

MAY/JUNE 2011



Home energy

\$15

Air Conditioning Best Practices

Retrofit Is IN!

**Strategies from
Successful Contractors**

**Multifamily Home
Performance Programs**

**IEQ Daydreams and
Nightmares**





Building a Multifamily HOME PERFORMANCE PROGRAM

Tales from California

BY JULIEANN SUMMERFORD

More money than ever before is being funneled into residential whole-building retrofit programs in California, thanks to state initiatives and American Recovery and Reinvestment Act (ARRA) stimulus funding. These initial investments are largely geared toward single-family homeowners, with multifamily units an afterthought. Renters make up 42% of California households, and about one-third of Californians live in apartments. Additionally, most low-income families live in multifamily dwellings. Often low-income families cannot afford to purchase a home, and as renters they lack the authority to invest in energy efficiency. So focusing on single-family homeowners leaves a large segment of the population underserved by whole-building programs.

Programs that target multifamily buildings gain economies of scale, multiply energy savings, and serve multiple dwelling units (average 50 units per apartment) in one transaction. Because the multifamily market is complex and multifamily buildings have varying characteristics, the single-family whole-house performance model does not easily translate to the multifamily market. Understanding the challenges, complexities, and opportunities unique to the multifamily market will help inform policy makers, program implementers, raters and home professionals to develop a multifamily home performance infrastructure to serve the needs of millions of Californians and inform interested states.

Characteristics of the Multifamily Market

Multifamily properties are unique and often complex. The type of building, the rigor and applicability of the energy code when the building was constructed, and metering configurations all contribute to this complexity. Ownership structures and resident profiles are also varied. The bottom line is that in terms of energy management, a one-size-fits-all approach is not realistic because:

- Building types vary from low- to mid- to high-rise; from four-plexes to apartments to condominiums; from dormitories to assisted-living facilities. Multifamily properties often include spaces and energy end-uses outside of residential dwelling units, including hallways, lobbies, parking garages, swimming pools, laundry rooms, and clubhouses. Furthermore, a multifamily property can be part of a larger, mixed-use property composed of both residential and commercial spaces.
- California's energy code addresses low-rise residential properties under the residential code and high-rise residential properties under the nonresidential code, so multifamily properties are often left out of residential and commercial efficiency programs. The result is that programs have little technical expertise or capacity to audit, assess, model, and verify energy use; or to implement performance-based improvements using building science principles.
- Ownership structure varies. Multifamily property owners may be individuals, mom-and-pop businesses, nonprofit housing sponsors, or large corporations.
- Dwelling units can be for sale, for rent at market rate or at affordable rates, or built for specific uses, such as transitional housing, assisted living, or student housing.
- Properties can be master-metered, individually metered, or some combination, or submetered for electricity and gas. In many cases, occupants pay part of the cost and owners pay the rest. This split incentive presents a special challenge in

Table 1. California Residential Building Stock by Vintage

Building Vintage	Single-Family Homes	Multifamily Dwelling Units
Pre-1982	5,554,290	2,723,422
1982-1991	6,634,644	3,334,332
1992-2000	7,355,358	3,551,042
2001-2005	7,548,578	3,624,041

SOURCE: California Energy Commission, 2003 Forecast Data for Residential Buildings

the multifamily market, where property owners have little incentive to invest in energy efficiency because the tenant reaps most, if not all, of the benefit.

- The way that affordable multifamily rental housing is financed presents many obstacles to paying for energy retrofits. These obstacles include a multiplicity of lenders and investors, who typically have approval rights on any future borrowing; and there are regulatory restrictions on how rents can be structured.

Opportunities in an Underdeveloped Market

Until 2005, multifamily buildings have also been somewhat overlooked in California’s energy code. A common strategy for addressing energy in the multifamily market is to extend single-family standards, best practices, and programs to low-rise multifamily buildings. It wasn’t until 2005 that the California Energy Commission (CEC) changed the multifamily baseline standard to reflect common multifamily building practices, closed some loopholes, included lighting energy use, discontinued a credit for under 20% glazing area, and based its water-heating standard on the type of water heating actually used in the building.

Before 2005, multifamily building projects could receive more credit than they had actually earned for complying with mainstream multifamily building practices because the buildings were being compared to a single-family baseline. For instance, central water-heating systems, typical in multifamily buildings, were compared to a baseline of individual water heaters. The baseline window-floor ratio, typically smaller in multifamily buildings than in single-family buildings, gave multifamily projects another route for achieving code compliance with subpar efficiency. Of the 3.5 million existing dwelling units, the vast majority were built prior to the energy code (see Table 1). This suggests that the multifamily building stock has substantial room for improvement.

Often prescriptive, low-income, or weatherization programs (if they serve multifamily buildings) offer full replacement or incentives for equipment located within the dwelling units but don’t address central systems. There are further opportunities in the multifamily market to upgrade central domestic hot water systems, for example, by installing demand and temperature controls, pipe insulation, and other features.

Designed for Comfort

In 2002, the California independently operated utilities introduced the state’s first comprehensive, whole-building, multifamily existing-building program: Designed for Comfort (DfC). This program’s eight-year tenure has provided the basis for California’s current programs.

DfC takes a comprehensive building analysis approach, using energy consultants and HERS raters, to audit, assess, model, and verify energy efficiency improvements in multifamily housing. The goal is to achieve a minimum of 20% improvement over existing conditions. Measures include installing high-performance windows; improved insulation; and high-efficiency heating, cooling, and water-heating equipment. Each of these measures, taken individually, can greatly reduce energy use; taken together, they can reduce energy use even more. Through a process of auditing and building simulation, the program takes an integrated, whole-

building approach to identify the most cost-effective measures and to capture the combined performance of measures designed to reduce heating, cooling, and water-heating energy use. This analysis is conducted using a CEC-approved building simulation that analyzes the combined effect of multiple improvements; compares trade-offs between different measures; and recommends the measures that will save the most energy at the least cost.

The modeled average efficiency gains for participating projects to date is 30% above existing conditions at an average installed cost per dwelling unit of \$2,373 before the \$700 per unit incentive (\$1,673 per unit after the incentive). To help offset the cost of the audit, analysis, and verification, DfC offered incentives for energy consultants and HERS raters of \$40 and \$50 per dwelling unit respectively. Program performance savings are shown in Table 2.

The DfC program was innovative but faced challenges due to a lack of infrastructure for existing multifamily buildings. For example, the CEC-approved simulation software was developed primarily to serve new construction and did not neatly model existing multifamily buildings. The software modeled heating, cooling, and water heating, but it did not model lighting and appliances. Also, the CEC-approved HERS infrastructure was



Tommy Young of E3Norcal reads gas meters at Ranch Terrace apartments, a 105-unit complex in Rancho Cordova, a suburb of Sacramento.

Table 2. Designed for Comfort Progress

Average Number Units/Property	Average Cost/Unit	Average kWh Savings/Unit	Average kW Savings/Unit	Average Therm Savings/Unit
66	\$2,373	604	1	53



ENERGICAL

Bank of electric meters at Ranch Terrace in Rancho Cordova.

developed to serve residential new construction and did not address central systems or high-rise residential buildings. And the workforce serving the residential new-construction market in California was divided into energy consultants (building simulation experts) and HERS raters, who conduct the field verification.

Collaborating to Develop a Program Infrastructure

With the wave of ARRA funding, California program implementers are seizing the opportunity to build upon the DfC model to develop a program infrastructure based on CEC's HERS II regulations and train more energy consultants and energy raters to serve this market. In 2009, EPA Region 9 formed the California Home Energy Retrofit Coordinating Committee (HERCC) to promote collaboration and consistency among home performance programs throughout the state (see "Policy Collaboratives: Drivers of Green Building and Energy Efficiency in California," HE Sept/Oct '10, p. 46). Initially formed to address single-family program delivery, a group of multifamily program implementers, experts, and stakeholders created the HERCC Multifamily Subcommittee (MF HERCC). The subcommittee's goals are—working collaboratively—to establish the infrastructure for multifamily performance-based retrofit programs, to encourage consistent program delivery, and to promote the multifamily programs as part of Energy Upgrade California. Funded by ARRA, Energy Upgrade is an alliance among California counties, cities, nonprofit organizations, government agencies, investor-owned utilities, and public utilities. Energy Upgrade intends to serve as the central clearinghouse for all retrofit programs throughout the state, to provide consistent information about programs to participants, and to develop the capacity of the home improvement industry.

Working collaboratively, as described above, the MF HERCC has made the following recommendations to serve as the basis for multifamily performance-based program design.

Consultant Model

The multifamily market lends itself to the consultant model as opposed to the single-family contractor model. In the consul-

tant model, the auditor is a third party. In the contractor model, a general contractor conducts the audit test-in and the analysis; makes the recommendations; does the installation; and conducts the verification test-out. Multifamily property owners typically prefer to work with their network of trusted contractors rather than with program-designated contractors. The HERS II regulations require a certified HERS II rater to conduct the audit, analysis, and verification. This requirement supports the consultant model. The result is that a third party helps to ensure quality and verify the installation of recommended measures. The contractor model appropriately provides single-family homeowners with one-stop shopping, and the contractor can incorporate the cost of the assessment into the price of the job. But multifamily buildings are more complex, and the consultant model allows the rater to focus on the energy performance of these buildings, and on the building science necessary to achieve it, leaving the contractor free to focus on quality installation.

Professional Qualifications and Training

To develop multifamily building expertise among raters, energy analysts, and building operators, current supplemental training efforts build upon existing HERS and HERS II training and certification by adding central systems, common areas, high-rise protocols, and advanced building analysis to ensure expertise in modeling multifamily buildings. Finally, training building managers to operate and maintain the energy efficiency systems will help to ensure the longevity of their energy upgrade investments.

Energy Analysis Software

The HERS II software module is based on CEC-approved code compliance software and therefore uses the same baselines, assumptions, and time-dependent valuation. This software, and versions of this software, is widely used by energy analysts and raters throughout the state. For retrofit upgrades that trigger Title 24 compliance, property owners must submit a Title 24 analysis in order to obtain a building permit. The HERS II module incorporates appliances and lighting; compares various options for increasing energy efficiency; rates a building against a net zero energy benchmark; provides a summary report; and uploads to the HERS Provider registry for verification purposes. It was developed primarily for single-family and low-rise multifamily buildings. The MF HERCC-HERS II Tools task group has formed to identify and resolve issues currently not addressed by the HERS II software and to modify the software accordingly. Modifications include tailoring lighting and appliance algorithms for multifamily buildings; addressing high-rise multifamily buildings; and comparing the energy use to existing conditions, Title 24, and CEC vintage defaults.

Putting Recommendations into Action— SMUD Home Performance Program

One of the first programs to adopt HERCC recommendations was the Sacramento Municipal Utility District (SMUD), which established its SMUD Home Performance Program—



ES/NORCAL

Young inspects central boilers at Ranch Terrace apartments. The boilers were upgraded in large part from a multifamily incentive program.

Multifamily (HPP MF) in 2010. Participating properties must achieve a minimum 20% improvement (as modeled) over existing conditions. An escalating incentive structure is designed to encourage deeper energy savings (see Table 3).

Property owners must use a rater on the SMUD's rater referral list who has successfully completed SMUD Home Performance Program—Multifamily Rater orientation; HERS and HERS II certification; and California Multifamily Existing-Building training (HERS II supplement).

SMUD partnered with Alameda County to develop and deliver the first training. The training focuses on auditing, modeling, and multifamily central systems. It serves as the basis for statewide training content and includes

- profiles of common types of multifamily building
- an overview of HERS II as defined by the CEC
- an overview of multifamily central and individual systems
- energy audit protocols
- energy modeling in multifamily buildings
- billing data collection and analysis training in cost analysis and metrics
- an overview of auditor and contractor qualifications
- quality assurance
- making recommendations
- verification procedures
- a written certification exam
- field training and walk-through audit

A Work in Progress

Although they are still in the early stages of implementation, California home performance programs for multifamily buildings are continuing to develop the tools, resources, and expertise needed to create a robust infrastructure. The following efforts are under way.

Multifamily Asset Manager Tool

The company I work for—the Heschong Mahone Group, Incorporated (HMG)—has developed a process and standards

through which to prequalify, prioritize, and advise multifamily property owners on the appropriate approach to, and programs for, an energy efficiency retrofit. Working from this, and in conjunction with various entities (Energy Upgrade Alameda County, San Diego County, the Housing Authority of the County of San Bernardino, and Enterprise Community Partners), we are developing the “Navigational Tool.” The collaborative is also developing a tracking tool. These tools will serve multiple functions and have a user-friendly web interface that multifamily asset managers can use to assess properties, navigate various approaches to energy retrofit, match programs with resources, and track energy and green improvements made to their properties. These tools will help asset managers to prioritize retrofits among property portfolios and to identify buildings ripe for whole-building analysis.

The property owner begins by entering some basic building information into the Navigational Tool, which helps the owner to:

- identify upgrade opportunities and the most appropriate retrofit approach (tune-up, prescriptive, or whole-building) for each property;
- prequalify properties that are ripe for whole-building, home performance investments;
- match the properties with applicable programs, funding, and financial products; and
- rank properties by upgrade priority (depending on what the property needed, and on which opportunities are the most cost-effective)

This tool is not intended to serve as the building simulation but to filter properties ripe for whole building and to direct others to the appropriate approach.

Building Operator Training

Energy management is often overlooked as a key strategy for saving energy. A systematic and comprehensive approach to managing energy in multifamily buildings not only will save money and energy but also will extend the longevity and performance of equipment and help building operators to identify and resolve building energy use problems before they show up on utility bills. The HERCC recommends, and various programs have funding for, training building operators and their staff. Collaboration continues to define the content of this training. The primary focus will be to train building operators to evaluate the performance of their buildings and to reduce operating costs through planned and preventive maintenance. This training, combined with the use of the Asset Manager Tool, will enable building owners to save energy by employing consistent and comprehensive energy management best practices.

Tenant Behavior

Tenant behavior plays a large role in a building's energy use, no matter how efficient that building is. One goal of efficiency programs is to encourage residents to manage their energy use and to provide tips on conserving energy. Various programs are de-

veloping ways for program staff and building management staff to meet this goal.

Tracking Actual Energy Consumption

Currently, there are two primary ways to obtain billing data for an individual multifamily property. The first is to collect utility account data and authorization from each dwelling unit or from a group of representative units, to extrapolate to the whole building, and to combine the results with any central and common-area consumption. The second is to ask the utility to aggregate consumption at the property level, which is a challenge for most utilities because of customer disclosure issues. These cumbersome options severely limit the property owner's ability to track pre- and post-investment energy use. It also limits the HERS rater's ability to calibrate building simulation models with billing data.

In 2009, EPA incorporated the multifamily building type in its Portfolio Manager benchmarking tool. This tool can easily track energy, water, and greenhouse gas emissions in master-metered buildings, but—like any tracking tool—it is harder to use in individually metered buildings. For individually metered buildings, each tenant must sign a release giving program and building staff

access to that tenant's utility accounts. California utilities have developed an automated benchmarking service whereby—when authorized by a commercial customer—the utility will automatically upload historical billing data and monthly data to the utility. This service could potentially be extended to multifamily buildings, if the issue of aggregation is resolved.

Financing and Rebates

For owners of affordable multifamily properties, rebates, energy savings, and the packaging of funding sources is helping to offset the cost of improvements. Traditional financing products must be further developed to provide a viable and sustainable source of funding for whole-building, deeper-energy investments. There is little financing for energy efficiency in multifamily buildings apart from

the financing provided by energy service companies. However, there are a few financing mechanisms that minimize or eliminate the up-front cash outlay:

- On-bill financing programs help qualified customers to pay for energy efficiency improvements through their utility bills.
- Bulk purchasing can help building owners reduce the cost of equipment and materials.

Table 3. SMUD Home Performance Program—Multifamily Incentive Structure

% Improvement	Incentive/ Dwelling Unit
20%	\$1,000
25%	\$1,200
30%	\$1,400
35%	\$1,600
40%	\$1,800

>> learn more

For housing statistics served by utilities in California, go to www.cpuc.ca.gov/PUC/energy.

For a bulk-purchasing tool put out by the EPA, go to www.quantityquotes.net.

For more on the work of the Heschong Mahone Group, go to www.h-m-g.com.

For information on Energy Upgrade California, go to <https://energyupgradeca.org/overview>.

For more information about Energy Upgrade California Multifamily Programs and related initiatives, go to: Sacramento Municipal Utility District (SMUD), <http://hpp.smud.org/multifamily-program>.

Alameda County: www.acgreenretrofit.org/Content/10006/MultifamilyResidences.html.

Sonoma, Los Angeles, and Alameda County: www.multifamilygreen.org.


Enterprise Community Partners
www.enterprisecommunity.org/local_work/northern_california/green_retrofit.asp.

www.enterprisecommunity.org/local_work/los_angeles.

Housing Authority of the County of San Bernardino
www.hacsb.com/about-hacsb/building-communities/green-initiatives.

For more information on HMG's multifamily program efforts, go to: www.h-m-g.com/multifamily/default.htm.

- Grants and loans are available from various sources. Intermediary organizations, such as Enterprise Community Partners, the Local Initiatives Support Corporation, and the Low Income Investment Fund, are working to support owners of affordable housing by offering some combination of grants, loans, and technical assistance. Public-sector agencies, such as HUD and DOE, provide various grants that are either specifically targeted to affordable multifamily housing or can be used for this purpose.

Creating a viable loan product for multifamily property owners will accelerate the pace of energy efficiency retrofitting. To the extent that energy and water savings can be underwritten, they can be used to attract private capital to finance the retrofits. But without the ability to accurately track energy savings data, lenders will be reluctant to develop such products. In the parlance of the financial community, loans will have to be over collateralized. 

Julieann Summerford is director of programs and evaluation at the Heschong Mahone Group, Incorporated. She has over 12 years of experience in designing and implementing residential energy efficiency programs for utility, government, and nonprofit clients.