

Home Performance with ENERGY STAR® in California: Moving Into the Spotlight

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Abstract

Recent California utility activities in comprehensive home energy retrofit programs are leading to increases in the use of this innovative energy efficiency approach for 2009 and beyond. These “whole house” programs, under the umbrella of the national Home Performance with ENERGY STAR® initiative by EPA and DOE, are scaling up across the state, moving from pilot efforts to energy savings program status in parallel with the traditional single-measure rebate activities common in California and elsewhere.

California is not the first state to adopt this concept; there are over 20 such programs in operation or planning nationwide. However, the new California programs are significant for some specific features as well as the unprecedented size of the populations they will serve in the Los Angeles, San Francisco, San Diego, and Central Valley areas. This paper describes the background, status, and plans of the California utilities’ programs as indications of progress in this field and as models for consideration in other areas of the country. Bottom line: The major California utilities are moving actively into comprehensive home retrofit programs.

Introduction

This paper presents an overview of the history and status of comprehensive home energy retrofit activities in California, where significant new program efforts are unfolding and may provide valuable models for use elsewhere. Typically termed “home performance” or “whole house” contracting, these retrofit activities are associated with the national Home Performance with ENERGY STAR® initiative and seek to combine energy assessments, repair prescriptions, and broad improvements to maximize the long-term energy, comfort, safety and health performance of existing homes.

Historically such programs are funded by electric and gas utilities or state energy authorities with the intent of making long-term energy savings while providing homeowners and society with additional non-energy benefits. Until recently, support for these programs has been limited in California due to concerns over cost-effectiveness relative to conventional single-measure energy efficiency programs. However, experience nationwide and from California utilities has shown that the vast majority of existing homes have high untapped potential for energy savings due to faulty construction, mechanical systems specifications and installations, and repairs and renovation. Increases in the state’s energy savings goals and understanding of non-energy benefits valuation may therefore produce significant changes in energy efficiency program design and delivery choices with far higher long-term benefits.

Background

Why Home Performance Contracting

Conventional residential energy efficiency programs tend to involve single improvements to either the building or its energy-using systems. Those programs are important parts of an overall energy efficiency strategy. They offer relatively low cost and early efficiency gains through technologies such as compact fluorescent lighting or insulation installations. However, those programs need to be balanced by others with longer-term and deeper energy savings, using infrastructure development, supply chain innovation, and public education to support more comprehensive improvements.

Home performance retrofits produce maximum long-term energy savings due to their comprehensiveness and in particular their emphasis on structural and equipment systems improvements with long service lives and synergistic effects—notably the improvement of the building's thermal efficiency, reduction of other appliance and lighting energy waste, and subsequent ability to “right-size” (always a reduction) of HVAC and water heating systems. In addition, home performance retrofits create uniquely broad and valuable non-energy benefits which serve to broaden the homeowner's justification for the cost of such broad and deep improvements (Knight and Lutzenhiser, 2006).

The National Home Performance Contracting Context

Apart from longstanding low-income weatherization programs using packages of multiple improvements, home performance improvement activities across the nation were small and sporadic until the Federal government's ENERGY STAR program created the “Home Performance with ENERGY STAR” initiative in the late 1990s. This program broadened the weatherization concept to the entire housing market. It does not finance local programs but lends the brand recognition power of ENERGY STAR to home energy retrofit efforts that meet its standards of quality and comprehensiveness. Since its inception over twenty local and state programs have been qualified, and in 2007 some 12,000 homes were improved. The overall rate of growth is high, with more programs being added and existing programs growing rapidly.

The nonprofit ACI, formerly known as Affordable Comfort Inc., is the primary national convener of conferences and related activities for the home performance and weatherization contracting communities. ACI's national and regional conferences, cosponsored by governmental agencies, vendors, and participants, provide extensive training, education, and networking opportunities for the emerging home performance industry.

The principal quality assurance and certification authority for this field is the Building Performance Institute. BPI certifies individual technicians, accredits contracting companies, and works to achieve common standards of performance across the industry. An allied organization is RESNET, the Residential Energy Services Network, which sets standards for home energy ratings services providers, or “HERS raters,” who work primarily to certify new high-performance homes for ENERGY STAR and other local new construction energy savings programs. These two organizations are now collaborating to establish a single common set of qualifications and tests for home performance analysts, including both contractor personnel and HERS raters. This collaboration is intended to help increase the home performance industry's ability to meet anticipated future growth.

The California Context

State Policies and Potential

California has long been a leading state in energy efficiency program initiatives and expenditures. Some \$2.5 billion in ratepayer funding is being invested in the current 2006-08 program cycle. These funds come from two approximately equal sources: a “public goods charge” on utility bills and a portion of the power procurement funds of the utilities in response to the Governor’s Energy Action Plan directing that cost-effective energy efficiency be maximized before using power generation options to meet the investor-owned utilities’ electric load requirements.

The California Public Utilities Commission, which among many other functions governs energy efficiency policy, program rules, and evaluations, is in the process of making a shift in energy efficiency program strategy. For much of the past decade the emphasis of state policy has been on individual technology upgrades rather than more comprehensive market transformation efforts, but recently the Commission has concluded that this conventional strategy is unlikely to meet the challenges posed by global climate change and the need for major atmospheric carbon emission reductions in all sectors. This is leading to a renewed interest in expanding the use of market transformation and more comprehensive efficiency efforts that may create deeper energy savings over the long term.

Included among such comprehensive efforts is the home performance retrofit concept. The investor-owned utilities (IOUs – Pacific Gas and Electric, Southern California Edison, San Diego Gas & Electric, and SoCalGas) new long-term California Energy Efficiency Strategic Plan (CEESP), ordered by the state’s Public Utilities Commission and completed with the involvement of many interests from utilities and governmental agencies to advocacy groups and program implementers, has identified whole house solutions as one of its top strategic initiatives. This strategy is leading the IOUs to develop and implement a new group of comprehensive retrofit programs—collectively the largest new initiative in the nation’s adoption of such programs.

The Cost-Effectiveness Issue

The state’s historical approach to selection of energy efficiency programs delivered by the electric and gas utilities and others is based on cost-effectiveness tests applied with specific rules and procedures. Those rules and procedures are focused on assuring that ratepayer funds which finance the programs achieve a positive return on those investments and that the energy savings are gained at less cost than the power purchases avoided. Many states follow this general approach, but the CPUC has been very conservative in its definitions of allowable costs and benefits. The dominant cost-effectiveness determinant is the Total Resource Cost (TRC) test. In the California version of the TRC the only allowed benefit is the net avoided cost of power (and a small emissions avoidance adder) while all program and participant expenditures are included on the cost side. This implicitly assumes that any other benefits gained are insignificant.

Most other states use variants of the TRC, but with often major differences. In particular, some states such as New York are much more liberal in defining benefits, notably in allowing “non-energy” benefits such as societal gains in employment, tax revenues, environmental improvements, and health effects. This results in greater cost-effectiveness for more

comprehensive energy efficiency programs that tend to deliver such benefits in addition to energy savings. The CPUC's recent consideration of climate change and realization of the need for more comprehensive programs to achieve ambitious carbon reduction goals has led to new consideration of those non-energy benefits. Changes in policy that encourage programs such as comprehensive home performance retrofitting could thus lead to a more balanced and diverse landscape of energy efficiency efforts.

New Approaches to Cost-Effectiveness

Initiated by the CPUC, a broad discussion is beginning in California over concerns about the adequacy of the present cost-effectiveness metrics and their use in selecting and evaluating energy efficiency programs. Much of this discussion is focusing on the Total Resource Cost test because of its unintentional bias against energy efficiency strategies such as comprehensive home retrofits. The crux of this concern is that the limited scope of the TRC may prevent some innovative program types from being selected, even if they offer deeper and longer-lasting energy savings and customer satisfaction.

Figure 1. Alternative Total Resource Cost Test Formulations

$\frac{\text{Utility Avoided Power Cost}}{\text{Program Cost and All Participant Costs}}$	$\frac{\text{Utility Avoided Power Cost} + \text{Non-Energy Benefits Value}}{\text{Program Cost and All Participant Costs}}$	$\frac{\text{Utility Avoided Power Cost}}{\text{Program Cost} + \text{Discounted Participant Costs}}$
Current California TRC Test (unbalanced: Restricted benefits vs. total costs)	With Non-Energy Benefits (Adds NEBs to balance total participant costs)	Alternative: Adjusted Cost (Reduces Participant Cost to balance limited benefits)

In Figure 1 above, the conventional California TRC test is summarized at the left. One approach to TRC improvement, as shown in the middle portion of the figure, is the monetization of non-energy benefits and adding those to the TRC's numerator along with the savings in avoided energy costs. A body of research results has developed over the past several years to support assignment of monetary values to various non-energy benefits (Amann, 2006) and some states already incorporate such values in their program evaluations. In New York State the upstate Home Performance with ENERGY STAR program was determined to have delivered a higher dollar value in non-energy benefits than in its energy savings, resulting in a strong TRC score and continued funding support (NYSERDA, 2007). The monetization approach will be a major focus of a white paper commissioned by the CPUC to help guide discussion and possible policy change.

An alternative approach, shown at the right side of Figure 1, is to accept the limited scope of the energy benefits as the TRC's numerator and balance the denominator with that energy savings-focused numerator. This revision of the TRC would involve reconsideration of the participant costs based on the participant's relative motivations between the energy and non-energy benefits to be attained. In effect, this approach converts the TRC to a "PRC" (Partial Resource Cost) test by removing the non-energy aspects from *both* sides of the cost-effectiveness balance. The rationale here is based on recent California surveys which show that only about 20% of the average respondents' motivation for having invested in comprehensive home retrofits

was due to a desire to reduce their energy bills (Knight and Lutzenhiser, 2006). This suggests that the participants were mostly choosing to buy the non-energy benefits, so the TRC should not include that 80% share of the participant costs. Obviously such a large reduction in the dominant term dramatically increases the TRC score.

The first alternate (center of Figure 1) is readily justifiable for all programs, but potentially slow in gaining enough agreement for adoption. The second alternate (Figure 1, right side) is less elegant but has the virtue of being relatively simple to verify through additional surveys and potentially more quickly adoptable in CPUC proceedings. It could also be used as a temporary solution while research and verification of the monetization approach continues.

California Programs to Date

Overview

The California Energy Commission and Pacific Gas & Electric (the principal energy provider in Northern and Central California) conducted several early research projects to investigate and improve various aspects of home performance contracting in 2000-2001 (BKl and PSD, 2000, Knight and Thomas, 2001). This was followed by the formation of the California Building Performance Contractors Association (www.cbPCA.org) to advocate for home performance programs and serve as a trade association for contractors and supporters of such activities. PG&E subsequently funded a four-year experimental whole house retrofit program which succeeded in training and supporting a basic cadre of qualified contractors to open that market.

Two other home performance programs have since been implemented -- one by Southern California Edison (SCE) for much of southern California centered around Los Angeles County, and the other by Anaheim Public Utilities, a municipal utility in Orange county, and both remain in operation as of 2008. These two programs differ slightly in contractor qualifications, project approval processes, and incentives, but contractor training and support for both programs are coordinated. The PG&E and SCE programs were designed and implemented by CBPCA, while Anaheim's program implementation was shared by Conservations Services Group (prime contractor, focused on administration and marketing) and CBPCA (subcontractor for all training and field support).

After a measured start, home performance program activity is expanding in California with more activity forecast than in any other state. The Southern California Edison program is being extended and expanded through 2011, Anaheim's program is continuing, and both PG&E and the Sacramento Municipal Utilities District (SMUD) are implementing new programs in late 2008 with plans to continue into 2009 and beyond. Other smaller California utilities have also expressed interest. CBPCA is expanding its efforts in building a statewide member-based trade association to promote common standards and information sharing among home performance programs in different California jurisdictions and by different implementers.

PG&E Implementation History and Plans

During 2002-05, CBPCA conducted a four-year pilot whole house retrofit program for PG&E, open to contractors in the utility's entire Northern and Central California service territory. Most contractors in the program were from the greater San Francisco Bay Area,

including its hot-climate eastern suburbs, with other contractors in Fresno, the bay delta area, along the northern coastal cities such as Santa Cruz, and the Sierra foothills. As an experimental infrastructure-building effort, the PG&E program was not required to meet explicit energy savings goals and its budget was limited. No contractor or customer incentives were included in the design due to its limited budget and classification as an information-only program.

That program's training and marketing goals were reached, but the lack of other program elements such as financial incentives and post-training support appeared to be a substantial deterrent in getting contractors to report test data and other results of their retrofit jobs. Also, because of the many barriers that face contractors in entering such a new and unknown field, many contractors did not make the transition from training graduates to continuing active home performance contractors. However, enough contractors have remained active and developed their capabilities to now be retrofitting several hundred homes per year based on self-estimates reported to CBPCA. In addition, even the trained but inactive contractors reported to the program's evaluators that the program induced them to make significant energy-saving improvements in their construction practices.

PG&E's Energy Training Center continued sponsorship of the contractor training activities following the completion of the initial whole house retrofit program. During 2008, those activities include several cycles of a basic 6-day home performance course, a 3-day advanced topics course including Building Performance Institute certification testing, a 1-day orientation for architects and designers, and a 1-day seminar in the business, marketing, and sales aspects of home performance contracting. Those courses are heavily attended and highly rated by attendees, but that training program includes no post-training support for the graduates.

In response to the increasing contractor demand as well as the recent California Energy Efficiency Strategic Plan's inclusion of comprehensive home retrofits among its top strategic initiatives (CEESP, 2008), PG&E has planned to implement a pilot home performance program for the second half of 2008. This new pilot program is intended as a ramp-up to a three-year program for 2009-11, and includes customer and contractor incentives as well as additional training, field support, marketing, and verification activities. The pilot program's goal for 2008 is 200 retrofitted homes with associated energy savings.

SCE Implementation History and Plans

Southern California Edison included a home performance program in its 2006-2008 portfolio. That program is a two-year "non-resource" program with no required energy efficiency savings goals but a broad range of training, marketing, and quality assurance objectives that are being met or exceeded by the program's activities. The training regime is the same as that now used in the PG&E programs, with ongoing enhancements shared by both programs. Although this SCE program is still in a skill-building phase with market momentum only recently beginning to develop, a growing group of contractors trained in the program have begun to do home performance assessments and retrofit projects.

The initial home performance program is being continued and expanded by SCE through the 2009-11 cycle. The program will add financial incentives for homeowners and contractors and the marketing effort will be increased. The 2009-11 program will have energy savings goals, and should benefit from the base of contractors already active through the 2006-08 program.

Other California Activities

Anaheim Public Utilities

Anaheim Public Utilities, serving the city of Anaheim (located in Orange county south of Los Angeles and surrounded by Southern California Edison service territory), is currently operating a home performance retrofit program that began in early 2007. Implementers are Conservation Services Group with CBPCA responsible for all training and field support. Training and support have been coordinated between Anaheim and SCE since the same contractors are likely to work in both service territories and need common standards and practices.

This local program is unique in California in its use of a homeowner loan interest rate buydown, its reliance on BPI certification for all contractors, and its requirement for pre-contract submittal of all jobs for city approval. As with SCE's program, the Anaheim program is in a contractor infrastructure building phase. The city utility is planning an enhanced marketing campaign now that an adequate number of contractors have been BPI certified, and the program is expected to continue beyond 2008.

Southern California Gas

SoCalGas, a Sempra Utilities company, serves the Los Angeles basin and overlaps much of SCE's service territory and municipal utilities including the Los Angeles Department of Water and Power, Pasadena, Anaheim, and others. SCG has no direct experience in retrofit home performance programs, but is planning to join with the Edison program in sponsoring a 2009-11 home performance program.

San Diego Gas & Electric

SDG&E, another Sempra Utilities company, is considering a pilot program for 2009-11. No further details are available as of the writing of this paper, but should be available from the utility by fall 2008.

Sacramento Municipal Utility District

SMUD is planning a new home performance program for implementation in the fall of 2008. While planning has been well coordinated with the California IOU programs, there will be some differences. This large municipal utility, covering Sacramento as well as much of its surrounding area, has a popular energy efficiency program including low-interest financing, and plans to use its current program incentives and marketing plus a special additional rebate for more comprehensive retrofits.

Other California Utilities

No other California utilities are known to be actively considering home performance retrofit programs. Los Angeles Department of Water and Power (LADWP) was involved in the California Energy Efficiency Strategic Plan and consideration will be given for the 2010-11

planning periods. Other California utilities are relatively small municipals and rural district utilities, often with budgetary limitations in fielding complex programs such as existing home retrofits. In coming years some of these smaller utilities may form consortia for more cost-effective administration of energy efficiency and renewables programs covering all members.

Program Evolution

California experience to date has provided a variety of lessons and refinements that may be useful elsewhere. First, the concept of whole house retrofits and home performance has been enthusiastically received by those trained in the IOUs' programs. Both building shell contractors (remodelers, insulators, home improvement specialists) and HVAC contractors have adopted the approach, as have some other market entrants. These include some HERS Raters, realtors, solar contractors, and building inspectors. But the barriers are high, both technically and often even more so with business, marketing and sales practices. Training must cover all those aspects, and a period of small-group field mentoring, business planning, and extended field advisory services are important program tools for helping to move trained graduates and their companies through the startup period.

A careful screening process is needed to prequalify applicants for training. In California, this has involved email announcements and utility flyers to contractors, followed by telephone and in-person interviews and introductory events to explain program requirements and benefits for contractors and other participants. Some decline after learning the investment, training, and business process requirements, typically on financial grounds; they are often too small and undercapitalized or wary of change. A further tactic to focus the training on serious and capable contractors is to charge for the training but offer full or partial reimbursement after satisfactory completion and reporting of ten or twenty home retrofit projects.

Experience has shown stringent technical qualifications are not always required to participate in home performance programs. Personality characteristics and background of the trainee may be even more important. For example, several realtors and an interior designer were allowed into the training because of their quick understanding of the program's potential within their businesses. These trainees were quick to make alliances with trained contractors and generated many high-value leads from their extensive client relationships. Some are now even qualified in complete home diagnosis and are among the most active participants.

Early California whole house retrofit programs were training and information programs (rather than "resource acquisition" programs that deliver energy savings) and didn't include substantial marketing or financial incentives for homeowners or contractors. Without those program features, job leads developed relatively slowly, making it harder for some contractors to survive in the home performance arena. This experience strongly suggests a need for utility marketing involvement and financial incentives to accelerate contractor success and program results.

Financial incentives are needed to motivate both contractors and customers. SCE's and PG&E's 2009-11 programs plan to offer financial incentives to customers and contractors. Customers can keep the rebate or apply it towards lower interest rate financing. Contractors will receive a financial incentive for performance of home diagnostics, post retrofit quality assurance testing and reporting of data. Special periodic competitive awards and public recognition are also being considered.

Contractors present another challenge: They don't like "paperwork" and formal reporting, and try to avoid those tasks which are critical to the utilities in meeting and proving their energy savings goals. Contractors in the early California whole house retrofit programs were offered free training and field support, small equipment purchase discounts, and limited co-marketing funds. These inducements proved to be poor motivators, since once trained and given some initial field support, the contractor could market his or her expertise—whether adequate or not—without bothering to report. The new customer incentives are intended to help solve that problem, since customers will not receive the incentive payments until the project is properly completed and reported.

Estimation of energy savings is inherently more complex in home performance programs because each home has different degrees of excess energy use, size, and limitations and may need different kinds and extent of improvements. Added to this is the need to limit or multi-phase the project due to the client's budget limits. Some programs in other states have required contractors to do the energy savings calculation using simulation models or other calculation techniques; in California we have found virtually universal rejection of any such approach, since to contractors it is mainly just another frustrating administrative task that gives them little if any value and costs them time and money.

CBPCA's reviews of available simulation models and other techniques for estimating the energy savings of a whole house retrofit have indicated that those tools tend to be unreliable predictors of actual bill savings in individual homes, due to inherent difficulties in modeling complex interactions and the many home variables involved as well as changes in weather patterns and occupant behavior after a retrofit. Also, as noted earlier in this paper, in California the homeowner's desire for energy bill reductions is only one of many factors in the decision to invest in a comprehensive retrofit (Knight and Lutzenhiser, 2006). In that context, the inevitable errors in quantitative predictions of energy savings too often result in unnecessarily emphasized but unrealized client expectations and dissatisfaction.

For all these reasons, CBPCA has not encouraged detailed energy savings estimation by contractors (although allowing it), instead encouraging more general statements about energy savings and centralizing the energy savings estimation tasks at the program staff level. This analysis uses a combination of utility bill disaggregation and bill-referenced simulation modeling based on the contractor's reported home baseline descriptive data, specific improvements made, and test-in/out data. CBPCA uses the results for program performance reporting purposes and educational feedback to contractors. This approach not only removes a barrier to contractor participation but also creates advantages in analysis across the homes reported by all contractors and the identification of patterns that may allow simplifications in savings estimation and reporting.

The independent quality assurance or validation process specified by both ENERGY STAR and the utilities generally require a review of each home's proposed project plus an independent inspection and testing of five percent sample of treated homes. In California, as in New York (NYSERDA, 2008), the onsite verifications have proven to be difficult and costly to schedule and complete. This is often due to homeowner resistance -- the project is done, they're satisfied, and they don't want to take the time. Contractors often feel it necessary to accompany the inspector, which adds resistance from them too. The IOUs' programs plan to have random in-field spot checks while a job is in progress in lieu of waiting until the contractor is finished. Mail-out homeowner satisfaction questionnaires will also be used for all reported jobs.

Conclusions

The Changing Program Environment

California's current review of its energy efficiency program strategy, based on carbon emissions reduction goals, is of interest not only for its possible effects on the future of home performance retrofit programs and comprehensive efforts in other sectors. That increasing emphasis on carbon reduction may raise the energy efficiency goals, and may be a precursor to similar efforts around the nation as climate change concerns and pressures on legislators continue to grow. The California policy discussion deserves broad attention, participation, and emulation in other states with similarly restrictive cost-effectiveness definitions and procedures.

Comprehensive energy efficiency improvement programs such as Home Performance with ENERGY STAR are already expanding around the country. However, progress is slow due to the restrictive cost-effectiveness approaches often used, as described in this paper. The state's new joint IOU energy efficiency strategic plan (CEESP) is signaling a major change in strategy to address existing home performance, and several of California's utilities are responding with justifiable caution while new policies are being developed and formalized. The introduction of several new home performance retrofit programs in California must now demonstrate their potential to attract a broad audience of homeowners and contractors, and ultimately the deep and widespread energy savings that appear to be possible only with such comprehensive approaches to the existing home market.

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