

Improving California's Multifamily Buildings: Opportunities and Recommendations for Green Retrofit & Rehab Programs

*Findings from the Multifamily Subcommittee
of the California Home Energy Retrofit
Coordinating Committee*



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EXECUTIVE SUMMARY

In California, the single-family home weatherization and whole-house performance sector is very active, with many programs already in place and new ones that began rolling out in the fall of 2010. While these programs have the potential to achieve impressive energy savings, their approaches do not neatly carry over into the multifamily and affordable housing sector.

The multifamily and affordable housing sector is different from the single-family sector in many fundamental ways, and optimal energy improvements at the whole-building level cannot be accomplished by merely modifying or expanding the single-family programs. The opportunities and challenges unique to the multifamily sector can only be met if there are well-designed and well-coordinated programs and policies that address this sector's specific infrastructure.

In recent decades, California's building energy efficiency standards, the California Home Energy Rating System (HERS), utility incentives and local government programs have made major strides in improving the energy efficiency of the state's building stock. However, neither single-family nor commercial building energy upgrade programs fully address the unique aspects of the multifamily sector and its subsectors. Multifamily developer/owners find it time consuming and daunting to sort through the range of individual measure and targeted programs that might apply to their properties, and to make sense of the varying application procedures and requirements associated with each program.

The Multifamily Subcommittee of the California Home Energy Coordinating Committee (MF HERCC) is working to address these challenges by coordinating development of standards, professional qualifications, verification procedures, and energy savings quantification and tracking tools. The California Home Energy Retrofit Coordinating Committee was convened by U.S. EPA Region 9 to develop consistent recommendations and standards for statewide home energy retrofit programs.

This report summarizes the MF HERCC's recommendations and analysis in six specific areas:

1. Program delivery
2. Professional qualification and training
3. Whole-building performance approach
4. Energy analysis software
5. Performance measurement, tracking and benchmarking
6. Low-income and energy efficiency program access and coordination

Summary of Recommendations

1. Program Delivery

- a. Use raters/verifiers and energy consultants to deliver multifamily incentive program services.*
- b. Give developer/owners the flexibility to hire and manage the construction and verification team.*
- c. Design individual measure-based incentive programs¹ and whole-building performance-based programs to be complementary and parallel offerings.*
 - Utilize a rater/verifier and energy consultant delivery model for whole-building performance programs and continue to utilize a contractor delivery model for individual measure programs.
 - Take into account the conditions under which a contractor-delivery approach may be appropriate for whole-building performance programs.
- d. Provide a single point of customer interface for multifamily property owners to streamline their participation.*

Incentive programs that deliver energy and green upgrade services for single-family homes, as well as individual measure-based programs for multifamily buildings, typically rely on pre-approved contractors. These contractors serve as the conduit for participating in the program and provide services such as diagnostics, verification and documentation. This contractor-list delivery approach, however, is unlikely to be successful for California's diverse and professionalized multifamily and affordable housing sector, for a number of reasons. Developer/owners typically have long-established relationships with a variety of specialized sub-trade contractors whom they may be contractually obligated to use, making it problematic to use program-designated contractors. Using raters/verifiers instead of contractors to delivery multifamily incentive program services also aligns with the HERS program model. California already has a well-established network of professional HERS raters, and existing multifamily programs already successfully use a rater model for program delivery. To support program delivery by raters, the MF HERCC has already developed whole-building audit protocols for use by raters/verifiers who are auditing multifamily buildings. There are circumstances, however, where a contractor-delivery approach may be appropriate; these should be considered when coordinating the offerings of individual measure-based incentive programs and whole-building performance programs.

When multiple programs (e.g. individual measure programs and whole-building performance programs as parallel offerings, or different offerings for low-income and market rate properties) are offered to the multifamily sector and sub-sectors, providing a single point of customer interface for multifamily property owners will reduce consumer confusion and improve program participation rates.

¹ Primary multifamily individual measure programs currently offered in California include the DOE Weatherization Assistance Program (WAP) administered by CSD, the CA Utility Rate-payer funded Statewide IOU Multifamily Energy Efficiency Rebate (MFEER) program, and the low-income Energy Efficiency (LIEE). See the CPUC matrix of MF programs included as an appendix to this report for examples of individual measure programs currently offered by IOUs.

2. Professional Qualification and Training

- a. Focus on qualifications of rater/verifier and add specialized expertise to audit team based on scope of upgrade.*
- b. Develop targeted training curricula and require completion of training by participating raters/verifiers, building operators, central systems contractors and users of energy analysis software.*
- c. Consolidate required qualifications and training for participating building professionals. Build the capacity for partners who deliver individual measures to become whole-building raters/verifiers or to install individual measures as part of a whole-building program.*

The MF HERCC recommends targeting specialized training at four types of professionals who work on multifamily buildings: rater/verifiers, building operators, central water heating system contractors, and energy analysts. Each of these training courses focuses on making sure that key professionals working on multifamily building upgrades have the knowledge and expertise to make effective decisions about building improvements, program participation and ongoing operational savings. Minimum professional qualifications have been established for the verification/audit team.

The minimum professional qualifications and associated training required for various programs statewide should be consolidated to maximize the programs' ability to share trained workforces, and to limit the number of trainings and certifications required of participating building professionals.

The recommended Property Manager/Building Operator Training includes content to empower the entities who operate multifamily buildings to provide education and outreach to building residents. Residents need information and tools to make smart decisions about using energy efficiently and keeping their homes healthy. A home environmental education component can increase behavior-based conservation, improve the lives of residents (especially low-income renters who may not have ready access to this information) and enhance relationships between property owners, tenants and the broader community.

3. Whole-Building Performance Approach

- a. *Offer funding programs based on a whole-building performance approach for multifamily energy efficiency improvements, rather than a prescriptive approach. This performance approach should be based on Title 24 and HERS II protocols for multifamily residential buildings that consider the energy end-uses of heating, cooling, water heating (including solar pre-heat), appliances and lighting.*
- b. *Require a minimum of 10 percent energy efficiency performance improvement for all projects, with additional targets for projects to reach 15 percent and 20 percent improvement.*
- c. *Ensure that program total resource costs are minimized by eliminating administrative inefficiencies and optimizing leveraging among programs.*
- d. *Provide utility-funded incentives for the whole-building performance approach to stimulate demand for comprehensive energy upgrades.*

Single-family upgrade programs have traditionally taken a prescriptive approach, allowing for specific, clearly defined packages of improvements to be made to participating buildings as an option in parallel to the whole-building performance approach. This prescriptive path is seen as a “ramp-up” for increasing workforce capacity. After extensive analysis, the MF HERCC has concluded that this type of whole-building prescriptive approach is not feasible for the multifamily sector. Because of the diversity of building types, system types and other factors discussed throughout this document that distinguish multifamily buildings from single-family homes, a statewide whole-building prescriptive approach to multifamily upgrades would require 16 or more distinct packages of measures. This would likely create a huge administrative burden, confuse the market and drive up program costs.

For multifamily whole-building programs, the MF HERCC recommends a performance approach to energy savings analysis and upgrades. Minimum performance improvement targets ranging from 10 percent to 20 percent are recommended based on the building’s vintage. Individual programs need to conduct their own cost-effectiveness analysis based on the program’s specific parameters. Utility-funded incentives to developer/owners will drive demand for energy and green upgrades.

4. Energy Analysis Software

- a. *Use code compliance software as the standard baseline reference for energy savings reporting in programs funded by the American Recovery and Reinvestment Act (ARRA) or investor-owned utilities (IOUs).*
- b. *Use supplemental software programs where necessary to optimize analysis of energy savings opportunities.*
- c. *Apply California Energy Commission (CEC) HERS II-type residential multifamily low-rise protocols to high-rise multifamily in the code compliance software.*
- d. *Align funding programs' use of various software platforms for compliance to reduce administrative barriers to program participation.*

For multifamily developer/owners, a major barrier to carrying out energy performance upgrades is the complex and sometimes conflicting requirements of incentive and funding programs. Using standardized Title 24 code compliance software is an important step toward streamlining program requirements. That

said, there must be some flexibility to use other software programs when needed to analyze certain types of improvements not well addressed by the Title 24 compliance software. The MF HERCC also recommends modifying HERS II code compliance software to address multifamily buildings including high-rise residential buildings (it currently applies to single-family and low-rise multifamily buildings, and was designed primarily with single-family assumptions), and coordinating requirements of funding programs to reduce duplication of energy modeling and analysis efforts.

5. Performance Measurement, Tracking and Benchmarking

a. Develop technical infrastructure for consistent building performance data analysis and tracking.

To ensure that projects are achieving the predicted energy savings, and to inform improvements to building energy savings estimates, the MF HERCC recommends that programs require a verification of achievement of performance improvement following the completion of the project, ideally based on bill analysis that accounts for external influences on usage during the period of evaluation. This performance feedback would help to evolve performance program guidelines and goals to reflect realized savings. However, in order to actualize this recommendation, the MF HERCC recommends development of the technical infrastructure—including consistent protocols, policies and tools—for multifamily building owners and asset managers to:

- Track, analyze, and evaluate their buildings on a portfolio level,
- Track building performance and plan improvements over time, and
- Receive Automated Benchmarking Service (ABS) for multifamily properties through their local utility.

6. Low-Income and Energy Efficiency Program Access and Coordination

a. Coordinate and integrate energy efficiency retrofit and weatherization programs serving the low-income sector by developing consistent program requirements, standards and audit protocols; modifying program structures to provide more flexibility for multifamily building owners; and supplementing prescriptive approaches with whole-building performance approaches.

b. Improve accessibility of low-income energy efficiency and weatherization programs to rent-restricted rental housing providers, thereby achieving additional market penetration and deeper energy savings by streamlining eligibility and administrative procedures.

c. Build capacity in the affordable housing industry for use of energy efficiency-based utility allowances and project specific utility allowance calculators.

Unless otherwise stated, the recommendations in Sections 1 through 5 above pertain equally to low-income and market rate properties. Additional recommendations that are entirely specific to low-income and weatherization programs are found here in Section 6.

For the multifamily housing sector, one of the major barriers to upgrading a building's energy performance is the plethora of sometimes confusing and often overlapping program requirements, incentives, financing sources, protocols and compliance software requirements. While this situation is a

challenge for market-rate developers, it is even more challenging for developer/owners of income-restricted properties, who face additional complicated program and funding requirements. In addition, low-income energy efficiency (LIEE)² programs funded by California Public Utilities Commission (CPUC) ratepayers and Weatherization Assistance Programs (WAP) funded by the U.S. Department of Energy (DOE) utilize a single-family program delivery model and have other barriers that make them difficult for multifamily properties to participate. As a result of these factors, most of the apartments which house low-income residents in California have not benefitted from or have been underserved by energy upgrade programs. To reduce barriers to participation, improved access to these programs and coordination of their requirements is essential.

Adoption of the recommendations in these six areas will allow California's energy and green upgrade programs to more effectively and quickly serve the multifamily building sector.

² Since these recommendations were initiated the CPUC/IOU Low Income Energy Efficiency (LIEE) program has been re-named Energy Savings Assistance Program (ESAP). Because these recommendations pertain to the program as it has been operated under the LIEE version, the term LIEE is used throughout the document for consistency.

INTRODUCTION

Challenges and Opportunities in the Multifamily Retrofit & Rehab Sector

In California, the single-family home weatherization and whole-house performance sector is very active, with many programs already in place and new ones rolling out in the fall of 2010. While these programs have the potential to achieve impressive energy savings, their approaches do not neatly carry over into the multifamily and affordable housing sector.

The multifamily and affordable housing sector is different from the single-family sector in many fundamental ways, and optimal energy improvements cannot be accomplished by merely modifying or expanding the single-family programs. The opportunities and challenges unique to the multifamily sector can only be met if there are well-designed and well-coordinated programs and policies that address this sector’s specific infrastructure.

In California, approximately one-third of households reside in multifamily buildings (Figure 1).³ Nationwide, more than 70 percent of multifamily housing units were constructed before building energy efficiency codes were established.⁴ Although multifamily buildings inherently tend to be more efficient on a per capita basis compared to single-family homes, the large population living in multifamily buildings combined with the age of these buildings means that the potential for energy savings in this sector is enormous.⁵

Figure 1. Distribution of California Households by Dwelling Type

(Source: CPUC Strategic Plan, 2008)

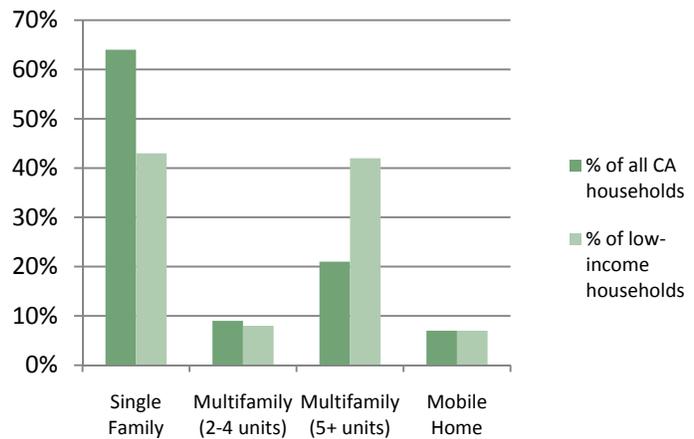
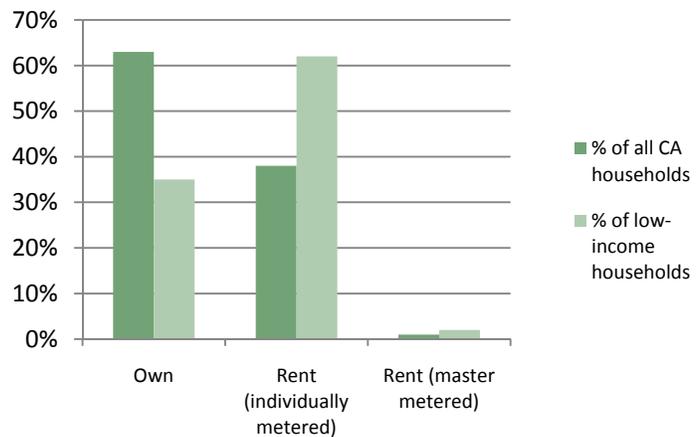


Figure 2. Distribution of California Households by Home Ownership

(Source: CPUC Strategic Plan, 2008)



³ California Public Utilities Commission, “California Long-Term Energy Efficiency Strategic Plan,” September 2008.

⁴ Energy Foundation, “U.S. Multifamily Energy Efficiency Potential by 2020,” October 19, 2009, prepared by The Benningfield Group, Inc.

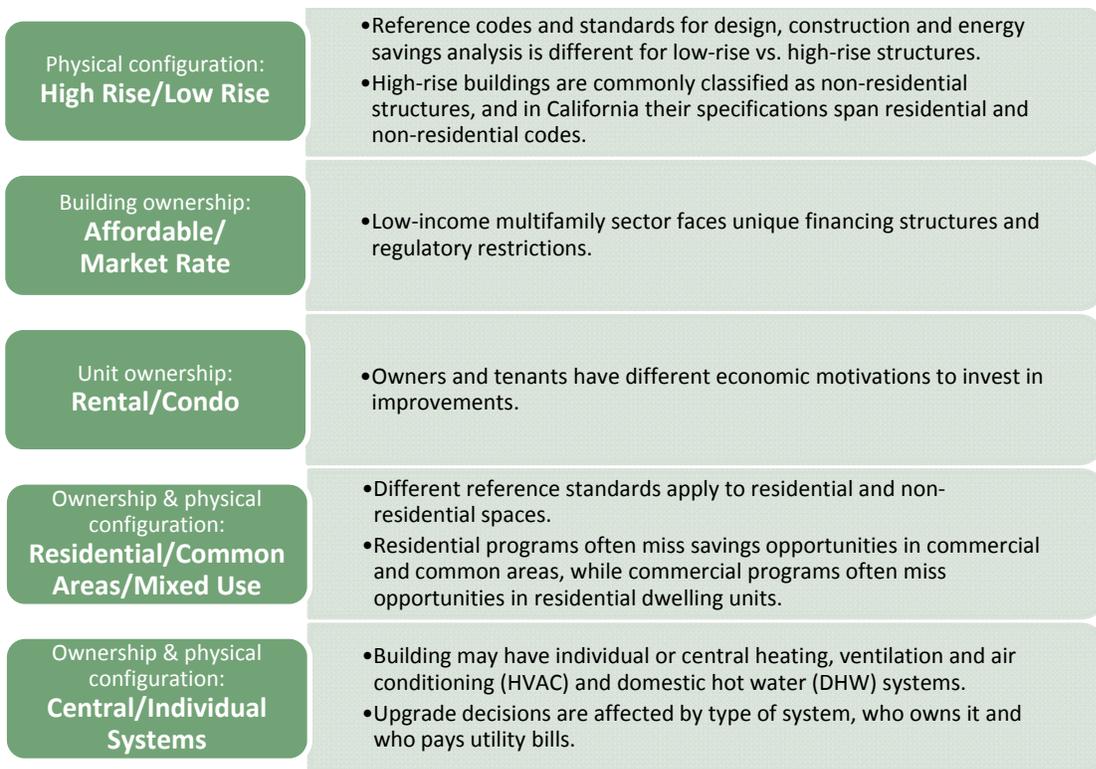
⁵ There are more than 2.4 million existing multifamily dwelling units in California. If 14 percent of those units were upgraded to improve energy performance by 25 percent, it would reduce annual energy consumption by 533,971 megawatt-hours (MWh) of electricity and 37 million therms of natural gas. Avoided greenhouse gas emissions

In the multifamily sector, energy savings and social equity are intertwined challenges. According to the California Public Utilities Commission, 42 percent of California households are renters rather than owners, and about one-third of these households qualify for low-income energy efficiency (LIEE) programs.⁶ Figure 1 and Figure 2 show dwelling types and home ownership rates for California households in general and for low-income households.

Compared to higher income homeowners, lower income renters spend a disproportionate amount of their income on energy, and yet they typically do not have the financial resources or ownership rights to make energy efficiency investments in their homes. Well-coordinated upgrade programs targeted at the multifamily and affordable housing sector can make a big difference in individual’s lives while supporting the state’s ambitious energy and climate change goals.

A central challenge to the successful implementation of market transformation strategies arises from the fact that the multifamily and affordable housing sector actually consists of a number of subsectors. These are shown in Figure 3 and discussed in greater detail in the “Understanding California’s Retrofit & Rehab Market” section later in this report.

Figure 3. Multifamily Subsectors



would be 430,245 MTCO₂E annually. (Calculations done using methodology from the California Air Resources Board (CARB) AB 32 scoping plan.) On a national basis, estimates of achievable potential for energy efficiency improvements in existing multifamily housing by 2020 would save more than 51,000 gigawatt-hours (GWH) of electricity and more than 2,800 million therms of natural gas. Avoided CO₂ emissions are estimated from at least 50 million tons to more than 100 million tons per year (Energy Foundation, op. cit.).

⁶ CPUC, op. cit.

The various building configuration and ownership variables shown in Figure 3 influence:

- Which reference standards apply,
- Who is the decision maker and therefore which measures will be selected for energy investments and associated payback,
- What is the financing and regulatory structure of the project and how that might constrain energy efficiency decisions, and
- Whether the common areas, the dwelling units or both are the focus of the improvements.

In recent decades, California's building energy efficiency standards, California's Home Energy Rating System (HERS), utility incentives and local government programs have made major strides in improving the energy efficiency of the state's building stock. However, energy efficiency programs often do not fully recognize the unique characteristics—and potential for energy savings—of the multifamily industry's subsectors. In some cases, multifamily buildings are treated generically as housing and lumped together with single-family residential programs, standards and policies. In other cases, multifamily buildings are treated as if they were commercial buildings—in other words, large structures with complex ownership, financing, development and management.⁷

Neither single-family nor commercial building upgrade programs fully address the unique aspects of the multifamily sector and its subsectors. Multifamily developer/owners find it time consuming and daunting to sort through the range of individual measure and targeted programs that might apply to their properties, and to make sense of the varying application procedures and requirements associated with each program. They would be more inclined to participate if programs, protocols and resources were better coordinated.

Fortunately, there is an opportunity for this systemic issue to be addressed in California today. Federal stimulus funds targeted at improving building energy efficiency, combined with ongoing programs such as those funded by utility ratepayers, are creating unprecedented opportunities for policymakers and program implementers to develop definitions, protocols and resources that are fine-tuned to the needs

Neither this nor that

In California's Building Energy Efficiency Standards, commonly known as Title 24, low-rise multifamily buildings are covered by the residential section of the code. The nonresidential code addresses envelope and HVAC in high-rise multifamily buildings, but the residential code addresses water heating, lighting and appliance energy use in high rises.

In this case and many others, the multifamily sector has to straddle the requirements of programs and standards designed for either single-family homes or commercial buildings. Deciphering which programs and reference standards apply requires the intervention of experts. As a result, too often multifamily retrofit projects wind up falling between the cracks, leaving substantial energy savings and other benefits on the table.

⁷ For some multifamily properties, the developer and owner are the same entity. In other cases, the property owner may not be a developer. In this report, the term "developer/owner" refers to a developer and/or owner, and is used to distinguish the more complex multifamily ownership structure from single-family home ownership.

of the multifamily sector and that are coordinated to reduce administrative inefficiencies and eliminate unnecessary costs and barriers to participation.

About the Multifamily Home Energy Retrofit Coordinating Committee (MF HERCC)

Dozens of entities across the state are actively involved in rolling out residential building upgrade programs. To coordinate their efforts and accelerate the rate at which California's buildings undergo energy and green building improvements, many of these entities came together in early 2009 to form an ad hoc group—the California Home Energy Retrofit Coordinating Committee (HERCC).

Convened by the U.S. EPA's Region 9, this collaborative of utilities, government agencies, building experts and others is working together to develop consistent recommendations and standards for statewide home energy retrofit programs. In its first year, the HERCC focused on single-family programs. Starting in January 2010, a Multifamily Subcommittee (MF HERCC) was formed to address the application of residential energy and green building programs to the unique needs of the multifamily and affordable housing sectors.

The MF HERCC's goal is to minimize administrative barriers to participation in multifamily retrofit and rehab programs emerging as part of Energy Upgrade California.⁸ It is doing this by coordinating development of standards, professional qualifications, verification procedures, and energy savings quantification and tracking tools. Within the MF HERCC, Task Groups address specific tasks such as audit protocols, IT systems and weatherization programs. The MF HERCC is chaired by StopWaste.Org; the Acknowledgments section in this document includes a list of participants.

Purpose of This Report

This report is intended for people involved in developing and implementing multifamily building upgrade policies, programs and incentive structures in California. The report summarizes the MF HERCC's recommendations for:

1. Program delivery
2. Professional qualification and training
3. Whole-building performance approach
4. Energy analysis software
5. Performance measurement, tracking and benchmarking
6. Low-income and energy efficiency program access and coordination

The following background information about California's multifamily building sector provides critical context for these recommendations and analyses.

⁸ Energy Upgrade California is a new statewide program that promotes improvement of California's building stock using funding from sources including utility ratepayers, local government and the American Recovery and Reinvestment Act (ARRA). Energy Upgrade California multifamily program elements and tools are scheduled to launch in 2011.

Understanding California's Multifamily Retrofit & Rehab Market

The State of California, as well as local governments, regional agencies and many entities in the private sector, have established ambitious goals for reducing building energy use and related greenhouse gas emissions. To achieve these goals, building upgrade programs must be quickly and effectively ramped up. But if these efforts are to succeed, multifamily buildings cannot be shoehorned into programs designed for single-family or commercial buildings. Instead, California needs well-coordinated programs tailored to the unique opportunities and market barriers faced by the multifamily sector. The following key issues are discussed below:

Multifamily buildings cannot be shoehorned into programs designed for single-family or commercial buildings.

- **Building types:** The diversity of multifamily building types makes it highly challenging to develop program delivery models, incentive programs and consistent packages of building upgrade measures that meet the needs of every situation.
- **Financing:** Programs that fund multifamily energy upgrades need to be coordinated with traditional sources of financing so that they serve as a stimulus rather than a barrier to building upgrade activities.
- **Split incentives:** Upgrade programs need to take into account the divergent economic motivations of multifamily building owners and occupants, as well as the different ways in which energy is used and paid for by tenants and owners in multifamily buildings.
- **Trigger events:** During a multifamily building's lifecycle, there are specific times when it is most cost effective and convenient for the developer/owners to make energy and green upgrades. Building upgrade programs should tailor their services to take advantage of these entry points.
- **Cost-effective energy savings measures:** There are many cost-effective energy savings measures that are unique to multifamily properties. These measures need to be taken into account when designing building upgrade programs and incentives and conducting outreach to multifamily developer/owners.

Building Types

The multifamily sector encompasses a range of building sizes, system types and configurations of dwelling units and nonresidential areas. These configurations generally fall into the categories shown in Figure 4, and are consistent with Title 24 building code definitions.⁹ When multifamily buildings undergo energy efficiency and green upgrades, these occupancy mixes and physical configurations affect how technical protocols and codes and standards (such as the residential vs. commercial versions of Title 24) are applied.

Figure 4. Multifamily Building Types

| | |
|------------------------------------|--|
| Low-rise Multifamily | <ul style="list-style-type: none"> • Three or more attached dwelling units with less than four habitable stories. |
| High-rise Multifamily | <ul style="list-style-type: none"> • Three or more attached dwelling units with four or more habitable stories. A mid-rise multifamily category is not defined separately from high-rise multifamily in Title 24 but it is generally accepted in the industry to refer to multifamily buildings of four to six stories. |
| Mixed-use Multifamily | <ul style="list-style-type: none"> • Three or more attached dwelling units as well as nonresidential spaces within one building envelope. Commercial spaces follow non-residential code; residential common area and corridors follow residential code unless they exceed 20 percent of total floor area. |
| Small Multifamily | <ul style="list-style-type: none"> • Three to five attached dwelling units that are in the configuration of a single-family home, such as a Victorian house converted into apartments, to which single-family protocols can be applied on a case-by case basis. |
| Multifamily Central Systems | <ul style="list-style-type: none"> • Three or more attached dwelling units that share common water heating or space conditioning equipment. |

Smaller multifamily buildings present a special case. In some jurisdictions in California, such as the cities of San Francisco and Berkeley, multifamily buildings with three to five dwelling units constitute a significant portion of their multifamily housing stock. Although these buildings may technically meet the multifamily definition of three or more attached dwelling units, they do not always have other defining characteristics of multifamily properties such as central mechanical systems, multistory construction

⁹ Title 24 defines multifamily housing as three or more attached dwelling units. However, various programs define multifamily housing differently; for instance some IOU programs consider buildings with two or more units, including duplexes, to be multifamily.

with high framing factors, or less overall exterior surface area per dwelling unit than a single-family home.

These smaller multifamily buildings are currently not well served by either single-family or multifamily programs. Pilot energy upgrade programs for small to medium multifamily buildings are currently underway in San Francisco and Maine. These programs will likely shed light on successful program design and implementation strategies for this subsector.

Until then, program administrators should take a case-by-case approach to determining whether these buildings fall under single-family or multifamily programs.¹⁰ Program administrators should also consider offering specialized incentives for this market subsector since they do not experience the economies of scale of larger multifamily buildings and they tend to be too small to be targeted for participation by multifamily incentive programs.

In addition, the building upgrade decision-making process and potential for improving the energy efficiency of these building types is further influenced by other factors, including whether the building is an affordable or market rate property, whether the units are rented or owned, and the type of utility metering and billing configurations in place (Figure 5).

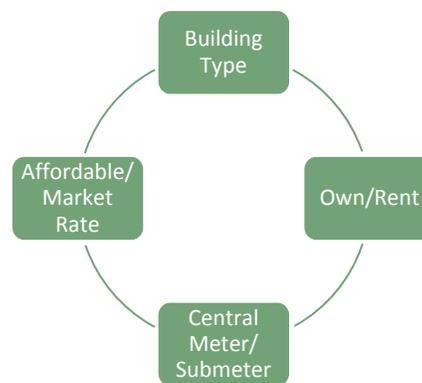
Because multifamily building types are so diverse, it is highly challenging to develop program delivery models, incentive programs and consistent packages of building upgrade measures that meet the needs of every situation.

Financing

A variety of incentives and financing options are available to property owners and developers interested in making green improvements to their buildings. In addition to conventional sources of multifamily and affordable housing upgrade financing, Energy Upgrade California will facilitate access to the following sources of technical assistance and funding to undertake green building improvements:

- Investor-owned utility energy efficiency and low-income programs

Figure 5. Factors Influencing the Multifamily Building Upgrade Decision-Making Process



¹⁰ Case-by-case analysis can be defined by parameters other than number of dwelling units, such as shared attic and crawl spaces, original building configuration (e.g., if the building was originally a large single-family home that has been converted into separate units), and utility metering configurations. Technical criteria to be used to refine the definition of small multifamily might include number of dwelling units, square feet, ownership access to all or part of building and presence of central mechanical systems.

- Energy efficiency programs funded by the State Energy Program
- U.S. Department of Energy's Better Buildings Program
- Local government and private sector funding programs
- Federal and state housing programs¹¹

Out of necessity, experienced multifamily housing owners and developers are adept at pulling together and layering myriad resources to complete a major construction, rehab or retrofit project. However, the decision to access incentive program resources is more complex for multifamily building owners than for single-family building owners. That's because:

- Construction in the multifamily and affordable housing industry is driven by multiple financing sources. These funding sources often have unique criteria that may limit the scope of a retrofit and supersede any requirements of an incentive program.
- Complex retrofit and rehab projects involve budgets ranging from tens of thousands to millions of dollars. For larger projects, it can take several years to line up capital. By the time a project is fully funded, design has advanced and opportunities to influence the scope are limited.
- Processes for permitting, insurance, general contractor and subcontractor arrangements, and ongoing building management bear more resemblance to the professionalized services in the commercial building sector than the single-family home sector.

The type of building ownership also has a direct impact on the economics of energy and green upgrades. As a recent report written by the Benningfield Group for the Energy Foundation explains,¹² single-family homes "are typically built to sell," while multifamily buildings are built to be held and to produce income, or in the case of affordable housing, "to show a positive monthly cash position." The report makes clear that owners of these buildings are "very different groups with very different motivations, financial considerations, and costing horizons." Programs intended to incentivize developer/owners to upgrade their properties must take these differences into account.

Despite the complexity of multifamily retrofit and rehab financing and economics, the multifamily sector presents significant opportunities for green and energy efficiency programs because:

- It is often more cost effective to perform efficiency upgrades on larger properties that have lower administrative and transaction costs per dwelling unit because of economies of scale.¹³
- Major rehabilitation projects are common in the multifamily sector. These projects typically have large construction budgets and may involve everything from replacing finishes and fixtures

¹¹ These include the California Tax Credit Allocation Committee (CTCAC), which administers federal and state low-income housing tax credit programs; California Debt Limit Allocation Committee (CDLAC), which allocates bond issuance authority to housing projects and programs; California Department of Housing and Community Development (HCD) programs; U.S. Department of Housing and Urban Development's (HUD) Green Retrofit Program (GRP) for multifamily housing; and U.S. Department of Energy's Weatherization Assistance Program (WAP) for low-income households.

¹² Energy Foundation, op. cit.

¹³ A single-family program might deliver savings of approximately 2,000 kWh per home. A multifamily program might deliver savings of approximately 650 kWh per dwelling unit. Accordingly, a 100-unit multifamily building would deliver 65,000 kWh per program participant, hence increasing the energy savings per program transaction.

to installing new building systems to reconfiguring dwelling units. It is cost effective and efficient to include energy efficiency upgrades at the time of these renovation projects.

- Standards and verification procedures developed by regulated retrofit and rehab incentive programs can provide quality assurance to financing sources that have green building criteria.
- Multifamily properties tend to be operated and maintained by professional building staff. Providing training and other resources to these people increases the odds that the building will be operated efficiently after energy upgrades are installed, and that persistent savings will be achieved.

To capitalize on these opportunities, it is important that the standards, verification and administrative requirements of newer energy funding programs be as complementary as possible with traditional sources of financing to help trigger more building upgrade activities rather than creating barriers to participation.

Split Incentives

The multifamily sector provides a textbook case of the economic barrier often referred to as “split incentives.” When occupants pay their own energy and water bills, a multifamily building’s developer/owner has little incentive to invest in upgrades such as more efficient water heaters, higher levels of insulation or more efficient lighting. This obstacle to energy improvements is particularly acute in the affordable rental housing sector. In the cases where occupants pay their own utilities, tenants would greatly benefit from efficiency upgrades but may not have the authority (as non-owner occupants) or financial resources to carry them out.

As illustrated in Figure 6, among multifamily households, approximately 88 percent are renters. Household income in renter households is roughly half the income of households where the occupants own their home. Renters “pay a higher share of their monthly income for utilities, and yet they are less able to affect the efficiency of their homes,” according to the Energy Foundation/Benningfield Group report. Among low-income renters, the need for energy efficiency is particularly evident: nearly 20 percent of their monthly income goes to energy bills, compared to roughly 4 percent for the average household. For the more than 790,000 California households at or below 50 percent of the federal poverty level,¹⁴ an average of 38 percent of their monthly income goes to paying utility bills.¹⁵

¹⁴ U.S. Census Bureau.

¹⁵ U.S. Energy Information Administration, 2005.

Although there is a great need to address energy efficiency in the multifamily sector, the split incentive issue creates a barrier to progress. Appliances such as refrigerators and clothes washers and dryers, for example, are often owned by the building developer/owner, who has little economic incentive to upgrade them to more efficient models. This is particularly true in markets where vacancy rates are low and the owner doesn't have to compete for tenants. Even when renters own their appliances, they may not be able to afford to replace them since renter-household incomes are typically about half that of owner-household incomes (Figure 6).

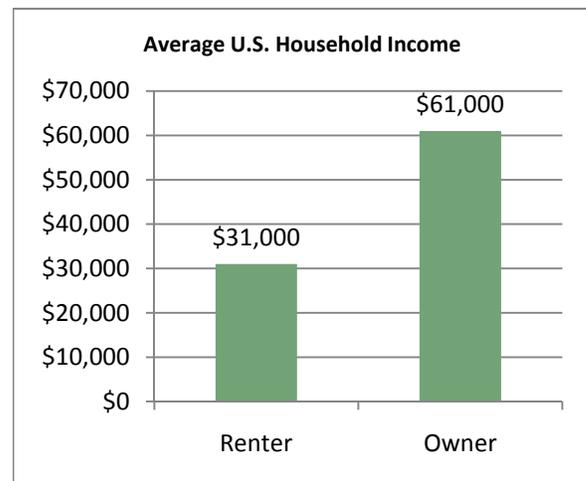
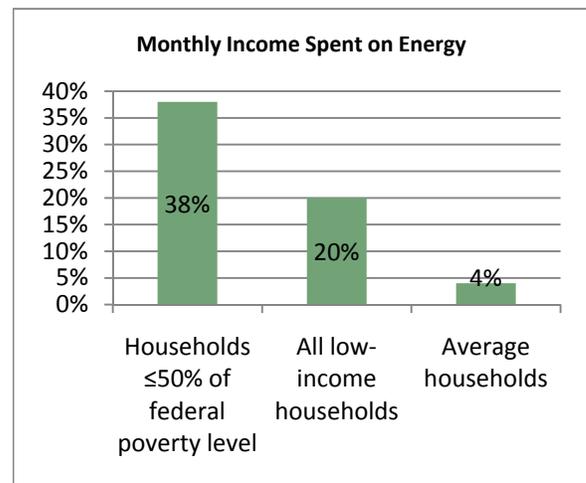
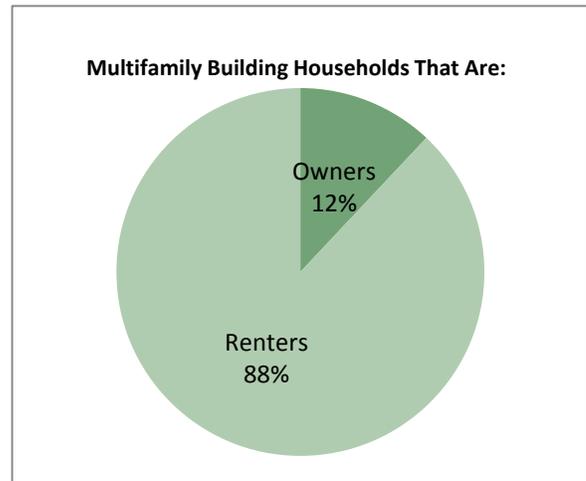
The predominance of central systems, particularly central water heating systems, in multifamily buildings often skews the split incentive: the developer might pay for central utility bills and therefore only be interested in upgrading the systems for which they will see a financial payback. This tends to make central system upgrades the "easiest sell" in a multifamily building upgrade. However, the opportunity associated with central systems is often offset by lack of a price signal to tenants, which in turn limits behavior-based conservation.

It is critical that building upgrade programs involve residents, managers and landlords alike to take into account these energy-use differences in the multifamily sector, as well as the "disincentives" caused by split incentives. The more that residents are educated and engaged in the upgrade process, the more reductions in energy use will occur.

Trigger Events

There are many discrete economic, financial and even regulatory events that may prompt a developer/owner to upgrade a multifamily building. However, in general, there are a few specific points in a multifamily building's lifecycle when it is typically more cost effective, convenient and efficient to make green and energy improvements. To maximize effectiveness, building energy upgrade tools,

Figure 6. U.S. Household Demographics



Sources: Energy Foundation, "U.S. Multifamily Energy Efficiency Potential by 2020," October 19, 2009, prepared by The Benningfield Group, Inc.; U.S. Energy Information Administration, 2005; U.S. Census Bureau.

resources and incentives need to be aligned with these “trigger events” so that developer/owners are motivated to incorporate energy efficiency and other green improvements into their overall upgrade plans.

Figure 7 lists the most common trigger events; all of these are excellent entry points for energy and green upgrade programs. The scope varies greatly depending on factors such as the age of the building, its condition, the type of occupancy, the history of previous improvements, and whether the building is an affordable or market rate property.

Figure 7. Events That Trigger Energy and Green Upgrades

| Trigger Event | Scope of Upgrade |
|-------------------------------|---|
| Tune-up/ Spruce-up | Ongoing maintenance of mechanical equipment or lower cost, easier-to-implement measures that spruce up a property at time of sale or purchase such as servicing mechanical equipment, repainting common areas, or making landscape and irrigation improvements. |
| Replacement | Replacement of specific central or individual equipment that is broken or aging, including water heaters, boilers, furnaces, air conditioners, appliances, lighting and irrigation systems. |
| Unit turnover | Unit-specific improvements made when occupants vacate. Upon vacancy, it is common practice to paint units, replace carpets, address moisture intrusion and other minor repairs, replace appliances, and make accessibility improvements. |
| Retrofit | Usually more limited in scope than a whole-building rehab, retrofits typically consist of a package of coordinated improvements designed to achieve a specific goal, such as seismic safety or energy efficiency. |
| Rehab | Building-wide overhaul may include remodeling common areas, upgrading structural elements, installing new electrical, plumbing and mechanical equipment, and more. |

Current programs tend to recognize and capture savings from only one of these entry points—typically either replacement or full rehab. Because programs don’t focus on the full spectrum of entry points, owners will typically either carry out limited energy improvements that don’t optimize whole-building performance, or they postpone energy upgrades until they are ready for a full-building rehab, which may entail years of raising funds.

Energy upgrade programs that recognize these entry points and tailor their outreach and services to these opportunities will increase their likelihood of success.

Cost-Effective Energy Savings Measures

The approach to selecting energy savings measures is different for multifamily than other building types. Although there are opportunities (depending on the climate zone) to save space-conditioning energy, the shared wall geometry of dwelling units and reduced external surface area in multifamily buildings means that less heating and cooling energy is lost to the exterior. Therefore in multifamily buildings, less of the savings will come from building envelope and heating, ventilation and air conditioning (HVAC) measures, and more will come from water heating efficiency gains and appliances. The predominance of water heating as the primary energy use is exaggerated in coastal areas where there is little need for heating and cooling.

The single largest and most consistent opportunity in multifamily housing is reducing the energy consumed to heat domestic water, particularly when central systems are present. It is common for multifamily buildings to have central water heaters, typically gas appliances with a large distribution system and recirculation loop. Increasing the AFUE¹⁶ of the water heater, combining the water heater with solar pre-heat systems, and implementing distribution system strategies such as extra insulation, recirculation controls and high-efficiency recirculation pumps, represent significant opportunities for cost-effective savings. These savings are weighed against the limitations in hot water sub-metering of central systems.

The single largest and most consistent opportunity in multifamily housing is reducing the energy consumed to heat domestic water.

There are many other ways in which multifamily savings opportunities diverge from single-family opportunities. For example:

- Common area and garage lighting in multifamily properties can use significant amounts of energy.
- There are operational efficiencies associated with ongoing equipment commissioning and professional energy management in multifamily properties.
- Multifamily properties may have fairly extensive irrigation and lighting of the exterior landscape and site.
- Compared to single-family homes, taller residential buildings have a smaller roof area relative to the overall building envelope area. As a result, measures such as attic insulation and radiant barriers will have less impact.
- Multifamily buildings often have limited roof or site area for installation of photovoltaic arrays.
- Air infiltration to the exterior of a multifamily building is of equal importance to heat and air transfer between dwelling units, and between dwelling units and common areas.
- Multifamily properties often have common ventilation systems utilized to exhaust kitchens, bathrooms and laundry rooms. These can contribute substantially to energy use.

¹⁶ Annual fuel utilization efficiency (AFUE) is a measure of the thermal efficiency of combustion appliances such as gas-fired boilers, water heaters and furnaces. Various other efficiency ratings apply to specific water heating equipment, such as Energy Factor for small tank-type electric water heaters, and Thermal Efficiency or Recovery Efficiency for large water heating equipment.

- Cooking and refrigeration comprise a larger portion of the energy budget in multifamily homes. Appliances in single-family homes are almost always owned by the occupant, whereas in multifamily, appliance ownership is less common.
- Almost all single-family homes have a washer and dryer, while apartment buildings often have central laundry facilities or no on-premises laundry at all.

Each of these differences will impact energy efficiency decisions and need to be taken into account when designing building upgrade programs and incentives and conducting outreach to multifamily property owners.

MF HERCC RECOMMENDATIONS FOR PROGRAM DESIGN AND IMPLEMENTATION

Since the beginning of 2010, the MF HERCC has focused on coordinating development of standards, professional qualifications, verification procedures, and energy savings quantification and tracking tools for the multifamily building upgrade sector. This report presents the subcommittee's recommendations and analysis in six specific areas:

1. Program delivery
2. Professional qualification and training
3. Whole-building performance approach
4. Energy analysis software
5. Performance measurement, tracking and benchmarking
6. Low-income and energy efficiency program access and coordination

1. Program Delivery

Recommendation

- a. Use raters/verifiers and energy consultants to delivery multifamily incentive program services.*
- b. Give developer/owners the flexibility to hire and manage the construction and verification team.*
- c. Design individual measure-based and whole-building performance-based programs to be complementary and parallel offerings.*
 - Utilize a rater/verifier and energy consultant delivery model for whole-building performance programs and continue to utilize a contractor delivery model for individual measure programs.
 - Take into account the conditions under which a contractor-delivery approach may be appropriate for whole-building performance programs.
- d. Provide a single point of customer interface for multifamily property owners to streamline their participation.*

Background and Analysis

Incentive programs that deliver energy and green upgrade services for single-family homes, as well as individual measure-based programs for multifamily buildings, typically rely on pre-approved contractors. These contractors serve as the conduit for participating in the program and provide services such as diagnostics, verification and documentation. This contractor-list delivery approach, however, is unlikely to be successful for California's diverse and professionalized multifamily and affordable housing sector, for the reasons described below. Instead, the MF HERCC recommends a rater delivery model.

A significant problem with using a contractor-delivery model for whole-building performance programs is that the developer will be limited to using only program-approved contractors; if the developer's other sources of construction funding are much larger than the energy efficiency rebates, the developer may have a strong motivation to not participate in the performance program. Often times the level of

rehab work being done in conjunction with the energy efficiency work necessitates using an experienced general contractor. Having to layer/stage the use of two contractors on one project is onerous, inefficient, and can cause on-site problems.

a. Rater Delivery Model

- **HERS has an established network of professional raters.** Using raters/verifiers and energy consultants to delivery multifamily incentive program services aligns with the HERS program model, which uses raters and energy consultants to prepare compliance documentation, conduct audits and diagnostics, and verify project installation. For new construction, the robust statewide HERS system has succeeded in building a large workforce of professional raters with expertise in building energy standards, auditing, energy analysis and diagnostic testing proficiency for both single-family homes and multifamily low-rise buildings. Given this well-established HERS network and protocols, it is practical and logical to continue to refine the HERS program to apply to multifamily retrofits and rehabs.
- **Existing multifamily programs already use successful rater/energy consultant models.** Performance-based incentive programs¹⁷ for multifamily building upgrades already successfully utilize a program delivery model in which an energy consultant or rater, not a contractor, is the primary conduit for accessing program services.
- **Multifamily owners need to integrate incentives with multiple funding sources.** Since the developer/owner makes the purchasing decisions and is responsible for completing the project, it is important that the incentives and services go directly to the developer/owner so they can integrate them with the overall project financing.

b. Hiring Flexibility

- **Multifamily owners will resist being limited to program-approved contractors.** Given the market factors discussed in this report's Introduction, it is important that multifamily developer/owners not be limited to using contractors approved by the incentive program. Developer/owners tend to have relationships with general contractors and trade contractors they trust, which is very different from single-family homeowners who don't typically have a suite of construction professionals under contract to them. Structuring incentive programs to deliver verification services via an energy consultant/rater/verifier team rather than a contractor gives multifamily developer/owners the flexibility and control to include energy and green building experts among the multitude of professionals they will hire in the overall design and development process.

To streamline program delivery across regions and project types, the MF HERCC has already developed whole-building audit protocols for multifamily building upgrade programs in California. These baseline

¹⁷ Multifamily performance-based programs for new construction include the following: ENERGY STAR for Homes Multifamily (EPA/statewide IOUs), the California Advanced Homes Partnership (Sempra and SCE), California Multi-Family New Homes (PG&E), and Green Building programs such as LEED for Homes (national), GreenPoint Rated (statewide) and Green Communities (national). Multifamily performance-based programs for existing buildings include the following: the GreenPoint Rated Existing Home Multifamily Pilot Program and the affordable specific Green Communities (national) and the discontinued program, Designed for Comfort (statewide IOUs).

protocols are designed to be tailored to the needs of individual programs. Provided in the form of a template, the protocols describe best practices for conducting whole-house energy, water and green building audits of multifamily buildings. The document includes sample language that programs can use to create their own customized Audit Specifications or Audit Protocol document.

c. Complementary Individual Measure and Whole Building Programs

- **Design Individual measure-based and whole-building performance-based incentive programs to be complementary and parallel offerings.**
- **Utilize a rater/verifier and energy consultant delivery model for whole-building performance-based programs and continue to utilize a contractor delivery model for individual measure programs.**

The MF HERCC recommends offering parallel program pathways with two delivery models:

- Individual measures with predetermined contractors, or
- Whole-building performance model with cash incentive issued to the owner/developer and flexibility in hiring contractors.

Individual measure programs (and single-family upgrade programs) have developed an established network of professional who are experienced in their specific trade (such as lighting contractor, home performance contractor, and so on) and are effective at both marketing program availability to potential clients and installing the specific set of measures. This infrastructure should be maintained and utilized for the delivery of individual measure programs. Because of the factors described throughout this report this contractor delivery approach is less viable on a whole-building multifamily upgrade project.

The following table outlines the scenarios when an individual measure vs. a whole-building performance approach would likely apply.

Table 1. Trigger Events and Likely Upgrade Approach

| Trigger Event | Likely Path |
|----------------------------|---|
| Tune-up / Spruce-up | Individual measures. |
| Replacement | Individual measures, as appropriate depending on which equipment is replaced. |
| Unit Turnover | Individual measures within units, or whole building if replacements are planned as part of comprehensive upgrade strategy and are applied consistently across enough units. |
| Retrofit | Individual measures or whole building, depending on scope of retrofit and how many systems/structural aspects are addressed. |
| Rehab | Whole building. |

If multifamily projects have the option of pursuing individual measure incentives or whole-building incentives, the following principles should be observed in designing multifamily programs to be complementary:

- Make whole-building performance-based incentive amounts large enough to be more attractive than adding up individual measure incentives.
- Where low-income individual measure-based incentives pay for the full cost of the measure, integrate those incentive funding sources with the performance-based approach.¹⁸

■ **Take into account the conditions under which a hybrid contractor-delivery approach (“construction management delivery model”) may be appropriate for whole-building performance programs.**

In California, factors such as the lack of comprehensive funding from a single source to drive deep energy improvements and the variability in cost-effective measure approaches across program criteria, building types and climate zones favor the consultant approach to performance-based programs. A contractor-delivery approach seems best suited to the individual measures programs. There are exceptions to this general recommendation. A hybrid of a contractor delivery model and rater/consultant delivery model (a “construction management delivery model”) might be appropriate for the performance approach in multifamily markets where the following conditions exist:

- The market consists of a limited geographic region with little variation in building types or climate conditions (e.g., similar measures tend to be cost-effective across all building types even using the performance approach);
- The program administrator has sufficient resources to train and provide quality assurance to various specialized multifamily sub-trade contractors involved in various aspects of a whole-building upgrade;
- Some entity involved in the process (such as a contractor or program administrator representative) is trained to provide necessary energy software analysis and building auditing, evaluation and verification for whole building performance approach; and/or
- A high level of integration exists among utilities, weatherization, local government and other funding programs to enable a turn-key program delivery. Under these circumstances, using the same set of professionals may allow for efficiency of quality assurance and leveraging of resources towards the cost of audits. This condition exists in

¹⁸ A number of questions remain to be resolved. For example, if whole building and individual measure programs are allowed to be combined on a project, how would the direct-install contractors vs. whole-building owner-selected general contractors be coordinated? Would a whole-building contractor be allowed to perform all the work, and would the building owner be issued the incentives for both individual measure and performance programs?

certain markets, such as those addressed by NYSERDA's multifamily program, but it is not typical of California.

In addition to grappling with the layering of funding issue, whole-building performance programs that are considering a contractor-delivery model will need to resolve the following issues:

- Which contractors would need certification among the various sub-trades involved in multifamily projects?
- Which certifications would apply?
- Who would perform the audit, energy analysis and verification?
- What percentage of the job cost is being covered by the program rebate?
- Can the entire upgrade be completed without leveraging other sources of construction funding? If not, are developers subject to different contractor requirements from other construction funding sources?
- Can the program justify limiting the developers to using only program-approved contractors?
- Do program administrators have resources to provide quality assurance on construction management throughout the project?¹⁹

For the reasons listed above, nascent multifamily performance-based programs should rely on the existing HERS infrastructure to deliver performance-based verification for work done by owner-selected contractors, while at the same time moving towards a "construction management delivery model" by providing training and capacity for specialty contractors as the California multifamily retrofit and rehab market develops more capacity and consistency.

d. Single Point of Contact

Multifamily building owners and managers find it daunting to sort through the various programs, funding and incentive options, and program requirements. To reduce obstacles to participation, the MF HERCC recommends streamlining multifamily program offerings by providing building owners/managers with a single point of contact.

This point of contact could be provided by one of or a combination of the following: utility, local government, third-party consultant, certification entity (such as U.S. Green Building Council, Build It Green, CalCERTS), or an online interface.

Whether the online navigation tool currently under development serves this function, or whether another tool or entity is used, having a single point of contact will help alleviate the difficulty and confusion of navigating the various programs by:

¹⁹ In NYSERDA's program, the "partner" (the consultant team) would be the point of contact to the owner, would perform the audit and produce the report, would be responsible to sign off at each stage of the construction including: design, bid documents, approval of winning contractor(s) documents, and an interim and final site inspection of construction. This is a large role but it makes the consultant the project manager and responsible for ensuring that predicted performance is realized through quality construction.

- Directing developers/owners to appropriate program(s) based on eligibility criteria and their likely approach to upgrading the building or buildings (e.g., individual measure vs. whole-building approach); and
- Directing participating developers/owners to a list of qualified contractors.

Stakeholders have also suggested that it might be helpful if this tool could eventually provide customized offerings and incentive calculations to projects if more than one program applies, and submit application materials to those programs on behalf of the property owner. Such an interface would reduce the burden and barrier to program entry for the owner.

In addition to connecting building owners and managers to appropriate programs and professionals, more robust single point of contact customer services may include customized technical assistance. The technical assistance provides preliminary guidance on determining the scope of the upgrade, and can be paired with the program and funding navigation services to ensure that the developer/owner is pursuing appropriate and feasible upgrades. Including technical assistance in the single point of contact will enable program participation and better decisions earlier in the design phase, however it can also add to program administrative costs and in order to “scale-up” services, initial program navigation would be more effective through a self service online web portal.

2. Professional Qualification and Training

Recommendations

- Focus on qualifications of rater/verifier and add specialized expertise to audit team based on scope of upgrade.*
- Develop targeted training curricula and require completion of training by participating raters/verifiers, building operators, central systems contractors and users of energy analysis software.*
- Consolidate required qualifications and training for participating building professionals. Build the capacity for partners who deliver individual measures to become whole-building raters/verifiers or to install individual measures as part of a whole-building program.*

Background and Analysis

a. Verification Team Qualifications

In the recommended rater-based program delivery model, the rater/verifier (may also be the energy consultant) will be required to have minimum qualifications as specified in Table 2. To meet the qualification requirements for specific tasks, the rater can assemble multidisciplinary teams consisting of internal employees or contracted partners with complementary skill sets. Raters will be responsible for ensuring that their personnel and any contractors assigned to perform services have the necessary qualifications, licensing, bonding, insurance, competence, skill sets and experience required to fulfill their respective responsibilities. In this capacity, program administrators, QA providers and Raters share the construction management responsibilities.

Table 2. Required Minimum Qualifications for Audit/Verification Team

| | Task | Minimum Qualification |
|---------------------------------------|--|--|
| Required for all multifamily projects | Energy Modeling and Utility Data Analysis | <ul style="list-style-type: none"> ▪ California Home Energy Analyst ▪ California Association of Building Energy Consultants (CABEC) Certified Energy Plans Examiner (CEPE) |
| | Whole Building Energy Audit, Recommendations and Third-Party Verification | <ul style="list-style-type: none"> ▪ HERS II Rater (CA Whole-House Home Energy Rater) ▪ CA Existing Building Multifamily Upgrade Training |
| Required depending on scope | HVAC system efficiency and balancing (including duct testing) | California Field Verification and Diagnostic Testing Rater |
| | <ul style="list-style-type: none"> ▪ Central domestic water heating and distribution system efficiency ▪ Commissioning and retrocommissioning | <ul style="list-style-type: none"> ▪ C-36 plumbing or C-4 boiler contractor license ▪ Multifamily Green Contractor Training |
| | <ul style="list-style-type: none"> ▪ Water, IAQ and resources measures ▪ Whole-building retrofits over time <ul style="list-style-type: none"> ○ EnergyPro MF Module: Improvement over baseline ○ Dwelling unit turn-over ▪ High-rise multifamily proxy to HERS II ▪ Central systems operational efficiency (BPI) | GreenPoint Rated Existing Home Multifamily Rater |
| | Combustion appliance safety | BPI Analyst |
| | Feasibility of renewable energy installation | CSI Approved Contractor (C-46 Solar Contractor license) |
| | Energy audit and recommendations for non-residential spaces > 20% floor area | ASHRAE II Auditor |
| | Operations and maintenance | BPI Multifamily Building Operator or NAHMA Green Building Operator |

b. Training

The recommended training consists of curricula targeted at four types of professionals who work on multifamily buildings: rater/verifiers, building operators, central water heating system contractors, and energy analysts. Each of these courses focuses on making sure that key professionals working on multifamily building upgrades have the knowledge and expertise to make effective decisions about building improvements, program participation and ongoing operational savings.

Rater/Verifier Training

To help ensure that multifamily upgrade programs are robust and lead to energy savings that persist over time, California needs third-party raters/verifiers who:

- Are well-versed in program and incentive requirements
- Have expertise in evaluating multifamily buildings and developing appropriate scopes of work for energy and green improvements
- Are skilled in verifying the quality of the completed work, including conducting post-installation verification tests

Training currently offered in conjunction with the California Whole-House Home Energy Rating System (HERS II) program addresses some of these areas. To build a market of raters/verifiers specially qualified to evaluate multifamily building upgrades, the MF HERCC has supported the development of a new training curriculum. This curriculum builds on the current HERS II curriculum and supplements it by training participants to rate multifamily buildings in various upgrade scenarios from replacements to unit turnovers, retrofits and comprehensive rehabs. Topics include:

- Central system (retro)commissioning
- Central domestic hot water (CDHW) controls
- Common area improvements (such as central system replacements)
- Tenant space improvements at unit turn-over
- High-rise multifamily protocols
- BPI operational efficiency and combustion safety protocols
- Water conservation
- Materials resource efficiency in rehabs
- Indoor air quality

The curriculum is intended to equip the multifamily rater with the broad range of skills necessary to act as the verification agent for various programs that provide incentives and financing to multifamily projects. To streamline delivery of the many upgrade programs available to multifamily building owners, the rater/verifier training should be coordinated with other available green upgrade programs. These include programs such as CPUC ratepayer-funded programs, the U.S. Department of Housing and Urban Development's Green Retrofit Program (GRP), the DOE Weatherization Assistance Program (WAP), Enterprise Green Communities, GreenPoint Rated Existing Home Multifamily, CA Low Income Housing Tax Credit program (LIHTC) and mandatory existing building upgrade policies referred to as Residential Energy Conservation Ordinances (RECO) and Commercial Energy Conservation Ordinances (CECO).

Property Management Staff and Building Operator Training

Because multifamily buildings have professional management and operations staff, training them in green operations and management will likely result in some persistence of conservation-based savings. For this training, the MF HERCC recommends building upon the Building Performance Institute (BPI) existing Multifamily Building Operator training.²⁰ The training includes technical content on:

- Energy-efficient building systems operations
- Concepts that would be included in any retrofit project's customized green building maintenance manuals
- Green product specifications
- Access to bulk procurement of ENERGY STAR equipment and green materials to bring down the cost premiums

²⁰ Longer term training plans should investigate coordination with other related training programs, such as Building Operator Certification (BOC) and National Affordable Housing Management Association (NAHMA) training programs.

- Materials they can use to educate residents about the building's green features and access to resident-oriented upgrade rebates (such as for compact fluorescent light bulbs, faucet aerators and appliance upgrades)
- Available incentive programs, particularly those applicable to trigger events such as unit turnover or equipment replacement (for example, IOU prescriptive rebate programs for refrigerators or other appliances or technologies owned by the resident)

As touched upon in the last bullet point above, part of the Property Management Staff/Building Operator Training participants should receive content regarding educating their residents on opportunities for energy saving upgrades in units and conservation behavior. Tenants need the information and tools to make smart decisions about energy use and promote healthy behaviors in their home. A home environmental education component can increase behavior based conservation, improve the lives of low income tenants and enhance the relationship between property owners, tenants and the community. Much of this consumer outreach and education is already taking place through Energy Upgrade California, but specific outreach to multifamily building residents should be considered.

Multifamily Central Water Heating Systems and Combustion Safety Training

Because of the sheer number of specialized subcontractors on any given comprehensive multifamily rehab project, it does not make sense to require a single contractor certification for all contractors and sub-trades. Rather, it will be more effective to target very specific professional training at the sub-trade that has the greatest potential for delivering efficiency improvements: contractors who work on water heating systems in multifamily buildings. As discussed earlier, in multifamily buildings, water heating systems account for a much higher portion of energy consumption compared to single-family buildings.

These contractors, who have C-4 boiler contractor or a C-36 plumbing contractor license, maintain and install centralized residential and commercial-sector energy-consuming equipment for water heating and space heating and cooling. Specialized training will give these contractors the expertise needed to optimize the specifications and operations of these systems.

This training would focus less on the verification methods and more on the efficiency gains to be made to conventional construction and operation practices. This training also includes combustion safety measures, and could incorporate retro-commissioning.

Energy Analysis Software Training

To help ensure that energy consultants have the capability to properly analyze multifamily buildings, a specialized curriculum should be developed that includes advanced training in multifamily-specific topics not included in the core HERS II trainings, energy analysis training or in the training required to become a Certified Energy Plans Examiner (CEPE) or Certified Energy Analyst (CEA). This advanced Multifamily Energy Consultant Curriculum would include instruction in the use of the California Utility Allowance Calculator, Energy Pro's GreenPoint Rated and high-rise Multifamily HERS II Modules, and supplemental operational energy auditing software (Treat and EA-QUIP).

c. Consolidated Qualifications

The minimum professional qualifications and associated training required for various programs statewide should be consolidated to maximize the programs' ability to share trained workforces, and to limit the number of trainings and certifications required of participating building professionals.

Stakeholders have noted that for whole-building performance-based programs, a review of LIEE/Weatherization and MFEER assessment/audit protocols and a comparison with HERs II plans would be helpful. Ideally, the protocols would be aligned so that data collected in first two programs could be applied to HERS II. The California Multifamily Existing Building Rater Training, which was first offered in Fall 2010 in conjunction with the California Whole-House Home Energy Rating System (HERS II) program, has already addressed this alignment of protocols.

To streamline program delivery across regions and project types, the MF HERCC has already developed whole-building audit protocols for multifamily building upgrade programs in California. These baseline protocols are designed to be tailored to the needs of individual programs. Provided in the form of a template, the protocols describe best practices for conducting whole-house energy, water and green building audits of multifamily buildings. The document includes sample language that programs can use to create their own customized Audit Specifications or Audit Protocol document.²¹

California's various individual measure programs (MFEER, LIEE, WAP) all have separate networks of contractor delivery partners, with non-standardized minimum professional qualifications. It is important to explore ways these different networks can be integrated, while continuing to sustain the community-based organizations that are currently delivering the individual measures.

3. Whole-Building Performance Approach

The MF HERCC recommendations primarily pertain to multifamily whole-building performance-based programs, such as those emerging as part of Energy Upgrade California (EUC). As discussed below, the MF HERCC recommends that the industry not attempt to develop packages of prescriptive measures for a whole-building approach due to the complexity of multifamily building types. It is important to note, however, that individual measure incentives should continue to be offered to multifamily properties that are not able or ready to take a comprehensive whole-building performance-based approach.

²¹ To download the Audit Protocol document, go to the Technical Resources page of www.multifamilygreen.org and follow the link to HERCC information.

Recommendations

- a. *Offer whole-building programs utilizing a performance approach for multifamily energy efficiency improvements, rather than a prescriptive approach to whole building improvements. This performance approach should be based on Title 24 and HERS II protocols for multifamily residential buildings that consider the energy end-uses of heating, cooling, water heating (including solar pre-heat), appliances and lighting.*
- b. *Require a minimum of 10 percent energy efficiency performance improvement for all projects, with additional improvement targets for projects to reach 15 percent improvement and 20 percent improvement.*
- c. *Ensure that program total resource cost is minimized by eliminating administrative inefficiencies and optimizing leveraging among programs.*
- d. *Provide utility-funded incentives for the whole-building performance approach to stimulate demand for comprehensive energy upgrades.*

Background and Analysis

a. Performance Approach Based on Title 24 and HERS II Protocols

For multifamily whole-building programs, the MF HERCC recommends a performance approach to energy savings analysis and the selection and funding of upgrades. This recommendation means that emerging whole-building programs should offer a performance-based approach but multifamily building developer/owners and tenants should still have access to prescriptive incentives for change-out of individual pieces of equipment.

Single-family upgrade programs have traditionally taken a prescriptive approach, allowing for specific, clearly defined packages of improvements to be made to participating buildings as an option in parallel to the whole-building performance approach. This prescriptive path is seen as a “ramp-up” for increasing workforce capacity. After extensive analysis, the MF HERCC has concluded that a whole-building prescriptive approach is not feasible as a primary tactic for the multifamily sector. Because of the diversity of building types, system types and other factors discussed earlier that distinguish multifamily buildings from the single-family residential sector, a comprehensive statewide prescriptive approach to multifamily whole-building upgrades would require 16 or more distinct packages of measures.²² This would likely create a huge administrative burden, confuse the market and drive up program costs.

A performance approach to whole-building improvements is well-suited to the multifamily sector, which is more professionalized than the single-family residential sector. Multifamily developer/owners are

²² Sixteen packages would cover the variables of inland vs. coastal (cooling or no cooling) strategies, central vs. individual mechanical systems, and high-rise vs. low-rise building types. This number of packages would not take into account building-specific variables, ownership types or nuances among the 16 climate zones. If a prescriptive whole-building package per climate zone were developed, it would require four packages per climate zone, resulting in 64 packages statewide.

likely to have the motivation and resources to undertake a more sophisticated analysis to target the best investment of available funds to serve the unique energy savings needs of their project.

The MF HERCC further recommends that the performance approach be based on Title 24 and HERS II protocols for residential buildings. These protocols consider the energy end-uses of heating, cooling, water heating, appliances and lighting. The protocols also include renewable energy such as solar photovoltaics and solar domestic hot water (although solar hot water is already part of the Title 24 performance calculation, photovoltaics is not). The HERS II methodology for multifamily buildings is being piloted by the GreenPoint Rated Existing Home Multifamily²³ program, building on the protocols of the performance-based Designed for Comfort program.

b. Performance Improvement Targets by Building Vintage

Many statewide policy objectives cite the California Public Utility Commission's (CPUC) strategic plan, which has set a goal of reducing energy consumption in existing homes by 20 percent by 2015 and 40 percent by 2020. In accordance with these policy objectives, a 20 percent performance improvement might at first glance seem to be the initial target to require of project upgrades. A subset of the MF HERCC members²⁴ analyzed what it would mean to achieve a range of performance-based energy improvement targets for various multifamily building types. This analysis suggests another approach: while a 20 percent minimum savings target would exclude upgrades to be undertaken in newer buildings, a 15 percent or 10 percent improvement might be feasible for newer buildings that are already reasonably efficient. This analysis establishes feasible minimum energy savings targets for buildings based on the year they were built. This feasibility analysis is described below.

The consultant team developed baseline models of three prototype multifamily buildings: a 4-unit low-rise, a 40-unit low-rise, and an 80-unit high-rise. These were then modeled in Title 24 code compliance/HERS II software to demonstrate measures necessary to achieve 20 percent and 40 percent energy performance improvements. The modeling was done for each of the 16 California climate zones with both central and individual domestic hot water systems and with both gas and electric heating systems. From this analysis it was determined that:

- 10 percent energy improvement was feasible across the board for all building types, system types, vintages and climate zones.
- 20 percent improvement required upgrades to both windows and wall insulation in many climate zones.

²³ The Energy Foundation and StopWaste.Org are jointly funding the development of a third-party rating system for multifamily retrofits as an extension of Build It Green's GreenPoint Rated program. As of March 2011, approximately 500 pilot multifamily dwelling units have been designed and/or constructed to meet GreenPoint Rated Existing Multifamily pilot program criteria including required energy reduction targets according to HERS II methodology.

²⁴ StopWaste.Org (project lead), Douglas Beaman & Associates (lead HERS II analysis), Heschong Mahone Group, Inc. (prototype development based upon Designed for Comfort projects), Nehemiah Stone (central water heating tune-up measures), Energy Soft (code compliance software baselines and improvements), California Energy Commission (HERS II direction), and various third-party HERS and GreenPoint Raters (pilot project energy measures verification, Title 24 documentation created and submitted to Doug Beaman for HERS II conversion).

- Older buildings and buildings with deferred maintenance will have many measure upgrade options for achieving a minimum 20 percent energy improvement target and are therefore the most likely program participants. However, programs should not be structured to exclude the portion of the building stock that has already undertaken some improvements and therefore might not achieve a 20 percent improvement in the current program enrollment.
- 40 percent improvement is often not possible to achieve in coastal climate zones without the use of solar pre-heat for domestic water heating.

For each of the prototype buildings analyzed, the following minimum targets for performance improvement were determined to be feasible (see Table 3). The MF HERCC recommends using these as baseline assumptions when designing multifamily energy upgrade programs.

Table 3. Feasible Performance Improvement Targets

| Building Vintage | Minimum % improvement | Baseline |
|----------------------------|-----------------------|--|
| Pre-1980 (pre-Title 24) | 20% | CEC default (statewide average data) |
| 1980–2000 | 15% | CEC default (statewide average data) |
| 2001–2008 | 10% | Code compliance (detailed energy performance data by climate zone) |

California’s Building Energy Efficiency Standards (Title 24) were established in 1978, so it is reasonable to assume that by 1980 they had taken effect and were being enforced. Buildings built before the code took effect represent the greatest opportunity for percent improvement over baseline. In this case, the baseline used for modeling improvement is based on average statewide data provided by the California Energy Commission (CEC).

In 2001, Title 24’s energy efficiency requirements became much more stringent than they had been. As a result, buildings constructed from 2001 to 2008 will have fewer opportunities for improving energy performance, hence the lower recommended target of 10 percent. Buildings built in the two decades between 1980 and 2000 were not required to be as energy efficient as more recent buildings, and thus are targeted for a 15 percent level of improvement.

Cost/Benefit Analysis of Performance Improvement Targets

What will it cost multifamily developer/owners to achieve these levels of performance improvement? To answer that question, the team analyzed a variety of scenarios, looking at the costs of various energy-saving measures in different building types and climate zones.

The Appendix includes tables showing the results of some of these scenarios. These tables serve to illustrate typical measures that might be used to achieve the performance targets for different types of

buildings in different climate zones with different water heating systems. These tables are merely examples and should not be construed as recommendations for specific packages of measures.

What follows is a summary of these illustrative examples; refer to the Appendix for details. (Note that these costs are construction-related expenses only and do not include any administrative costs, energy analyst costs, or other ancillary costs and they do not take into account variables in wage assumptions such as Davis Bacon Requirements).

- **For a 40-unit low-rise building built before 1980**, achieving a 20 percent performance improvement might include improving the attic and wall insulation, replacing windows and sealing ducts. The estimated cost would be \$2,861 per dwelling unit, with a straight line payback ranging from 5.2 years to 14.3 years, depending on the climate zone.
- **For the same prototype building built between 1980 and 2000**, achieving a 15 percent performance improvement might include improving attic insulation, sealing and insulating ducts, verifying refrigerant charge, and replacing air conditioners and water heaters. The cost per dwelling unit is estimated at \$3,117, with a payback ranging from 6.6 years to 9.9 years, depending on climate zone.
- **For the same prototype building built between 2001 and 2008**, achieving a 10 percent performance improvement might include improving attic insulation, verifying refrigerant charge, sealing and insulating ducts, and replacing water heaters for an estimated cost of \$1,970 per dwelling unit and a payback ranging from 9.5 to 19.1 years.

As discussed below, stimulating demand for these improvements will require appropriately structured incentive programs.

c. Ensuring Administrative Efficiencies

Cost-effectiveness evaluations typically limit their analysis to the hard cost of the upgrade versus the amount of energy saved by that upgrade. The CPUC Total Resource Cost (TRC) of a program includes a cost-effectiveness analysis, as well as other program administration and measure life considerations. While this metric is useful to gauge effective use of public funds, there are many other cost-related considerations that are not part of a TRC calculation which determine program success. Stakeholders have expressed concern about using TRC/cost effectiveness as the exclusive standard by which these efforts are based. Particularly for programs serving low income households, there may be other bases for justifying a program beyond the typical Utility program/CPUC's Total Resource Cost methodology. Below are some examples of perspectives that program administrators may wish to consider, even though they may not be integrated into the formal cost-effectiveness analysis.

- **Developer/owner perspective:** While some building owners are interested to obtain rebates for individual measures, discussions at the Multifamily Weatherization Forum²⁵ indicated that current individual-measure programs (particularly LIEE and WAP) may not be cost effective for multifamily rental properties that are weighing their investment of time

²⁵ Developer Panel: Eden Housing statements by Melanie Burnett.

against the project’s potential return and the constraints the project might put on other decision-making factors. These developer/owners want depth or breadth: if they are going to spend the time to participate, they want to undertake substantial upgrades to one property (depth), or individual measure upgrades across an entire portfolio (breadth).

- **Energy measure savings perspective:** Appendix A provides an illustrative cost-benefit analysis that informs these recommendations. The costs in Appendix A are based on the DEER database, which some stakeholders believe to underestimate actual costs, and may not factor in local market conditions and prevailing wage rules that are required when leveraging certain government funding.
- **Program design and implementation perspective:** The original report provides a set of recommendations to improve the cost-effectiveness of program design and implementation that reduces program delivery costs by minimizing duplication of efforts, leveraging existing infrastructure and resources, reducing barriers to participation, and streamlining program offerings and administration. The optimal mf program environment is one which fully ssleverage and integrate low-income programs, individual measure programs, whole building performance based programs with all applicable State, Federal and local programs in order to streamline and improve program delivery, and achieve maximum energy efficiency savings relative to the expenditures by ratepayers, taxpayers, and other financial investments.

c. Whole-building performance based Incentives

Current incentive programs for multifamily buildings are not typically attractive enough to motivate building developer/owners to undertake costly and complex retrofit and rehab projects. Instead, these incentive programs are structured to “piggyback” onto the owner’s existing substantial retrofit/rehab budget. The incentive amount may be enough to partially offset the cost of higher efficiency equipment, for example, but is typically not enough to be the deciding factor for whether to undertake the retrofit/rehab project. As an added complication, it can take years for owners to assemble financing for complex retrofit/rehab projects that include energy upgrades; in the meantime, energy savings opportunities are lost.

Although this report does not provide recommendations for specific incentive levels, the MF HERCC does recommend offering:

- Utility-funded rebates and technical assistance based on a Title 24/ HERS II performance approach requiring a minimum of 10 percent to 20 percent energy savings depending on the vintage of building.
- Utility-funded rebates in combination with technical assistance, professional training and marketing benefits. Table 4 shows an example multifamily incentive package. This comprehensive approach to incentivizing improvements is utilized by the well-established multifamily programs offered by the New York State Research and Development Authority (NYSERDA).

Table 4. Example Package of Incentives for Multifamily Developers/Owners

| Type of Incentive | Function of Incentive |
|---|---|
| Cash rebates for meeting performance targets | Offset or cover hard cost of installed upgrade measures |
| Added cash incentives (“kickers”) | Encourage exceptional performance well beyond the program goals; encourage comprehensive third-party verified green building program certification |
| Rater verification rebate | Offset cost to developer of hiring rater/verifier |
| Energy consultant rebate | Offset cost to developer of hiring energy consultant |
| Technical assistance | Help owners meet program requirements and align energy compliance documentation with other funding sources |
| Building operator training | Provide free or discounted building operator training to improve developer/owner’s ability to operate buildings efficiently |
| Marketing assistance | Assist developer/owner with promoting energy efficiency efforts through benefits such as labeling programs, awards, publicity opportunities and collateral material |

Individual programs need to conduct their own cost-effectiveness analyses based on the program’s specific parameters. They should evaluate the pros and cons and cost issues of per-unit performance-based incentives versus incentives based on actual savings or percentage savings for the whole building. While the simplicity of a per-unit approach to incentives may appeal to developers, utilities may be more comfortable with incentives designed to correlate with incremental predicted kWh & Therm savings.

The performance approach must have minimum savings goals (either percentage of TDV savings, source Btus or dollars saved, or actual kWh/kW/therms), that are reasonable and scaled to the appropriate incentive offering. Deemed savings from individual measures could not apply to the performance-based target, but ideally, some type of software could be used to save and layer installation records so that savings are appropriately accounted for.

Whole-building incentives should reflect the significance of the investment involved in a performance-based upgrade, including the expense of an audit. It should be sufficiently larger than the incentives that can be gathered by a comparable series of single-measure incentives, to provide adequate incentive to participate in the performance path.

4. Energy Analysis Software

Recommendations

- a. Use code compliance software as the standard baseline reference for energy savings reporting in ARRA or utility funded programs.*
- b. Use supplemental software programs where necessary to optimize analysis of energy savings opportunities.*
- c. Apply CEC HERS II type residential multifamily low-rise protocols to high-rise multifamily in the code compliance software.*
- d. Align funding programs' use of various software platforms for compliance to reduce administrative barriers to program participation.*

Background and Analysis

a. Code Compliance Software and HERS II

For energy code, incentive or green building program compliance in California, the performance approach to energy savings documentation most commonly utilizes Title 24 energy code compliance software. The calculation rules used with the software are defined in the Alternative Calculations Method (ACM) manual.

Code compliance software programs, which are often referred to as ACM software, are limited to measures that can be shown to have cost-effective savings in Title 24; these programs do not include any kind of operational savings that can be calculated using other energy auditing performance software. Despite this, it is preferable to use the ACM software programs as the common platform in multifamily building upgrade programs because:

- They are standardized statewide and include the various baselines, assumptions, and time dependent valuation (TDV) consistent with the energy code for new construction.
- There is a large workforce of professionals who are proficient with these programs.
- Projects are required by state law to utilize them for building permit purposes; requiring another program would be redundant and add cost to the design process.

The HERS II program has a special module built into the ACM software, as well as integrated to the HERS provider's registries. This module allows the user to:

- Compare multiple runs (several proposed improvement package options) against existing conditions (baseline) and receive a building performance score relative to Net Zero Energy.
- Create a summary report of resulting energy savings in therm, kWh and kW for baseline versus options (proposed) using California TDV methodology.
- Integrate the proposed measures with the statewide system established for measure installation verification.

The HERS II software is currently being improved to:

- Better allocate savings from residential appliances and lighting to multifamily projects (the software's original algorithms were based on single-family assumptions);
- Treat high-rise multifamily similarly to low-rise multifamily; and
- Compare building improvements not only to existing conditions but also to Title 24 (benchmark)/CEC vintage defaults. This will enable the energy analyst to account for improvements made to a building over the life of the structure.

Longer term plans to improve HERS II software for multifamily that will require a Title 24 code change and/or extensive research for adoption include:

- Modeling and savings estimates for central domestic hot water (CDHW) recirculation controls (time-clock, temperature modulation controls and demand controls).
- Modeling and savings estimates for ventilation in high-rise multifamily buildings.

b. Supplemental Energy Auditing Software

While it is ideal for California building upgrade programs to require energy analysis and reporting in standardized software programs, there are benefits to using other programs that might do a better job of analyzing operational energy improvements associated with building commissioning, maintenance, adding controls, optimizing daylight and other measures. Unlike EnergyPro, which is a software program commonly used for CA Title 24 code compliance, other software programs such as TREAT and EA-QUIP are specifically designed to handle energy auditing.

c. Software for High-rise Buildings

Currently, the HERS II compliance software addresses low-rise but not high-rise multifamily buildings. The MF HERCC recommends that the HERS II version of the compliance software be modified to apply also to high-rise multifamily buildings. This improvement in the software will allow the HERS II report to show the non-residential and residential end-use calculations embedded in the code assumptions for high-rise buildings all in one performance calculation.

d. Software Required by Funding Programs

As discussed in the Introduction to this report, to carry out complex building construction or improvement projects, multifamily developers/owners typically have to access funding from a variety of sources. Currently, many of these funding programs require developers to use different compliance software. If an owner is pursuing multiple sources of funding, it is expensive and inefficient to have to produce multiple models and compliance reports using different software for the same building.

For example, there are a number of software programs, including TREAT and EA-QUIP which do not have the CA T-24 ACM integrated, that DOE has approved for use in WAP. In California, WAP implementation entities require multifamily projects to use these DOE-approved programs. As a result, multifamily projects often have to undergo energy analysis in multiple software programs to meet the requirements of code compliance, utility incentive programs and Weatherization Assistance Program (WAP).

Coordinating the software compliance requirements of these funding sources will eliminate barriers to participating in utility, WAP and other building upgrade programs.

5. Performance Measurement, Tracking and Benchmarking

Recommendation

- a. Develop technical infrastructure for consistent building performance data analysis and tracking.*

Background and Analysis

a. Technical Infrastructure

In order to ensure that projects are achieving the predicted energy savings, and to inform improvements to building energy savings estimates, the MF HERCC recommends that programs require a verification of achievement of performance improvement following the completion of the project, ideally based on bill analysis which accounts for external influences on usage during the period of evaluation. This performance feedback would help to evolve performance program guidelines and goals to reflect realized savings. However, in order to actualize this recommendation, the MF HERCC recommends development of the technical infrastructure—including consistent protocols, policies and tools—for multifamily building owners and asset managers to:

- Track, analyze, and evaluate their buildings on a portfolio level,
- Track building performance and improvements over time, and
- Receive Automated Benchmarking Service (ABS) for Multifamily properties through their local utility.

Improved ability to consistently track and analyze building performance and improvements would likely result in an increase in the rate and effectiveness of energy efficiency upgrades in multifamily buildings. In addition, the ability to demonstrate meaningful, actual data and energy performance to financial institutions might result in additional availability of incentives or financing for energy upgrade projects.

Lack of access to information about energy used by a building's individual dwelling units is currently a major barrier to multifamily energy upgrades. The commercial building industry's effort to benchmark²⁶ energy performance needs a parallel in the multifamily sector. Improved automatic access to utility data is necessary to give property owners and program managers a means of understanding the efficacy of proposed and completed upgrades, and is necessary for program administrators to evaluate the cost-effectiveness and efficacy of their programs.

For individually metered buildings, access to aggregated anonymous data is vital for obtaining a complete picture of energy use beyond the common areas. Ideally, aggregated anonymous data would be available directly from the utilities, ensuring customer anonymity while providing completeness of the data. There are alternate methods of obtaining this information, which provide an estimate of actual data usage. One commonly used approach is to extrapolate the data based on a sample of individual units, but results in spotty data. A second approach, which would likely have high administrative costs in

²⁶ Commercial buildings utilize EPA's ENERGY STAR Portfolio Manager tool to receive a benchmark of energy performance for program compliance. In CA AB 1103 is motivating the utilities to provide ABS to commercial properties.

addition to spotty data, is to obtain waivers from residents allowing access their utility bills. A third approach is to access data through periodic program Impact Evaluation. The evaluation typically reviews twelve months of utility bill usage data before and after participating in the program, however this information is only available on a comprehensive level several months or years after a project has participated in a program and is not typically completed for all buildings in a program.

6. Low-Income and Energy Efficiency Program Access and Coordination

Unless otherwise stated, the recommendations in Sections 1 through 5 above pertain equally to low-income and market rate properties. Additional recommendations that are entirely specific to low-income weatherization programs are found here in Section 6.

Some of the MF HERCC and extended stakeholder discussions pertaining to the low-income weatherization programs are generalized to recommendations about individual measure vs. whole building program interrelation, and to the leveraging of programs to improve cost-effectiveness. The low-income specific individual measure programs (including LIEE and WAP) are discussed in these recommendations, in the context of suggesting they consider offering a whole-building performance approach in addition to their individual measure approach. The adoption of the whole-building approach for these programs has specific implications and barriers, especially since LIEE and WAP have a history of only serving the individual dwelling units and not the common areas due to concerns that public funding serve the low-income residents rather than a landlord.

Recommendations

- a. Coordinate and integrate energy efficiency retrofit and weatherization programs serving the low-income sector by developing consistent program requirements, standards and audit protocols; modifying program structures to provide more flexibility for multifamily building owners; and supplementing prescriptive approaches with whole-building performance approaches.*
- b. Improve accessibility of low-income energy efficiency and weatherization programs to rent-restricted rental housing providers, thereby achieving additional market penetration and deeper energy savings by streamlining eligibility and administrative procedures.*
- c. Build capacity in the affordable housing industry for use of energy efficiency-based utility allowances and project specific utility allowance calculators.*

Background and Analysis

For the multifamily housing sector, one of the major barriers to upgrading a building's energy performance is the plethora of sometimes confusing and often overlapping program requirements, incentives, financing sources, protocols and compliance software requirements. While this situation is a challenge for market-rate developers, it is even more challenging for developer/owners of income-restricted properties, who face additional complicated program and funding requirements. In addition, CPUC ratepayer-funded low-income energy efficiency (LIEE) programs and DOE/HUD funded

Weatherization Assistance Programs (WAP) utilize a single-family program delivery model and have other barriers that make them largely inaccessible to multifamily rental properties.

As a result of these factors, many low-income apartments in California have not benefitted from or have been underserved by energy upgrade programs. To reduce barriers to participation, improved access to these programs and coordination of their requirements is essential.

a. Coordination and Integration

Low-income program services are not coordinated with other energy efficiency programs, incentives or rebates, making it difficult for owners to maximize benefits and energy efficiency opportunities. This lack of consistency between requirements in low-income and energy efficiency programs holds true when speaking in the broader sense of low-income programs (for example, affordable housing financing through TCAC, HUD, CDLAC or HCD that requires energy efficiency and sustainable practices) as well as the energy-specific programs within the CPUC-funded Low-Income Energy Efficiency (LIEE)²⁷ and DOE/HUD-funded Weatherization Assistance program (WAP).

For the developer/owner, it is difficult to decipher which programs they are eligible for, what the various compliance and verification requirements are, and whether it is worthwhile to piece together multiple prescriptive programs to undertake a comprehensive building rehab. While there is significant funding in low-income programs, owner/developers of affordable multifamily rental housing who attempt to participate in LIEE and WAP programs confront many barriers. The following strategies would substantially minimize those barriers:

- **Coordinate delivery of energy efficiency and weatherization programs.** Program implementers oriented toward single-family homes often assume that their programs work equally well for multifamily buildings. However, as discussed in Sections 1 and 2 above, their delivery mechanisms and protocols are designed for single-family homeowners and are not appropriate for the developer/owner who provides housing for tenants. In addition, low-income and weatherization programs each have their own unique service delivery structure. Unless, for example, a provider for the weatherization assistance program is the same provider for a utility low-income energy efficiency program, energy services cannot be leveraged or combined without utilizing a separate set of contractors. For multifamily properties, this fragmentation can be addressed by empowering the multifamily owner to carry out the approved scope of work by hiring and managing qualified contractors, with concurrence or approval from the program providers.
- **Adopt whole-building performance approaches.** Implementers of some low-income programs for single-family, energy efficiency and weatherization programs have typically limited the range of measures available to multifamily properties. This prescriptive-list approach constrains the scope of work undertaken by property owners and residents, and often misses opportunities to make substantive improvements to central heating, cooling and water heating systems and other building elements contributing to energy use. A whole-building performance-based approach, as described in

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Section 3 above, would expand the scope of the improvement and contribute to greater resource leveraging.

- **Adopt consistent energy audit protocols.** Multifamily energy efficiency and weatherization programs use different energy auditing and assessment tools and protocols for determining the range of allowable investment. The federal Weatherization Assistance Program relies on TREAT or EA-QUIP, and is further developing standardized audit tools, which is markedly different than the energy analysis requirements under Title 24 or those used by other energy upgrade programs. Allowing cross-use of the auditing tools and protocols would enable greater integration and leveraging.

b. Improved Access

Because most low-income energy efficiency and weatherization programs were originally designed to serve single-family homeowners, certain program requirements or restrictions make it difficult if not impossible for multifamily properties to participate. The following strategies will improve access for multifamily properties:

- **Streamline eligibility procedures.** Low-income energy efficiency and weatherization programs require individual households to complete applications for energy efficiency improvements and assistance. These programs also require each household to individually agree to participate and individually allow access, even though lease agreements usually give building owners/managers the right to authorize such work. This process impedes participation by low-income properties. Allowing property owners to apply for and authorize energy improvements on behalf of low-income households would reduce barriers to reaching this market segment and enable whole-property energy upgrade approaches. For regulated affordable housing properties, this process can be further streamlined by permitting households to be qualified for the program based on certified income records maintained by the property owner pursuant to state or federal regulations.
- **Achieve additional market penetration, and deeper energy savings, in low-income programs** by designing programs that are attractive to owner/developers of affordable multifamily rental properties- the entities who provide housing to the majority of the state's low-income population.²⁸ The low-income market has expressed interest in a performance based whole-property approach

²⁸ Data from utility filings of June 1, 2007 and the May 10, 2007 workshop presentations on renter access issues in CPUC Rulemaking 07-01-042 (available at <http://docs.cpuc.ca.gov/published/proceedings/R0701042.htm>) The share of dwellings serviced by LIEE programs that are multifamily closely reflect the share of low-income dwellings that are multifamily. This break-down does not reflect which measures were installed in multifamily units, and whether or not the units were in rental or ownership housing projects. (See following table).

| Multifamily Dwellings Service By LIEE | PG&E | SCE | SDG&E | SoCalGas |
|--|------|-----|-------|----------|
| Estimated MF low-income dwellings by utility as a % of all low-income dwellings (2003) | 28% | 54% | 50% | 41-66% |
| MF dwelling treated through 2006 , as a % of all dwellings serviced through 2006 | 26% | 44% | 49% | 37% |
| MF dwellings treated by utility (2009), as a % of all dwellings serviced 2009 | 16% | 13% | 52% | 23% |

for their existing portfolio, similar to what they are used to implementing in their high-performance new construction projects which participate in incentive and green building programs.

- **Include new individual measures in LIEE.** New individual measures could be proposed for inclusion in the LIEE program that would better serve the needs of multifamily dwellings. In particular the measures in multifamily buildings that serve the common areas or central systems should not be excluded as they represent missed energy savings opportunities. In addition, consider utilizing the definition of accrual of benefits from common-area installations to individual tenants as defined in the California Solar Initiative's (CSI) Multifamily Affordable Solar Homes (MASH) program.²⁹
- **Adopt categorical income-eligibility policies for WAP and LIEE programs.** Examples of categorical income-eligibility are found in HUD³⁰ national protocols and NYSERDA³¹ multifamily program low-income by proxy income eligibility. Conditions for income eligibility approach might include:
 - Principal contact is property owner and/or manager, on behalf of tenants,
 - Income documentation certified through other programs and regulations should be accepted,
 - A minimum of 66 percent of households should qualify the whole building, and/or
 - When single-measures in individual units are applicable, still allow individual units to income qualify.

If adopting categorical income-eligibility policies for WAP, include as one of the qualifying categories for categorical enrollment into LIEE appropriate parameters of tenants residing in low-income public housings, via the process directed by the CPUC in Decision 08-11-031.

Also, program administrators should identify multifamily buildings in utility service territories whose tenants already automatically qualify for the LIEE program without income or categorical documentation in accordance with Ordering Paragraph 6 of CPUC Decision 08-11-031.

- **Interpret WAP Savings to Investment Ratio (SIR) calculations as allowed to be bought-down with owner investment or incentives in order to give more flexibility to developers around which measures they install.** Multifamily rental property owners said that many of the building upgrade measures of most interest to them are not supported by the WAP program if they do not show a positive SIR calculation. For example, when window improvements do not show a positive SIR calculation in mild climate zones, this measure is not supported by the WAP program. In order to

²⁹ MASH Track 2 allows applicants to compete for higher incentives above Track 1 rates if the installation provides a quantifiable "direct tenant benefit" (i.e., any operating costs savings from solar that are shared with their tenants). Other categories of benefits that are considered in determining an award include energy efficiency improvements, green job creation or training, outreach and education for tenants on sustainability topics (MASH Semi Annual Progress Report, July 2010).

³⁰ To access the HUD announcement, instructions and the relevant forms and worksheets, visit the GREEN website Developer/Owner Resources page (see the links below "Self-Certification Documents for Addition to the DOE Multifamily Weatherization Listing"): www.chpc.net/preservation/OWNERRESOURCES.html.

³¹ To See NYSERDA Multifamily Performance program for Existing Buildings Income-Eligibility by proxy, click *Project Interest Form* at www.getenergysmart.org/MultiFamilyHomes/ExistingBuilding/BuildingOwner/Participate.aspx.

capture the minimal amount of energy savings, in combination with other benefits of sound exterior assemblies, moisture damage repair and improved occupant comfort, the owner should be able to demonstrate investment of construction funding to buy-down the SIR calculation (on an individual measure basis or a whole building performance basis) and achieve weatherization funding contribution towards more energy efficient windows.

Additional considerations for SIR calculations include:

- Leveraging to buy down SIR should be sought and allowable by utility and government funding sources, including other federal funding sources such as Energy Efficiency Conservation Block Grant funding (EECBG).
- Calculating SIR on a whole-package basis as an alternative to calculating SIR on a measure-by-measure basis may better enable whole building approach.
- Variables used in the SIR calculation should be clearly defined (discount rate, fuel escalation rate, general inflation rate, measure life, how energy cost rates are calculated.etc).

d. Energy Efficiency-Based Utility Allowances and Project-Specific Utility Allowance Calculators

Utility Allowances are mechanism specific to affordable housing. For information on the utility allowance concept see: <http://www.gosolarcalifornia.org/affordable/cuac/> . Energy efficiency based utility allowances are a mechanism to provide building owners with a pay-back for investments in energy efficiency. While HUD has deemed their use as best practice, individual Public Housing Authorities who often set utility allowances for projects often do not have the resources to implement their use.

- **Pool resources.** Resources should be pooled and coordination take place among California Energy Commission (CEC), Tax Credit Allocation Committee (TCAC), Housing and Urban Development (HUD), Public Housing Authorities (PHAs), to:
 - Provide technical assistance to Public Housing Authorities for interpretation and implementation of EEBUA/CUAC policies.
 - Develop and implement EEBUA for new construction and existing buildings on a more uniform and wide-spread basis.
 - Train energy consultants on the use of the CEC project-specific California Utility Allowance Calculator (CUAC).
 - Establish protocol/case study for the current CEC/LIHTC CUAC new construction tool to work for low-income financing programs in addition to LIHTCs (e.g., HUD section 8 tenant voucher program or other HUD programs).

CONCLUSION

In California, policies and programs for energy and green building improvements have traditionally treated multifamily buildings as a subset of the single-family residential or commercial building sector. Tremendous energy savings opportunities have been overlooked because these policies and programs have not adequately recognized the unique infrastructure and market realities of the multifamily building sector.

The MF HERCC's work has brought to light the importance of tailoring energy and green upgrade policies and programs to the specific market opportunities and challenges faced by the multifamily sector. By adopting the recommendations in this report, energy and green upgrade programs can more quickly and effectively deliver their services and achieve their goals of energy savings, greenhouse gas emissions reduction and job creation.

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The first draft was released on October 7, 2010 at a public stakeholder meeting attended by more than 80 industry professionals. Recommendations pertaining to coordination of energy efficiency and low-income programs were further developed at a Multifamily Weatherization Forum held at Housing and Urban Development offices in San Francisco on February 10, 2011 where 70 low-income housing and energy efficiency professionals discussed program design, coordination and capacity building for low-income programs to better serve multifamily rental housing. During and since the October public stakeholder meeting and the Multifamily Weatherization Forum, additional items have been identified as clarifications and refinements to the original report and as priorities for improving the MF HERCC's program design recommendations.³²

MF HERCC participants are listed here. Participation in MF HERCC meetings does not constitute endorsement of any specific recommendation in this report by the organizations represented.

³² The October 2010 report and clarifications and additional recommendations in the March 25th Addendum were developed and discussed at the following meetings: MF HERCC (3/10, 4/10, 7/10, 8/10, 10/8/10, 12/7/10, 1/27/11), IT task group (11/16/10, 1/21/11), Weatherization task group (11/5/10, 12/21/10, 1/31/11, 2/2/11, 3/2/11), HERS II Tools task group (11/12/10, 1/7/11, 1/26/11, 2/15/11, 3/8/11), Public Stakeholder (10/08/10) Weatherization Forum (02/10/11).

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 Jose Buendia, Southern California Edison
 Timothy Burroughs, City of Berkeley
 Nicole Capretz, Environmental Health Coalition
 Maria Caudill, Department of Community Services &
 Development
 Lupe Chacon, San Diego Gas & Electric Company
 Lin Chin, City of Oakland
 Amri Christianto, Southern California Edison
 Lowell Chu, SF Environment
 Jack Clark, Center for Sustainable Energy CA
 David Cohen, Energy Coalition
 Karen Contreras, Pacific Gas and Electric Company
 Michelle Cook, Southern California Gas Company
 Neal De Snoo, City of Berkeley
 Martyn Dodd, Energy Soft
 Diana Downton, City of Oakland
 Andrea Dravo, Building Performance Institute
 Amy Dryden, Build It Green
 Devi Eden, California Energy Commission
 Lydia Ely, San Francisco Mayor's Office of Housing
 Cathy Fogel, California Public Utilities Commission
 Marc Flemming, The Energy Coalition
 Steven Frantz, Sacramento Municipal Utility District
 Merrian Fuller, Lawrence Berkeley National
 Laboratory
 Jerone Gagliano, Performance Systems Development
 Hugo Gonzalez, Southern California Gas Company
 Ken Hejmanowski, Renewable Funding
 DeDe Henry, SDG&E
 Fran Hereth, Kango Development
 Meghan Hori, City of Oakland
 Ann Kelley, SF Environment
 Karen Kho, Stopwaste.Org
 Miya Kitahara, StopWaste.Org
 Adam Knowles, Sempra
 Helen Lam, California Energy Commission
 Heather Larson, Stopwaste.Org
 Robin LeBaron, National Home Performance Council,
 Inc.
 Brooke Lee, SF Environment

Ted Leopkey, U.S. EPA
 Sam Lerman, California Energy Commission
 Maryann Leshin, Enterprise
 Leif Magnuson, U.S. EPA
 Raymond Manion, SF Environment
 Lela Manning, Sempra
 Bruce Mast, Build It Green
 Andrew McAllister, Energy Center
 Elizabeth McCollum, Heschong Mahone Group
 Nancy McKeever, California Air Resources Board
 Ramon Mendez, Enterprise
 Julia Mendoza, San Diego Gas & Electric
 Beckie Menten, California Energy Commission
 Catherine Merschel, Build It Green
 Rashid Mir, California Energy Commission
 Cynthia Mitchell, TURN
 Devon Muto, County of San Diego
 Ross Nakasone, CHPC
 Adrian Ownby, California Energy Commission
 Eileen Parker, Bevilacqua-Knight, Inc.
 Craig Perkins, Energy Coalition
 Lauren Rank, Los Angeles County
 Collin Rich, Enterprise
 Judy Roberson, Pacific Gas and Electric Company
 Candy Robinson, Sempra
 Michele Rodriguez, Bevilacqua-Knight, Inc.
 Billi Romain, City of Berkeley
 Russ King, CalCerts
 Matt Schwartz, CHPC
 Ruben Schwartz, SF Environment
 Tara Siegel, Low Income Investment Fund
 Jennifer Somers, U.S. Department of Energy
 Jeff Staller, Heschong Mahone Group
 Nehemiah Stone, Benningfield Group
 Scott Straight, Renewable Funding
 Jonathan Strunin, Bevilacqua-Knight, Inc.
 Elizabeth Stuart, Lawrence Berkeley National
 Laboratory
 Julieann Summerford, Heschong Mahone Group
 Jeffrey Summerville, Strategic Energy Innovations
 Cynthia Swaim, Southern California Gas Company
 Toni Turnbull, CalCERTS
 Wayne Waite, HUD Office of Energy
 Camille Watts-Zagha, California Public Utilities
 Commission
 Scott Wentworth, City of Oakland
 Jason Wimbley, Department of Community Services
 & Development

REFERENCE STANDARDS

The following standards comprise a basis for reference in multifamily retrofit programs:

- ASHRAE, Commercial Building Audit Standards (2004)
- Building Performance Institute, Inc., *Technical Standards for Multifamily Building Analysts* (2008)
- California Energy Commission, "Energy Efficiency Standards for Residential and Nonresidential Buildings" (Title 24–2008)
- California Energy Commission, *HERS Technical Manual* (2008)
- City of Berkeley, "Money For Energy Efficiency Audit Standard"
- Enterprise, "San Francisco Bay Area Affordable Multifamily Retrofit Initiative Audit Protocol"
- GreenPoint Rated Existing Home Multifamily program
- RESNET, *RESNET Standards*, Chapter Seven, Comprehensive Home Energy Audit
- U.S. Department of Housing and Urban Development, *Energy Conservation for Housing—A Workbook* (1998)

APPENDIX A: Cost/Benefit Analysis for a 40-unit Low-rise Prototype

The tables below illustrate the cost/benefit analysis process described in the Recommendations section of this report. The cost/benefit analysis is shown for a 40-unit low-rise prototype in representative climate zones 3, 8, 10 and 12. These tables are not recommendations for specific packages of measures; rather, they are merely examples intended to demonstrate the types of measures—and their associated costs—that might be used to achieve a certain performance target for a specific building type, vintage and climate zones.

Table A- 1. Pre-code Baseline
Example measures to achieve at least 20% energy savings across climate zones

| Energy Efficiency Measures Used in Calculations | | | DEER Cost Data unless noted | | | Total Cost for building divided by 40 |
|---|-------------------------|-----------------------|-----------------------------|--------------|----------------|---------------------------------------|
| Measure | Baseline | Improved | Material | Labor | Total/DU | |
| Attic Insulation | R-11 | R-38 | 0.75/s.f. | 0.61/s.f. | \$478 | |
| Wall Insulation | R-0 | R- 13 | 0.32/s.f. | 0.62/s.f. | \$263 | |
| Window Replacement | Single Pane Metal Frame | Dual Pane Vinyl Frame | 16.00/s.f. | 5.70/s.f. | \$1,622 | |
| Seal Duct Leakage | 28% | 15% | \$56/DU | \$442/DU | \$498 | |
| Estimated Material & Installation Cost | | | | Total | \$2,861 | |

| CZ | Estimated Improvements Summary | | | | First Year Savings | | Estimated Installation Cost | Straight Line Payback (yrs) |
|----|--------------------------------|------------|---------|--------|--------------------|--------------|-----------------------------|-----------------------------|
| | | HERS Index | kWh | Therm | Total | Per Dwelling | | |
| 3 | Vintage Baseline | 154 | 138,121 | 13,530 | \$73,567 | | | |
| | Improved House | 127 | 129,243 | 10,020 | \$65,572 | | | |
| | Savings | | 8,878 | 3,510 | \$7,995 | \$199.88 | \$2,861 | 14.3 |
| | Percent Improvement | 17.5% | 6.4% | 25.9% | 10.9% | | | |
| 8 | Vintage Baseline | 174 | 166,072 | 10,403 | \$82,349 | | | |
| | Improved House | 142 | 144,347 | 8,939 | \$71,021 | | | |
| | Savings | | 21,725 | 1,464 | \$11,328 | \$283.20 | \$2,861 | 10.1 |
| | Percent Improvement | 18.4% | 13.1% | 14.1% | 13.8% | | | |
| 10 | Vintage Baseline | 214 | 208,770 | 11,321 | \$102,461 | | | |
| | Improved House | 163 | 169,236 | 9,191 | \$82,351 | | | |
| | Savings | | 39,534 | 2,130 | \$20,110 | \$502.75 | \$2,861 | 5.7 |
| | Percent Improvement | 23.8% | 18.9% | 18.8% | 19.6% | | | |
| 12 | Vintage Baseline | 229 | 194,862 | 15,597 | \$101,119 | | | |
| | Improved House | 164 | 156,889 | 11,118 | \$79,103 | | | |
| | Savings | | 37,973 | 4,479 | \$22,016 | \$550.40 | \$2,861 | 5.2 |
| | Percent Improvement | 28.4% | 19.5% | 28.7% | 21.8% | | | |

Table A- 2. 1980-2000 Code Baseline
Example measures to achieve at least 15% energy savings across climate zones

| Energy Efficiency Measures Used in Calculations | | | DEER Cost Data unless noted | | | | |
|---|----------------|--------------|-----------------------------|-----------|----------|---------------------------------------|--|
| Measure | Baseline | Improved | Material | Labor | Total/DU | | |
| Attic Insulation | R-19 or R-30 | R-38 | 0.4/s.f. | 0.45/s.f. | \$300 | Total Cost for building divided by 40 | |
| Duct Leakage | 28% | 15% | \$56 | \$442 | \$498 | | |
| Refrigerant Charge | Standard | Verified | \$12/ton | \$37/ton | \$72 | 1.5 ton AC system | |
| Replace A/C system | SEER 8.9 | SEER 13.0 | \$12/ton | \$37/ton | \$72 | | |
| Duct Insulation | R-4.2 or R-2.1 | R-8 | \$612/ton | \$448/ton | \$1,590 | Cost Estimated | |
| Water Heater | EF .52 | EF .62 | \$550 | \$200 | \$750 | | |
| Indoor Lights | Incandescent | CFL | \$25 | \$0 | \$25 | | |
| Outdoor Lights | Incandescent | CFL & Sensor | \$10 | \$100 | \$110 | | |
| Estimated Material & Installation Cost | | | Total | | | \$3,117 | |

| CZ | | HERS Index | kWh | Therm | First Year Savings | | Estimated Installation Cost | Straight Line Payback (yrs) |
|----|---------------------|------------|---------|--------|--------------------|-------------------|-----------------------------|-----------------------------|
| | | | | | Total | Per Dwelling unit | | |
| 3 | Vintage Baseline | 133 | 134,399 | 10,670 | \$67,280 | | | |
| | Improved House | 110 | 107 | 9,024 | \$54,722 | | | |
| | Savings | | 134,292 | 1,646 | \$12,558 | \$313.95 | \$3,117 | 9.9 |
| | Percent Improvement | 17.3% | 99.9% | 15.4% | 18.7% | | | |
| 8 | Vintage Baseline | 151 | 151,230 | 9,188 | \$74,362 | | | |
| | Improved House | 119 | 119,141 | 7,520 | \$58,203 | | | |
| | Savings | | 32,089 | 1,668 | \$16,159 | \$403.98 | \$3,117 | 7.7 |
| | Percent Improvement | 21.2% | 21.2% | 18.2% | 21.7% | | | |
| 10 | Vintage Baseline | 180 | 182,592 | 9,621 | \$88,771 | | | |
| | Improved House | 143 | 142,996 | 7,917 | \$69,241 | | | |
| | Savings | | 39,596 | 1,704 | \$19,530 | \$488.25 | \$3,117 | 6.4 |
| | Percent Improvement | 20.6% | 21.7% | 17.7% | 22.0% | | | |
| 12 | Vintage Baseline | 184 | 169,778 | 12,069 | \$85,917 | | | |
| | Improved House | 149 | 132 | 9,935 | \$67,002 | | | |
| | Savings | | 169,646 | 2,134 | \$18,915 | \$472.88 | \$3,117 | 6.6 |
| | Percent Improvement | 19.0% | 99.9% | 17.7% | 22.0% | | | |

Table A- 3. 2001-2008 Code Baseline
Example measures that will achieve at least 10% energy savings across climate zones

| Energy Efficiency Measures Used in Calculations | | | DEER Cost Data unless noted | | | |
|---|----------|----------|-----------------------------|--------------|----------------|---------------------------------------|
| Measure | Baseline | Improved | Material | Labor | Total/DU | |
| Attic Insulation | R-30 | R-38 | 0.40/s.f. | 0.45/s.f. | \$300 | Total Cost for building divided by 40 |
| Refrigerant Charge | Standard | Verified | \$12/ton | \$37/ton | \$72 | 1.5 ton AC system |
| Seal Duct Leakage | 28% | 15% | \$56/DU | \$442/DU | \$498 | |
| Duct Insulation | R-2.1 | R-8 | | | \$350 | Estimated Cost |
| Water Heater | EF .575 | EF .62 | \$550 | \$200 | \$750 | |
| Estimated Material & Installation Cost | | | | Total | \$1,970 | |

| Estimated Improvements Summary | | | | | First Year Savings | | Estimated Installation Cost | Straight Line Payback (yrs) |
|--------------------------------|---------------------|------------|---------|--------|--------------------|--------------|-----------------------------|-----------------------------|
| CZ | | HERS Index | kWh | Therm | Total | Per Dwelling | | |
| 3 | Vintage Baseline | 125 | 131,044 | 9,407 | \$66,838 | | | |
| | Improved House | 116 | 124,151 | 8,486 | \$62,717 | | | |
| | Savings | | 6,893 | 921 | \$4,121 | \$103.03 | \$1,970 | 19.1 |
| | Percent Improvement | 7.2% | 5.3% | 9.8% | 6.2% | | | |
| 8 | Vintage Baseline | 144 | 150,527 | 8,071 | \$73,934 | | | |
| | Improved House | 130 | 139,091 | 7,321 | \$67,995 | | | |
| | Savings | | 11,436 | 750 | \$5,939 | \$148.48 | \$1,970 | 13.3 |
| | Percent Improvement | 9.7% | 7.6% | 9.3% | 8.0% | | | |
| 10 | Vintage Baseline | 172 | 180,983 | 8,442 | \$87,870 | | | |
| | Improved House | 152 | 163,665 | 7,918 | \$79,237 | | | |
| | Savings | | 17,318 | 524 | \$8,633 | \$215.83 | \$1,970 | 9.1 |
| | Percent Improvement | 11.6% | 9.6% | 6.2% | 9.8% | | | |
| 12 | Vintage Baseline | 175 | 168,413 | 10,733 | \$84,943 | | | |
| | Improved House | 155 | 152,763 | 9,567 | \$76,655 | | | |
| | Savings | | 15,650 | 1,166 | \$8,288 | \$207.20 | \$1,970 | 9.5 |
| | Percent Improvement | 11.4% | 9.3% | 10.9% | 9.8% | | | |

APPENDIX B: Investor-Owned Utility Programs Available for the Multifamily Sector

The following table is a draft list of investor-owned utility programs available for the multifamily sector.

| Type | Program | Target Audience | Offering | Eligibility | Application Requirements | Target # Units (2010-2012) | Program Budget (2010-2012) | Program Websites |
|-----------------------|---|--|--|---|---|--|--|--|
| STATEWIDE RESIDENTIAL | Low Income Energy Efficiency (LIEE) Program | Low income households ¹ | No-cost energy efficiency and appliance repair and replacement measures. Most measures available to single family are available to MF units as long as occupants are income qualified and building owner/property manager has consented to the work. | Tenants are eligible with approval of property owner or manager. In program year 2009 MF dwellings accounted for 27% of total LIEE project work. Entire complexes can also be verified based on the 80-20 rule. | Income must be verified by service provider and each participant must sign an application. Utility verified CARE recipients are automatically eligible though still require independent income verification. | Total: 747,054 PG&E: 249,982 SCE: 166,890 SCG: 289,414 SDG&E: 40,768 | PY2010: \$310,685,254 PY2011: \$318,786,772 (LIEE program budget cycle is from 2009-2011; only figures for applicable years are listed.) | www.socalgas.com/residential/assistance www.sdge.com/residential/assistance/energyTeam.shtml www.pge.com/energypartnerswww.sce.com/residential/income-qualified/ema/energy-management-assistance.htm |
| | California Advanced Home Program (CAHP) | Developers/builders for new construction and significant remodel | Performance based incentives starting at \$0.18/kWh, \$0.73/therm, and \$27.63/kW at 15% > Title 24, with incentive caps at 45% > Title 24. \$100 unit base incentive. PV kicker; additional incentives for compact and green certified homes. Design and technical assistance provided. | New MF construction and performance-based "gut and remodel" of existing MF structures. New construction, affordable, and market-rate MF complexes of three dwelling units or more. | Projects can apply any time between 1/1/2010 and 12/15/2012, prior to project completion (defined as prior to drywall installation). Applying early in design phase is highly recommended. Project applications should be submitted six months prior to any financing applications. Recommended project documents for submittal include a letter of intent, building plans, lot plan, application form, Title 24 checklist and other Title 24 documentation, and other energy efficiency documentation. | No specific unit goal for the multifamily segment. | \$51,383,787 total PG&E: \$13,521,688; SCE: \$24,894,000; SDG&E: \$4,398,013; SCG: \$8,570,086 | www.pge.com/newhomes www.CaliforniaAdvancedHomes.com www.sce.com/builder www.sdge.com/builderservices/newHomes.shtml |

¹ Household income less than 200% of federal poverty level. Multifamily is defined as 5 or more units.

| Type | Program | Target Audience | Offering | Eligibility | Application Requirements | Target # Units (2010-2012) | Program Budget (2010-2012) | Program Websites |
|-----------------------|--|--|--|--|--|---|--|--|
| STATEWIDE RESIDENTIAL | Energy Upgrade California | MF complex owners/managers of existing buildings | Single family: performance incentives up to \$4,000 for installation of measures reducing energy use by 20%; prescriptive incentives up to \$1,000 for installation of basic package of measures. ² MF incentive packages currently under development. | Existing buildings, major energy efficiency upgrades. | Application available on Energy Upgrade California website. | No specific target for MF | Currently only available for single family dwellings; incentives aimed at MF market expected in 2011. | www.sdge.com/energyupgrade www.sce.com/residential/rebates-savings www.socalgas.com/rebates/residential PG&E website to be determined. |
| | Multifamily Energy Efficiency Rebate Program | MF complex owners/managers of existing buildings | Prescribed rebates on a range of energy efficiency lighting, appliances, and building envelope for dwelling and common areas. Non-incentive offerings include education on the value of energy efficiency and cross-marketing with LIEE offerings. | Existing buildings, minor energy efficiency upgrades. Affordable and market rate complexes of 2 dwelling units or more. Tenants eligible to receive services with landlord approval. | Funds available until depleted, held on a first come, first serve reservation basis. Supporting documents must be submitted within 45 calendar days of reservation. Documents include Multifamily Reservation Form, Rebate Application, Invoice / Proof of Purchase. SDG&E documents also include Product Location Forms for common area and apartments. | PG&E: 15,000 direct mailers/year. SDG&E, SCE: 20,000 mailers/year. SCG: No stated targets. ³ | \$80,188,539 total PG&E: \$20,856,887; SCE: \$45,732,227; SDG&E: \$5,131,751; SCG: \$8,467,674 | www.pge.com/multifamily www.sdge.com/residential/multiFamilyRebate.shtml www.sce.com/residential/rebates-savings/multifamily/multifamily-energy-efficiency.htm www.socalgas.com/rebates/multifamily |

² Blower-door-based air sealing, attic insulation, pipe wrap for all accessible domestic hot water heater piping, duct sealing, and an optional measure—low flow showerhead or thermostatic control valve for showerheads.

³ IOU's have also established non-program delivery targets such as ensuring properly licensed contractors and direct outreach to large property managers (3 per year for PG&E, SDG&E, SCE).

| Type | Program | Target Audience | Offering | Eligibility | Application Requirements | Target # Units (2010-2012) | Program Budget (2010-2012) | Program Websites |
|-----------------------|---------------------------------------|---|---|---|--|---|---|--|
| STATEWIDE RESIDENTIAL | Appliance Recycling Program (Not SCG) | Res. and comm. building occupants, either existing occupants or at the time of transfer | Free pick-up and recycling of eligible, functioning appliances along with a monetary incentive. | Refrigerators, freezers, and room AC units (excluding SCE) available for pick up from residential and commercial locations. | Participants phone-in or schedule a pick up via website. | 15,722 recycled appliances per year. There is no specific MF target. | \$67,784,646 total PG&E: \$20,241,876; SCE: \$39,342,770; SDG&E: \$8,200,000 | www.appliancerecycling.com/weborder/rebatex.aspx?ProgramID=1 www.sce.com/residential/rebates-savings/appliance/fridge-freezer-recycling.htm www.sdge.com/residential/rebates.shtml |
| | Home Energy Efficiency Survey | Residential households | HEES provides opportunities for residents to assess the energy impact of their dwelling spaces, appliances and plug load devices. | Residential single family and multifamily units. | Customer may take the survey on line or via mail. | PG&E: 42,000 on line, 7,245 mail in, 4,000 in home, and 105 phone surveys. SCE: 21,875 on line, 13,125 mail in, 7,875 in home, and 875 phone surveys. SDG&E: 2,500 on line, 800 mail in surveys. SCG: 5,000 on line, 5,000 mail in, and 5,500 in home surveys. | \$32,396,994 total PG&E: \$21,018,892; SCE: \$6,950,911; SDG&E: \$2,049,080; SCG: \$2,378,112 | www.socalgas.com/residential/energysurvey/index.html No website info has been supplied by PG&E, SCE, or SDG&E for this program. |

| Type | Program | Target Audience | Offering | Eligibility | Application Requirements | Target # Units (2010-2012) | Program Budget (2010-2012) | Program Websites |
|----------------------|----------------------------------|---|--|--|--|--|--|--|
| STATEWIDE COMMERCIAL | Commercial Calculated Incentives | Buildings on a commercial rate, including portions of buildings | Calculated and tailored incentives for non-residential retrofits. Non-incentive offerings include technical assistance for application preparation. | Common areas of multifamily complexes. | Standard application form available online. Pre and post project inspections. | All commercial rated customers - no specific target for multifamily. | \$149,047,635 total PG&E: \$84,820,223; SCE: \$52,007,662; SDG&E: \$4,248,850; SCG: \$7,970,900 | www.sce.com/customized_solutions/www.sdge.com/business/esc www.pge.com/mybusiness/energysavingsrebates No website info has been supplied by SCG for this program. |
| | Non-Residential Audits | Non-residential; MF property owners/managers. | Three audit levels: basic audits, integrated audits, and retrocommissioning (RCx) audits. Basic and online integrated audits target users below 200 kW; RCx audits are intended for larger users. Each audit generates a final audit report with recommendations for improvements. Program offers technical assistance to increase conversion rates. | All non-residential commercial establishments. Specific audits geared towards different customer types. | Online energy audits available for specific business types (including apartment complexes). To request a more in-depth audit, customers are routed to the business customer service center. | Only commercial rated customers. | \$34,192,073 total PG&E: \$20,237,598; SCE: \$10,559,031; SDG&E: \$1,562,143; SCG: \$1,833,301 | www.pge.com/mybusiness/energysavingsrebates/analyzer/index.shtml www.sce.com/business/ems www.sdge.com/business/rebatesincentives/programs/allPrograms.shtml www.socalgas.com/rebates |
| | On-Bill Financing | Commercial, Industrial, Institutional | Full upfront cost covered for eligible measures and customers with good credit, as determined by IOU. Estimated energy savings must be greater than debt servicing. Financing provided at 0% interest over 5 years, ⁴ \$5,000 to \$100,000 loans tied to meter. | Active accounts in good credit standing with at least two years bill payment history. Multifamily common area locations (owner not living on premises). Financing does not qualify for residential applications. Measures must qualify for a rebate or incentive through IOU program. | Standard application form available online. IOU inspects project prior to commencement and verifies calculated energy savings. Must submit energy saving workbook indicating existing and proposed equipment, operating hours, and technical specifications. | All commercial and industrial customers. | \$143,554,308 total PG&E: \$18,500,000 SCE: \$15,000,000 SDG&E: \$5,000,000 SCG: \$3,500,000 | www.sdge.com/obf No website info has been supplied by SCG, PG&E, or SCE for this program. |

⁴ Loan terms can be lengthened to match expected life of measure.

| Type | Program | Target Audience | Offering | Eligibility | Application Requirements | Target # Units (2010-2012) | Program Budget (2010-2012) | Program Websites |
|----------------------|--|---|---|---|--|----------------------------|---|--|
| STATEWIDE COMMERCIAL | Commercial Deemed Incentives | Non-residential; multifamily property owners/managers | Provides rebates to non-residential customers for installing energy efficient lighting, refrigeration, food service, natural gas (PG&E and SDG&E only) and other technologies. | All nonresidential commercial establishments. Portions of multifamily complexes / facilities on a commercial rate (i.e., corridors, atriums, etc.) | Standard application form available online. | All commercial customers. | \$143,554,308 total PG&E: \$58,516,685; SCE: \$53,263,233; SDG&E: \$16,520,919; SCG: \$15,253,471 | www.pge.com/businessrebates www.pge.com/tradepro www.sce.com/Express_Solutions www.sdge.com/businessrebates www.socalgas.com/energyefficiency |
| | QI/QM Duct Test and Seal, Refrigerant Charge and Airflow | Residential and commercial building occupants | Service providers promote program through participating HVAC contractors who receive incentives to perform quality installation and quality maintenance service on new and existing HVAC systems. | Customer must have an active residential single family or small commercial electric account. Installation must take place at a PG&E service address, and must be located in Climate Zones 2, 4, 11, 12, or 13 for DTS. No climate zone requirement for RCA. | Contractor is paid an incentive for performing work for customer. Contractors enter into agreements with Verified Service Providers who administer program and quality assurance checks. | N/A | Residential QI: PG&E: \$13,711,409 SCE: \$3,080,674 SDG&E: \$83,481 SCG: \$87,168 Comm. QI: PG&E: \$7,383,067 SCE: \$2,499,972 SDG&E: \$61,695 SCG: \$55,996 Res / Com QM: PG&E: \$9,378,683 SCE: \$28,486,042 SDG&E: \$97,751 SCG: \$203,209 | www.pge.com/myhome/saveenergymoney/rebates/coolheat/duct/ No website info has been supplied by SoCal Gas, SCE, or SDG&E for this program. |

| Type | Program | Target Audience | Offering | Eligibility | Application Requirements | Target # Units (2010-2012) | Program Budget (2010-2012) | Program Websites |
|----------------------|---|--|--|---|---|---|--|--|
| PARTNERSHIP PROGRAMS | Palm Desert Demonstration Pilot | Commercial and residential customers in the City of Palm Desert. | Big Bold Energy Efficiency Strategies and innovative approaches to encourage energy efficiency. Effective behavioral messaging pilot, Set-To-Save marketing campaign and pilot projects. One-Stop-Shop for Palm Desert residents, On-Bill Financing for public agencies and businesses. Support to City's AB811 Energy Independence Program (EIP). | Commercial and residential customers in the City of Palm Desert. | Palm Desert Applications on Set-To-Save website. | 457,072 gross Therm (2010-12 goal) ⁵ | \$649,300 (Approved budget through 12/31/2010) | www.settosave.com |
| | San Francisco Energy Watch MF Plus Program (PG&E) | MF property owners and managers | Free energy audit and incentives for efficiency measures for lighting, HVAC and building envelope. MF Plus serves both dwelling units and common space. | Deemed and calculated incentives are provided to participating contractors for the installation of qualified energy efficiency products in existing MF complexes with 2 or more dwelling units. | Participating contractor must submit Incentive Application Form and signed Site Access Agreement prior to installation. Following completion of project, participating contractor submits an Installation Verification Form and supporting documentation. | N/A | Approx. \$3,000,000 for PY2010-2012 | www.sfenergywatch.org/multifamily.html |
| | Moderate Income Direct Install (MIDI) Program** | Moderate income customers. | Free energy assessment and free installation of efficiency measures, such as comprehensive lighting, attic insulation, pipe wrap, hot water heater blankets, and low flow showerheads and faucet aerators. MIDI serves both multifamily dwelling units and common space. | MIDI targets customers at 200% - 400% above federal poverty level. Tenants eligible with approval of property owner/mgr. Also serves common spaces in low income buildings (LIEE does not serve common spaces). Consistent with LIEE, MF dwellings are defined as those in buildings with five or more dwelling units. Also serves single family. | MIDI serves multifamily customers who are approached by LIEE but determined to be ineligible for LIEE during the income verification process. | N/A | \$4,352,000 for PY2010-2011 | TBD |

⁵ Local Government Partnership Programs are non-resource programs that coordinate and support all Core Program offerings including Residential Multi-family by leveraging the authority, unique local expertise and roles of local governments in the communities they serve. Through its effort in energy efficiency education, training, reach codes and community outreach, the M&O component of each LGP Program is designed to increase energy efficiency practices and stimulate greater participation in all Core Programs including those for Multi-family.

| Type | Program | Target Audience | Offering | Eligibility | Application Requirements | Target # Units (2010-2012) | Program Budget (2010-2012) | Program Websites |
|----------------------|--|--|---|---|--|---|---|--|
| THIRD-PARTY PROGRAMS | Multifamily Solar Pool Heating Program (SCG) | MF complex owners/managers of existing buildings | Aims to encourage large apartment building owners and property mgrs. to install solar water heating systems for swimming pools. Requires installation of solar collectors, booster pumps, solar system controller, and additional material and appurtenances (including, but are not limited to hot water CPVC piping, valves, fittings, drains, air separators, sensors, and insulation and collector structural support). | Apartment complexes with minimum of 40 occupied residential units with pools that are heated throughout the year. | Customers qualify to receive products and services through completion of a Customer Enrollment Form and Installation Agreement: contractor shall provide for review and approval a copy of Installation Agreement Form that program will use to document execution of those services selected by the customer. | Goals for 2010-11 are 105 installations/projects | \$1,497,491 | www.energxsolar.com |
| | Multifamily Direct Therm Savings (MFDTS) and Multifamily Home Tune-Up Program (MFHTUP) (SCG) | MF property owners and tenants | Offers no-cost direct installation of water heating devices (low-flow showerheads, bathroom aerators, kitchen aerators, and common area pipe wrap) and provides valuable efficiency education to both multifamily property owners and tenants. | MFDTS: Existing buildings within the following SCG service counties: Los Angeles, Ventura, Kern, San Luis Obispo, and Santa Barbara. MFHTUP: Existing buildings within the following SCG service counties: Orange, San Bernardino, Riverside, and Imperial. | Customers who have qualified to receive energy efficiency devices and services complete a Customer Enrollment Form. The Customer Enrollment Form records program participation and contains relevant customer information. | Target # of installations or projects: 2010 - MFDTS: 1,200 MFHTU: 21,067. 2011 - MFDTS: 600 MFHTUP: 44,123. | MFDTS: \$3,044,872 MFHTUP: \$1,895,109 | MFDTS: https://buildingsolutions.honeywell.com/Cultures/en-US/Markets/Utilities/ MFHTUP: www.ecosconsulting.com/solutions/utility |
| | On Demand Efficiency (SCG) | Residential; MF building owners or management | Program sells and installs demand control recirculation pumps to qualified customers. | MF residence apartment complexes with central boilers and a timeclock or no control. | Potential participant is contacted via phone and screened for applicability; participant is sent program collateral and directed to program website for more info; participant submits a rebate application. | 810 | \$2,575,400 | www.oderebateprogram.com |

| Type | Program | Target Audience | Offering | Eligibility | Application Requirements | Target # Units (2010-2012) | Program Budget (2010-2012) | Program Websites |
|----------------------|---|--|--|---|--|---|----------------------------|--|
| THIRD-PARTY PROGRAMS | Hot Water Control (SDG&E) | Non-residential; MF property owners/managers | Program implements domestic hot water (DHW) control systems in hotels, motels, resort condominiums, and senior care facilities plus other associated hot water end uses (e.g., on-site kitchen and laundry facilities). | DHW control systems in hotels, motels, resorts and senior care facilities plus other associated hot water end uses (e.g., on-site kitchen and laundry facilities). | Customers will participate in a web-based interactive presentation which uses as an example technology on similar facilities to those installed (size and plumbing configuration). | # of installed lodging rooms: 55,000 # of installed kitchen/laundries: 360 | \$2,985,110 | www.savegas.com/PagesPublic/Programs.aspx |
| | California Multifamily New Homes (PG&E) | Developers/builders for new construction and significant remodel | Performance based incentives starting at \$0.18 / kWh, \$0.73 / therm, and \$27.63 / kW at 15% > Title 24. Incentives plateau at 45% > Title 24. \$100 / unit base incentive. Additional incentives for energy consultants at \$50/unit and third party verification at \$60/unit that cap at 200 units. | New MF construction and performance based "gut and remodel" of existing MF structures. New construction, affordable and market rate MF complexes of three dwelling units or more. | Though projects can apply at any time prior to completion between 1/1/2010 through 12/15/2012, applying early in the design phase is highly recommended to ensure acceptance of proposal. Application package includes signed application, W9 form, building plans, Title 24 documentation, and service territory verification | N/A | \$4,408,293 | http://multifamily.h-m-g.com/ |

