<sup>111</sup> does not break down how the 41 POU invested their PGC funds into the four categories, but collectively, they invested 1.81 percent of their PGC to fund energy efficiency. Six of the POU also indicated that their expenditures exceeded the 2.85 percent minimum<sup>112</sup>.

The performance of the POU energy efficiency programs for 2011 is summarized in the following table:

**Table 2: POU Program Summary<sup>113</sup>**

Year	Net Peak kW Savings	Net Annual kWh Savings	Net Lifecycle MWH Savings	Total Utility Cost (\$)
FY05/06	52,552	169,302,601	2,249,214	\$ 54,412,728
FY06/07	56,772	254,331,659	3,062,361	\$ 63,151,647
FY07/08	82,730	401,919,205	4,473,801	\$ 103,907,266
FY08/09	117,435	644,260,232	6,749,912	\$ 146,093,107
FY09/10	93,712	522,928,998	5,586,299	\$ 123,433,250
FY10/11	81,121	459,458,539	4,604,364	\$ 132,372,795

Source: AB 2021 Progress Report: Achieving Cost-Effective Energy Efficiency for California; December 2010; California Energy Commission; CEC-200-2010-006.

More than 40 percent of the current year energy savings are attributed to lighting retrofits (207 million kWh), while comprehensive retrofits came in second (79 million kWh) and cooling projects came in third (78 million kWh). Of the total savings achieved by POU programs, more than 96 percent of all POU savings can be attributed to the “Big 15” POU, underscoring their impact on this sector (Table 3).

110 2009 AB 2021 Progress Report: Achieving Cost-Effective Energy Efficiency for California; December 2010; California Energy Commission; CEC-200-2010-006.

111 Energy Efficiency in California’s Public Power Sector: A Status Report; California Municipal Utilities Association (CMUA); March 2012.

112 Alameda, Burbank, Modesto Irrigation District, Palo Alto, Roseville, and Truckee Donner

113 Id.

**Table 3: POU's Most Heavily Influencing Energy Efficiency Savings, FY 2011**

Utility (Big 15)	Net Peak KW Savings	Net Annual KWh Savings	Market Share of Total Savings	Cumulative Market Share of Total Savings
SMUD	23,440	170,640,740	37.1%	37.1%
LADWP	19,397	127,246,175	27.7%	64.8%
Silicon Valley Power	2,207	24,575,528	5.3%	70.2%
Riverside Public Utilities	5,076	22,395,710	4.9%	75.1%
Anaheim Public Utilities	4,254	13,102,684	2.9%	77.9%
Modesto Irrigation District	4,262	12,244,346	2.7%	80.6%
Pasadena Water and Power	2,070	12,244,298	2.7%	83.2%
Burbank Water & Power	1,841	11,941,532	2.6%	85.8%
Glendale Water and Power	6,145	11,763,873	2.6%	88.4%
Imperial Irrigation District	2,882	10,034,126	2.2%	90.6%
Roseville Electric	2,001	8,633,947	1.9%	92.5%
City of Palo Alto Utilities	642	6,457,345	1.4%	93.9%
Turlock ID	1,136	4,329,618	0.9%	94.8%
San Francisco PUC	592	3,633,801	0.8%	95.6%
Truckee Donner Public Utility District	1,136	3,400,293	0.7%	96.3%

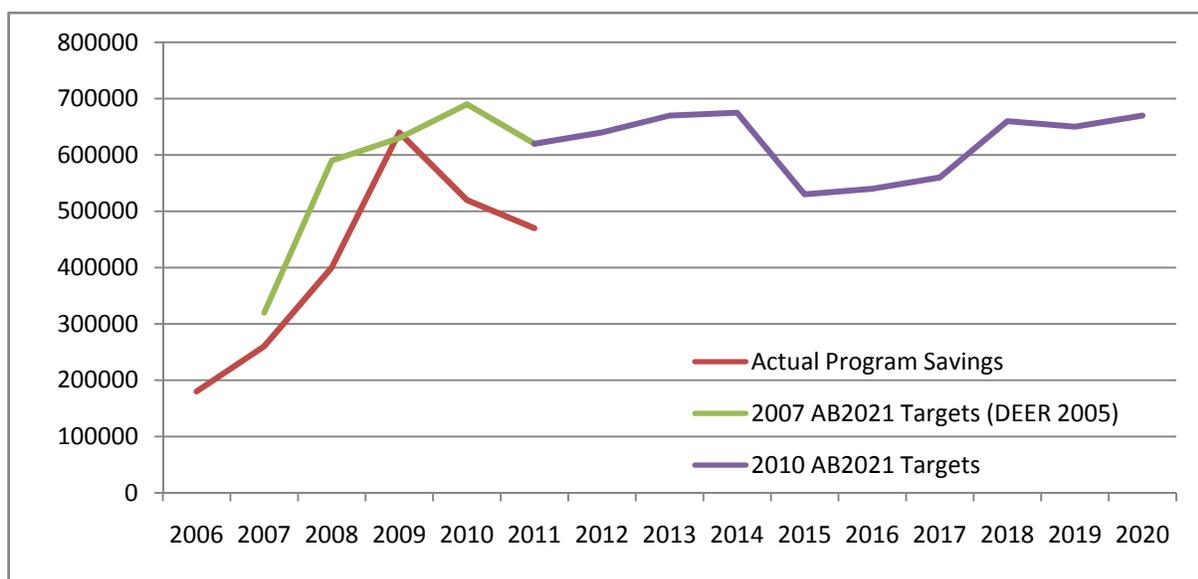
Source: AB 2021 Progress Report: Achieving Cost-Effective Energy Efficiency for California; December 2010; California Energy Commission; CEC-200-2010-006.

The 41 POUs are coordinating efforts more closely and reporting as a unified body. To highlight this achievement, Table 4<sup>114</sup> identifies program savings, past targets, and future 10-year rolling targets for the large group.

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114 Id.

**Table 4: AB 2021 Actual Savings and Program Targets (MWh)**



Source: California Energy Commission.

Based on the *CMUA Annual Report*, the POU's diversity and quantity of energy efficiency programs rivals those of the IOUs. The 41 POU's operated more than 450 programs in total<sup>115</sup>. Some of the more popular programs that are operated by multiple POU's include:

- Home Energy Reports:** Six utilities (Anaheim, Burbank, Glendale, Palo Alto, Pasadena, and SMUD) deliver customized printed energy use reports and provide online access to randomly selected residential electric customers. These reports compare the electric usage of each recipient with similar households. The Home Energy Reporting system is a proprietary technology platform that integrates usage data with an array of third party housing, GIS, and demographic data to derive personalized insights about customers and their energy use. The software analytics engine enables the coupling of insightful messaging with specific, targeted action steps for each household to help the customer reduce electricity consumption. Currently, the program integrates existing billing data and multiple external data sources to educate customers on how they can save energy.
- Programs Focused on Education:** The close relationship between public power utilities and the communities makes education a logical focus of locally driven energy efficiency programs. Major challenges continue to adversely affect school district funding throughout California, and most POU's actively support schools to help them reduce energy consumption and manage their energy expenditures. To that end, significant attention is given to programs that replace less efficient lighting and air conditioning systems. Other utilities creatively promote educational activities for students to learn the basics of energy science, energy conservation, and energy efficiency.

<sup>115</sup> Many of these programs are similar in structure and serve multiple utilities. Therefore, there may only be 100 to 150 discrete programs.

- **Smart Grid Upgrades:** Six POU's are in various stages of implementing a smart grid program. SMUD appears to be leading the pack in many respects, having completed installation of smart meters for greater than 99 percent of their customers.
- **Whole-House Efficiency Programs:** Many utilities give serious consideration to the system benefits that are realized by customers as they consider investing in energy efficiency programs. Burbank Water & Power is an example of a public power utility that has aggressively deployed such a program, commencing its "Green Home House Program" in November 2009. This CMUA award-winning program has several components, all provided at no charge to participants:
  - In home Energy and Water Education: A Burbank retained consultant meets with residents to discuss energy and water usage.
  - Efficiency Installations: Devices that save electricity, water, and natural gas are installed for free in the home, including showerheads, bathroom and kitchen faucet aerators, and CFLs.
  - Attic Insulation: Attic insulation levels are reviewed in homes with central air conditioning. When below a specified R value, the homeowner is offered free insulation as part of the program's service.
  - Duct Testing and Sealing: When crews are dispatched to provide insulation services, a duct testing and sealing team is included, providing these services for free as well.
  - Air Conditioning Tune up Services: The contractor also provides free tune up services for central air conditioners, including refrigerant charge, airflow adjustment, and condenser coil cleaning.
  - Irrigation System Inspection and Programming: To complement the water side of the utility, Burbank has included irrigation system inspection and controller programming as part of this on site program. Controllers can be programmed to comply with the city's landscape watering ordinance and the irrigation system will be turned on and inspected for any overspray or other problems.

#### *Investor-Owned Utilities' Voluntary Programs*

The history of California's IOU-administered energy efficiency programs began with the decoupling of energy revenues from total energy consumption. This decoupling occurred for gas utilities in 1978 and electrical utilities in 1983. In the period prior to decoupling, a utility would make additional profit on each additional unit of energy sold, leading the utility to try to sell as much energy as possible. Under the Electric Revenue Adjustment Mechanism (ERAM), the utilities don't have a monetary incentive for their customers to increase energy use. For residential customers in general, electrical energy rates have been designed to escalate with increased consumption; for commercial customers, rates are higher during periods of peak use. The combination of the ERAM and rate structures has created a business environment where there is a strong economic incentive to use energy-efficient equipment. In 2001, the State of California moved one step closer toward prioritizing energy efficiency in the portfolio of strategies used to meet energy demands. The loading order policy establishes energy efficiency

(and demand response)<sup>116</sup> as the priority resources in meeting California’s energy needs, directing the IOUs to accomplish all feasible demand reduction possible before acquiring new generation resources. Funding for these programs have been provided through fees assessed on ratepayer utility bills and is allocated to a prescribed set of programs through the IOU energy efficiency portfolio planning process.

The portfolio planning process is a major effort of the Energy Division of the CPUC. The first step in the portfolio planning process is to establish targets for energy demand reductions. The CPUC works with the Energy Commission and consultants to determine the amount of energy demand anticipated over a set period (generally three years). The CPUC then investigates the potential for energy efficiency savings in IOU territories over this same period and directs the IOUs to meet energy savings goals derived largely from this estimated potential through their portfolio of programs. To provide further direction on the type of programs the IOUs should consider, the CPUC provides a guidance document establishing the principles the IOUs should consider in developing their programs. In addition to this guidance document, energy efficiency programs are governed by a set of CPUC policies, including the *Standard Practices Manual* and the *Energy Efficiency Policy Manual*. These policy documents clarify the administrative procedures and policies that must be considered in developing and administering IOU programs.

Energy efficiency programs that are administered by the IOUs generally fall into one of two categories. The majority of IOU program funds are spent on statewide programs; the remainder of IOU program expenditures goes to IOU-specific programs<sup>117</sup>, local programs, third-party programs, and government partnerships. Overall, the 2009-2011 Energy Efficiency Portfolio contained more than 120 programs in the four IOU jurisdictions.

**Table 5: California IOU Energy Efficiency Statewide Program Categories (2010-2012)**

Residential	Heating, Ventilation and Air Conditioning (HVAC)
Commercial	Codes and Standards
Industrial*	Emerging Technologies
Agricultural*	Workforce Education and Training
New Construction	Statewide Marketing Education and Outreach
Lighting Market Transformation	Statewide Demand-Side Management (DSM) Coordination and Integration

\* Not directly related to building energy efficiency

Source: California Energy Commission.

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116 Codified in 2005 as Public Utilities Code Section 454.5(b)(9)(C).

117 There are four investor-owned utilities in the State of California, each with a specific (though occasionally overlapping) geographical jurisdiction. The IOUs may operate a single statewide program, or they may operate programs that are specific to the needs of their geographical jurisdiction. Often even a statewide program will vary slightly from IOU to IOU.

Statewide Programs

**Table 6: IOU Reported Savings to CPUC, May 2012**

	2010 Installed Savings			2011 Installed Savings			2010/2011	
	GWh	MW	MMth	GWh	MW	MMth	GWh	MMth
PG&E <sup>118</sup>	1,735	303	18	1,519	270	33	3,254	51
SCE <sup>119</sup>	NA	NA	NA	1,419	261	0	1,419	0
SDG&E <sup>120</sup>	311	50	1	609	105	2	920	3
SCG <sup>121</sup>	3	2	28	10	8	62	13	90
<b>Totals</b>	<b>2,049</b>	<b>355</b>	<b>47</b>	<b>3,557</b>	<b>644</b>	<b>97</b>	<b>5,606</b>	<b>144</b>

Source: California Energy Commission.

Each of the major program categories listed in Table 5 has standardized programs administered by the IOUs within their respective service territories. These programs are further separated into resource programs and non-resource programs. A resource program is one that provides a directly measurable energy savings. A non-resource program guides customers to other utility incentive programs or finance/nonutility program.

The figures in Table 4 are as presented by the utilities and unverified by the CPUC. All IOU program activity is subject to independent Evaluation, Measurement and Verification (EM&V), and the most recent comprehensive EM&V report is from the 2006-2008 IOU program cycle. Table 5 below indicates the total verified results for the 2006-2008 cycle resulting from California's \$2.1 billion investment in energy efficiency programs. The IOU programs were found to be cost-effective, with every dollar invested in programs being earned back with an additional \$0.14 in net benefits to the state.

**Table 7: Verified IOU Program Savings, 2006-2008 Program Cycle**

	Annual Impact		Lifecycle Impact		% of 2008 IOU sales Gross
	Gross	Net*	Gross	Net*	
	<b>GWh</b>	6,497	4,097	66,142	42,736
<b>MW</b>	1,175	779	n/a	n/a	n/a
<b>MMTherm</b>	84	44	1,379	690	1.0%
<b>Tons of CO<sub>2</sub></b>	4,116,173	2,642,128	45,021,664	24,291,576	n/a

118 PG&E submittal– 2011 Report of Pacific Gas and Electric Company (U 39 M); May 1, 2012; Table 1

119 SCE submittal – Southern California Edison (U 338-E) 2012 Annual Report for 2011 Energy Efficiency Programs; May 1, 2012; Table 1

120 SDG&E submittal – San Diego Gas and Electric Company (U 902-M) Energy Efficiency 2011 Annual Report; May 1, 2012; Table 1

121 SCG Submittal – Southern California Gas Company (U 904G) Energy Efficiency 2011 Annual Report; May 1, 2012; Table 1

\*Net savings amount excludes those savings that would have been achieved in the absence of the IOU programs

Source: 2006-2008 Energy Efficiency Evaluation Report, July 2010  
(<http://www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/EM+and+V/2006-2008+Energy+Efficiency+Evaluation+Report.htm>).

Recommendations from the 2006-2008 IOU programs' evaluation are being implemented in current program cycles and include:

- Improving program tracking data collection and maintenance.
- Screening large commercial customers to reduce cases where utility funds are used to implement projects that would have occurred absent the program.
- Program portfolios diversifying their offerings so that savings are not so heavily concentrated in one technology (as they were for compact fluorescent bulbs in the 2006-2008 cycle).
- Better ongoing coordination between utilities and evaluators to allow for mid-course corrections in program implementation/design and to allow for more pre-installation evaluation checks.
- Review of evaluation of priorities that recognize expanded program and policy objectives (for example, AB 32, the California Long-Term Energy Efficiency Strategic Plan).

#### *Whole House Performance Program*

In adopting the 2010-2012 portfolio of energy efficiency programs, the CPUC also directed the IOUs to develop a new type of program – one that endeavors to achieve energy efficiency upgrades for residential buildings as a whole, rather than individual measures within the building. The IOUs were directed to implement this program on a pilot basis and move swiftly into statewide implementation, building from lessons learned from the pilots. The Whole-House Performance Program was the first of its kind in California and recognized the direction given by the *Strategic Plan* to move away from single-measure rebate programs, toward strategies to encourage deeper, more comprehensive energy upgrades. (58 percent of the IOUs' 2006-2008 program savings were from indoor lighting upgrades, and only 2 percent attributable to whole-building approaches.<sup>122</sup>) Direction was given at the time to develop a multifamily component of the WHPP, and the IOUs are working toward developing a statewide multifamily approach. San Diego Gas & Electric (SDG&E) rolled out a multifamily pilot program in the fall of 2011, but that was put on hold while a statewide approach continued development. Also, the nonresidential sector lacks a parallel whole building upgrade approach. In cooperation with the CPUC and the CEC, the IOUs rebranded the WHPP program as Energy Upgrade California in 2010.

#### *Nonresidential Programs With Whole Building Options*

While the IOUs do not offer a whole building program for the commercial sector, analogous to the Energy Upgrade California program available in the residential sector, there are some

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121 Ibid.

programs that provide for greater flexibility and could be used by the savvy energy analyst to package together a whole building improvement.

### **Calculated Incentives**

The Calculated Incentives Program is a resource program that provides customers with comprehensive technical assistance and design in support of customized retrofit and retrocommissioning projects, as well as incenting those projects according to their savings.

### **Direct Install**

The Direct Install Program is a resource program that uses qualified contractors to install energy efficiency hardware retrofits. These retrofits are installed for the utility customer free of charge. This program is designed to create peak demand and energy savings from commercial customers with a monthly demand of less than 100 kW. Current direct install programs are largely single efficiency measure retrofits.

### **Nonresidential Audit**

The Nonresidential Audit Program is a resource program that provides customers with basic audits, integrated audits, and retrocommissioning audits. These audits provide an inventory of technical project opportunities and financial analysis information.<sup>123</sup>

### **Continuous Energy Improvement**

The Commercial Continuous Energy Improvement Program is a non-resource program that provides a toolkit of planning and other resources, including analysis, benchmarking, goal setting, project implementation support, performance monitoring, and energy management certification.

### **Savings By Design.**

The program targets new construction, which is primarily newly constructed buildings, but is also applicable to major renovations/remodeling projects that are additions or expansions of an existing building or site footprint). The program uses whole building or systems approaches. More information: <http://www.savingsbydesign.com/savings-design-program-overview>

### **Local Programs**

These programs include pilots and emerging programs that are not-yet standard offerings such as zero net energy pilots, on-bill financing, and some marketing and education programs.

### **Third-Party Programs**

To provide a more robust portfolio of programs, the IOUs periodically issue a request for proposal (RFP), asking third parties to submit proposals on how they can cost-effectively help meet California's energy efficiency goals. These are generally resource subprograms and frequently serve niche and/or hard-to-reach markets.

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123 R.12-05-015\_EE-EMV - SCE 2011 EE Annual Report.

## **Government Partnerships**

The IOUs have developed partnerships with customized offerings for the State, University of California/California State University systems, California's Community Colleges, and dozens of local governments. These are a combination of resource and non-resource subprograms. One exciting feature is the Innovator Program, whereby local governments (and others) submit proposals to address local energy issues.

## **The California Long-Term Energy Efficiency Strategic Plan**

In 2008, the CPUC adopted, with Energy Commission support, a visioning document to guide investment in energy efficiency for coming years, the *Strategic Plan*. Motivated in part by policy drivers such as AB 32, the *Strategic Plan* serves as a roadmap to guide energy efficiency investment in California. The *Strategic Plan* establishes goals for energy efficiency improvement through 2020 and develops short-term, mid-term, and long-term strategies for achieving those goals.

A key effort of the *Strategic Plan* is to articulate how the CPUC intends to achieve market transformation through its programs. Market transformation is defined as "*Market transformation includes promoting one set of efficient technologies, processes or building design approaches until they are adopted into codes and standards (or otherwise substantially adopted by the market), while also moving forward to bring the next generation of even more efficient technologies, processes or design solutions to the market*"<sup>124</sup> The *Strategic Plan* notes that the current utility strategy in designing and delivering efficiency programs is focused on harvesting the low-hanging fruit, or implementing measures that are low-cost, quick to install, and achieving a high return in the form of energy savings. While these short-term strategies can be important in terms of rounding out the total portfolio, they lack the long-term perspective necessary to drive toward market transformation.

The existing portfolio of programs and the policies that support them (such as the *Standard Practices Manual and the Energy Efficiency Policy Manual*) are largely focused on short-term savings strategies. The CPUC Energy Division has been working to realign the portfolio of programs to be consistent with the direction of the *Strategic Plan* and move buildings towards achieving deep, comprehensive energy upgrades. AB 758 implementation is a very important opportunity for the Energy Commission, CPUC, POU's and industry stakeholders to work together toward this common state goal.

## **The State and Local Energy Efficiency Action Network**

The State and Local Energy Efficiency Action Network<sup>125</sup> is an effort facilitated by the federal government that seeks to help states, utilities, and other local stakeholders take energy efficiency to scale and achieve all cost-effective energy efficiency by 2020. This initiative has engaged diverse stakeholders in developing and implementing eight energy efficiency roadmaps across the residential, commercial, and industrial sectors, as well as key crosscutting topics, including EM&V; financing; building codes; consumer information and behavior; and

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124 California Public Utilities Commission D. 09-09-047 at 88-89.

125 <http://www1.eere.energy.gov/seeaction/>.

driving ratepayer-funded efficiency through regulatory policies. The Energy Commission participates in the EM&V working group, whose focus is to transform evaluation, measurement, and verification to yield more accurate, credible, and timely results that accelerate deployment and improve management of energy efficiency.

### **Energy Service Companies**

ESCOs are private firms that offer implementation and project management support for energy efficiency upgrades and on-site renewable energy. The predominant business model for ESCOs is a “guaranteed savings” arrangement whereby an owner arranges financing for a project, and the ESCO guarantees a level of energy savings sufficient to make the loan repayments. The ESCO is typically paid the value of the energy that is saved beyond what is needed to repay the loan.

About 80 percent of ESCO business is with the federal government and the municipal, university, state, and hospital (MUSH) markets, the remainder being split between industrial, public housing, and a little for commercial real estate (CRE). Penetration in the CRE market is thought to be low primarily because ESCO agreements tend to have payback periods between 10 and 20 years. CRE owners often sell their properties on a far shorter time frame.

ESCOs have been active among California municipal government, but less with universities and the State. The universities have a long-standing partnership with the IOUs, and the state is in the process of upgrading an early wave of about 450 buildings, with plans for a larger wave of new projects in the future.

### **American Recovery and Reinvestment Act-Funded State Energy Programs and Energy Efficiency and Conservation Block Grants**

In 2009 President Barack Obama signed into law the American Recovery and Reinvestment Act. The purpose of the ARRA was to provide an infusion of capital across the country to kick-start the economy and put Americans back to work. Through the ARRA, millions of dollars were set aside to fund energy efficiency and renewable energy programs across the country. California’s total funding for all ARRA activity was more than \$34.7 billion. Of that, California received \$314.5 million for Energy Commission-administered programs under the SEP and the Energy Efficiency and Conservation Block Grants (EECBG).

As the Energy Commission was developing a proposal for how to use the ARRA funds, Governor Arnold Schwarzenegger signed AB 758 into law. The ARRA funding provided an opportunity for the Energy Commission to implement many different pilot approaches to accomplishing building retrofits, particularly in the residential sector. The Energy Commission decided to dedicate nearly \$110 million of the total ARRA award to pilot energy efficiency programs – branded as Energy Upgrade California programs in collaboration with the CPUC, IOUs, SMUD and local governments.

Pilots included targeted commercial programs to upgrade lighting and HVAC controls in markets, parking lots and stairways; multifamily projects to assess and upgrade multifamily buildings; finance programs to bridge the funding gap for all sectors; workforce development to

train and prepare a green workforce; single-family, whole-house performance program to upgrade homes, and Department of General Services finance program for state agencies to upgrade state-owned buildings – together creating sorely needed jobs. Some of these pilot ARRA programs were so successful they received additional funding from less successful efforts. By the end of the Energy Commission’s implementation of ARRA, more than \$190 million was invested in Energy Upgrade California programs.

Through the single-family and multifamily upgrade programs, the Energy Commission provided millions of dollars in funding to local government partners to pilot the Energy Upgrade California program locally. The statewide Energy Upgrade program infrastructure was developed to create a coordinated program among all partners, including an extensive outreach network in 30 California counties. Efforts were made to coordinate the program structure, vocabulary, outreach, education, marketing, and branding, and to ensure necessary financing and qualified contractors/raters were available for consumers to take action and complete projects. Local upgrade programs were available in Sacramento through SMUD’s Home Performance Program, eight Bay Area counties through the Association of Bay Area Governments (ABAG), the city of Fresno, and the counties of Los Angeles, Santa Barbara, and San Diego.

The Energy Commission’s ARRA SEP contracts ended April 30, 2012, and the Energy Commission Efficiency Division’s ARRA EECBG contracts ended June 14, 2012. Six ongoing finance programs are extended until 2013 (San Francisco’s Mayor’s Office of Housing) and 2017 (CHF, Los Angeles County, Sonoma County PACE, San Francisco Commercial PACE, and city of Los Angeles Commercial PACE). Additionally, the CPUC *Guidance Decision* directs the IOUs to maintain support for successful ARRA programs. The four IOU’s submitted and the CPUC approved proposals with PG&E<sup>126</sup>, Southern California Edison (SCE)<sup>127</sup>, SDG&E<sup>128</sup> and Southern California Gas (SCG)<sup>129</sup> for a total of nearly \$9 million of unspent 2010-2012 funds to be used to provide continuation funding for ARRA programs in 2013-2014. The funded programs collaborate with 22 partners; much of the funding is to reduce the cost of financing and the remainder is to fund marketing, education, outreach and training programs.

Below is a description of the regional and public/private partnership pilot programs that were carried out with ARRA funding administered by the Energy Commission, including lessons

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<sup>126</sup> Pacific Gas & Electric’s Compliance with Ordering Paragraphs (OPs) 28 and 119 of Decision (D.) 12-05-015; 8/20/2012

<sup>127</sup> Southern California Edison’s Compliance with Ordering Paragraphs (OPs) 28 and 119 of Decision (D.) 12-05-015; undated

<sup>128</sup> Compliance with Ordering Paragraphs (OPs) 28 and 119 of Decision (D.) 12-05-015 Regarding San Diego Gas & Electric’s Selected ARRA Programs for Continuation through the End of 2012; 7/31/2012

<sup>129</sup> Compliance with Ordering Paragraphs (OPs) 28 and 119 of Decision (D.) 12-05-015 Regarding SoCalGas’ Selected ARRA Programs for Continuation through the End of 2012; 8/1/2012

learned from the perspective of the ARRA contractor/program implementer and the Energy Commission. These are self-reported and do not include input from the formal Energy Commission EM&V studies that are underway and will be finalized in April 2013. General information about EM&V studies can be found later in this chapter.

## Finance Programs

### *CHF Financing*

The CHF MIST I finance program provided below-market interest rates (0-3 percent), 15-year term loans to moderate-income single-family homeowners in CHF member and associate member counties and cities. CHF closed 1,043 loans for a total of more than \$23.6 million in financed single-family energy efficiency upgrades. These upgrades occurred in 33 counties and were done by 44 building contractors. Based on a sampling of upgrades, CHF estimates an average of 30 percent energy savings annually. The contract with CHF has been extended for five years for the next phase of the program (MIST II), which will include administering a revolving loan fund and a loan loss reserve fund.

Many things were learned from this successful ARRA program. Current energy efficiency mortgage products, such as the FHA 203(k) loan program that CHF intended to leverage extensively but could not, are unattractive to borrowers in the current real estate market. However, a whole-house energy efficiency financing program with generous terms meets a clear market need. Building contractors are a key asset in developing and selling a whole-house energy efficiency upgrade program. DOE requirements for the ARRA contracts were, at times, difficult for CHF and homeowners to comply with and caused project delays. Utility rebate leveraging was problematic, and CHF received numerous calls from homeowners about rebate delays of up to four months or more. Energy savings verification through the utility data was sporadic or did not occur at all, even with the homeowner's approval for the release of the data. Flexible and generous underwriting of loans (including no reliance on credit scores) helped the program successfully upgrade many homes; however, this may present a challenge for the ongoing finance program as loan terms will likely change with a higher interest rates as lenders rely heavily on credit scores to determine risk.

### *PACE Financing*

The Local Government Commission contract included four PACE financing pilot programs, some of which have been extended until 2017, including a residential program in Sonoma County (Sonoma County Energy Independence Program) and commercial PACE pilots in the city of Los Angeles, City/County of San Francisco, and Placer County.

The PACE pilot team tested its program models in each modeled regions to use lessons learned and best practices to create a replication plan that can be used by other local governments interested in PACE, demonstrated how PACE addresses the financial barriers traditionally faced by property owners seeking to fund upgrade projects, and allay the concerns raised by the FHFA and Office of the Comptroller of the Currency (OCC).

The cities of Los Angeles and San Francisco designed and launched the first two owner-arranged commercial PACE programs in the nation, including development of program documents and outreach materials<sup>130</sup>. The programs instituted a number of different mechanisms aimed at increasing awareness and driving demand for PACE financing in their respective regions. Los Angeles funded energy audits to assess potential energy savings and spark interest in the program. Both Los Angeles and San Francisco established debt service reserve funds (DSRFs) that decrease risk to participating lenders, by covering delinquent assessment payments. Placer successfully transitioned from a treasury-funded, residential-only PACE program to a treasury funded commercial PACE program. In addition, because of Sonoma County's hugely successful SCEIP program, it served as the residential PACE model, while also incorporating and expanding upon its commercial program. Sonoma County supported marketplace expansion for HERS Whole-House Home Energy Raters/Building Performance Contractor-funded energy audits, transformed its Web portal, and conducted the first ever PACE pooled bond and alternative financing strategy feasibility analysis. Each of these programs worked to align their programs with the Energy Upgrade California guidelines, transformed its program website and integrated its local resources into the statewide Energy Upgrade California Web portal.

Together, the four pilot programs contributed to the creation of a PACE Replication Kit as a long term resource for those jurisdictions considering the adoption of PACE programs to reduce barriers to adoption of energy efficiency, water efficiency and renewable energy generation system installations.

#### *Affordable Multifamily Retrofit Initiative*

The San Francisco Mayor's Office of Housing's (SFMOH) Bay Area Multifamily (BAM) Fund provided loans for energy efficiency upgrades to affordable multifamily projects in the Bay Area. The BAM Fund completed 18 multifamily audits and originated four loans totaling about \$200,000 in ARRA funds to three borrowers for six buildings with a total of 529 units. SFMOH estimates the average annual energy savings for these retrofits is 16 percent. This contract with SFMOH has been extended for one year for the ongoing administration of the existing loans.

Several barriers were encountered when attempting to achieve their goals to recruit highly risk-averse affordable housing developers to take advantage of the program, including a lack of preprogram data on the value of energy savings in retrofit applications in large multifamily affordable housing projects; a lack of capacity among the developers to deal with the complexity of whole-building energy efficiency retrofits; and difficulty in adding additional debt to the complicated ownership and financing structures that are common with large multifamily affordable housing projects. Further, the Bay Area's modest climate resulted in

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130 An "owner-arranged" PACE program is one in which the responsibility for securing financing is on the project developer or building owner. Once financing has been negotiated, the county will secure the loan with a first priority lien and collect and remit payments via the property tax infrastructure. More information on these programs can be found in Chapter 2 of this document.

small loans that did not scale well, given the complexities of analysis, underwriting, and implementation. Borrowers also wanted to fix dysfunctional equipment as opposed to installing energy-efficient features. And the split incentive between landlords and tenants reduced the pool of applicants to only master-metered buildings.

### *Department of General Services*

The Department of General Services received \$25 million to establish the Energy Efficient State Property Revolving Fund to provide loans to state departments and agencies for energy projects on state-owned buildings and facilities to achieve greater long-term energy efficiency, energy conservation, and energy cost and use avoidance. The program has successfully provided more than \$22.7 million in loans to large and small energy efficiency projects. In 2011, the Legislature passed AB 1392 (Bradford, Chapter 488, Statutes 2011) to allow the Energy Commission to add up to \$50 million to the loan fund should underperforming ARRA contract funds need to be transferred to fund more state building upgrades.

The Energy Commission learned that this is a good mechanism to address state-owned building efficiency needs, as many state department and agencies took advantage of this program and loans are already being repaid. Department of General Services could do a better job administering this loan program by allocating more staff resources. Close attention must be paid to quality assurance and quality control, as some installation issues arose.

### *Innovative Financing in Los Angeles County*

In April 2012, the Los Angeles County contract was expanded by an additional \$11 million in SEP funds for various innovative loan enhancement programs that are extended until 2017, including residential and nonresidential loan loss reserves, residential interest rate buy downs, and municipal building revolving loan funds and loan loss reserves. The finance programs are expected to launch by fall of 2012.

## **Residential Whole-House Upgrade Programs**

### *Statewide Energy Upgrade California Program*

The Local Government Commission contract developed the Energy Upgrade California program statewide infrastructure. Energy Upgrade California is the statewide energy and water efficiency and renewable energy generation upgrade program for single-family, multifamily, and commercial buildings. It is a one-stop resource for information on building upgrade benefits, rebates/incentives, financing, finding a participating contractor, workforce training, and home energy ratings. Through this contract, a massive statewide marketing, education, and outreach effort was put in place to establish a statewide marketing program, tools and resources; coordinate program outreach with 30-plus program counties; and develop the program Web portal as the one-stop resource for homeowners. This contract also included four PACE programs (described above).

Much was learned through this effort. Statewide program coordination was challenging with so many partners adhering to different timelines, with different program priorities and goals. Coordinated marketing, education, and outreach investment is important to the program's success. Having a trained workforce available to consumers at the rollout of the program helps to ensure that consumer confidence builds in the program and the upgrades are performed to a high quality; however, it is not enough to simply provide training classes. Ongoing, supportive, and hands-on workforce support will ensure the quality of the certified professionals. Leverage energy assessments to inspire action, as they are a key touch point with homeowners to inform them of the opportunities available at their property. Also understand that the Energy Upgrade California program requests a complex and time-intensive undertaking for homeowners, and more hands-on outreach such as homeowner workshops can improve conversion rates.

### *Retrofit Bay Area*

The ABAG's Retrofit Bay Area provides retrofits for single-family and multifamily properties through an extensive network of property owner incentives, including utility rebates and marketing and outreach messaging to promote comprehensive whole-house upgrades. Uses for ARRA funds include subsidizing homeowner rebates for upgrade projects that will reduce energy use by an average of 20 percent; establishing contractor scholarships for BPI/HERS whole house trainings; implementing an outreach program that reaches contractors, homeowners, and local governments throughout the eight-county region; and refining marketing and outreach strategies as the program moves from ramp-up to full program implementation.

ABAG partnered with eight counties and a team of public and private partners to develop and implement Retrofit Bay Area, a comprehensive regional-scale residential upgrade program. Retrofit Bay Area aligned local government workforce and outreach stakeholder pathways, business capacity, utility infrastructure, and consumer demand to implement an energy efficiency whole-building market transformation program. The program created innovative regional and local rebate programs to help homeowners offset the high costs of home energy upgrades.

The program concluded that the complicated contractor credential requirements, lack of contractor knowledge of the marketplace and the benefits of home energy upgrades, and lack of homeowner trust in contractors to complete upgrades created obstacles in completing projects through the program. The continued education of contractors through sales and marketing training, as well as local government support of participating contractors and local marketing efforts featuring home performance contractors, is critical to overcoming these barriers. Lack of project data from the utility caused programmatic problems with issuing regional and county matching rebates. And last, this program was just ramping when the ARRA funds expired, causing some market confusion as to what program elements were still ongoing.

### *SMUD Home Performance Program*

The SMUD ARRA contract provided for Home Energy Rating System Phase II (HERS Whole House) audits and whole-house retrofits for single-family and multifamily properties; provided high-quality retrofits for low- to moderate-income foreclosed, newly purchased, and renovated properties; and offered HERS whole-house assessments and energy efficiency rebates with a minimum of 10 percent energy savings to multifamily buildings.

SMUD's original contract was structured with heavy emphasis on their single-family Home Performance Program, but there was not enough uptake; so an amendment was put into place to expand the program to multifamily homes. In the end SMUD reported that the single-family BPI performance contractor-originated assessment to retrofit conversion rate was roughly 44 percent, while the alternative approach for homeowners who chose independent HERS Whole House rater assessments converted at 7 percent. The single-family program required BPI

performance contractors to be the responsible party for qualification of projects for incentives. As the program progressed, SMUD found increased engagement of HERS Raters by participating contractors to complete assessment work and achieve successful projects. SMUD found that homeowners were confused by SMUD's dual offering (independent consultant and performance contractor) approaches. SMUD believes moving forward that a less confusing approach would make it easier to educate and market the HPP to consumers.

### *Fresno Regional Comprehensive Residential Retrofit Program*

Fresno's Regional Comprehensive Residential Retrofit Program provided no-cost whole-house home energy audits (HERS Whole House), offered training and support to develop a workforce for whole-house retrofits, and built and engaged a local infrastructure for building performance contractors and independent home energy raters to provide energy audits/ratings and quality assurance for energy upgrades.

The program completed more than 1,200 audits, and more than 100 local contractors attended BPI certification training. The program continues to gain traction with homeowners, local lenders, HERS Raters, and contractors and is ready to expand coverage from its current geographic scope of Fresno, Kern and Kings counties to include Madera County. Program administrators learned that while energy bills in this region of California are high, homeowners require education to take baby steps toward efficiency measures and the whole house approach. Not all homeowners are ready or able to undertake a comprehensive energy upgrade but may be able to tackle one or two do-it-yourself projects to tighten the envelope. This program will continue by partnering with PG&E in this region.

### *Retrofit Los Angeles*

The Los Angeles County Energy Upgrade California program included upgrades for single-family and multifamily properties through an extensive network of property owner incentives, including utility rebates. Cities, councils of Governments, and utilities work collaboratively to implement strict protocols that assured consistent project quality, high-performance, and verifiable results. This contract was expanded by an additional \$11 million for ongoing finance programs until April 2017, including residential and nonresidential loan loss reserves, residential interest rate buydowns, and municipal building revolving loan funds and loan loss reserves.

This contract had many challenges implementing this program countywide with multiple utility partners. The program was slow to start and is still ramping up. Lack of project data from the utility was problematic for Los Angeles County, as it needed verifiable savings to issue local rebates. Project coordination with the utility was also slow with many barriers, which contributed to the slow ramp in the county. Lack of financing options for building owners also contributed to the low program uptake.

### *Energy Upgrade in San Diego*

Energy Upgrade in San Diego County cultivated a sustainable market for energy upgrades for market-rate and affordable single-family and multifamily buildings in a regional effort to reduce energy consumption and create jobs. The program helped create a properly trained energy upgrade workforce, educated owners about the program and incentives, and developed tools and best practices that could be applied to future single-family and multifamily residential Energy Upgrade programs.

San Diego learned that on-the-job training programs and classroom time developing “soft skills,” such as resume building, financial literacy, and sales/administration skills, are critical to contractor and program success. Highly successful outreach and education efforts are required to get consumer’s attention about program components. The multifamily program was successful conducting HERS energy assessments and multifamily rater trainings because of the regional coordination. Program administrators learned that is critical to provide a significant amount of technical and design support to multifamily building owners and newly training HERS multifamily raters, which led to wide interest and uptake in the program, even though minimal rebates were available to conduct energy assessments.

### **Targeted Commercial Upgrade Programs**

At the time of the ARRA funding, there was not a similar statewide emphasis on performance-based upgrades in commercial buildings as there was in residential buildings. Because of this, Energy Commission ARRA funding for the commercial sector focused on emerging technologies identified through PIER Program research that offered strong potential for implementation into the market place. Therefore, the Commission funding sought to help these technologies reach market readiness and avoid the “valley of death” that some emerging technologies face.

### *EnergySmart Jobs*

PECI’s EnergySmart Jobs Program focused on both job creation and energy efficiency. PECI trained California Conservation Corps (CCC) members to serve on energy efficiency survey teams and trained participating contractors to install targeted energy efficiency measures (light-emitting diode [LED] refrigerated case lights and refrigeration controls). The CCC survey teams conducted initial efficiency surveys at grocery stores and mini-marts throughout the state and uploaded the data they collected to a central database that is accessible to participating contractors. The participating contractors then proposed cost-effective retrofits to store owners and conducted the work. Participating contractors were also encouraged to hire the trained CCC members as full-time staff, and PECI then trained replacement CCC surveyors.

EnergySmart Jobs distributed \$9.9 million in project direct incentives among roughly 3,500 projects and spent another \$8.3 million on job training, energy efficiency surveys, marketing, and administration. The EnergySmart Jobs program retrofits were estimated to save California businesses more than 61 million kWh (worth about \$8.4 million) per year. The program trained 132 CCC personnel and 156 contractors from 83 Californian contracting firms. Those CCC

personnel were organized into six teams that conducted 6,025 energy surveys and more than 1,700 post install inspections of completed projects.

### *Energy Technology Assistance Program*

Energy Solutions' Energy Technology Assistance Program (ETAP) was designed to stimulate the California economy through investing in energy efficiency at public facilities in cities, counties, and transit districts, and at higher education campuses. The program identified and recommended specific opportunities for cost-effective energy efficiency projects in public buildings and then invested in those energy-saving measures by providing rebates to reduce the equipment capital costs for facility owners. The program also invested in workforce development activities by sponsoring technical training sessions for HVAC and lighting installers, seminars for public agency staff, and professional internships for college students and mid-career professionals seeking to gain experience in the energy efficiency field. The goal of the program was to create new sustainable jobs for California workers; acquire significant, reliable, and long-term energy savings through program implementation of proven retrofit measures; and further develop the market for energy efficiency technologies.

ETAP successfully demonstrated that advanced control technologies (such as lighting occupancy controls and motor controls) represent a significant energy savings opportunity for institutional and commercial buildings. The demand for advanced control products was extremely strong – participating organizations easily absorbed an \$850,000 increase in the program's rebate budget. ETAP has been tremendously successful, overseeing the installation of 114 advanced controls projects in public sector buildings that will save more than 23 million kWh of electricity and more than 948,000 therms of natural gas annually, as well as reducing peak electricity demand by more than 1,300 kW.

### *Oakland Shines*

QuEST's Downtown Oakland Targeted Measure Saturation Project brings targeted energy measures to about 9 million square feet of commercial buildings in an economically disadvantaged area in Oakland. About 60 percent of the funding is used to buy down the costs for installing occupancy-controlled bi-level lighting fixtures for parking lots/garages, wireless lighting and HVAC controls, integrated classroom lighting ,and integrated office lighting system. Oakland Shines successful ARRA program installed bi-level lighting projects in more than 30 buildings, installed LED case lights in about 130 businesses, and leveraged more than 580,000 kWh savings through traditional PG&E programs. By the end of the program, Oakland Shines exhausted the entire ARRA award of more than \$5 million.

Through the ARRA program, QuEST learned that the program was limited by the short implementation timeline, preventing greater energy savings and higher cost-effectiveness ratio. QuEST administrators also thought it was important to ensure that all participating contractors have a clear understanding of DOE compliance requirements – what they are and how they satisfy them. Two projects dropped out of the program toward the end, claiming that paying

their workers a prevailing wage carried a higher cost than the financial incentive that was offered. And last, more communication more often is a critical component to managing the collaboration of several different organizations participating in one program.

## Mandatory Energy Upgrade Programs

AB 758 gives the Energy Commission the authority to develop regulations to achieve the legislative goals. This could include developing mandatory rating and labeling requirements and potentially include mandatory energy upgrades as a component of the program. For any mandatory program to be successful in achieving the objectives, there needs to be sufficient market infrastructure developed to support program implementation. The goal of the Energy Commission is to first establish and refine the appropriate tools and other supportive market infrastructure and attempt to accomplish program objectives through voluntary approaches before considering mandatory programs.

### *Residential and Commercial Energy Conservation Ordinances*

Residential and commercial energy conservation ordinances are mandatory approaches that require efficiency improvements to existing buildings. Usually focused around some trigger point, such as the sale of a home or the upgrade of meter infrastructure, these ordinances require a specific set of measures be installed on a property if not already present (capped at a certain level of investment per property). The city of San Francisco introduced the first Residential Energy Conservation Ordinance, or RECO, in 1982. Since then, the city of Berkeley and the city of Austin, Texas, have followed suit, with Berkeley's ordinance effective in 1987 and Austin enacting its ordinance in 2008.

In 1994, Berkeley expanded its RECO program to include commercial buildings, implementing the first commercial energy conservation ordinance. CECOs operate similarly to RECOs, requiring the property owner to bring the building up to compliance with a minimum level of investment at the time of sale or major renovation (defined as more than \$50,000 or an increase in conditioned space.)

### *Energy Audit and Related Requirements*

In December 2009, the city of New York adopted Local Law 2009/087 that requires existing buildings greater than 50,000 square feet to obtain an energy audit and control system commissioning every 10 years (applies to residential and nonresidential properties). The requirements extend further for city buildings, stating "...reasonable capital improvements ... that are recommended in the building's energy audit shall be completed, including, at a minimum, all those improvements ... having a simple payback of not more than seven years ..."

In November 2008, the Austin, Texas, City Council approved the Energy Conservation Audit and Disclosure Ordinance (#20081106-047). In addition to rating and disclosure requirements for nonresidential facilities and mandatory energy audits for homes and apartment complexes, some apartment complexes are also required to undergo energy retrofits. The Austin Energy Efficiency Retrofit Task Force crafted the ordinance with input from local real estate agents and other parties. "High energy-use" properties consuming more than 150 percent of the average

multifamily energy use per square foot in Austin must make energy retrofits within 18 months to bring the property to within 110 percent of the average.

The City of San Francisco's Energy Efficiency in Existing Buildings Ordinance (described in Chapter 5) is another example of a mandatory audit requirement relating to nonresidential buildings, although the ordinance does not include any mandatory upgrade requirements.

#### *Title 24, Part 6, Building Energy Efficiency Standards*

While California's Building Energy Efficiency Standards are not mandatory for existing buildings, they do set the requirements that apply in the case of building additions, alterations, and some repairs. In determining the conditions that trigger Title 24 requirements (for example, what alterations does it apply?), the Energy Commission can influence the extent of energy efficiency upgrades for existing buildings.

## **Market Needs**

If California is to succeed in achieving its ambitious goals for existing buildings, it is important that all of the components of the market are well-developed and that an appropriate "trigger" mechanism is used to put the process into motion. Program design should consider the availability of these components and ensure programs are designed to engage existing market capacity effectively, provide support in areas of weakness, and monitor to ensure quality as well as for evaluation purposes—all with as simple an approach as possible for the participants.

Key needs to be considered include, but are not limited to:

- Incentives and financing that can make projects more attractive to the customer, and thus saleable by the contractor.
- Building ratings that encourage and reinforce a customer's decision to upgrade the property and that provides the information to reach practitioners and decision makers.
- Energy audits/assessments that are universally accepted and trusted to provide accurate savings estimates.
- Highly qualified, trained, properly certified and capable contractor teams able to provide a compelling project experience to the building owner and occupants.
- Outreach and education programs that effectively stress building performance, including important drivers such as: (1) reduced energy costs and impact; (2) rebate incentives; (3) non-energy benefits such as health, safety, comfort, and indoor air quality; (4) local job creation; (5) recycling dollars within the local economy<sup>131</sup>; (6) national security; (7) energy independence; and (8) greenhouse gas reduction.

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131 Using The Allowance Value From California's Carbon Trading System, Legal Risk Factors, Impacts to Ratepayers and the Economy; Next 10; May 2012; from page 6: "...household efficiency measures are more distributed and therefore more job intensive, and when households save money on energy, their spending on alternative goods and services is about 16 times more job intensive than the energy fuel supply chain."

## Whole Building Approach

A major failing of single-measure-based rebate programs is that they do not acknowledge that buildings are an interrelated combination of mechanical systems, appliances, and the physical attributes of the building itself. To accomplish the ambitious energy reduction goals developed both in the *Strategic Plan* and in AB 32, deep retrofits must be achieved in California's existing building stock. These deep retrofits are most cost-effectively achieved when the building is treated as an entire system. Whole-building approaches minimize cream skimming, where only the measures that pay back quickly and provide the greatest return on investment are implemented. Packaging these low hanging fruit measures with deeper, more comprehensive measures helps to improve the economic feasibility of the entire package of improvements. This also makes for a more efficient use of program resources over time, as a property does not have to be "touched" multiple times to achieve its full potential level of savings.

Implementing the whole building approach also requires a workforce that is trained in the concept of "building science." There can be important health and safety implications to implementing whole building approaches. This is seen in the residential sector, where many existing buildings lack the proper mechanical ventilation to ensure adequate indoor air quality. When contractors "seal" a building by reducing building envelope air leakage, this can eliminate the infiltration and create negative pressure in the house, causing carbon monoxide issues. This example amplifies the need to roll out programs in conjunction with the supporting market infrastructure, in this case a trained workforce.

Most energy efficiency upgrades to nonresidential buildings address a small subset of the building's energy consuming systems. Typically, only lighting equipment upgrades, or replacing the motors in heating and cooling systems are chosen because they are measures that are relatively easy to identify and implement. But to meet California's aggressive energy efficiency policy goals, single-measure retrofits will not suffice. Rather than the 5 to 10 percent energy savings realized in the majority of efficiency upgrades, a "deep" retrofit aims to realize a minimum of 30 percent or greater energy savings.

The New Buildings Institute, reporting from the Deep Savings in Existing Buildings Summit held in September, 2011<sup>132</sup> (attended by national, state and regional leaders in existing building energy efficiency), noted several themes that are consistent with successful deep retrofit projects. First, it is important to recognize the trigger points in a building's life cycle that provide the opportunity for a comprehensive efficiency upgrade. Adaptive reuse of a building, end-of-life equipment or building component replacements, upgrades needed to meet current code requirements, new purchases or property refinances, and portfolio planning are some of the excellent opportunities to pursue a deep retrofit. Once an opportunity is available, deep retrofits are made easier by increasing and improving financing options, aligning programs and policies (for example, updating cost-effectiveness tests used in utility incentive programs such that packages of measures rather than single measures are encouraged<sup>133</sup>), and developing sets

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132 <http://newbuildings.org/summit>.

of efficiency solutions that have broad applicability across specific building types and size categories.

The CPUC, as noted above, rolled out a performance-based whole house program in the residential sector starting in 2010 in PG&E service territory, followed shortly by programs in each of the IOU territories. Over the past two years, program administrators have had an opportunity to observe the level of success of the initial program approach and adapt the program for more successful implementation. Energy Commission-administered ARRA residential programs supported an over \$130 million investment in this market sector, providing funds for strong local partnership infrastructure; a skilled workforce; marketing, education, and outreach; rebate incentives; and low-cost financing for program participants.

For residential buildings, the CEC, CPUC, IOUs, POUs and local governments developed the Energy Upgrade California brand to bring together the disparate whole house upgrade programs offered by these entities and to reach common energy goals. It will take this level of collaboration and commitment to transform a single measure market to the whole building approach.

The multifamily and commercial sectors have not received the same level of attention or investment in the whole-building approach. The CPUC has reiterated its intent that IOUs develop whole-building approaches for the multifamily sector<sup>134</sup>, and a few ARRA-funded programs offered pilots to test different program design options. The commercial sector has some related program offerings in the IOU portfolio, such as the commercial calculated incentive program described above, and the Savings by Design program for new construction (including newly constructed buildings and major renovations/remodeling projects that are additions or expansions of an existing building or site footprint. However, it has yet to establish a comprehensive whole building program that aims to address the building as a system to deliver comprehensive upgrades.

### Performance-Based Incentives

A key strategy toward deeper retrofits is to develop “performance-based” incentive programs. Incentive strategies that are focused on promoting one type of technology over another provide a rebate to offset the incremental cost of the equipment, or the increased cost of the premium

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<sup>133</sup> Deep Energy Savings in Existing Buildings: Summit Summary; New Buildings Institute; February 2012; from p4 “... Align programs and policies. Programs and policies must align to support and rapidly drive deep energy savings in existing buildings. While aggressive policies and energy efficiency targets are in place, there are substantial conflicting regulatory areas that constrain deep energy savings. These include cost-effectiveness tests applied per individual measure rather than packages of measures, defining ‘total’ resource cost to include customer contribution without crediting other customer benefits, short- term program planning (e.g., annual kWh goals) and the absence of price signals on the value of deeper and monitored energy efficiency. At the rate level, there is a lack of effective price signals to reflect true costs of generation and delivery as well as the absence of carbon pricing.”

<sup>134</sup> CPUC Decision 12-05-015, p. 186. 2012.

efficiency choice over the conventional technology choice. Performance-based incentive programs reward the customer based on the improvement in efficiency over the baseline<sup>135</sup>. This approach encourages customers to implement as much efficiency as is feasible and cost-effective, helping to promote deeper retrofits. However, initial attempts at delivering a performance-based incentive program, particularly in the residential sector, are far from perfect. The modeling approach currently used, as well as the existing administrative process, can be burdensome and prohibitive for contractors. While this does not indicate that the performance-based approach should be abandoned, it does caution program implementers to carefully consider underlying assumptions in program design and to learn from existing efforts. It is expected that the contractor community will be a key stakeholder in discussions to resolve these issues.

### Fewer, More Integrated Programs

The energy efficiency portfolio overseen by the CPUC currently consists of more than 120 programs across the four major IOU jurisdictions. It is very difficult for customers to navigate through these program offerings and identify the right program for their project. Additionally, existing program offerings, as noted above, tend to offer rebates for single measures rather than groups of measures. If a project involves multiple technologies, including renewable energy, then the customer is forced to complete separate applications and meet program requirements across these programs. Many programs that would have yielded monetary gain for the owner or utility customer have had limited uptake in the market due to the time involved in learning about the program and complying with all of the requirements for participation, as well as other barriers. Each of these separate programs has its own administrative staff to support it, marketing and outreach strategy to generate customer interest and uptake, and EM&V effort to evaluate the effectiveness of the program. This is an inefficient use of resources that results in customer confusion and frustration.

A major effort of the Energy Upgrade California program was to develop a “one-stop-shop” Web portal where customers would be offered information about rebates for multiple programs in their county, obtain financing for the project, find a qualified contractor, and be able to apply for each of the relevant programs through one seamless application. Unfortunately, there were many challenges integrating application procedures for IOU, local government, and other state programs, and the ultimate vision was not fully realized. Energy Upgrade did demonstrate that there is considerable value in streamlining and integrating a range of measures and program approaches into a single, branded, statewide program.

### Coordination Between Upgrade Programs and Complementary Programs (Marketing, Education & Outreach; Workforce, Education & Training; Financing)

Energy upgrade programs should be developed in coordination with market infrastructure, such as a coordinated marketing messaging and outreach efforts, a trained and qualified

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<sup>135</sup> “Baseline” can refer to a building’s energy use prior to upgrades, or to a defined standard such as Title 24, Part 6. California IOU retrofit rebate programs have typically used Title 24, Part 6 as a baseline, while utility EBCx program savings and the whole-house performance program use a building’s historical energy use or existing conditions defined through an energy assessment as a baseline.

workforce, and available financial incentives. Energy upgrade programs that operate in a vacuum with little understanding of the availability of qualified contractors or low-cost financing will not achieve significant market penetration, or will encounter early failures from which it is hard to regain consumer confidence. As AB 758 anticipates more comprehensive energy upgrades, it is particularly important to ensure that customers have financing options to enable the deeper investment required, and to ensure that these customers can rely on the products they are purchasing to deliver the promised benefits.

### **Balance the Need for Quality Assurance/Quality Control (QA/QC) with the Need for a Streamlined Program**

QA/QC procedures are an important part of a program. These policies mitigate against errors in program delivery, helping to ensure a quality project is installed that delivers on customer expectations and administrator requirements. However, it is important to establish a streamlined QA/QC process that is effective, yet quick and easy for the building owner and the contractor. Existing QA/QC procedures can cause multiple visits to one property, each involving time from the property owner to provide access to the building. It would be ideal if the QA/QC process were streamlined to eliminate multiple steps, visits, and players for the building owner. There is value in providing verification to the building owner that the project was completed to standard, but ideally this effort will be accomplished with minimal disruption to the building owner. The goal should be to have a properly trained and competent workforce to avoid callbacks and have only minimal disruptions to the building owner. For example, in the residential sector, a QA verifier and a HERS Rater could coordinate the visit to a home if the retrofit project also triggers Title 24, Part 6, requirements.

### **Appropriate Tools to Support Performance-Based Programs and Persistence of Savings**

With a drive to implement more performance-based approaches, there is an increasing need for tools that can accurately portray the baseline conditions of a property and model the anticipated improvement in energy performance due to a package of measures. For comprehensive efficiency upgrades to be specified, it is important for energy upgrade professionals to adopt the integrated design practices used in new construction projects. Once implemented, specific management practices and monitoring technologies can help the energy savings from these retrofits persist through ongoing building operations (particularly in the commercial sector).

The existing software tool for residential whole house Energy Upgrade California program, EnergyPro, was originally developed for code compliance and has been used in the existing residential sector through the HERS program. EnergyPro was used by the IOUs in implementing Energy Upgrade California, and several contractor organizations have suggested either further improvements to the EnergyPro model to enhance the usefulness, ease of use, and accuracy of this tool or consideration of alternate software platforms for use in upgrade programs.

Building energy simulation is often used in the design of newly constructed buildings to analyze the energy impacts of alternative building components and systems. As part of US DOE's Commercial Buildings Initiative, the NREL developed a building retrofit workflow

training tutorial for retrofit energy modeling<sup>136</sup>. This is an example of the type of industry support that will allow retrofit professionals to benefit from the design tools typically used to optimize the energy efficiency of newly constructed building projects. The Rocky Mountain Institute's RetroFit Depot<sup>137</sup> also provides guidance to the industry on the "redesign" processes needed to achieve deeper levels of efficiency in building upgrade projects.

There are also best practice monitoring and benchmarking processes that have been used successfully to sustain the energy-saving benefits of a commercial building upgrade project. Best practice, deep retrofit projects include the installation of monitoring systems that allow building operators to track energy use and identify system conditions that need attention. Technologies that provide ongoing fault detection and diagnostics for energy-intensive equipment and systems are also cost-effective components of comprehensive retrofits. Energy use targets developed through a benchmarking or performance rating process can be used in ongoing building operations by comparing current energy performance to these targets. This whole-building energy use monitoring can identify when operations fall outside an expected range, so that investigations can be made to identify why expected performance is not being realized. Best practices include updating the targets when significant changes to building services and/or building energy systems are made, to keep the performance targets relevant and useful in ongoing building operations<sup>138</sup>.

### Learn From EM&V Efforts on the ARRA Programs

In addition to the IOUs investment in Energy Upgrade California by way of their Whole House Performance Program, the Energy Commission and local governments across the state used millions of dollars of ARRA funding to invest heavily in the Energy Upgrade California program that supported the rollout of innovative approaches to achieving energy upgrades. These programs were able to apply strategies that would be more difficult to integrate into the IOU portfolios, due to the emphasis on high, short-term energy savings established by the existing set of CPUC policies. EM&V studies on these programs will provide a wealth of available information to compare different approaches across different regions in California.

Both the CPUC and the Energy Commission are undergoing EM&V studies. All evaluation efforts are critical to implementing AB 758 as they provide valuable insight about the program, consumers, and implementers.

The CPUC is undertaking detailed EM&V impact evaluations and other work to characterize and quantify market effects associated with promotion of whole-house residential retrofit techniques and business practices by the IOUs and other program sponsors in California. The primary analytic strategy to be used in the study will consist of a cross-sectional comparison of the development of the market for whole-house residential retrofit and home performance

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136 [http://apps1.eere.energy.gov/buildings/commercial\\_initiative/resource\\_database/detail.cfm?p=357](http://apps1.eere.energy.gov/buildings/commercial_initiative/resource_database/detail.cfm?p=357).

137 [http://www.rmi.org/retrofit\\_depot](http://www.rmi.org/retrofit_depot).

138 A useful resource on this topic is the *Building Performance Tracking Handbook*, published by the California Commissioning Collaborative (<http://www.cacx.org/PIER/handbook.html>).

services in California and in a geographic area with little or no history of such program activity. CPUC's studies include onsite visits, program data collection, and cost-effectiveness analysis.

Interim results have been released by IOU contractors for two evaluations – *PG&E Marketing Effectiveness Study* and *SCE Contractor Training Assessment*. The *PG&E Marketing Effectiveness Study* is described as a unique view of the effect on the reactions to the Energy Upgrade California marketing strategies. The *SCE Contractor Training Assessment* provided an in-depth examination of training designs, methods, and materials. While these evaluations will provide tremendous insight to the IOU's implementation of the whole-home performance program, these evaluations did not include direct evaluations of the Energy Commission's ARRA Energy Upgrade programs or processes. Interim findings are mixed, and the Energy Commission cautions implementers to understand the results related to *PG&E's Marketing Effectiveness Study*, for instance. Evaluators presented strategies, collateral, and messaging developed specifically for PG&E program and not the ARRA statewide or local programs, yet compared the results of the total program effort without attempting to discern which materials caused the impact. ARRA programs had coordinated marketing, education, and outreach campaigns distributed widely in PG&E territory by Energy Commission-sponsored ARRA programs. A homeowner may have received different marketing messages and media from programs in the Bay Area by PG&E, ABAG, and the statewide campaign. In Sacramento, customers may have received information from PG&E, SMUD, and the statewide campaign. This may have lead to consumer confusion and program identify surrounding messaging, collateral, and media impressions. This highlights the challenges in conducting separate EM&V efforts for a program with multiple coordinated implementers.

The Energy Commission is also undergoing EM&V efforts that proactively address program performance. The evaluation will assess program achievements relative to stated goals and in the context of all efforts in California to improve residential building efficiency. Part of the Energy Commission's EM&V efforts includes developing a data warehouse that will store all of the Energy Upgrade California project data from local governments and the IOUs. This data will provide implementers and the US DOE with a wealth of information to study about the whole house upgrade market. EM&V results are not expected until April 2013.

### Address the Split Incentive

A challenge to the uptake of energy efficiency is split incentives. This challenge takes different forms. Common split incentives exist between landlord and tenant, and between different cost centers within organizations. Quite often, the entity that would have to assume the risk and capital outlay to perform an analysis and retrofit is not the entity that would realize the savings from resultant changes. There are some model lease structures to address tenant split incentives and some policy arrangements that can be made within an organization<sup>139</sup>, but no policies that require those types of leases to be implemented.

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139 UC Davis operated the Purchased Utilities Management Plan (PUMP) from 1993 to 2002, an innovative program that rewarded entrepreneurial energy management.

## Consistent and Clearly Communicated Program Support

If policy signals are weak and short-lived, the market will hesitate to move in response. Though the CPUC has made clear the intention to provide long-term support for many programs (for example, 10-year commitment to California Solar Initiative [CSI] and parts of Energy Upgrade California), one long-term complaint from the market has been the apparent tendency to start and stop programs at what seems to be short notice to a market that has much inertia (in other words, capitalizing labor, training, and marketing efforts to address current policy). Such a “fits-and-starts” approach damages relationships between industry stakeholders; just as contractors build up capacity in response to policy support, they are unable to recuperate their investment as support dwindles.

## Support Local Government Efforts

Local governments are deemed “essential partners”<sup>140</sup> and are asked to lead the pack for their communities but have resource and structural issues that make it difficult for them to do so. The pursuit of short-term sales tax and property tax revenue streams tends to run counter to meeting long-term state energy, water, waste, and climate reduction goals. Sales taxes and property taxes are the two largest sources of income for a city’s general fund. Both are volatile and need to grow over time to fund city services. The perceived need for continual local economic growth can run counter to many state goals. Frequently, land-use decisions are made that assist meeting short-term general fund needs while the long-term implications of the decision may not be well-defined. Meeting state goals will require commitment to long-term planning principles, but long-term planning can be compromised due to the four-year cycle that elected officials (at all levels) must contend with. Local governments are important allies for meeting AB 758 goals, and it is imperative that local officials who have an innate desire to be excellent stewards of the lands that they are accountable for receive the support they need to steer local planning, project, and administrative efforts in ways that complement and align with the state’s long-term goals. SB 375 (Steinberg, Chapter 728, Statutes 2008), the Sustainable Communities Strategy (SCS), is a nascent effort being implemented by metropolitan planning organizations (MPO; for example, SACOG, SCAG, SANDAG) that address local and regional transportation related energy use; the SCS does much to encourage local governments to meet state goals (for example, CEQA streamlining, higher priority in Metropolitan Transportation Plan for smart projects, MPO grants to local governments). However, there are no complementary programs that address building energy use. AB 758, if properly implemented, can be that program.

## Options for Addressing Needs

### Streamlining Programs via the Energy Upgrade California Model

The CPUC *Guidance Decision* provides direction for the utilities to transition the Energy Upgrade California brand to an umbrella brand for residential and small commercial efficiency

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140 ARB *Climate Change Scoping Plan*, December 2008, page 26.

programs<sup>141</sup>. The Energy Upgrade California brand has proven effective in the residential sector and has extensive resources, marketing, and outreach behind it. The recent decision by the CPUC to adopt the brand across sectors could provide a platform for integrating programs and attempting to achieve a streamlined interface for property owners to connect with available resources.

### **Coordinating Quality Assurance/Quality Control Across Entities**

Experiences in the residential sector demonstrate that multiple QA/QC visits to a home can result in a negative experience for homeowners and may serve as a disincentive for program participation. One possible option to address this issue would be to coordinate the QA/QC visits from different entities (for example, IOU program QA/QC with BPI QA/QC and/or HERS Rater QA/QC).

### **Allowing for an Alternative Cost-Effectiveness Framework That Addresses Non-Energy Benefits**

The tension between state goals for comprehensive whole-building retrofits and the reality that these efforts are not meeting existing cost-effectiveness requirements imbedded into IOU programs is a challenge. However, these whole-building approaches deliver on important “non-energy benefits” such as health, comfort, and safety that are highly valued by the customers and not currently incorporated into valuation metrics. The CPUC has developed a white paper to address the role of non-energy benefits and is building a public record on this issue (more below under “Balancing Benefits With Costs”).

### **Providing Funding and Tools to Support Local Governments**

Since local governments are essential partners, they need to be provided with the tools that will allow them to develop long-term goals that are well-aligned with long-term state goals. The CPUC has for several years been testing the abilities of local governments to deliver energy efficiency to their communities through the Local Government Partnership Program<sup>142</sup>. In the 2010-12 programs the CPUC provided \$60 million in funding beyond the Local Government Partnership Program. For SCE this was called the Local Government Strategic Plan Pilot program; for PG&E this was called the Green Communities and Innovator Pilot program. Both were well received by the local governments and the CPUC. These programs could continue to be modified over time as lessons are learned to provide continued support to local government-driven initiatives.

Other strategies could include providing annual incentives to cities that are meeting measurable and verifiable targets designed to achieve AB 758, SB 375, SB X7-7 (Steinberg, Chapter 4, Statutes 2009), AB 32 and other state goals. Since many California cities are served by both IOUs and POU, an IOU-funded incentive program targeted for all cities could be used to help leverage POU funding for these dual-served cities. In addition, expand a program that the city of Sacramento piloted between 2006 and 2009 whereby it provided bid preferences to supply

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141 CPUC Decision 09-09-014, p. 300. 2012.

142 For example, PG&E submittal- 2011 Report of Pacific Gas and Electric Company (U 39 M); May 1, 2012; Innovator Pilots, page 46

chain vendors and contractors that worked towards meeting the city's Sustainability Master Plan (SMP) goals and targets; except that state goals and targets would be used in place of the SMP's goals. This program has additional advantages in that it can be designed as a business attraction and retention process for the State.

## **Challenges / Risks / Barriers**

### **Balancing Benefits With Costs**

The drive toward deeper retrofits will be met with the challenge of demonstrating the cost-effectiveness of programs to encourage these deep improvements. The WHPP has not yet been determined cost-effective, based on the CPUC's current cost-effectiveness tests. However, CPUC policy requires only that the utility's entire portfolio of EE programs – and not individual measures – achieve cost-effectiveness based on established methods. The CPUC uses two metrics to determine if the benefits of the EE portfolio are greater than its costs -- the Total Resource Cost (TRC) test, which looks at the perspective of the utilities and all their customers, and the Program Administrator Cost (PAC) test<sup>143</sup>, which measures the utility perspective.

Through a workshop process, the CPUC is considering updates to its cost-effectiveness calculations that may better identify and include long-term and hard-to-quantify benefits that result from programs such as the WHPP. While the CPUC may adopt such approaches for evaluation of future IOU portfolios, it is important for program administrators and implementers to continuously endeavor to improve the WHPP's overall cost-effectiveness.

### **Tool Development Is Constrained by Resources**

Both in the residential and nonresidential sectors, tool development will be a key component of supporting current and emerging programs. For these tools to be most useful to the marketplace, they would ideally be designed and delivered in an open source technology format. This allows other entities – whether they are state agencies, utilities, or private companies – to develop applications that can integrate with the basic tools, thereby leveraging publicly funded software and databases and encouraging the market to develop and support business applications that leverage the open source tool library. Development of new tools or upgrading existing tools to be available under an open source license will require a significant resource investment, but is an important paradigm shift away from the current practice of ongoing public expenditures on privately owned tools that cannot be shared or multi-purposed. Without a concerted effort by the Energy Commission and the CPUC, tool development and supporting databases will continue to be program-specific and largely proprietary, which may provide short-term solutions but will increase the long-term program delivery costs for the state

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143 The TRC analyzes the benefits of a portfolio (calculated in terms of energy savings and avoided utility supply-side costs, including the forecast of future avoided carbon emissions) and divides these benefits by the full cost of portfolio implementation, which includes administration, overhead, and the incremental cost of the EE technology (that is, only the portion of the equipment's cost that can be attributed to energy efficiency) paid by both utility (via rebates) and the customer. The PAC uses the same benefits but divides them only by the utility costs.

and limit market participation in improving and expanding the tools employed by decision makers to improve building energy efficiency. The Energy Commission has made a commitment for all future software developed in support of efficiency programs (for example, energy code compliance) to be made available to other government agencies, utilities, and the industry under an open source software license. Further, the Energy Commission is designing this software such that it will be relatively easy to support multiple efficiency programs that require some type of building energy analysis, using the same software architecture.

#### **Adopting Energy Upgrade California to a Broader Market Base Could Dilute the Brand**

While Energy Upgrade California has achieved results in the residential sector, there is a risk that the decision by the CPUC to expand the brand to other efficiency programs in the IOU portfolios could dilute the original meaning of the brand. Energy Upgrade California was adopted based on market research at a specific, targeted market sector most likely to implement single-family residential upgrades. While the brand imaging and aesthetic may be consistent across programs, any effort to expand the brand to other market segments should be supported by a similar targeted marketing effort. Updates to the Web portal to accommodate these new sectors should consider carefully which barriers the market sector experiences to accomplishing upgrades and tailor Web portal additions to help overcome these specific barriers.

## CHAPTER 7: Compliance and Enforcement

The key factor to realizing energy savings from Building and Appliance Efficiency Standards development and implementation efforts is compliance with the standards. Compliance with regulations requires care and creativity; there typically has to be a value proposition (carrot) and a punitive consequence (stick). Another important component is the establishment and support of a process and a culture that endorses compliance through increased understanding of the standards and makes the process of proving compliance as easy, transparent, native to the normal business processes, and automated as possible.

Measuring compliance can be difficult. No recent studies to determine statewide compliance with the Building Energy Efficiency Standards for alterations to existing buildings have been conducted; however, there are a variety of compliance related issues that continue to be brought to the attention of the Energy Commission. These problems prevent California from realizing the full value of the work done to create and approve standards improvements. Looking more closely at the issues that exist with compliance will help move the State toward realizing the full value of the standards and will also create a credible framework to support the Governor's commitment to the US DOE Secretary Steven Chu, to have a plan to achieve 90 percent compliance by 2017.

This section identifies the status of compliance and enforcement activities for alterations to existing buildings, the compliance process, its strengths and weaknesses, and needs to improve the process.

### Market Status

#### Current Status of Standards Compliance and Enforcement

The current status of energy standards compliance in California varies depending on the building type (residential or nonresidential), the scope of the project (additions or alterations), location of the project (enforcement agency jurisdiction), and climate zone, and other factors. While the level of compliance with the Energy Efficiency Standards for residential HVAC change-outs is unknown, it has been reported that building permits are lawfully pulled for fewer than 10 percent of such projects.<sup>1</sup> Contractors often avoid pulling a permit for an alteration to an existing building, causing an unfair business advantage by not complying with the law. Several issues contribute to a low compliance rate in building alterations including: permits not being pulled, lack of enforcement agency resources for enforcement, and the complexity of the standards requirements and compliance process.

#### *Defining Standards Compliance and Enforcement*

Compliance is the process followed to achieve energy savings by meeting the minimum requirements of the standards. Enforcement is ensuring that minimum compliance with the standards has been met and to ensure there are consequences if noncompliance is found. It involves a number of steps and actors to complete.

The process of complying with and enforcing the Energy Standards involves several actors. These include:

- Legislature – provides legal basis to develop and implement standards.
- California Energy Commission – responsible for the rulemaking process that results in standards development and adoption, responsibility to develop tools to encourage and support compliance and enforcement of the standards, and sponsoring research into efficiency measures and methods that support the advancement of technology.
- Gas and Electric Utilities – provides support for analysis of proposed measures for inclusion in the standards and effective implementation of the standards to encourage compliance including training programs; and provide incentive programs for energy efficiency measures.
- Enforcement Agencies – the city, county, and state agencies that issue approval for construction activity provide plan review and perform inspections (code enforcement) for all applicable codes, including the Building Energy Efficiency Standards.
- Third-party plan reviewers and inspectors – the companies enforcement agencies use to outsource some plan review and/or inspection functions.
- Home Energy Rating System Industry – HERS Providers and Raters certified to conduct special inspections of the installed energy efficiency measures.

Other key market actors include product manufacturers and distributors, building science researchers, third-party incentive program implementers, consultants, software vendors, trade organizations, other state agencies, such as the Contractors State License Board.

All of these parties must communicate and cooperate for the compliance and enforcement process to run efficiently.

### *Essential Standards Components*

Strong Building Energy Efficiency Standards are one of the most fundamental, affordable, and effective mechanisms for increasing energy efficiency in existing buildings. However, the level of compliance with the Standards determines the amount of actual savings realized. Recent economic analysis indicates that every dollar spent on energy standards compliance and enforcement initiatives yields \$6 in energy savings<sup>144</sup>.

The Warren-Alquist Act requires the Energy Commission to periodically update and adopt building standards to decrease waste in the use of energy. It requires that the Energy Commission, in an open public process, develop performance-based standards promulgated in terms of energy consumption per gross square foot of floor space but may also include devices, systems, and techniques required to conserve energy. The standards shall be cost-effective when taken in their entirety and when amortized over the economic life of the structure when compared with historical practices.

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<sup>144</sup> <http://www.imt.org/uploads/resources/files/PolymakerFactsheet-EnergyCodeCompliance.pdf>

The structure of the Energy Standards recognizes the fact that prescriptive and mandatory measures, while easier to understand, present limited opportunity to encourage design flexibility and advancement in technologies and best practices. It also recognizes that the majority of influences driving building design decisions are not energy considerations, but aesthetics, functional requirements, and cost; so the Energy Standards are structured to allow tradeoffs to accommodate the wide range of design and construction choices.

There is also a need to continue to improve the energy savings from the standards, to address the commercialization of new technologies and to increase the level of stringency of the standards over time. These improvements also lead to necessary complexity with the standards.

One outcome of providing flexibility and increasing stringency is that the standards become more complex overall. Complexity can deter compliance; many designers and enforcement agency professionals do not understand the standards requirement. Unknowledgeable designers have difficulty demonstrating compliance. Unknowledgeable building department professionals become reluctant to enforce what they don't understand and can't defend.

The next sections will examine compliance components and evaluate strengths weaknesses and opportunities inherent in the Standards compliance process.

### **Current Process for Designing, Building, Documenting and Inspecting a Compliant Addition or Alteration to an Existing Building**

To obtain a permit for an addition or alteration to an existing building, documentation is required to demonstrate that the project complies with the Standards using either the prescriptive or performance method. The process for an alteration can be as simple as specifying required attributes of the project, such as insulation R-value and roofing material reflectance during reroofing, the efficiency of equipment during water heater replacement when obtaining a counter permit<sup>3</sup>. For an addition, it can be as complex as creating a comprehensive building simulation model, involving input from many design disciplines, and then preparing a compliance submittal package with the appropriate signatures, registry stamp and a plan set with the compliance documentation printed on them and the energy efficiency measures identified on those plans. Enforcement agency plan review for an addition can take 2-3 weeks. Correction notices are then issued and addressed and the plans receive another review before issuing the building permit.

Regardless of whether the process is simple or more complex, requirements need to be identified, documented on the required set of forms, signed, and submitted.

During construction, inspections at the building site are required to ensure that the essential design components and measures are installed properly in the building. This can range from a simple inspection, as in the case of an alteration, to a complex set of inspections for an addition involving enforcement agency professionals and third party inspectors. Specialized forms, such as the Installation Certificate (CF-6R) and the Verification Certificate (CF-4R) document the energy efficiency measures that are installed and the testing and verification required during the construction and inspection processes.

Designed as a summary of requirements, these specialized forms are on plan sets for quick reference. The forms are useful documentation for holding specialized market actors ranging from designer to installer to contractor accountable for realizing energy savings through appropriate design and correct installations of measures that meet energy efficient requirements of buildings. While the forms are useful tools for ensuring compliance, reliance on forms as the primary mechanism for compliance has several disadvantages. For example, the form-based mechanism does not account for activities occurring outside of traditional delivery paths; these activities include indirect purchases for appliances and unpermitted retrofits. In addition, specialized knowledge is required or must be obtained to competently address the standards in many instances. Involvement of many market actors, from design to installation, can lead to fragmentation and confusion throughout the process. Furthermore, the contractors do not typically educate the homeowner or building occupant on what is supposed to be in the building and how it should work (closing the loop).

### Role of the Energy Commission and Others Who Support Compliance Improvement

The Energy Commission is responsible for developing the regulations in a public proceeding. They are also responsible for interpreting and supporting the adopted regulations. They do this via an extensive compliance support network of activities, including:

- Energy hotline, energy videos and support of an Online Learning Center ([www.energyvideos.com](http://www.energyvideos.com)), complaint investigation and resolution
- Outreach to local enforcement agencies individually as well as through their International Code Council (ICC) chapters, participation in association events and tradeshows, providing plan review assistance
- Collaboration with the CSLB and other state licensing organizations to educate licensed design professionals, contractors and industry experts, conduct complaint investigation and resolution, and support a “no tolerance policy” with contractors not pulling permits or meeting field verification requirements.
- Collaboration with the CPUC, IOUs and POUs to undertake activities to improve compliance
- Participation in the following trade and advocacy organizations: The American Institute of Architects, Western HVAC Performance Alliance, Compliance Improvement Advisory Group, National Fenestration Rating Council, Cool Roof Rating Council, California Building Officials (CALBO) Education Weeks, International Heating and Air Conditioning Institute Annual Trade Show, National Association of State Energy Officials (NASEO)
- HERS Industry oversight

California IOUs have been a major contributor to compliance improvement in existing buildings through their support of organizations that work to improve compliance in strategic ways, including the Compliance Improvement Advisory Group and the Western HVAC Performance Alliance. The IOUs have provided a comprehensive set of targeted and role-based

training courses and job aids that help contractors, analysts, and building departments improve their job performance with respect to energy efficiency and have supported the effort to improve the education and performance of building energy analysts, including the creation of a comprehensive certification program in cooperation with the California Association of Building Energy Consultants (CABEC).

## **Needs**

### **Simplify the Compliance Process While Retaining the Ability to Tighten the Standards and Provide Performance Standards Flexibility**

The most frequent complaint by enforcement agencies and contractors, with regards to the Energy Standards is that the compliance process is too complex. There is a lot of confusion as to what forms are required, who is required to complete them, and when to require them<sup>5</sup>. This confusion has led to building upgrades being completed and approved without the proper inspections, testing, and verifications completed. The need to simplify the process while retaining the ability to tighten the standards and provide performance standards flexibility is necessary both to ensure compliance and achieve the state's energy policy goals.

#### *Options for Addressing Need*

An option to simplify the compliance process would be developing a mobile software application that can be used in the field by HERS Raters to automate the process of entering verification results and uploading them directly to the HERS Provider data registry. Other features of this application would include photo documentation of the results, generating a task list for revisions to the building energy model, and items to recheck by the Rater at a later time.

An option to simplify the entire compliance process would be to move toward a more automated compliance process. Automation components could include offsite permit application and approval, data integration with other systems such as the HERS Provider registry, city and county business software, manufacturer's data, building analysis software, and more. One example of automation that would simplify compliance would be an electronic process similar to Turbo Tax®, where the client answers a series of questions that filter and customize the compliance choices when completing compliance documentation. This filtering logic can be used in applying the Energy Standards so that permit applicants only have to see and respond to those questions and requirements that apply to their individual permit application and project scope. By creating a user interface that guides the applicant through a series of questions about their project, users would only need to see requirements to which they must pay attention.

#### *Challenges, Barriers, Risks*

There are many challenges that face simplifying the compliance process, such as added time and cost to the building owner, expensive software development and maintenance, and security risks associated with automating sensitive information, all of which have benefits as well. The most critical challenge with a simplified process is to implement and train the existing market actors on how the new process works. Curriculum would need to be developed to address the changes before their implementation.

## Customize and Target Outreach and Standards Education From a Role-Based Standpoint

Historically, training for the Energy Standards in California was created and delivered by subject matter experts (SMEs) without the benefit of formal job task analyses so that the training could be effectively targeted to the functional needs of the audience. Although this has begun to change recently, there is a need to understand the needs of professionals in each role supporting compliance, and to create and deliver more training specifically tailored to how each performs his/her duties.

### *Option for Addressing Need*

The Energy Commission could partner with relevant organizations (for example, the California IOUs and POUs, CABEC, CALBO, CSLB) to perform needs assessments studies and job task analyses (JTAs) for each of the professionals needed to achieve a high level of standards compliance. Once the needs assessment studies and JTAs are complete, the partners would create or approve curricula that could be used by multiple parties who deliver training. This should result in more effective training, more uniform delivery across training platforms, and even a reduction in the perception of the standards; inaccessible complexity.

### *Challenges, Barriers, Risks*

Development of effective needs assessment studies and JTAs is neither a quick nor necessarily inexpensive activity. It will need to involve a large number of SMEs, a solid facilitation team, and professionals with deep experience in job task analysis and curricula development. That will involve a significant cost and runs the risk of taking longer than would be optimal for delivering timely training for compliance with a specific iteration of the standards. (Standards are revised every three years.) Additionally, the activity will need to be updated during each cycle of the standards, which means a reliable long-term funding source needs to be identified.

### *Other Options for Addressing Need*

The Energy Commission and its partners (that is, the utilities, CALBO, CABEC, CSLB, AIA, IHACI) could develop and deliver regular updates to appropriate professionals through bulletins, newsletters, presentation at chapter meetings, social media channels, the Energy Commission's Online Learning Center, and regular workshops (on emerging compliance issues, changes to standards or standards enforcement tools, and other compliance-related details). One risk in this approach is that if each of the organizations performing the outreach does not ensure that the training material is adequately engaging, the time restraints of the target audiences could mean that the messages would be largely ignored.

The Energy Commission could recruit professionals to cross-train others. For example, HERS Raters could use their experience and approved curricula from the Energy Commission or utilities to educate HVAC contractors on what the code requires of them. Or CABEC members could do the same for targeted enforcement agency professionals. The obvious challenge with this outreach approach is ensuring consistency and accuracy in what is taught and how to support the effort.

One challenge with any approach to delivering more effective outreach and education on Energy Standards compliance topics is measuring the effectiveness. The real measurement of effectiveness is whether compliance occurs.

### Increase Permit Participation for Alterations Involving Energy Efficiency (HVAC Change-outs, Reroofs, Water Heaters, and Window Replacements)

Many contractors and homeowners who are doing single-component alterations bypass the permit process. A recent survey, conducted through the Western HVAC Performance Alliance that assessed the risk of contractors not pulling a permit for residential HVAC change-outs, revealed that there is a relatively low expectation of consequences, and the fines associated with the violation are not high enough to motivate a contractor to obtain a permit. This market condition has created an “underground economy” that encourages noncompliance, ultimately undermining the Energy Commission’s goal of achieving 90 percent compliance with the Standards.

#### *Options for Addressing Need*

To increase permit participation, the CPUC has issued in their CPUC decision 12-05-015 the following orders:

49. Pacific Gas and Electric Company, Southern California Edison Company, San Diego Gas & Electric Company and Southern California Gas Company shall include in their 2013-2014 applications a “Fast Track” Energy Upgrade California job approval protocol based on the Heating, Ventilation and Air Conditioning Energy Replacement Protocol. This proposal shall apply more generally to the Energy Upgrade California program.

50. If needed, Pacific Gas and Electric Company, Southern California Edison Company, San Diego Gas & Electric Company, and Southern California Gas Company shall propose changes to the Heating, Ventilation and Air Conditioning Upstream Incentives program to bring it into alignment with Senate Bill 454, while preserving it as a cost-effective program.

51. No incentives for equipment requiring a building permit shall be provided any contractor or customer without that contractor or customer certifying that s/he has complied with all permit requirements and utilized a licensed contractor.

52. Programs proposed by Pacific Gas and Electric Company, Southern California Edison Company, San Diego Gas & Electric Company, and Southern California Gas Company shall comply with Senate Bill 454 requirements, and all applicable programs shall support Heating Ventilation and Air Conditioning permit acquisition as a matter of course.

53. Pacific Gas and Electric Company, Southern California Edison Company,

San Diego Gas & Electric Company and Southern California Gas Company shall institute the following changes to support Heating Ventilation and Air Conditioning (HVAC) permit acquisition in conjunction with their HVAC and Energy Upgrade California programs:

- a. Energy Upgrade California jobs involving HVAC replacements must include submittal of the HVAC permit number and a contractor certification that appropriate permits have been obtained, for inclusion in program records.
- b. Show in their 2013-2014 applications all programs to which the requirements above apply (and present copies of the incentive/rebate applications or other documentation) evidence that they are in full compliance with Senate Bill 454 and this decision.<sup>6</sup>

Another more aggressive option would be to track HVAC equipment serial numbers from the manufacturer or distribution points to actual permit addresses. This could be accomplished by a cooperative effort of equipment manufacturers, distributors, and enforcement agencies developing the process and database to track and monitor the equipment.

#### *Challenges, Barriers, Risks*

This phenomenon of ignoring requirements to pull permits is not driven fundamentally by a desire to avoid the Energy Standards so it cannot be solved by Energy Standards efforts alone. Coordination among enforcement agencies, manufacturers, the contractor community and the CSLB must occur. Investor-owned utility incentive programs are requiring homeowners to certify that they have complied with all applicable laws. This process could be improved by the incentive programs requiring copies of the final building permit to validate compliance. The lack of permits being pulled will not be solved by one actor but rather a concerted effort by all increasing their attention and commitment in this area.

## **CHAPTER 8: Reaching Property Owners and Program Awareness: Marketing, Education, and Outreach**

Marketing, education, and outreach are three complimentary strategies that collectively comprise the public-facing aspect of a program. ME&O is a critical component of a program, equally as important as the availability of financial resources and the strength and rigor of quality assurance standards. Without a well-designed ME&O program, consumers will never know or care about the resources available to them, or the action being requested of them. A marketing, education, and outreach program is intended to motivate consumers to take a specific action. The definition of marketing, according to the American Marketing Association, is the activity and processes for creating, communicating, delivering, and exchanging offerings that have value for customers, clients, partners, and society at large. A necessary activity under marketing is advertising or selling a program, including energy efficiency programs. Marketing consultants under the Energy Upgrade California program stated that a consumer requires three “touches” or “impressions” before the intended message sticks and they consider taking the intended action – in this case, initiating and completing a whole-building upgrade. To make those touches, there is a need to invest in a well-thought-out statewide ME&O campaign. Advertising is used to broadcast messages through traditional media channels – television and radio ads, print ads, and billboards. Outreach compliments marketing activities by delivering the same message through on the ground messengers, such as building industry professionals, program staff, local government, business and community leaders, and non-profit organizations. Education overlaps with outreach, and is designed to inform consumers about the “why” to take action. Education also is important in terms of delivering a specific set of skills to a workforce; this issue is elaborated in the workforce development chapter. For the AB 758 program, the action consumers will be asked to consider is the choice to upgrade the energy efficiency of a building.

The goal of the AB 758 program – driven and informed by the efficiency targets adopted jointly by the CPUC and supported by the Energy Commission in the *Strategic Plan* – is nothing short of market transformation, requiring action from a huge majority of currently indifferent California consumers. This task is made further difficult by the complexity of energy efficiency as a product. You cannot touch or feel energy efficiency – even after the installation of a project, in many cases – which makes it even more difficult to sell to consumers. In addition, choosing to upgrade a property with energy efficiency measures is often invasive and can take time to coordinate and oversee. To address these inherent challenges, the AB 758 program will need to focus on developing and supporting the rollout of a strong ME&O program aimed at overcoming barriers that impact reducing energy use, saving money and creating jobs.

Effective ME&O includes raising awareness and action steps to promote industry and consumer involvement in cost-effective, energy-saving measures that support AB 758 policy mandates. All ME&O activities should stimulate and support AB 758 implementation, including monitoring progress, taking corrective action, and measuring success. As part of the process to

develop strong and appropriate ME&O messaging to raise program awareness, market research should include ways to message the program. Research should include the CPUC and Energy Commission EM&V efforts related to Energy Upgrade California. According to the CPUC process evaluation on Energy Upgrade marketing and outreach, participating contractors found that the most effective messages for their program participants are focused on comfort, incentives, and lowering energy bills<sup>145</sup>. So program messages should include these key benefits. Secondary benefits such as reducing energy use; saving money; creating jobs; revitalizing local economies; reducing greenhouse gas emissions; improving air quality and health; training contractors and raters; educating on affordable financing options; and educating property owners and businesses about the “whole building” approach to energy efficiency upgrades should also be considered. ME&O will need to capitalize on every area that touches AB 758 to build and maintain continuity in all ME&O efforts and push energy efficiency concepts into the marketplace.

## **Market Status**

The existing ME&O activities are too often characterized by a plethora of poorly coordinated messages, many focused on promoting a specific measure or activity. While there are significant investments in ME&O activities, particularly on the part of the IOUs<sup>146</sup>, much of this marketing is singularly focused on promoting a specific program or measure and not on generating awareness or a call to action for making substantial energy efficiency improvements in buildings as a whole. Generally speaking, consumers are confused about building energy efficiency; they may know it exists, and some may know it is a good decision, but few are capable of sorting through the cacophony of messages to identify the useful information to make an informed decision. This confusion is amplified in the nonresidential sector, where buildings and potential measures are often much more complex. The market is not yet well-supported by the appropriate tools to communicate energy efficiency opportunities in an effective manner. Finally, real estate and appraisal communities do not consider the value of energy efficiency when presenting or assessing a property, resulting in little incentive to invest in efficiency improvements. The combined result of these barriers is a consumer base reluctant to invest in energy efficiency, or unsure of where to start. This is particularly true in the current economic recession.

The CPUC recognized the need to bring together the marketing, education and outreach activities for a holistic, statewide approach in its *Long Term Strategic Plan* process. The *Strategic Plan* calls for the need to have a coordinated, statewide framework for messaging all energy efficiency programs. The elements of this statewide ME&O effort were conceptualized as a consistent statewide brand, a comprehensive focus to promote energy efficiency based on

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145 “Interim Finding and Recommendations from the Whole House Process Evaluation – Training and Marketing.” Presentation prepared by SBW Consulting, Inc., ASW Engineering, and Opinion Dynamics Corporation. May 18, 2012.

146 About \$176 million of the CPUC Energy Efficiency Portfolio from 2006-2008 was invested in ME&O programs. IOU Energy Centers hosted nearly 550,000 hours of training for nearly 40,000 unique attendees during the 2006-2008 program cycle.

messages informed by market research, and supportive social marketing and strategic partnerships to further the message in ways that resonate with consumers. This statewide effort was also envisioned to include a Web portal, a virtual space where all interested parties could share peer-to-peer thoughts and experiences related to energy efficiency in California. This Web portal would also be a place where consumers could connect to the resources available and appropriate for them. Additionally, the *Strategic Plan* noted the necessity to further target this larger, statewide effort to specific market segments to ensure the messages used are relevant to the intended audience.

The recent ARRA-funded Energy Upgrade California program effort was informed significantly by the ME&O findings of the *Strategic Plan*. The Energy Upgrade California program developed a single, statewide brand based on market research and coordinated across stakeholders. The Energy Upgrade California program focused on single-family residential households for the first phase of the program, defining a specific market segment, and identifying potential early adopter characteristics and the messages that resonate with these early adopters through research. All ARRA recipients investing in existing building programs were encouraged to adopt the Energy Upgrade California brand and messaging strategies, particularly those programs with a focus on single-family home.

The Energy Upgrade California program centered in many ways around the Energy Upgrade California website, envisioned as a one-stop-shop Web portal for consumers to access information and resources and get motivated to take action and upgrade the efficiency of their whole house, as well as learn about finance programs and connect with a participating contractor or rater. The program leveraged the statewide efforts by reaching out to trusted messengers in key regions across the state, such as local governments, nonprofit organizations, and participating contractors and raters. In this way, the Energy Upgrade California program was able to deliver a coordinated message, informed by market research and targeted at a specific market segment, building on the expertise of regional leaders working on the ground with local credibility.

This effort is a first step in a significant move toward greater integration of programs both internally within the IOU structure and across California. Evidence indicates strongly that the strategy is working<sup>147</sup>. While the Energy Upgrade California effort was funded through limited-term ARRA funding, elements of the program live on. The recent CPUC decision adopting the 2013-2014 portfolio guidance document directs the IOUs to use the Energy Upgrade California brand as the “umbrella brand” for statewide residential and small commercial programs, and to take over maintenance and management of the Web portal, moving forward, with a 10- year commitment.

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147 Web analytics from the Energy Upgrade California Web portal show a connection between significant marketing and outreach pushes and Web portal activity, showing that the ME&O portion of the program is driving consumers to the Web portal. Additionally, the CPUC reports that one-third of all Energy Upgrade California contractors received their leads through the Web portal, helping to demonstrate that ultimately the ME&O efforts are converting to projects.

Commercial properties have not been covered by Energy Upgrade California, with some isolated exceptions; Los Angeles' PACE initiative is branded as Energy Upgrade California, although it cannot be reached from the main Energy Upgrade California homepage. For commercial owners and managers, ME&O is offered through a variety of channels such as industry groups, professional bodies, utilities, webinars, vendors, journals, electronic newsletters, websites, and so forth. Given the complexity of commercial properties and the vast array of options for improving energy efficiency there is understandable confusion.

There is little formal research on ME&O in the commercial sector, but interviews with a number of industry stakeholders on behalf of the Energy Commission raised the following general points:

- The Class A office sector is thought to be the most knowledgeable on the topic of energy efficiency, and small commercial owners typically the least knowledgeable. Accordingly, the Class A office sector is using this knowledge to create a competitive advantage in terms of lower operating costs and enhanced brand image.
- Larger firms tend to be better resourced and have dedicated energy managers who can monitor technology trends and utility offerings. They also typically have a network of trusted contractor partners who can provide guidance and support, and higher levels of support from their utilities.
- Building owners are most influenced by their peers in how they approach energy efficiency. This can come in the form of published case studies, conference/webinar presentations, networking events, and so forth.
- When considering ME&O, commercial properties should be broken into logical subgroups based on building type, size, ownership type, and so forth, so as to tailor messaging and resources.
- The availability of training to support owners in making the business case for energy efficiency is limited.

Given the complexities of the commercial market, successful ME&O strategies will likely comprise a combination of approaches rather than a one-stop solution.

## **Market Needs**

The Energy Commission's role and responsibilities in AB 758 create a critical need to educate and support all stakeholders by helping them understand where they fit into the implementation of this legislation, as well as their role in the "call to action." Using the Energy Upgrade California program as the umbrella brand for statewide residential and small commercial, existing and new resources are needed to leverage ME&O options that will equip the energy industry and consumers with the knowledge, skills, and ability to upgrade residential and nonresidential buildings. Because not all changes in energy policy are presented in a media that suits each stakeholder, the perceptions of policy makers, building owners, and homeowners must be addressed in designing and delivering marketing messages. To supplement this targeted marketing, a general education and awareness campaign on energy

efficiency in existing buildings, the whole-building approach, as well as energy assessment/audits, ratings, and labels, should be addressed. ME&O should target those who are in the best position to make decisions on energy efficiency upgrades and move them to greater engagement. For instance, the first level of engagement for a homeowner might be a “touch” from their utility. This leads the consumer to look at a website and learn about Energy Upgrade California. The website motivates them to call a participating contractor, who can further market the program through making the case during a consultation with the property owner. Each of these steps represents a different level of engagement, and each needs to be carefully thought out as part of the ME&O programs.

Around California there are mandatory approaches that require efficiency improvements to existing buildings. These approaches are typically focused around some trigger point, such as the sale of a building or the upgrade of meter infrastructure. These are opportune times to get information in front of property owners and decision makers to take action while doing other efficiency upgrades to the property. In developing and implementing a marketing plan for AB 758, these types trigger points should be considered and a targeted strategy for each trigger point should be developed to provide education and awareness opportunities to engage property owners to take action.

### **Need for a Well-Developed Statewide Marketing, Education, and Outreach Plan**

Due to the recent direction from the CPUC to adopt the Energy Upgrade California brand as the umbrella brand for statewide residential and small commercial efficiency programs, the Energy Upgrade California program is poised to be the primary channel for a significant portion of AB 758 ME&O activities. This will provide an avenue to inform consumers across California about the state’s policy commitments to energy efficiency and the value of energy efficiency, to California in general and consumers specifically. However, care must be taken in expanding this brand to other market sectors to ensure that momentum is gained, not lost. Interfacing of statewide, regional, and local ME&O, as well as with workforce, education, and Outreach, is important to define early on in the process and to coordinate to leverage critical resources. The financial investment in ME&O must be clearly defined and a budget set aside to plan and meet the overall AB 758 project goals and targets. Such budget detail such as line items reflecting what sort of marketing channels are being funded, and what audiences they are intending to reach is critical when evaluating effectiveness and determining course correction. Meaningful messages around this program must motivate and present a “call to action,” such as saving money, helping the environment, health and comfort, certifying a competent workforce, and reducing dependence on foreign oil/fossil fuels.

### ***Options for Addressing the Need***

A well-developed ME&O plan includes a research strategy that reviews AB 758 program objectives, existing studies, surveys, websites, and prior marketing efforts to develop an overarching statewide ME&O approach for all sectors under AB 758. Analysis should be done to determine the balance between advertising and in-person marketing. The CPUC’s recent Energy Upgrade California process evaluation concluded that mass media is not the most

effective medium for marketing the program<sup>148</sup>. The results indicate that word-of-mouth contact with promoters at events or contractors as sources for learning about the program were twice as effective. Research on Flex Your Power had a similar conclusion. Based on the research conducted, develop detailed outreach and marketing plans for each specific sector targeted under the AB 758 program scope. Include information in the plans about finance programs and explain how the building industry professional workforce can be integrated as key marketing agents. Brand guidelines exist for the Energy Upgrade California program and can be expanded to the nonresidential sector to ensure consistency under the umbrella brand. Then further ensure that the brand is managed and the guidelines are adhered to through education and outreach to partners and building professionals to strengthen the brand.

Ensure buy-in from the IOUs. Current IOU investment is focused on single measure approaches, and the IOUs represent by far the largest market share of investment in ME&O activities in California. Securing their commitment and involvement is crucial to overcoming the disparate and occasionally conflicting messaging that pervades existing markets. An example of this is the huge potential pathway for effective outreach by targeting utility consumers based on regional and local energy consumption and building characteristics. The key source of this data are the utilities, and there need to be options for securing data revealing consumption patterns for targeted marketing purposes.

Focus on expanding the Energy Upgrade California Web portal development to incorporate other sectors; such efforts will need to consider carefully the barriers present in each intended market segment and the key benefit messages to these decision makers. Ensure that pieces of the program's Public Relations campaigns, such as media buys and earned media strategies, are coordinated statewide including leveraging efforts with local partners and building industry professionals.

### *Challenges, Barriers, Risks*

There are challenges under the program – market research is expensive and timely and may not be feasible for the fractal-like divisions in existing market segments. Further, coordination across stakeholders and local partners is important, but it takes time and not all parties are ready to build consensus. A barrier is that the IOUs are risk-averse and require layers of approval from legal and regulatory, which takes time and results in less information made available to decision makers on ME&O activities. A risk when expanding the existing Energy Upgrade California program messaging and brand to markets outside of the initial launch of the residential whole house performance program, is that the brand itself may become diluted or inappropriately used. It will take careful planning, coordination, and policing for the expansion of the brand to work effectively.

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148 "Interim Finding and Recommendations from the Whole House Process Evaluation – Training and Marketing." Presentation prepared by SBW Consulting, Inc., ASW Engineering, and Opinion Dynamics Corporation. May 18, 2012.

## Communicate Value of a Well-Designed Marketing Education and Outreach Effort

Some policy makers do not understand the inherent value or connection between a well-designed ME&O program and the success of the larger program it supports. Marketing in particular is often perceived as a luxury expense that should be used sparingly. However, program administrators and building industry professionals understand the need for a robust and well-funded ME&O program as critical to their success. This perception of marketing as a program luxury will have to be addressed to gain policy maker buy-in for well-funded ME&O program components.

### *Options for Addressing Need*

More research into the ARRA programs to demonstrate a linkage between ME&O campaigns and uptakes in program participation. Educate policy makers of ME&O efforts using proven results. Establish a detailed budget and timeline to clearly explain what policymakers get for the investment. Below are performance metrics from the statewide Energy Upgrade California ARRA contract to demonstrate results from an 18 month effort<sup>149</sup>.

Upgrades completed (as of May 2012)

- 4,566 total upgrades completed or in progress

Web Portal:

- 2,177,470 unique page views
- 327,314 visitors to site since launch (~770 / day)
- More than 5,920 user accounts created
- 553 contractors or raters registered on the site
- Nearly 7,000 contractors contacted through the site

Marketing / Outreach

- 104,000 person to person direct stakeholder interactions
- 334 stakeholder workshops
- More than 196 million paid and earned media consumer impressions

### *Challenges / Barriers / Risks*

There is a risk that too aggressive a political campaign could backfire and result in a backlash against ME&O programs at a time they are most needed. Explaining the need for a robust and well-funded ME&O effort and defending against the view that ME&O is a disposable budget item is a delicate dance. It's critical to educate policy makers about the benefits of ME&O while appreciating the optics that marketing can be viewed as a luxury item.

### **Leverage Trusted Messengers**

The key to a cost-effective ME&O plan is to use existing trusted voices to deliver a carefully crafted message. For homeowners, these trusted voices might be community leaders, city officials, community organizers, or even neighbors who participated in the program. For

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<sup>149</sup> Results are self-reported by ARRA funding recipients; a separate EM&V effort is underway to consider the effect of the program, but results will not be available until April 2013.

commercial building owners and business decision makers, these trusted voices may be property management associations, industry peers, business leaders, and others. Identifying these regional partners and empowering them with resources and the underlying statewide message are important – so too is incorporating the feedback these individuals or organizations will have regarding the appropriate regional perspective. Other critical partners and messengers are building industry professionals, other energy professionals and facility managers, who often are the first point of contact with a property owner or decision maker. Supporting this workforce with the tools to communicate the program benefits and training the workforce in sales techniques to help close the deal will support program success.

#### *Options for Addressing This Need*

Use existing channels developed. Coordinate ME&O efforts by region and sector to make efforts more cost-effective. Plans should be developed to determine how best to engage the best program messengers. Ensure that messages are carefully coordinated with partners and building industry professionals for successful leveraging. Provide resources for existing outreach channels to enable their ability to spread the message on behalf of the program, including cooperative marketing resources for building industry professionals. Provide training to building industry professionals on how to market and sell the program so they can help close the deal by getting the decision maker to take action.

#### *Challenges, Barriers, Risks*

The right level of granularity should be established to determine the most cost-effective way to achieve a regionally and sector-appropriate approach. Do you partner at the city or county level, try for larger regions including groups of counties, property management associations or business leaders? In addition, it may be difficult to identify these “trusted community members” without significant time and exposure to a region or community.

#### **Marketing, Education, and Outreach Should Communicate the Value of a Trained Workforce**

Training a skilled workforce has benefits not only for Energy Upgrade programs, but can also support long-term market transformation. Highly skilled building industry professionals will carry their skills and knowledge into their everyday work, not just installations supported by a rebate or incentive program. To support the potential for this transformative effect, ME&O plans should communicate the value of choosing a particular building industry professional over another. Property owners and decision makers may not understand the value of certification programs and therefore might not be willing to pay a premium for a building industry professional with a particular skill set. Communicating the value add of these trained professionals in a way that resonates with the intended audience will help create demand for these professionals. This demand in turn will generate more employment opportunities for the emerging green workforce, stimulating more professionals to seek out training opportunities and creating a positive feedback loop with benefits for the energy improvement industry at large.

## Implement and Support Innovative and Creative Marketing, Education, and Outreach Strategies

Developing a practice of using creative and flexible ME&O strategies will help the program adapt to innovative communication avenues and reach a broader audience. Empowering existing communication channels in new and interesting ways could also help expand the reach and accessibility of the program in a cost-effective manner. For example, the program could use guerrilla marketing/social media to promote creative thinking and innovative communication approaches. The mandates and activities of the AB 758 program will be a new directive and concept for numerous entities. Using innovative marketing strategies and social media can help to communicate to a broader set of stakeholders. Connecting to and empowering these stakeholders can also increase the reach of the program.

### *Options for Addressing This Need*

Foster innovation at the local and regional level to support new or emerging marketing and outreach models, such as the Home Makeover Contest in Los Angeles County<sup>150</sup> and the Cooperative Marketing approach piloted in four regions (Bay Area, Sacramento, Los Angeles, and San Diego)<sup>151</sup>. Establish a social media presence through existing websites such as Facebook and Twitter to connect to a larger group of people and allow peer-to-peer sharing.

### *Challenges, Barriers, Risks*

The Cooperative Marketing pilots achieved different levels of success as each had different program designs and rules. The more successful programs encouraged a high level of innovation by participating contractors. Uptake was lower in regions that had stricter guidelines related to how the Cooperative Marketing funds could be spent. While Cooperative Marketing is a great investment to leverage creative ME&O with building industry professionals, future programs should be investigated before further resources are invested in developing a statewide approach which is consistent and most effective based on past pilots.

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150 The Los Angeles Home Makeover Contest was a strategy used to bring Energy Upgrade California program awareness to property owners in Los Angeles. Builders and participating contractors donated equipment and labor to the winner and finalists of the competition. Five finalists won free energy upgrade projects for their homes and the grand prize winner won a \$50,000 home energy makeover – aiming for a zero net energy home. A property owner was only required to sign-up on the Energy Upgrade California Los Angeles County Web portal page to be eligible to win.

151 Cooperative Marketing is a cost-sharing approach. Participating contractors and local government partners shared the cost of contractor marketing collateral. The participating contractor could co-brand with the Energy Upgrade California program using program-created materials and inserting their name, contact information, and logo. They could also create their own marketing campaign and use the Energy Upgrade California logo on their materials. Each participating contractor had a specific budget he or she was allotted, and when that contractor successfully completed a certain number of upgrade projects through the Energy Upgrade California program, the budget was reset, and he or she was allowed to use more Cooperative Marketing funds.

Another challenge is that efforts to use social media to further the ME&O objectives of the Energy Upgrade California program have had tepid success and are an expensive investment<sup>152</sup>.

### Consistent and Clearly Communicated Program Support

The marketplace responds to policy signals. If policy signals are weak and temporal, the market in turn will hesitate to move. The Energy Upgrade California program ME&O efforts, largely supported by ARRA funding, have been struggling to maintain momentum as program administrators attempt to communicate to consumers across California the implications of the end of the Energy Commission-ARRA funding period. Though the CPUC has made clear the intention to support the program for the next 10 years, the effects on ME&O are unclear moving forward. This is most articulated by the ME&O gaps felt between the end of local government coordination and outreach contracts under Energy Commission-led ARRA and the continuation of ME&O under the CPUC guidance. Both local government and the HERS Whole House industry received significant support under Energy Commission-led ARRA programs but are not extensively emphasized in the program direction for the 2012-13 transition programs. The CPUC has done a valiant job providing opportunities for continuity of the role of local governments as Energy Upgrade promoters. The CPUC has authorized \$5 million – \$15 million in spending in 2012 to continue local government or Energy Commission-lead financing or ME&O activities. The efforts related to ME&O by the IOUs are voluntary however. The CPUC also authorized local governments to submit Regional Energy Network proposals for the first time ever, and most of these are expected to focus on Energy Upgrade program implementation and marketing. Further, the CPUC required the IOUs to identify appropriate roles for local governments in Energy Upgrade program delivery going forward, and local governments will have the opportunity to comment on how the IOUs have done this in the application review period. Finally, the CPUC also removed control over statewide Energy Upgrade ME&O from the IOUs to the California Center for Sustainable Energy (CCSE) to implement statewide on behalf of all IOUs.

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<sup>152</sup> The Energy Upgrade California program experienced low participation in Facebook and Twitter. Participation was steadily increasing when the Energy Commission ARRA funding ended. Social media such as maintenance of a Facebook or Twitter account is labor-intensive and expensive. Having optimal program outreach through those channels requires a 20-hour per week investment.

## **CHAPTER 9:**

# **Data Needs for Decision Support**

Markets succeed when relevant information is broadly available and easily acted upon. Data collection, organization, analysis and delivery are actions needed to remove the market barriers to the adoption of energy efficiency in buildings. California's consumers, building owners, and many existing building professionals all need information on the energy savings expected from efficiency upgrades, and on the relative performance of existing residential and commercial building properties. Financial institutions need to assess investment risks, which is best supported by measured performance data incorporated into probability distributions of cost savings from existing building efficiency improvements.

While individual project data is needed as inputs to the many different market analyses that will support investments in energy efficiency, only aggregated metrics are required to report the results of these analyses. To be useful to many stakeholders, individual project data does not need to include the confidential descriptors that identify specific property addresses or personal data on the project participants. This fact allows California policy makers to cast a broad net to find appropriate sources for building performance data, recognizing that data confidentiality concerns do not need to conflict with the market needs for the data.

There is tremendous value in centralizing all energy performance data into one place, using a common taxonomy and shared infrastructure. All parts of the market should have access to it. Special applications can be built to access and analyze the data to serve these markets. Financial institutions need actuarial data to reduce the risk of uncertain energy efficiency project results. Government agencies need building characteristics, performance, and market size data to shape, defend, and implement policy. Industry decision makers, including consumers, benefit from understanding the performance results of public energy efficiency investments. Information technology resources are substantially leveraged because the performance data is stored, organized, documented and kept secure in a single information technology infrastructure, rather than dispersed among an endless number of smaller, disparate database applications.

An example of an effective data collection and sharing effort is the CSI database, which makes a great deal of solar information available to consumers, businesses and government. When CSI participants apply for incentives with the program, they provide data about their home or business and about the solar system they are installing. The program then chooses among the many application data fields the items expected to be of greatest interest to the public, then "cleans" the "Raw Data Set," and reports the data on the public CSI website. This database is used by many stakeholders worldwide for reference, reporting, marketing analysis, business planning and many other purposes.

### **Market Status**

To date, California's building energy performance data is not organized, nor is it made available to the people who need it. An extremely limited portion of all the building characteristics and

market data collected by the CPUC, Energy Commission, and utilities is made available to the public, or put to use meeting the market needs for building energy performance information. The CPUC's EM&V data, the Energy Commission's forecasting data, as well as the building specific information collected by utilities in their incentive program implementation processes form a rich set of performance data that has not yet been organized and made accessible to support decision making by consumers, building owners, financial institutions, policy makers, or other market actors. Data collected for singular purposes that is not made available to the market for multiple applications is a lost opportunity and a waste of limited resources.

The Energy Commission, as part of the ARRA collaboration, is in the process of creating a data warehouse that will capture all single family project data from ARRA partners including local governments, public and private utilities, and California HERS II providers. The data warehouse will be a repository for specific project information from such sources as job reporting templates (JRTs), EnergyPro files, Home Performance XML files, and/or additional XML formats. It will also include incentive, financing, and rating information.

The goal is to develop a comprehensive set of data from Energy Upgrade California projects for EM&V purposes, as well as for AB 758 program development. Under ARRA, the US DOE requires the Energy Commission to conduct EM&V and report the results to them. This data warehouse will help the Energy Commission meet its reporting obligation to the US DOE, as well as provide a rich set of performance data for AB 758 program development and implementation. It is anticipated that more than 4,000 individual project records to be housed in the warehouse.

The Energy Commission views the Energy Upgrade California program as a pilot program for developing the comprehensive program required by AB 758. The purpose of the Energy Upgrade program is to make it easier for property owners to get information about making and financing energy efficiency improvements, and to connect customers with participating contractors, financing options and financial incentives. AB 758 requires the Energy Commission to develop and implement a comprehensive statewide program to achieve greater energy savings in California's existing residential and nonresidential buildings. The purpose of the AB 758 assessment of Energy Upgrade program is to evaluate the specific questions identified in the bill and use that information to determine the most effective ongoing ways to deliver the components of the comprehensive program statewide into the future. The data collected from Energy Upgrade program will aid the AB 758 assessment.

The Energy Commission has taken great care in the development of the data warehouse and the secure transfer and storage of local and utility data. The data warehouse will maintain data integrity and confidentiality requirements as required by the Energy Commission and utilities. Project data from all sources will be married by project so that the warehouse includes one detailed project record per Energy Upgrade California project. This allows users to review, study, and understand all the benefits the property received through the Energy Upgrade program and analyze the data pre- and post-upgrade. Access to the data will vary depending on need; most data will be viewable only through the Energy Upgrade California Web portal project-reporting user interface, which will make standardized project data reports available

from the data warehouse taking into consideration the confidentiality of the data. Data will be generally viewable in redacted or aggregated form.

Additionally, the CPUC has directed the IOUs to investigate development of a data warehouse to collect financing related project performance and repayment data which could potentially assist in evaluating the risk of energy loans<sup>153</sup>. There is more about this data collection effort in chapter 2. While this effort is focused on information most relevant to the financing sector, this database could be developed in concert or coordination with the Energy Commission data warehouse to consolidate the most useful information related to a project under one house.

The US DOE has begun an effort to establish a clearinghouse of building energy performance data that is organized using a common data taxonomy. The vision for DOE's Building Performance Database (DBPD) is to provide the database infrastructure so that other government agencies and private organizations can contribute non-confidential data, as well as leverage the DBPD to meet market data needs:

*The DOE Buildings Performance Database is a decision-support platform, comprised of a database and data analysis tools, that enables engineering and financial practitioners to evaluate energy efficiency products and services in commercial and residential buildings. The initial tool set includes an energy savings forecasting tool that uses an actuarial based methodology to develop energy savings distributions and a financial tool that forecasts cash flows from these energy savings distributions.*

*Designed to address existing market barriers, the DOE Buildings Performance Database enables more precise analysis of the risks and benefits of energy efficiency projects, helping individuals make informed decisions on completing and investing in these improvements. [DOE\_BPD\_Fact Sheet 120111.pdf]*

The CPUC's *Guidance Decision* directs the utilities to find ways to protect customer privacy while still sharing individual efficiency project data with financial entities and other stakeholders (5.3.3.5. Financing Database Development and Data Sharing, pg. 133). The *Guidance Decision* also directs the utilities to explore possible ties to DOE's national Building Performance Database (pg. 134), and to propose methods by which more detailed performance and usage data can be measured, stored, and used, for implementation and/or piloting during the 2013-2014 transition period (pg. 223). The utilities are risk averse when it comes to divulging their customer's energy project and consumption information. Special care must be made when crafting easy-to-use and understand customer release tools, especially when the utilities are moving to all electronic application processes.

Because the market will benefit from information derived from measured performance data, it is important for project data collected to include energy bills and a general identification of location. Unless customers have given prior release, this data is confidential and cannot be shared. The Energy Commission, the CPUC and California utilities must work toward a systematic process of gaining this required customer release, consistently across all programs, in

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153 CPUC Decision 12-05-015, p. 116. 2012.

a manner that is not burdensome for the customer, and protects their personal and business needs for confidentiality. California has an opportunity, and a responsibility, to organize and share building energy performance information to meet the market needs for information. California is quite capable of addressing all relevant data confidentiality concerns by entering into non-disclosure agreements with utilities to only release redacted or combined data or building an easy-to-use electronic customer release forms educating customers about the need and use of their energy data. Absent a California energy efficiency database, we all can benefit from the federal government's building performance database infrastructure development and support.

It is the hope of the Energy Commission that all parties will see the benefits and value of the Energy Upgrade California data warehouse and will work toward expanding its development and use for other project needs such as AB 758 and other efforts.

# **CHAPTER 10:**

## **Summary of Findings and Conclusion**

### **Major Findings of the Scoping Report by Sector**

#### **Investing in Energy Efficiency (Financing)**

Financing is an important component of an energy upgrade program, particularly as the state seeks to motivate deeper investments in properties. The economic recession beginning in 2008 has greatly hampered access to capital across all market sectors, and those seeking financing are finding unfavorable terms (such as interest rate and length of loan.)

Several marketplace needs are identified to increase the investment in energy efficiency. Financial products need to be designed to specific programs or purposes, taking into consideration the impact of financing terms on the value proposition. Lower interest rate and longer term lending are needed to promote deeper investments.; To support this effort, more data needs to be collected to support evaluation of energy efficiency projects and to make access to the secondary market easier, which could increase scale and lower interest rates. The split incentive, where the owner does not pay utility bills and therefore has no incentive to invest in improving the efficiency of the property, is a market barrier to investment in energy efficiency. Similarly, the value of energy improvements is not currently well integrated into the real estate valuation process.

#### **Workforce Development**

A well-qualified workforce is a crucial component of a successful program. Qualified workers are necessary to effectively and reliably deliver the program goals, providing long lasting savings and building consumer confidence. While the Energy Commission and other entities across the State (Workforce Investment Boards, Employment Training Panel, Employment Development Department, and California's Community Colleges) have been investing in green workforce development, the economic recession has hit the construction industry particularly hard. A balance must be struck between programs that deliver robust training but are affordable and easy to integrate into existing work demands.

Stackable credentials are needed in the marketplace to provide increasing depth of training certification, achievable over time. Energy efficiency standards need to be well defined; while some effort has been put into defining residential energy efficiency standards, there is no prevailing whole building certification for the nonresidential sector. Workforce development efforts need to be well aligned with the programs they support, and should be coordinated across programs to ensure maximum opportunities for the trained workers. The long-term value inherent in training a quality workforce should be communicated more effectively to the market. Training should focus on existing skill gaps and increasing the capabilities of the workforce.

#### **Energy Assessments and Ratings**

Energy assessments and ratings are key components of the AB 758 program. These two tools collectively can communicate the anticipated energy performance of a property and the

opportunities for improvement. Assessments are a key component of program design, serving to communicate the opportunities in a building. Ratings can serve to communicate the relative value of one property over another.

### **Residential Ratings and Assessment (Including Disclosures)**

The California Home Energy Ratings System administered by the Energy Commission is the only recognized rating system in the state. AB 758 calls upon the Energy Commission to evaluate the effectiveness of the HERS system in achieving the goals of the program. While the HERS program is inherently a rating program, Raters are expected to deliver comprehensive, whole building assessments to property owners in preparing and delivering a rating certificate. In addition to the HERS assessment protocol, the Building Performance Institute (BPI) offers a Building Analyst certification which has been relied upon by the IOUs in their whole building performance programs. The interaction of these two assessment protocols, based on the experiences gained in the ARRA programs, is a key point of discussion in the Scoping Report.

The Scoping Report recognizes that for ratings to be effective, they need to be coordinated with specific trigger points, such as the sale of a property, and should be supported by an infrastructure for valuing the energy improvements of a property. To better support programs, the software tools supporting ratings and / or assessments should better calibrate to actual energy bills rather than relying completely on simulations. The Scoping Report also acknowledges the demands of the stakeholder community to offer multiple software platforms to perform assessments, and identifies the potential need to establish a HERS “lite” option which could deliver a rating with less diagnostic testing than would be appropriate for an investment grade audit. The Scoping Report acknowledges the need to better integrate performance contractors with energy raters. Finally, there is a need to move the application of whole building multifamily ratings and assessments from pilot phase to statewide programs.

### **Nonresidential Ratings and Assessments (Including Benchmarking and Disclosures)**

The Energy Commission is introducing new tools for both asset ratings and energy use ratings in the commercial building sector. One of the tools the Energy Commission is developing is the California Building Energy Use Rating Tool, which is intended to compliment the ENERGY STAR Portfolio Manager for commercial building owners in California. The Building Energy Asset Rating System, or BEARS, is California’s asset-based rating system and is being piloted.

Nonresidential energy assessments tend to be much more time and labor intensive than their residential counterparts (depending on the size of the building) due to the increase in size and complexity of mechanical and electrical systems in the building. Currently, there is no one method used for nonresidential whole building energy assessments. More typically, energy assessments for large-scale facilities occur in phases, where an initial investigative audit is performed to screen out buildings with low potential for savings and more comprehensive investment grade audits are subsequently performed to prepare a project proposal for consideration. Often, the ASHRAE level I-III protocols are relied upon to deliver these progressive assessments.

Existing building commissioning or EBCx is an energy assessment, which focuses on the system wide performance of the mechanical and electrical equipment in a building and makes recommendations for improvements to the facility. A key difference of EBCx is that the process does not stop at the audit report, but continues past installation of the measures and often includes post installation testing of the equipment and training of the building maintenance staff to ensure persistent savings.

Given the variety of rating systems available nationwide, there is a need for recognized rating systems which building owners can trust. If disclosure policies are contemplated as part of the program, it is important that the Energy Commission and other implementing agencies coordinate with stakeholders and develop any policy through a collaborative approach. Robust and inexpensive tools are needed to screen for potential energy efficiency opportunities to streamline program delivery and bring down costs. Similarly, cost-effective audits and/or EBCx investigations need to be developed and leveraged as a platform for moving into whole building approaches in the nonresidential market.

### Energy Upgrade Programs

As stated above, the existing emphasis in energy efficiency rebate programs – the major source of funding for energy efficiency in the state – has been on single measure approaches. The CPUC and select POUs are moving in the direction of providing whole building programs, but these programs have encountered challenges. For the single-family residential sector, there is a tension between the existing rigor of quality assurance and quality control policies and procedures and the need for a streamlined program design. The existing tools in the marketplace have not provided low cost and contractor friendly interfaces coupled with a modeling approach that meets the needs of program policies. Finally, the existing whole building programs of the IOUs are very far from the cost effectiveness requirements of the CPUC on an individual program basis, constraining the ability of these programs to scale. Existing cost effectiveness methodologies give no weight to non-energy benefits such as health, safety, comfort, and productivity which tend to be the most important motivating points for building owners. Significant learning opportunities exist from the ARRA programs, and these lessons are being gleaned and compared against emerging evaluation, monitoring, and verification reports of the CPUC. Coupled with stakeholder feedback, particularly from the contractor community, recommendations can be identified to improve upon existing program design. For the nonresidential and multifamily sectors, there is not yet a whole building approach, though the CPUC *Guidance Decision* does encourage the IOUs to develop programs to fill this gap.

The Scoping Report acknowledges that though there is a whole building program for the single-family residential sector, this needs to be expanded to the multifamily and nonresidential sectors, coupled with well designed performance based programs that build upon lessons from the 2010-2012 IOU portfolio and the ARRA programs. Programs need to be coordinated with their supportive infrastructure, including marketing, education, and outreach, workforce development, and financing programs. There is a particular need to resolve the overly burdensome quality assurance and quality control policies of existing residential whole building programs, and to streamline these necessary policies. There is a need for appropriate

tools to support the implementation of performance based savings and help ensure the persistence of the savings these programs seek to provide. Finally, there is a need to balance the tension between whole building approaches and the existing cost effectiveness framework, particularly around valuing important non-energy benefits.

### Compliance and Enforcement

It is difficult to gauge the status of existing compliance with codes and standards, partially as a result of the lack of coordinated data collection across a very large group of players. Ensuring compliance with existing codes and standards is also very difficult as there are many trigger points at which the standards would apply, and each of these actors – from designer and contractor to building official to IOU program representatives – have a part to play. However, building standards are a crucial component of California’s energy policy, and need to be relied upon to deliver projected savings, ensure safe and healthy homes, and mitigate the impacts to peak load associated with construction defects.

There is a need to simplify and improve the existing compliance process, while also preserving the ability to tighten the standards and provide flexible performance standards. Education and outreach around the standards needs to be customized and targeted to the specific implementing roles (that is, building official, contractor, etc.) Finally, there is a need to increase permit compliance related to energy efficiency measures which require pulling permits, for example; alterations, additions, and HVACs change outs.

### Marketing, Education, and Outreach

ME&O is a very important component of any program, but particularly one that is akin to a ‘social change’ program. To achieve market transformation, the value of energy efficiency must be communicated in relevant, targeted messages that motivate property owners to take action. The Energy Commission, CPUC, local governments, and stakeholders partnered through the ARRA program efforts to develop a single brand and statewide message for the residential whole house program; this approach minimized market confusion that could have occurred through competing messages and brands and help the brand find traction among Californians. The CPUC voted in the *Guidance Decision* to extend the Energy Upgrade California brand as the single umbrella brand for residential and small commercial energy programs.

There is a need for the AB 758 program to be supported by a researched and well developed marketing, education and outreach plan. This plan should be supported by market research and articulate how particular program messaging needs to target the intended customer base. Similarly, there is a need to leverage trusted messengers to communicate the value of the program. ME&O should support workforce development activities by communicating the value of trained, certified professionals and generating demand for these workers. The ME&O plan should consider and support innovative approaches that gain traction, particularly those identified as successful in the ARRA programs. Finally, there is a need to communicate the value and importance of ME&O efforts to accomplishing program goals and building consumer demand for energy efficiency.

## Data

The market succeeds when data is available to inform program design and evaluation efforts. California has been investing in energy efficiency for more than three decades, but unfortunately the data available to program administrators when conducting market analyses, developing targeted program design, and learning from the experiences of past programs is lacking. The CPUC, the IOUs, and the Energy Commission all collect valuable data related to building performance, demand and supply forecasting, and program evaluation, but this data is not managed in a consolidated location and some of it is not available for public consumption, even through anonymous formats that protect personal information. The Energy Commission is developing a data warehouse to hold information from multiple sources related to the Energy Upgrade California ARRA program efforts, but this only resolves a portion of the problem. The CPUC has similarly directed the IOUs to develop a database to contain project information related to projects that are financed through IOU programs, with the intention of supporting secondary market financing efforts.

## Conclusion

Achieving market transformation in energy efficiency is a long term challenge. The AB 758 program offers an opportunity to bring the energy efficiency community together and develop a collaborative, common vision for how to establish energy efficiency as a way of life in California. Overcoming the very real obstacles will require openness and participation at every level of engagement. While the challenges are real, the opportunity is vast and success of this program will provide lasting benefits to California's economy and environment.

## GLOSSARY

- Affordable Housing:** Subsidized housing for households with lower incomes, in which rent or mortgage and utility costs, do not exceed a specific percentage, typically 30 percent, of the gross annual household income. Detailed programmatic level definitions of “affordable housing” may vary slightly from this broader definition.
- ASHRAE 90.1:** A nationally developed standard that provides minimum requirements for energy efficient designs for buildings except for low-rise residential buildings. Similar in concept to California’s Title 24, Part 6, many states use this standard for energy efficiency compliance requirements.
- Assembly Bill 549:** Assembly Bill 549 directs the Energy Commission to “investigate options and develop a plan to decrease wasteful peak load energy consumption in existing residential and nonresidential buildings ... and report its findings to the Legislature.” (AB 549, Longville, Chapter 905, Statutes of 2001)
- Assembly Bill 758 (AB 758):** Legislation passed in 2009 requiring the Energy Commission to develop programs and regulations to cost effectively improve the energy efficiency of existing building stock in California. It also requires the CPUC to evaluate financing options using existing and proposed IOU programs.
- Assembly Bill 1103:** Legislation passed in 2007 requiring the Energy Commission to develop regulations to ensure that buildings that are sold, leased, or refinanced obtain an energy rating using Energy Star Portfolio Manager and to disclose the rating to potential buyers, lessees or lenders.
- Assembly Bill 2021:** Legislation passed in 2006 that required POU’s to estimate potentially achievable cost effective energy efficiency at least once every three years, to establish annual energy efficiency improvement targets using a 10-year rolling estimate, to have their savings claims

	evaluated independently, and report annually on these activities to their customers and to the Energy Commission. The Energy Commission is required to report on POU activities in the IEPR.
<b>Compliance Improvement Advisory Group:</b>	Collaborative of professionals from a variety of organizations, such as building departments, contractors, utilities and the Energy Commission, to help increase compliance with California's energy standards.
<b>Contractors State License Board:</b>	Governing body that regulates and licenses the contractor industry in California.
<b>Cool Roof Rating Council:</b>	Non-profit organization that develops methods for evaluating and labeling the thermal emittance and solar reflectance of various roofing products.
<b>Energy Action Plan:</b>	A program of the California Public Utilities Commission. The Energy Action Plan was founded by an Energy Action Plan document that established shared goals and proposed specific actions to ensure that adequate, reliable, and reasonably priced electrical power and natural gas supplies are achieved and provided through policies, strategies, and actions that are cost-effective and environmentally sound for California's consumers and taxpayers. The Energy Action Plan was originally released in 2003, and updated in 2008.
<b>Energy Star Portfolio Manager:</b>	A whole building energy use rating and benchmarking tool that results in a numeric score where 100 is a very efficient building and zero is a very inefficient building.
<b>EnergyPro:</b>	A privately developed software tool which is approved by the California Energy Commission to show compliance with the performance approach in the Building Efficiency Standards (Title 24). EnergyPro is also currently used in the investor owned utility whole house performance programs to establish an energy usage baseline, model potential improvements, and predict post-installation energy savings.
<b>Global Warming Solutions Act</b>	Legislation authorizing the Air Resources Board to develop programs and regulations to reduce statewide

<b>(AB 32):</b>	greenhouse gas emissions to 1990 levels by 2020.
<b>Green Economy:</b>	A term used by the Employment Development Department to convey economic functions which generate and store renewable energy, recycle existing materials, involve energy efficient product manufacturing, distribution, construction, installation, and maintenance, education, compliance, and awareness, or natural and sustainable products and manufacturing.
<b>Guidance Decision</b>	CPUC 2013-14 Energy Efficiency Portfolio Guidance Decision; D. 12-05-015. Available at <a href="http://www.cpuc.ca.gov/puc/">http://www.cpuc.ca.gov/puc/</a>
<b>HERS Provider Data Registry:</b>	Database that contains a list of certified HERS raters and results of HERS verification and diagnostic tests.
<b>HERS Provider:</b>	Organizations approved by the Energy Commission to train and oversee Raters conducting HERS verification in newly constructed buildings, alterations, additions, the New Solar Home Partnership Program (newly constructed residential buildings), and to perform California Whole-House Home Energy Ratings.
<b>HERS Rater:</b>	An individual certified by a HERS provider to test the energy features of a home and produce a HERS rating describing the energy efficiency of the home.
<b>Home Energy Score:</b>	A federal asset rating tool being developed by the Department of Energy in conjunction with Lawrence Berkeley National Laboratory for residential buildings.
<b>Interim Performance Approach:</b>	An approach to modeling existing residential buildings that was developed by the California Energy Commission in conjunction with the California Public Utilities Commission. The Interim Performance Approach was intended to provide a standardized methodology for simulating existing building energy use and projected savings from the installation of efficiency measures while the HERS Whole House program was under development. The Interim Performance Approach utilizes EnergyPro software and allows building performance contractors to conduct simulations and develop information required for investor owned utility and local government

	Whole House performance programs.
<b>International Code Council:</b>	Association that supports the development of codes and standards in the construction industry to ensure safe and affordable construction practices.
<b>Investor Owned Utilities:</b>	For profit utilities owned by private investors and regulated by the CPUC.
<b>Junior Capital:</b>	Junior capital is capital that is offered as a portion of a loan or portfolio of loans, but is second in line, or subordinate, to the senior capital. In the event of loss or default on a loan, the senior capital will be fulfilled before the junior capital.
<b>Loan Loss Reserve Fund:</b>	A loan loss reserve fund is a reserve fund used to offset the impact of defaults on a loan to the financial institution lending the money. In a loan loss reserve fund, monies are set aside and are drawn upon to cover delinquent payments or defaults on a loan, mitigating losses to the lender.
<b>National Association of State Energy Officials:</b>	Non-profit organization composed of governor-delegated energy officials from each state and territory, along with members from public and private entities, in an effort to improve state energy programs and policies.
<b>National Fenestration Rating Council:</b>	Non-profit organization that independently rates and labels the energy efficiency qualities of doors, windows, skylights, and attachment products.
<b>Off Balance Sheet:</b>	Off-balance sheet is a term used to indicate a type of debt that does not appear on a traditional 'balance sheet.' An example of this would be a service agreement, where the company offering the service provides the up-front capital and requests repayment on a monthly basis. In this arrangement, the 'borrower' is obligated by contract to repay a sum of money, but the sum does not appear as a traditional loan on a balance sheet.
<b>Performance Approach:</b>	Method for demonstrating compliance with California's energy standards that allows for tradeoffs between the energy efficiency of various building components.

<b>PowerPathway:</b>	A PG&E training program using a sector strategy approach and is offered in collaboration with high schools, community colleges, the public workforce development system, unions, and four-year universities.
<b>PowerSaver:</b>	A subsidized lending product offered through the U.S. Department of Housing and Urban Development's (HUD) Title 1 pilot program.
<b>Prescriptive Approach:</b>	Method for demonstrating compliance with California's energy standards by requiring minimum energy efficiency levels are attained by each building component.
<b>Publicly Owned Utilities:</b>	Non-profit utilities regulated by locally elected boards.
<b>Senate Bill 375:</b>	The Sustainable Communities Act of 2008 requires Metropolitan Planning Organizations (MPO) to develop transportation related greenhouse gas reduction targets for 2020 and 2035; requires MPO's to develop a Sustainable Communities Strategy Plan to achieve those targets. SB375 also includes incentives for local governments to voluntarily comply.
<b>Senate Bill 454:</b>	Legislation that authorizes the Energy Commission to establish a process to enforce appliance energy standards and prohibits public utilities from issuing rebates for energy upgrades unless certification has been obtained that the improvements follow all permitting and licensing requirements.
<b>Senate Bill 1037:</b>	Legislation passed in 2005 that required the POU's to use cost effective energy efficiency as the preferred first energy source when procuring new resources and to report annually on their energy efficiency activities to their customers and to the Energy Commission.
<b>Senate Bill X7-7:</b>	The Water Conservation Act of 2009 requires water purveyors in the State to reduce water consumption, on a per capita basis, by 20 percent by 2020.
<b>Smart Grid Infrastructure:</b>	Meters that use information and communications technology to gather and act on information, such as information about the behaviors of suppliers and consumers, in an automated fashion to improve the efficiency, reliability, economics, and sustainability of

the production and distribution of electricity, natural gas and other commodities.

**State Energy Sector Partnership Grant:**

A program funded by the Department of Labor. The purpose is to develop regional sector strategies for energy efficiency and renewable energy industries that align the Governor's overall workforce vision, state energy policies, and local and regional training activities that lead to employment in targeted industry sectors.

**Strategic Plan**

CPUC and CEC Long Term Energy Efficiency Strategic Plan

**Test In / Test Out:**

A method to determine performance of systems before and after an energy efficiency measure is installed. Most frequently used for residential retrofit energy efficiency projects.

**Warren-Alquist Act:**

Legislation that gives statutory authority to the Energy Commission and requires the Energy Commission to periodically update and adopt building standards to decrease the waste in the use of energy.

**Western HVAC Performance Alliance:**

Collaborative of professionals from the HVAC industry, utilities, and the CPUC to help support the goals outlined in the California Long-Term Energy Efficiency Strategic Plan.

## LIST OF ACRONYMS

ABAG	Association of Bay Area Governments
ACCA	Air Conditioning Contractors of America
ACM	Alternative Calculation Method
AIA	American Institute of Architects
AMI	Advanced Metering Infrastructure
AP	Accredited Professional (LEED)
APR	Annual Percentage Rate
ARB	California Air Resources Board
ARRA	American Recovery and Reinvestment Act
ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning Engineers
ASTM	American Society for Testing and Materials
BAM	Bay Area Multifamily
BEARS	Building Energy Asset Rating System
bEQ	Building Energy Quotient
BESTEST	Building Energy Simulation Test
BIG	Build it Green
BMIR	Below Market Interest Rate
BOMA	Building Owners and Managers Association
BPI	Building Performance Institute
BPC	Building Performance Contractor
BTU	British Thermal Unit
CABEC	California Association of Building Energy Consultants
CAEATFA	California Alternative Energy and Advanced Transportation Financing Authority
CALBO	California Building Officials
CalCERTS	California Certified Energy Rating Testing Services
CALCTP	California Lighting Controls Training Program
CalHFA	California Housing Finance Agency
CBECS	Commercial Building Energy Consumption Survey
CBEURT	California Building Energy Use Rating Tool
CBPA	California Business Properties Association
CBPCA	California Building Performance Contractors Association
CCC	California Conservation Corps
CEC	California Energy Commission
CEU	Clean Energy Upgrade
CEUS	California End Use Survey
CEWTP	Clean Energy Workforce Training Program
CF-4R	Verification Certificate
CF-6R	Installation Certificate

CFL	Compact Fluorescent Lamp
CHF	CRHMFA Homebuyers Fund
CMUA	California Municipal Utilities Association
CPUC	California Public Utilities Commission
CRE	Commercial Real Estate
CRHMFA	California Rural Homes Municipal Financing Authority
CRRC	Cool Roof Rating Council
CSD	California Department of Community Services and Development
CSI	California Solar Initiative
CSLB	Contractors State License Board
CWIB	California Workforce Investment Board
DGS	Department of General Services
DOE	United States Department of Energy
DSM	Demand-Side Management
DSRF	Debt Service Reserve Fund
EBCx	Existing Building Commissioning
ECM	Energy Conservation Measure
EECBG	Energy Efficiency and Conservation Block Grant
EEM	Energy Efficient Mortgage
EER	Energy Efficiency Ratio
EIS	Energy Information System
EM&V	Evaluation, Measurement and Verification
EPBD	Energy Performance of Buildings Directive
ERAM	Electric Revenue Adjustment Mechanism
ESAP	Energy Savings Assistance Program
ESCO	Energy Service Company
ETAP	Energy Technology Assistance Program
FHA	Federal Housing Administration
FHFA	Federal Housing Finance Agency
FDD	Fault Detection and Diagnostics
GHG	Greenhouse Gas
HBC	House Budget Committee
HERCC	Home Energy Retrofit Coordinating Committee
HERS	Home Energy Rating System
HERS II	HERS Whole House
HMG	Heschong-Mahone Group
HPwES	Home Performance with Energy Star
HTM	HERS Technical Manual
HUD	U.S. Department of Housing and Urban Development
HVAC	Heating, Ventilation and Air Conditioning
IBEW	International Brotherhood of Electrical Workers
ICC	International Code Council

IHACI	Institute of Heating and Air Conditioning Industries
IOU	Investor Owned Utility
IEPR	Integrated Energy Policy Report
IRBD	Interest Rate Buy Down
JTA	Job Task Analysis
kWh	Kilowatt hour
LADWP	Los Angeles Department of Water and Power
LEED	Leadership in Energy and Environmental Design
LIHTC	Low Income Housing Tax Credits
LLR	Loan Loss Reserve
MIST	Moderate Income Sustainable Technology
MLS	Multiple Listing Service
MOU	Memorandum of Understanding
MPG	Miles per Gallon
MUSH	Municipal, University, State and Hospital
NABERS	National Australian Built Environment Rating System
NAIOP	National Association of Industrial and Office Properties
NASEO	National Association of State Energy Officials
NEB	Non Energy Benefit
NECA	National Electrical Contractors Association
NFRC	National Fenestration Rating Council
NOAA	National Oceanic and Atmospheric Association
NREL	National Renewable Energy Laboratory
OBR	On-Bill Repayment
OCC	Office of the Comptroller of the Currency
PAC	Program Administrator Cost
PACE	Property Assessed Clean Energy
PE	Professional Engineer
PGC	Public Goods Charge
PG&E	Pacific Gas and Electric
PIER	Public Interest Energy Research
PIP	Program Implementation Plan
POU	Publicly Owned Utility
PRC	Public Resources Code
QA/QC	Quality Assurance/Quality Control
RASS	California Residential Appliance Saturation Survey
RCx	Retrocommissioning
RECO	Residential Energy Conservation Ordinance
RFP	Request for Proposals
ROP	Regional Occupation Program
SCE	Southern California Edison
SCEIP	Sonoma County Energy Independence Program

SDG&E	San Diego Gas and Electric
SEED	Standard Energy Efficiency Data
SEP	State Energy Program
SFMOH	San Francisco Mayor's Office of Housing
SME	Subject Matter Expert
SMUD	Sacramento Municipal Utility District
TDV	Time Dependent Valuation
TRC	Total Resource Cost
WAP	Weatherization Assistance Program
WHEEL	Warehouse for Energy Efficiency Lending
WHPP	Whole House Performance Program
ZNE	Zero Net Energy