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Appendix B

General Reference Information

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*



Final Report
April 11, 2011

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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 deliver 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)

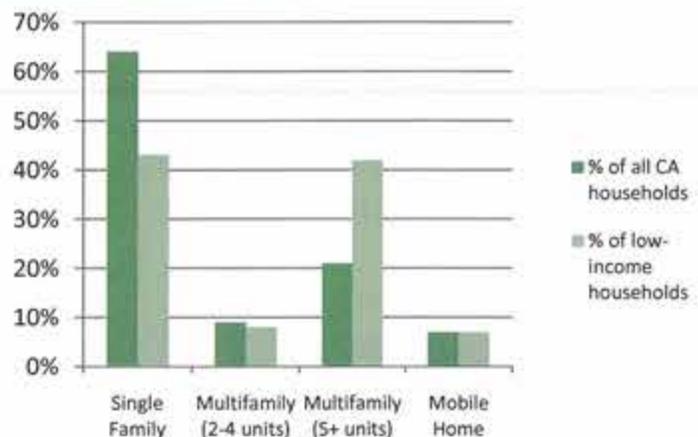
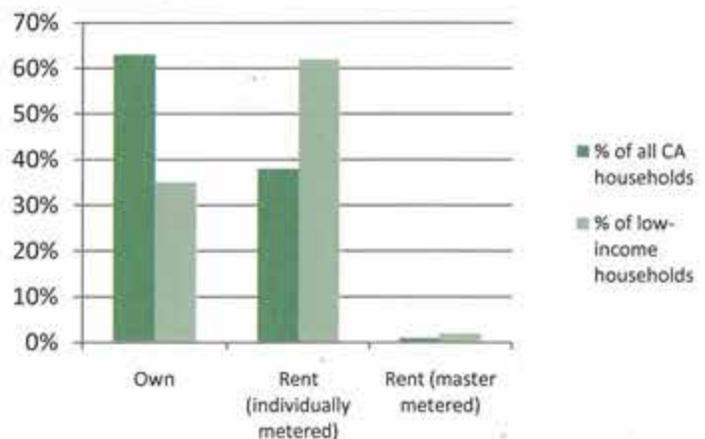


Figure 2. Distribution of California Households by Home Ownership

(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

Physical configuration: High Rise/Low Rise	<ul style="list-style-type: none"> •Reference codes and standards for design, construction and energy savings analysis is different for low-rise vs. high-rise structures. •High-rise buildings are commonly classified as non-residential structures, and in California their specifications span residential and non-residential codes.
Building ownership: Affordable/ Market Rate	<ul style="list-style-type: none"> •Low-income multifamily sector faces unique financing structures and regulatory restrictions.
Unit ownership: Rental/Condo	<ul style="list-style-type: none"> •Owners and tenants have different economic motivations to invest in improvements.
Ownership & physical configuration: Residential/Common Areas/Mixed Use	<ul style="list-style-type: none"> •Different reference standards apply to residential and non-residential spaces. •Residential programs often miss savings opportunities in commercial and common areas, while commercial programs often miss opportunities in residential dwelling units.
Ownership & physical configuration: Central/Individual Systems	<ul style="list-style-type: none"> •Building may have individual or central heating, ventilation and air conditioning (HVAC) and domestic hot water (DHW) systems. •Upgrade decisions are affected by type of system, who owns it and who pays utility bills.

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).

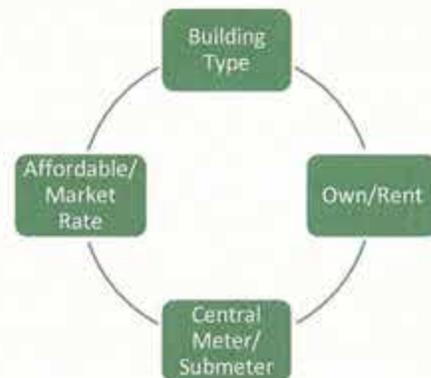
Because multifamily building types are so diverse, it is highly challenging to develop program delivery models, incentive programs and consistent packages of building upgrade measures that meet the needs of every situation.

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).

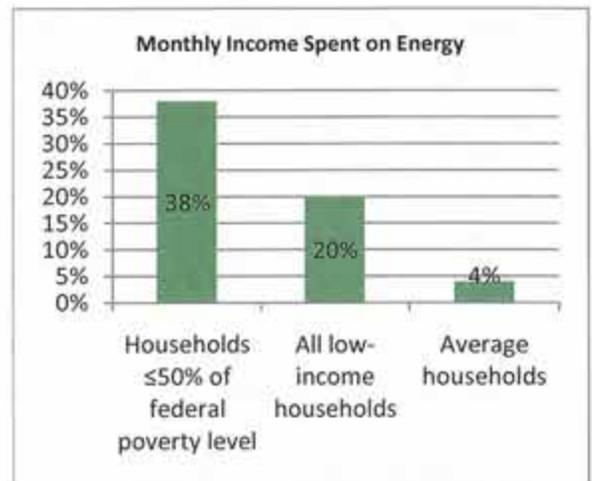
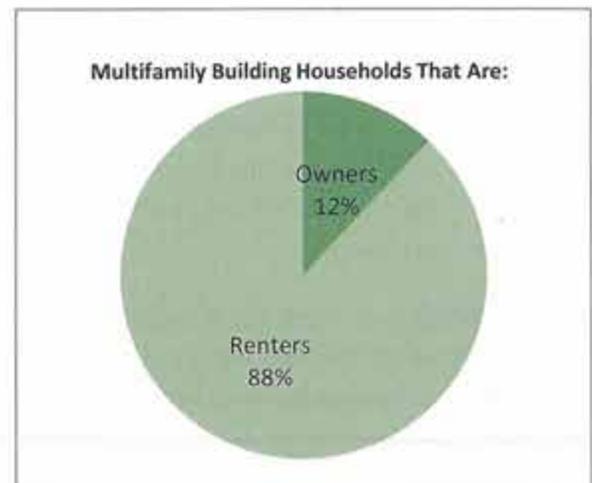
The predominance of central systems, particularly central water heating systems, in multifamily buildings often skews the split incentive: the developer might pay for central utility bills and therefore only be interested in upgrading the systems for which they will see a financial payback. This tends 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), Hescong 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 gage 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

²⁷

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.

ACKNOWLEDGMENTS

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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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 Doug Beaman, Doug Beaman Associates
 Christopher Becker, Build It Green
 Megan Billingsley, Lawrence Berkeley National
 Laboratory
 Narish Bonakdar, Benningfield Group
 Andy Brooks, Association for Energy Affordability
 Cal Broomhead, SF Environment
 Nathan Bruner, Sempra
 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 Christiano, 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 Horl, 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			Total Cost for building divided by 40
Measure	Baseline	Improved	Material	Labor	Total/DU	
Attic Insulation	R-30	R-38	0.40/s.f.	0.45/s.f.	\$300	1.5 ton AC system
Refrigerant Charge	Standard	Verified	\$12/ton	\$37/ton	\$72	
Seal Duct Leakage	28%	15%	\$56/DU	\$442/DU	\$498	Estimated Cost
Duct Insulation	R-2.1	R-8			\$350	
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.

Investor Owned Utility Programs Available for the Multifamily (MF) 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/energypartners www.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. PG&E: \$13,521,688; SCE: \$24,894,000; SDG&E: \$4,398,013; SCG: \$8,570,086	www.pge.com/new/homes 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.

Investor Owned Utility Programs Available for the Multifamily (MF) Sector

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	<p>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</p> <p>MF incentive packages currently under development.</p>	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.socialgas.com/rebates/residential PG&E website to be determined.
	Multifamily Energy Efficiency Rebate Program	MF complex owners/managers of existing buildings	<p>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 LIFE offerings.</p>	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.	<p>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.</p>	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.socialgas.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).

Investor Owned Utility Programs Available for the Multifamily (MF) Sector

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/energy/index.html No website info has been supplied by PG&E, SCE, or SDG&E for this program.

Investor Owned Utility Programs Available for the Multifamily (MF) Sector

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/energy/savingsrebates 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/energy/savingsrebates/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.	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

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

Investor Owned Utility Programs Available for the Multifamily (MF) Sector

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
	Q/M 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 Provides 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.

Investor Owned Utility Programs Available for the Multifamily (MF) Sector

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	N/A	\$4,352,000 for PY2010-2011

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.

Investor Owned Utility Programs Available for the Multifamily (MF) Sector

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/solutions/utility 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

Investor Owned Utility Programs Available for the Multifamily (MF) Sector

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/laundry dries: 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/

**American Recovery and Reinvestment Act
Recommendations for Energy Upgrade California in the Bay Area**

Prime Contractor Name: Association of Bay Area Governments

Final Deliverable: White Paper on Policy Recommendations

Contract Agreement Number: 400-09-021

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EXECUTIVE SUMMARY

A. Paper Purpose

This final deliverable provides recommendations from the eight counties and the Association of Bay Area Governments that implemented Retrofit Bay Area under California Energy Commission (CEC) contract 400-09-021 related to the program design, marketing and outreach, workforce development, and financing components of Energy Upgrade California™. The purpose of these recommendations is to inform future CEC and California Public Utilities Commission (CPUC) funding opportunities, requests-for-proposals and other related energy efficiency policy initiatives and programs. These recommendations are focused on improvements, and changes going forward, to achieve deeper energy savings in building retrofits, expand contractor capacity, drive consumer demand, and inform and improve the program design. The Retrofit Bay Area Final Report provides a high level summary of the program's contractual deliverables, accomplishments, best practices, lessons learned, and program budget expenditures. In order to provide the necessary background, pieces of the final report are included in this paper and the final report in its entirety is included as an attachment.

B. Program Background and Approach

The Association of Bay Area Governments (ABAG) partnered with eight counties and a team of public and private partners to develop and implement Retrofit Bay Area, a comprehensive regional-scale residential retrofit program. The assembled partners represented 103 local governments in California's second most populous region with over 7 million residents, and a diversity of program expertise that draws together leadership at the local, state, and national level. Retrofit Bay Area was created to develop a program that would rapidly accelerate home energy upgrades (i.e., retrofits) across the region, achieve deep market penetration, and accomplish market transformation in alignment with State energy policy. The program was designed to help transition the region from the utility single measure approach to a whole building approach, in order to achieve deeper energy savings that meet State energy goals. The program was also designed to be highly transferrable, both statewide and nationally.

Retrofit Bay Area aligned local government workforce and stakeholder outreach pathways, business capacity, strategic and targeted local government agency marketing efforts, utility infrastructure, and consumer demand to implement an energy efficiency whole building market transformation program that completed the following:

- Leveraged government workforce, stakeholder outreach, and targeted marketing programs to engage the private sector to harness market forces and accelerate program participation
- Expanded the energy upgrade delivery capacity of building professionals and the industry growth through workforce development programs

- Drove consumer demand for home energy upgrades through innovative marketing and communication strategies that leveraged existing community and private-sector distribution channels and promoted word-of-mouth program promotion

C. Project Structure

Retrofit Bay Area acted as a regional energy network of the statewide Energy Upgrade California™ program (Energy Upgrade), developed and implemented by local governments in coordination with Pacific Gas and Electric Company (PG&E), the CPUC, and the CEC. Energy Upgrade is an umbrella brand with a one-stop-shop website (www.energyupgradeca.org) for home owners wanting to find qualified contractors to conduct energy saving improvements that will reduce energy use, make homes more comfortable, and improve indoor air quality. Energy Upgrade is an unprecedented energy efficiency market transformation program aimed at changing the historical single measure approach to a scientific whole building approach. In the Bay Area, the program is designed to leverage PG&E’s Investor Owned Utility (IOU) program incentives and QA/QC process, as well as the customer and community engagement resources, targeted marketing, workforce capabilities, and codes and standards of the participating local governments.



Figure 1: Retrofit Bay Area Energy Upgrade California Program Relationships

D. Top Recommendations from ABAG counties on Energy Upgrade 2.0

Local governments can provide the support and impetus for comprehensive energy management actions to fill the gaps in the utility program and help the state achieve its energy goals. ABAG counties have proven during this two year ARRA State Energy Program grant period that they can successfully operate an energy program by providing financing, funding local incentives, and successfully leveraging their local stakeholder infrastructure for extensive and intensive workforce training, and marketing and outreach. The goal is to increase the reach of ratepayer funds, and complement ongoing work occurring in existing partnerships.

To this end, Retrofit Bay Area local governments provide the following recommendations that should be prioritized for local government implementation in support of Energy Upgrade. For the remainder of this document, “local government” is used to refer to both regional (e.g. ABAG) and local (i.e. county

level) government agencies; recommendations to be considered “regionally” would tend toward implementation by a regional body while those to be considered “locally” would tend toward county level implementation. The body of this document also contains recommendations for other program partners, principally the CPUC and PG&E.

- **Leverage the existing local government infrastructure in the San Francisco Bay Area.** Provide significant funding through a Regional Energy Network, and/or Local Government Partnerships to maintain the regional Bay Area local government support for Energy Upgrade California that was initiated with the Association of Bay Area Governments’ Retrofit Bay Area program..
- **Launch regional financing strategies.** Provide regional affordable-financing to fund building retrofit projects such as credit enhancement tools (e.g., loan loss reserve), interest rate buy-down programs, and Property Assessed Clean Energy (PACE) programs, and; provide contractor financing/growth capital to purchase equipment, and manage cash flow problems caused by IOU rebate processing times.
- **Pilot “a la carte” menu-based incentive program.** Local governments are in the best position to launch a pilot program using an “a la carte” menu approach of energy-savings-based point-weighted measures such as Flex Path in Los Angeles County ¹. Local governments can be more flexible and nimble than PG&E and can easily streamline and implement efficiencies by quickly launching a simpler program design, reduce overall administrative burden, and reduce job processing time. A menu-based incentive can replace the existing IOU Basic Package, allowing the utilities to focus their efforts on a performance based program that offers higher levels of incentives.
- **Increase incentive offerings and conduct research on effectiveness.** Offer regional assessment rebates and evaluate their effectiveness. Offer rebates for assessments or project “kicker” to encourage participation in the IOUs Advanced Package and evaluate how effective the rebates are in leading to completed upgrades. By administering assessment rebates (for test-in and test-out), local governments have access to real-time feedback on project participation, which enables fine-tuning of consumer marketing strategies and contractor support. Until broader data sharing obstacles with the IOUs are resolved, the only way for local governments to conduct meaningful program EM&V is by using the project data obtained by administering a rebate.
- **Disaggregate project data.** Provide Bay Area local governments with disaggregated data on completed upgrades to enable evaluation of: marketing and outreach efforts, the impact of

¹ Such efforts could build upon the Energy Upgrade California in Los Angeles County Flex Path Program: https://energyupgradeca.org/county/los_angeles/flexpath_overview

incentives upon project uptake, and program cost-effectiveness tied to both energy and non-energy benefits.

- **Launch large-scale multifamily program.** Launch a comprehensive multifamily whole-building retrofit program in the Bay Area utilizing the lessons learned and best practices from the existing pilots and California Home Energy Retrofit Coordination Committee Recommendations including initiatives of targeted outreach, comprehensive technical assistance, audit rebates, professional training, and addressing split incentives.
- **Continue marketing and outreach.** Continue to conduct local government Energy Upgrade California marketing and outreach campaigns and support these with regional “mass media” marketing campaigns (i.e. targeted online or TV buys) to promote general consumer awareness.
- **Expand real estate partnerships and promote market differentiation for green properties.** Continue to train real estate professionals on the benefits of energy upgrades and the value of including green features and labels in MLS listings. Build upon an East Bay pilot program to promote “greening the MLS” throughout the region. Expand a Better Buildings Program Green Labeling pilot that has been launched in Alameda and San Francisco Counties to achieve greater market value and transparency for green properties at time-of-sale transactions.
- **Support contractors through training and consumer outreach.** Fund widespread and broadly defined contractor training/mentoring including required technical training (e.g., Building Performance Institute, HERS Building Performance Contractor, combustion safety testing, field technician skills) and business development training (e.g., EnergyPro, sales and marketing, financing). Leverage all program components (e.g., marketing, QA/QC, etc.) to position Participating Contractors as trusted building professionals.
- **Provide “third party” property owner and contractor support.** Provide neutral “third party” assistance and advising to property owners as they enter and begin to navigate the energy upgrade process and apply for associated rebates. Provide same assistance and advising to contractors applying for local government rebates. This role could be served by local governments or non-profit organizations.

PROGRAM GOALS

A. Retrofit Bay Area Program Goals

The original goals of Retrofit Bay Area mirrored those of the American Recovery and Reinvestment Act of 2009 (ARRA): (a) energy savings, (b) job creation/preservation, and (c) economic recovery. The program was designed to implement a comprehensive whole building energy efficiency retrofit program for existing residential buildings.

To achieve these goals, Retrofit Bay Area identified a set of three core program objectives that addressed the major barriers to market transformation and served to guide program design. These three objectives aimed to spur residential energy retrofits.

- Provide financing mechanisms, including both Property Assessed Clean Energy (PACE) and alternative financing, to address the high upfront cost of energy retrofits
- Demonstrate more effective marketing and outreach methods to inform and motivate property owner participation
- Streamline participant, contractor, and administration processes to reduce the high transaction costs and build a quality green workforce

ABAG was the prime contractor, lead facilitator, and convener of the Retrofit Bay Area program. ABAG led project management activities, had primary budget and contract oversight, and maintained a program website and call center. ABAG convened bi-monthly Steering Committee meetings, and quarterly Program Advisory Committee meetings. The Steering Committee was composed of one representative from each county. Their primary role was to seek agreement on the implementation of the regional program design, marketing and outreach strategies, workforce development support, and local stakeholder engagement. The Program Advisory Committee included the Steering Committee and key program stakeholders from the building trades, education, non-profit, real estate, and workforce development sectors, who were the on-the-ground implementers of the program. Their primary role was to advise the Steering Committee on the practicality of regional program activities and to obtain feedback and buy-in from their respective constituencies in support of the program. The following figure illustrates the organizational structure of the program.



Figure 2: Funding/Contractor Organizational Structure

In addition to ABAG, the Retrofit Bay Area partners consisted of eight local lead agencies representing eight of the nine Bay Area counties. Each of these agencies was responsible for planning and implementing their local Energy Upgrade programs. Two local lead agencies, StopWaste.org and the Sonoma County Regional Climate Protection Authority (RCPA), had the lead role in producing regional

deliverables (Table 1). These regional deliverables benefited all local government partners by establishing regional consistency of program design, quality assurance, marketing templates, and workforce gaps analysis for use by all participants. Bevilacqua Knight, Inc. (BKl), a private energy consulting company, was selected through two separate competitive procurement processes by StopWaste.org and RCPA to support program design, implementation, and administration. In that role, BKl provided administrative support, completed key regional deliverables, and provided oversight of sub-consultants charged with completing various regional deliverables.

Table 1: Regional Deliverables

ABAG	StopWaste.Org	Regional Climate Protection Authority	Local Governments
Contract Administration and Program Oversight	Regional Marketing Plan and Collateral	Regional Reporting Administration	County-Level Reporting; Subcontracts with implementation partners;
Coordinate Program Advisory Committee and Steering Committee	Regional Multifamily Program Design, Training Curriculum, Contractor Requirements, HERS II Software Module, Stakeholder Outreach, Asset Manager Tool, Quality Assurance Protocols	Regional Workforce Development Plan	Implementation and customization of program; Coordination and management of activities and partners for local workforce, education, building trades, realtor, retailer, and marketing and outreach
Regional Local Government Website	Regional Incentive	Regional Participant Recruitment	Local policy, codes and standards; Links to Climate Action Plans
Regional Customer Support Call Center	Regional Web-Based Tracking Platform	Regional Public Policy Recommendations, Implementation Plan	Health, Safety, and Public Service
Contractor Scholarship Management	Regional Real Estate Training Curriculum, Multiple Listing Service Green Features Guidance Document	Regional Contractor Qualifications, and Certification Requirements	Contractor training workshops and homeowner outreach and support

B. Alignment of CPUC, PG&E, and Local Government Strategic Goals

Retrofit Bay Area was part of an unprecedented level of coordination between state agencies, local governments, and IOUs initiated to leverage resources and reduce confusion in the market. However, due to conflicting priorities and timelines there were many challenges to implementing a coordinated approach. The Prescriptive Whole House Retrofit 2010-2012 residential energy efficiency portfolio of the four California investor owned utilities had lower program targets than the local governments, creating a misalignment in program delivery and coordination. PG&E's original target for their entire territory was 15,500 single family upgrades to be conducted from January 2010 to December 2012; within the ABAG region (as just a part of PG&E's territory), the original local government program target was 15,000 single family and 2,000 multifamily upgrades to be conducted between July 2010 and March 2012. Regardless of the fact that these original targets were later reduced by both PG&E and ABAG local governments, in the future alignment between these agencies' targets will be necessary for more successful program delivery and coordination.

C. Key Outcomes

Retrofit Bay Area sought to create jobs and stimulate the economy through a comprehensive program to implement energy upgrades in existing residential buildings. In light of the activities and accomplishments outlined above, Retrofit Bay Area participants are proud to have achieved the following key program outcomes:

Creation of a market for whole building energy retrofits

Prior to the launch of Retrofit Bay Area and Energy Upgrade California, there was no regional market for whole building energy retrofits. Before these programs started, individual entities were advancing various components of the whole building approach. Building performance contractors were performing energy retrofits through the national Home Performance with ENERGY STAR program, which was administered by the California Building Performance Contractors Association. Local governments were exploring financing options, but without consistent loading order requirements. Utilities were offering single measure energy efficiency rebates but had no rebates for comprehensive whole-building projects delivering deeper energy savings. Each effort had its own terminology, protocols, and priorities. Retrofit Bay Area and Energy Upgrade California effectively changed this landscape, introducing consistency and standardization that has enabled the regional market to evolve into a statewide program. In an unprecedented collaboration, contractors, local governments, and utilities have developed consistent messaging, standard contractor participation requirements and quality assurance protocols, and complimentary incentive programs.

Alignment of infrastructure for ongoing program support

Central to program successes to date, and to continued improvement of the program moving forward, is the unique aligned infrastructure of program partners. Coordination in program design and implementation between contractors, local governments, and utilities paved the way for the creation of this new regional market. While it is clear that there are challenges within the current program

design, this evolving collaboration will enable program partners to continue to refine the program and effect those changes that are most necessary to maintain the momentum the program has established.

A regional market primed for continued growth

Retrofit Bay Area primed the region's whole building energy retrofit market for increased and continued growth. Marketing and outreach activities have begun to accelerate energy retrofit uptake as messaging has been refined and critical grass roots relationships have been established. This layered approach, initiated by local governments, complements contractor and PG&E Whole House Rebate marketing efforts, allowing multiple and aligned marketing outreaches to consumers. Workforce development activities have expanded Participating Contractor skills and increased the capacity of the regional workforce to fulfill key roles within the whole building energy retrofit industry. Finally, quality assurance and reporting protocols have promoted consumer confidence in work performed under Energy Upgrade California, and enabled local governments to begin communicating program accomplishments to constituents. In addition, Retrofit Bay Area conducted an indoor air quality pilot to redefine and expand consumer understanding of the values and benefits to be derived from energy efficiency upgrades.

While achieving market transformation within the 13 months of program operation under Retrofit Bay Area is unfeasible, it is important to recognize that the program has paved the way for a full market transformation to follow, wherein the whole building energy retrofit industry achieves increased energy savings while spurring job creation and economic development. The unprecedented partnership developed under Retrofit Bay Area between local governments, PG&E, and contractors has yielded the current program accomplishments cited above. Retrofit Bay Area's local governments and program partners are actively seeking the means to build on these accomplishments to provide continued support of Energy Upgrade California.

In a final analysis of program goals, Retrofit Bay Area offers the metrics in Table 1.2. Retrofit Bay Area cites energy retrofit totals based upon the PG&E Whole House Rebate program data. Job creation data are based upon program grant funds, as well as leveraged funds, and are calculated from the CEC directive for this data.²

² "Use the Council of Economic Advisers' Estimates of Job Creation (May 2009) from the American Recovery and Reinvestment Act of 2009, to provide a formula-based estimate of jobs created by the proposed program. Divide the total investment in the program by \$92,000 to estimate the number of direct jobs created. The total investment shall include ARRA SEP funding and all leveraged funds." — Request for Proposal California Comprehensive Residential Building Retrofit Program #400-09-403 (CEC October 2009).

Table 2: Retrofit Bay Area Key Outcome Metrics: PG&E Whole House Rebate Data

Single Family Retrofits promoted through PG&E Whole House Rebate Program ³	
Number of Retrofits Achieved (Completed)	1,029
Number of Retrofits Promoted (Completed and in Process) ⁴	1,643
Average Energy Savings per Retrofit	32%
Average kWh savings per Retrofit	1,163
Total kWh saved (Calculated from Average for Completed Retrofits)	1,196,727
Average Therm savings per Retrofit	391
Total Therms saved (Calculated from Average for Completed Retrofits)	402,339
Average Cost per Retrofit	\$14,439
Total Value of Retrofits Incentivized (Calculated from Average for Completed Retrofits)	\$14,857,731
Average Square Footage per Retrofit	1,874
Total Square Footage Retrofitted (Calculated from Average for Completed Retrofits)	1,928,346
Participating Contractors (All PG&E Territory)	206
Participating Contractors (ABAG Territory only)	90
Multifamily Retrofits promoted through Local Lead Agency Programs ⁵	
Number of Retrofits Achieved (Completed Units)	826
Number of Retrofits Promoted (Completed Buildings)	30
Total Value of Retrofits Incentivized	\$23,929,414
Total Square Footage Retrofitted	435,797
Job Creation – Retrofit Bay Area	
Jobs Created – Program Funds (\$11,350,000)	123
Jobs Created – Leveraged Funds ⁶ (Local Funds)	121
Jobs Created – Leveraged Funds ⁷ (Private Capital + PG&E Whole House Rebate Funding)	161
TOTAL⁸	405
Jobs Created – Associated PACE Programs ⁹	190

³ PGE Whole House Data for Retrofit Bay Area Program metrics as of 3/31/2012.

⁴ "Retrofits Achieved" were noticed as complete by PG&E as of 3/31/2012; "Retrofits Promoted" were noticed as at least initiated by PG&E as of 3/31/2012 and therefore reflect local lead agency marketing efforts to promote upgrades through 3/31/2012.

⁵ StopWaste.org and County of San Francisco metrics as of 3/31/2012; these programs were primarily funded through programs other than Retrofit Bay Area; the single family and multifamily data sets are inherently different based upon the goals of the separate program operators.

⁶ \$11,152,854 in Energy Upgrade aligned Local Funds reported through 2/29/2012.

⁷ \$14,857,731 in Private Capital and Rebate Funding for PG&E Rebated Retrofits through 3/31/2012.

⁸ Total jobs created by the program include direct jobs funded by Retrofit Bay Area directly, and indirect jobs generated by activities that leveraged program activities.

⁹ \$17,469,773 in PACE Lending through the Sonoma County Energy Independence Program through 2/29/2012; it is not possible to disaggregate Retrofit Bay Area only leveraged funds from this total.

Recommendations for Local Government Support of Whole Building Retrofits

Present whole-building energy retrofit programs have provided an essential initial step in moving from the limited capacity of the single measure approach to more integrated whole building models with much higher energy savings potential. What is needed now is to learn from the experience of the initial efforts of Energy Upgrade California and developing program improvements in virtually every aspect. Given the disparity between achievements and trends to date versus strategic state energy goals, it is likely that at least some of those improvements must be radical rather than incremental. In this report we suggest some of the most important big changes and how they might be achieved and integrated into an overall strategy for Energy Upgrade California in the short- and long-term.

The following is a vision of the broad range of program improvements that will be needed to reach the State's 2020 energy goals. Although these recommendations are an outgrowth of the regional program perspective, the policy recommendations can be broadly interpreted and applied statewide. In sum, this vision describes an unprecedented level of public engagement, public agency and utility commitment, legislative leadership and action, new and flexible regulatory innovation, new delivery business models, intensive program support, local government and community organization involvement, practical research, and attraction of private capital and financing models. Not everything can be implemented immediately and some recommendations may be better implemented using a phased approach; the conclusion of this report therefore offers recommended priorities and a division between immediate practical improvements and subsequent more far-reaching changes.

The following recommendations are presented in four major categories; Program Design, Marketing and Outreach, Workforce Development and Financing. Within each category, specific recommendations are offered for federal, CPUC/PG&E, and local government (both "regionally", tending towards a regional body, and "locally" tending towards county level) implementation as appropriate.

A. Program Design — Keep it Simple

Energy Upgrade California was designed to be a "one-stop-shop" to quickly connect property owners¹⁰ with the information and resources that would enable them to pursue the energy upgrades most appropriate for their needs. Multiple programs and program partners were united under this umbrella, with the California Public Utilities Commission (CPUC) and California Energy Commission (CEC) setting overall policy and direction and Investor Owned Utilities (IOUs) and Municipal Utilities, local governments, and participating contractors integrating their aligned programs and services.

¹⁰ The term *property owner* includes homeowners and, in some counties, owners of commercial and industrial properties.

Unfortunately, property owners and contractors, as the most critical Energy Upgrade participants, often complained about the complexities of navigating this multiparty collaboration.

The following recommendations are focused on how to keep the program design simple in order to increase property owner and contractor participation in the program and facilitate better information exchange between all program partners. These recommendations attempt to recognize the role that program partners have played, and will continue to play, in Energy Upgrade's program design as program policy and direction continues to be shaped at by the CPUC, CEC, and IOUs, and implemented by the local governments and participating contractors.

Work with program partners at the most effective levels

At the level of the CPUC/ PG&E:

- **Gain high-level regulatory and utility management backing for program design flexibility.** To maximize Energy Upgrade's possible contributions to State 2020 energy savings goals, the program must push the whole building upgrade market forward while also capitalizing on the potential benefits of changes within that market. The current program design and approval process is too slow, has too many individual and serial phases of review and approval, and does not allow for course correction or program enhancements in a timely manner based on market feedback (e.g. Basic Path). This means refining the existing program (e.g., more flexible menu based program design, reducing or eliminating home energy modeling requirements) while also more fully embracing existing and new technologies (e.g., incorporating individual measures such as pool pumps into the program, incentivizing even deeper energy savings by combining efficiency and renewable measures, increasing use of smart meter capabilities). This flexibility must not overburden or overcomplicate the market.
- **Develop a more practical program design.** Upgrade results (e.g., installed measures, energy savings, etc.) need to be reported as accurately as possible, but contractors should bear as little of this burden as possible as reporting methods are refined. Options for a more practical program design include eliminating simulation modeling on all homes, developing a menu of point-weighted measures, and using smart meter data to improve home audits; program improvements such as these can be tested using small scale pilot studies. Random sampling can also be used to confirm energy savings on an aggregate basis; responsibility for modeling can also be moved from contractors to program administrators. Especially for small companies just entering this industry, every hour spent processing rebates and associated energy models is time not spent in the field performing energy upgrades.
- **Keep home energy ratings such as HERS Whole House independent of IOU whole building upgrade rebate programs.** Initiatives such as rebates to promote HERS Whole House ratings need to be carefully deployed to avoid overlap and market confusion with the

energy retrofit components of Energy Upgrade. The integration of the HERS Whole House rating into Energy Upgrade created confusion among homeowners, some of who thought HERS Whole House ratings were required for the PG&E Whole House Rebate Program, and extra work for raters and PG&E Whole House Rebate program Participating Contractors, who had to explain to customers the complex relationship between raters and rating rebates and whole house contractors and the whole house incentive program.

- **Modify the CPUC cost-effectiveness determination to include non-energy benefits.** This is critical to capture the additional value of green building measures and initiatives to be promoted and/or incentivized by statewide interests and to achieve deeper energy savings and meet greenhouse gas goals. Furthermore, this will make it easier for such efforts at the regional or local level to be incorporated under the Energy Upgrade umbrella. Benefits should at a minimum include easily captured cost-effectiveness metrics such as water and waste water savings; other non-energy benefits that could be included with further research include greenhouse gas emission reductions, indoor-air quality, added property value, and other metrics as appropriate.
- **Redesign quality assurance and control protocols (QA/QC) to continue to assure public safety while reducing complexity and redundancy.** QA/QC desktop reviewers and field inspectors should apply consistent standards across all projects. Determinations of modeling solutions for unique circumstances or nuances of the program should be documented and communicated to all QA/QC staff to ensure consistency throughout the program; these same consistent determinations should be clearly communicated to contractors. QA/QC implementers should embrace a mentorship approach when working with contractors verses playing a strict enforcement role. Homeowners should only be requested to be present for one field QA/QC inspection (i.e., third-party or other protocol not performed by the contractor) from the program. QA/QC field inspectors should only report findings to the contractor and program administrators unless a critical safety error requiring immediate correction is found (inspector comments and feedback unnecessarily shared with the homeowner undercut the contractor).
- **Refine the energy predictive process by comparing predicted energy savings to actual utility bill data.** This will increase the accuracy of energy saving reported by program partners, which is critical to building property owner confidence in Energy Upgrade as the statewide brand and the home performance industry as a whole. Performing post-project energy performance comparisons will also provide valuable information on actual results of energy retrofit projects and which technologies are most effective.
- **Align state regulatory and policy agency activities to reflect the interrelated nature of energy and climate goals.** State agencies such as the CEC, California Air Resources Board, the Department of Public Health, and others working with State energy and climate goals

should be given the means to coordinate and incentivize all programs tied to these goals under the umbrella of Energy Upgrade.

Regionally and locally:

- **Utilize local government incentives to complement the utility program design and incentive.** Local government incentives can best promote existing utility programs and/or improve the value proposition of upgrades incentivized by utility programs by requiring no additional property owner and contractor burden. Property owners and contractors having to cope with multiple protocols and incentive documentation requirements results in additional time and work. Aligning local government incentive programs with Energy Upgrade protocols will eliminate these inefficiencies, provided that all program partners have real-time access to comprehensive program data regardless of the originator of that data. Furthermore, local governments are well positioned to develop and pilot new rebate programs that could later be adopted utility programs.

Centralize data/reporting regionally

At the level of the CPUC/PG&E:

- **Develop and implement a plan for data capture, mining, and distribution to program partners.** Comprehensive and consistent data reporting is critical for all program partners and their ability to both report on program successes (e.g., progress towards greenhouse gas emissions reduction targets) and improve program components (e.g., the effectiveness of targeted marketing efforts and workforce development strategies). New solutions are needed to overcome utility data reporting limitations due to customer privacy concerns so that individual upgrade data is easily accessible to all program partners.
- **Reduce duplicative paperwork and data entry for rebate processing.** Contractors and homeowners should not bear the burden of uncoordinated and unleveraged data needs from program partners. Within a single application/rebate process (e.g., the PG&E Whole House Rebate program), tools need to be offered to contractors to streamline customer and project data entry.

Regionally:

- **Interface with funding agency, state regulators, and utility parties.** The current infrastructure of program partners and existing communication channels developed under the Retrofit Bay Area program in support of Energy Upgrade California has built an effective regional model. This model should be further leveraged to maintain and expand upon the critical partnerships and program momentum that has been forged by to date.

- **Simplify reporting on grant activities.** Local government partners should concentrate reporting efforts on sharing simple program metrics and budget reporting to allow local government resources to be concentrated on program implementation.
- **Establish a program performance monitoring system to effectively communicate progress and feedback to funders/policy makers.** While local government partner reporting burdens need to be minimized, local governments have the deepest understanding of what Energy Upgrade property owner and contractors need and what is driving their participation in the program. Marketing, lead generation, and project data combined with homeowner and Participating Contractor surveys allow local governments to provide funders and policy makers with program progress data and informed recommendations on results and next steps; any monitoring system must allow for easy and transparent communication of this information.
- **Coordinate and disseminate metrics at the highest level possible.** Simple local government reporting requirements aggregated at the regional level would allow timely and efficient communication of program activities to all program partners.
- **Research data/reported metrics.** Regionally directed research will maximize the relevance of available data to locally and regionally identified research topics. Research topics currently prioritized by program partners include: valuation of non-energy benefits; predicted savings vs. SmartMeter reported savings; energy upgrade uptake vs. targeted marketing efforts; innovative energy efficiency program delivery models; removable barriers in energy efficiency regulatory processes; cost effectiveness tests for air quality; greenhouse gas emission reductions; and added property value of energy efficiency and non-energy upgrade benefits.
- **Coordinate research requests and program feedback received from all stakeholders.** Similar research and feedback topics could be communicated most effectively under a regional model, while disparate topics could be compared and used to inform each other.

Locally:

- **Report on limited metrics specific to local implementation activities.** A focus on clearly identified contract related metrics (e.g., number of consumers reached, etc) will allow local government partners to concentrate efforts on actual implementation.
- **Identify research priorities.** Local government partners are well positioned to identify research priorities because they interact with homeowners, Participating Contractors, and other industry players. Local governments also have local policy and planning needs that need to be informed by program data.

Reduce burdens for program participation for the most critical participants (property owners and contractors)

Regionally (in coordination with all program partners):

- **Reduce duplicative paperwork and data entry for incentive processing.** Local government incentive programs often vary in program design and timing. Consumer and contractor confusion caused by these variations can be best minimized by aligning local incentives with the utility incentive programs design and establishing a comprehensive data capture plan. This would make it easier for contractors and homeowners to maximize the value of Energy Upgrade's one-stop-shop and eliminate the present increased barriers to participation.

Continue to develop multi-unit and multifamily program components.

In coordination with all program partners, use multifamily pilot programs currently being implemented by select local governments¹¹ as models for developing program-wide multifamily services:

- **Develop whole-building incentives that complement standard financing sources for multifamily buildings.** Most multifamily owners will be leveraging significant sources of external funding to complete whole-building upgrades. Therefore, utility incentives need to be designed so that multifamily owners can utilize their own contractors, rather than being limited by a utility-approved list. This can be achieved through a rater/energy consultant delivery model instead of the typical single-measure direct install approach. Incentive amounts also need to be high enough to compensate for any additional cost an owner may incur for utility required combustion safety testing.
- **Offer a streamlined customer service experience for multifamily owners.** Multifamily owners should not be required to participate in multiple utility programs (low-income, single-measure direct install, and whole building) if they wish to undertake a whole-building approach. Owners are interested in doing a whole-building audit and then receiving a customized set of incentives that could be drawn from low-income, single-measure or whole-building program sources.
- **Leverage existing relationships with key multifamily stakeholders and promote a holistic approach in technical assistance, training, and grant program.** Multifamily owners are interested in a range of issues, including water conservation, waste reduction, renewable energy, etc. Local governments are the best positioned to conduct outreach and screen properties appropriate for comprehensive upgrades. Currently, PG&E does not plan to cover rebates for

¹¹ Local government multifamily pilot programs initiated in conjunction with Retrofit Bay Area include those by San Francisco Department of the Environment and Stopwaste.org in Alameda County.

energy audits. Therefore, local rebates for multifamily audits can help move the market, because they help owners make the business case for pursuing improvements.

- **Sponsor trainings for multifamily professionals to grow the market.** Local governments can organize comprehensive trainings for multifamily professionals, so that they are able to serve multiple financing programs, not just the utility rebate program. Because multifamily owners often need to layer funding sources, it is critical that different programs have some coordination of professional qualifications and training requirements.
- **Address split incentive issues.** Green labeling is one way for multifamily owners to overcome split incentive issues.

B. Marketing and Outreach — Drive Consumer Demand

Marketing and Outreach is a critical component for driving consumer demand. Retrofit Bay Area developed a Regional Marketing and Outreach Plan that provided guidance to local county implementers. Retrofit Bay Area leveraged local resources and stakeholder groups to provide a cohesive and comprehensive approach to marketing and outreach of Energy Upgrade California in the Bay Area that served as guide for Bay Area counties in promoting and launching successful local marketing campaigns. The Energy Upgrade California marketing campaigns have achieved an initial measure of homeowner education, and as they continue to push the brand will build broader awareness and higher participation, which is the key to future program implementation and market transformation.

The following recommendations are focused on how successful integration of multifaceted marketing and outreach efforts between the state, utilities, regional partnerships, and local governments can drive consumer demand. Energy Upgrade California Participating Contractors are the primary implementers of consumer education. As the “front line troops” and key sales force for the Energy Upgrade California, Participating Contractor participation in and feedback about local marketing and outreach is essential to program success. Local government partners also play a vital role in educating consumers about building science and the full range of energy efficiency and renewable energy generation options available to meet a variety of homeowner goals, needs, and budgets. These recommendations offer options for strengthening the marketing and outreach capacity of Participating Contractor and local governments and opportunities to continue to integrate additional energy programs into the one-stop-shop model.

Continue the Energy Upgrade Brand as the One-Stop-Shop

At the level of the CPUC/PG&E:

- **Maintain the Energy Upgrade California website as the one-stop-shop online resource.** The development of a comprehensive “one-stop-shop” website effectively connected property owners with program resources, incentives, Participating Contractors, and county specific information such as local incentives, event listings, news announcements, and newsletters. In addition the website connects Participating Contractors to consumer leads and information on trainings, marketing resources, workforce resources, and scholarship programs. The Energy Upgrade California website is a vital communication and education tool that provides property owners convenient access to program information and program partners a centralized portal for coordination and resource sharing. To increase the relevance of county Energy Upgrade landing pages to actual county Energy Upgrade programs, greater customization of these local landing pages must be allowed.
- **Make the Energy Upgrade California website more robust and consumer friendly.** While it is critical the website remain accessible and easily navigable, much could be done to

increase the consumer education through the Energy Upgrade website. The Action Planning Tool can better educate homeowners about how their property could be improved and better match them with contractors that perform these services (e.g., add more educational content on website about professional certifications and specialties, allow more room on Participating Contractor listings for contractors to highlight their experience, skills, and services).

- **Incorporate all CPUC/CEC initiatives under the Energy Upgrade California umbrella.** The one-stop-shop model for market transformation has the capacity to expand its scope to include additional energy efficiency programs such as those addressing occupant behavior (e.g., Flex Your Power), income-qualified energy services, emerging technology incentives, water conservation, and green labeling; demand response programs; HERS Whole House rating, and renewable energy initiatives. This strategy will allow Energy Upgrade California to clarify and integrate the benefits and services of each initiative (e.g., HERS Whole House rating as project verification/resale tool) into a well-defined consumer-friendly marketplace. By addressing the full range of property owner needs for residential and commercial properties, the Energy Upgrade California program can further streamline the marketplace, expedite consumer awareness about the multiple ways in which they use energy, and offer a holistic menu of choices to reduce and stabilize property owner energy costs.
- **Continue to apply the Energy Upgrade California brand to all marketing and outreach collateral and media advertisements.** Promoting the Energy Upgrade California brand is essential to growing the one-stop-shop model and supporting property owner participation. Continue to support program partners in the appropriate use of Energy Upgrade brand elements and integration of the brand with local government, other local program partner, and Participating Contractor and IOU marketing efforts to ensure consistent messaging and consumer recognition.
- **Communicate to property owners a “call to action” that generates a sense of urgency to participate in Energy Upgrade.** Develop and implement an IOU “call to action” marketing campaign that communicates key information and actionable steps to homeowners. Delivered by the State and IOUs, this “call to action campaign” would reinforce regional/local Energy Upgrade California marketing campaigns and support program credibility.
- **Continue to partner with Local Governments to deliver local marketing and outreach.** Local government partners in Energy Upgrade California have built effective marketing and outreach campaigns that fulfill their role as protector of community health and safety in the context of climate change. These campaigns use the Energy Upgrade California brand customized with local messaging and engage local governments and business, community,

faith-based, and nonprofit organizations to promote Energy Upgrade. This local stakeholder-based approach engages trusted local leaders and satisfied Energy Upgrade homeowners as credible spokespersons for the program, provides opportunities to partner with local allies, helps avoid duplication of effort and market confusion, and provides additional outreach channels through supporting group meetings, newsletters, and websites.

- **Collaborate with local governments to target consumers.** Market research and local community data are valuable resources for identifying categories of property owners with high degrees of interest in energy retrofit services. Several Energy Upgrade local government partners have used local and regional market research and local building, demographic, and assessor data to map the location of likely Energy Upgrade customers. This mapping tool could be implemented statewide in collaboration with local governments; in addition, the value of the mapping tool could be enhanced if utility account data on energy use were made available to further refine the map accuracy.
- **Align and coordinate program service areas for all program partners.** During early program implementation, lack of coordination between program partners led to multiple marketing messages and consumer confusion. Aligning and coordinating program service areas, messaging, and outreach activities for PG&E, local governments, and other program partners such as Ecology Action would ensure a unified marketing message, reduce consumer confusion, increase program awareness and understanding, and generate demand.¹²

Regionally (in coordination with all program partners):

- **Refine regional market research with program results and new research.** Market research helps identify target audiences, property owner motives and considerations, key marketing messages and delivery channels, and provides a basis for the marketing strategies to drive participation. Valuable data has been collected during initial program implementation; this data combined with new areas of investigation offer an opportunity to refine market assumptions and more effectively target outreach activities.
- **Maintain brand guidelines/templates and collateral artwork components.** Maintaining brand templates and press materials at the regional level that are shared, customized, and distributed at the local level supports the brand integrity, reduces customer confusion, and leverages local marketing programs to increase consumer awareness.

¹² Sonoma County offers an example of a successful integration of multiple programs where the Sonoma County Regional Climate Protection Authority collaborated with the Sonoma County Energy Independence Program (PACE) on a single marketing campaign.

- **Conduct regional “mass media” marketing campaigns to promote general consumer awareness.** Designing and implementing regional mass media advertising campaigns (e.g., radio, television, print, Web) supports local marketing campaigns by increasing general consumer awareness of the brand. An increase in community awareness of Energy Upgrade California supports Participating Contractors as they process program leads and generate new leads through their own marketing activities. Increased general awareness also supports local government marketing campaigns designed to deliver multiple “touches” to target audiences and in engaging local allies to promote the program.
- **Maintain clear program priorities across aligned and complementary initiatives.** Key program priorities (e.g., loading order, whole-building approach, greenhouse gas emission reduction, economic recovery) are essential to fulfilling State energy goals. As new or existing local, regional, and state energy programs are integrated into the Energy Upgrade California one-stop-shop, it will be important to work with these energy program implementers to ensure their programs align and complement Energy Upgrade California priorities.
- **Train local real estate professionals in the features and value of energy upgrades and green labeling.** Real estate professionals are allies on two fronts: they can educate their clients about energy or green home features and they can participate in documenting green features on the Multiple Listing Service (MLS), where available. Early communications with the real estate industry indicate that MLS providers are more likely to consider adding green features and labels if their real estate agents ask for that service. In addition, real estate agents have ample opportunity to educate their client about efficiency and green features once they have received training to ensure they are prepared to offer reliable information. Local government partners are well positioned to facilitate real estate agent trainings and participate in ongoing dialogue with local MLS groups to encourage adoption of green features.
- **Green labeling can create additional value for a home at time-of sale.** Research conducted in other parts of the U.S. and Europe shows that green labeled homes sell for a premium. This additional value at time-of-sale can help homeowners justify making energy improvements to their home, particularly in the mild climate zones where the payback for advanced upgrades is lengthy. Alameda and San Francisco Counties are sponsoring a California based study that will be released in the second quarter of 2012.

Locally:

- **Continue to conduct local government Energy Upgrade California marketing and outreach campaigns.** Local lead generation is enhanced by customized local marketing and outreach campaigns that leverage local business, community, and government groups;

trusted local opinion leaders; local Energy Upgrade California homeowners; and local Participating Contractors. Leveraging an outreach network composed of business, community, faith-based, and government groups allows local marketing campaigns to use existing communications channels and local relationships gain support of local leaders and deliver the program message to large groups where they already gather. Using state branding elements and local messaging and partner alliances, local marketing campaigns also bring the program message directly to property owners where they live, work and play — to create a community dialogue about the value and importance of taking direct action to reduce energy use and greenhouse gas emissions.

- **Support local “mass media” marketing campaigns to promote general consumer awareness.** Mass media advertising campaigns (e.g., radio, television, print, Web) can be very effective at generating website visits and increasing consumer awareness of the benefits of energy upgrades. Local government partners are well positioned to implement customized, co-branded local mass media campaigns that reach local audiences with compelling local messaging and local partner support. These campaigns need to be planned to as not to cause confusion with neighboring agencies marketing their own programs, though adoption of earlier recommendations to align incentive program offerings will also reduce possible confusion from overlapping campaigns.
- **Support earned media, and local case studies to promote general consumer awareness.** Local marketing campaigns are enhanced with earned media (e.g., articles, blogs, radio, and television show interviews) featuring newsworthy events and interviews with local Participating Contractors, homeowners, and program representatives. Local energy retrofit case studies with homeowner testimonial and analysis of project data are another important tool in generating interest in the program. Local government partners are well positioned to leverage existing press relationships for earned media opportunities and provide case study profiles for use on the Web, in advertising, and in outreach events such as Home Tour and Energy Champion events.
- **Maintain contact with local stakeholders and industry partners to communicate program benefits and obtain feedback.** Local stakeholders and industry partners can support program success by offering advice and insight into the needs and challenges of their constituencies. Maintaining contact with these groups through an Advisory Committee or other means allows local government partners to early on detect new challenges that may lead to a course correction or successful strategies that can be expanded.
- **Implement and evaluate innovative community-based marketing programs with local group partners to generate leads.** An effective method of generating leads is to engage local organizations (e.g. churches, schools, community based organizations, etc.) to encourage member participation in Energy Upgrade California by offering various types of

rewards to the partner group for each lead. This model effectively targets marketing activities and funding to high value groups and leverages the relationships and enthusiasm of the group members in carrying the energy retrofit value to interested homeowners.

- **Provide one-on-one assistance to property owners.** Because building science and the whole-building approach are new concepts for property owners, early experience show that many homeowners value having a trusted third party guide to help them navigate the energy retrofit process. Local government staffs are well positioned to offer that neutral third-party guidance and answer questions honestly and without bias.
- **Engage local cities, and other local energy services partners, to align local initiatives and clearly communicate long term program initiatives/commitments.** Local city incentives and local energy programs (e.g., nonprofit programs, income-qualified programs, IOU energy partner programs) can be very effective at increasing upgrades and close coordination between cities and local energy program and the local government lead agency is a critical part of program implementation. Encouraging cities and local energy partners to align their incentives and services with the utility incentive programs will facilitate easier program use by contractors and property owners.

Continue to advance marketing initiatives just begun under current programs

Regionally:

- **Engage in ongoing effort to encourage Multiple Listing Service (MLS) groups to include value-add green features.** Retrofit Bay Area established a Real Estate Working Group to address how best to incorporate green features into the MLS. This group produced *Guidelines for Greening Multiple Listing Services in California*, which recommends steps for adding green and efficiency features to MLSs statewide. Because MLS groups are individually owned and each administers its service independently, the process of gaining interest and consensus on green features is complex. In addition, feedback from the real estate industry indicates that realtor demand for green features is needed in most cases to instigate a change. A one-year Bay Area-based pilot program has been proposed to test the recommended guidelines. Regional and local partners can support this effort by staying informed and communicating developments to local leaders who are positioned to champion green features.
- **Continue to promote bulk/preferred purchasing models.** Initial programs to offer these services found that it is difficult to get Participating Contractors to change vendors due to established relationships and many did not have the capacity to absorb the administrative requirements to participate. Simplifying the bulk purchase program administration and

offering support to establish participation by contractors are good next steps to improving this service and affording the benefits of cost reduction to Participating Contractors.

Locally:

- **Implement partnerships with local home improvement retailers.** Local government-sponsored Retailer Outreach Programs can be instrumental in reaching locally owned businesses, many with a track record of community involvement, by providing in-store marketing displays, in-store training for staff, and in-store homeowner workshops and information tables. These resources allow the participating retailer to offer added value to its customers while local marketing campaigns reach homeowners through an additional outreach channel. Participating Contractor involvement in the in-store homeowner workshops and tabling also provides additional lead generation opportunities.

C. Workforce Development — Expand Contractor Capacity

One of the goals of Energy Upgrade California was to set standard credentials and qualifications for contractors performing whole building energy retrofits. This uniform set of standards created statewide consistency and helped streamline requirements for contractors entering, and looking to scale up in, the evolving home performance industry. While this has promoted a high level of quality workmanship and consumer protections, it also required contractors invest thousands of dollars and hundreds of hours to master the necessary training and equipment.

The following recommendations are focused on how to expand contractor capacity to participate and grow in the program. For those contractors already in the program, this means increasing the number of energy retrofits that each contractor is performing. For non-participating contractors, it means clearly demonstrating how and why they should participate in the program. These recommendations attempt to recognize that certain strategies will be critical to address issues with the current program design and required credentials and qualification, while other strategies that may better engage contractors would be fundamental shifts in program design and required credentials/qualifications.

Assist contractors and building professionals participating in Energy Upgrade to meet and exceed program standards and participation requirements.

At the level of the CPUC/PG&E:

- **Assure contractor capability through intensive quality verification and mentoring to emphasize improvement instead of penalty.** Online contractor reference resources should be complemented with field support upon request; field job verifications and inspections could provide a prime opportunity to provide field mentoring to Participating Contractors.
- **Allow immediate job approvals for qualified contractors with streamlined QA/QC protocols.** Participating Contractors performing a sufficient volume of upgrades with consistent quality that meet or exceed program QA/QC desktop review and/or field inspection protocol should be provided a fast-track option for job and rebate approval. This would decrease the time required for “fast-track qualified” contractors to complete their sales and job installation cycle, and allow for increased numbers of upgrades to be completed. Furthermore this would allow program partners to provide an increased amount of mentoring to new or lower volume contractors by focusing existing QA/QC resources on those contractors with the greatest need for this attention.
- **Mitigate the impact of any mid-course program design modifications.** Changes within any Energy Upgrade incentive program impact Participating Contractors and potentially various other program partners. Regardless of scale, frequent changes decrease a Participating Contractors’ confidence in how they can plan around program components in the long

term. Furthermore, such changes can complicate the education process between a contractor and a homeowner, as seen in the roll out of HERS Whole House rebates. Accurate and timely information on program modifications and, where possible, the implementation of changes on a quarterly rather than as needed basis would mitigate these impacts.

Regionally:

- **Serve as central communication hub for coordination of regional incentive programs and general program feedback.** Participating Contractors typically work within a service territory that is larger than a single county/municipality. Therefore regional structures for communicating to contractors on applicable program components, and to program partners with contractor feedback, provides an efficient means for enhancing these critical Energy Upgrade partnerships.
- **Reinforce communication on PG&E Whole House Rebate Program changes.** Upon receipt of official changes within Energy Upgrade incentive programs, regional communication to contractors should reinforce any communication about the changes and be sufficiently informed in order to direct contractors to the appropriate contact/resource for access to and follow up on such changes.

Locally:

- **Reinforce communication on PG&E Whole House Rebate Program changes.** As per above, local government partners should be appropriately informed to support communication of official changes within Energy Upgrade incentive programs in order to support local contractors (e.g., additional local training such as for EnergyPro).

Assist contractors and building professionals participating in Energy Upgrade to adjust/expand their business model as necessary

At the level of the CPUC/PG&E:

- **Provide trainings to help Participating Contractors develop non-technical skill sets to increase sales/capacity.** The success of the whole building upgrade industry and Energy Upgrade incentive programs depends upon Participating Contractors' ability to navigate and excel within an evolving marketplace. This marketplace is being shaped by market forces as well as the activities of program partners, so wherever possible these partners should provide extensive support to help Participating Contractors meet the upgrade targets set by government partners. Necessary non-technical trainings currently identified by program partners include: EnergyPro training, Sales and Marketing training, report generation, business management, and business model innovation.

- **Offer subsidized financing for necessary contractor investments.** Affordable and accessible growth capital allows contractors to scale their business through investments in training and equipment and assistance with cash flow. It costs thousands of dollars for one field crew to be trained and equipped to perform whole building upgrades. New contractors looking to participate in Energy Upgrade are unsure of the revenue they can generate through Energy Upgrade and perceive this investment as a barrier, while Participating Contractors looking to expand their number of field crews must have the upfront resources required to do this. See “Financing Recommendations” for more details.
- **Coordinate timing of workforce development programs with job creation results and estimates.** Early in the Energy Upgrade California implementation, workforce development partners devoted green job grant funding to preparing workers for home performance and HERS Whole House rater jobs. The training effort took place before Energy Upgrade California was launched, which led to a gap between newly trained workers and anticipated job creation from Energy Upgrade California program. Project and job creation data from Energy Upgrade California can be used to inform workforce development partners as they plan programs that better align actual need with qualified job candidates. A job gap analysis prepared for the regional partnership offered an additional resource for workforce development planning. Furthermore, workforce development programs need to be given clear and consistent direction as to the credentials and backgrounds required by Energy Upgrade programs (e.g., certain workforce development programs have trained formerly incarcerated individuals to work in green building, but PG&E requires clean background checks to enter properties being upgraded).
- **Increase the functionality of the Energy Upgrade statewide website to better serve all program contractors and building professionals.** Be it a rater, participating whole house contractor, solar installer, or another building professional in any program under the Energy Upgrade umbrella, the statewide website needs to have increased functionality to better connect contractors with property owners. Functionality that more clearly identifies contractors that provide the services homeowners are seeking or ranking systems based upon some type of metric such as consumer surveys or QA/QC compliance would help with this need.

Regionally:

- **Fill-in the gaps on contractor trainings that the CPUC/PG&E is unable to provide either by type or location.** Once the CPUC/PG&E has determined which contractor trainings they will provide on a consistent basis, regional local government partners need to be given the flexibility to roll out trainings based upon market demand. All trainings provided by program partners (at all levels) need to be communicated to contractors in an organized and regular fashion from a single source.

- **Facilitate a job board in coordination with local and regional partners.** Contractors and workforce development program trainees are often working or looking for work within the same regional marketplace. Therefore regionally centralized communication channels (e.g., job board) that Workforce Investment Board training programs to Participating Contractors would provide the best avenue to connect these groups to fill employment opportunities.

Locally:

- **Sponsor/provide tool lending libraries with local workforce partner organizations.** Especially as new contractors look to and begin participating in Energy Upgrade California, tool lending libraries hosted by program partners such as Building Exchanges can provide initial access to the specific equipment necessary to perform whole building upgrades. This “no cost to contractor” resource will help them determine the potential revenues to be earned performing energy retrofits, allowing them to eventually make this investment in equipment with confidence.
- **Work with local contractors to provide access/engagement with local marketing and outreach initiatives.** Partnerships between local Participating Contractors and local marketing efforts are a win-win for all program partners. Contractors participating in local government marketing and outreach events can have direct communication to potential leads and can benefit from consumer assurance that comes with the contractor’s visible participation in an “official program.” At the same time program partners win by having a perceived “expert” that can speak with authority about how an energy retrofit will benefit the homeowner.

Recruit new contractors and building professionals to participate in the Energy Upgrade program.

At the level of the CPUC/PG&E:

- **Provide contractor and field technicians any required technical skill training for free or at substantially discounted rates.** Program required technical training can take a working building professional out of the field for a week or more, meaning that they pay not only the cost of training but also the cost of lost work. This barrier is partially offset by offering these trainings for free or at reduced cost; for the PG&E Whole House Rebate Program this currently would include Building Performance Institute Building Analyst certification and Basic/Advanced Technical trainings.
- **Refine program design to reduce the “costs of participation” perceived by contractors.** The current PG&E Whole House Rebate Program requires contractors to pay for required training, equipment, energy modeling software, and rebate processing capacity prior to earning their first Energy Upgrade rebate for a homeowner. This high cost for participation

is difficult for many non-participating contractors to justify, especially considering the added challenges of dealing with consumer frustration with multiple QA/QC requirements and delays in rebate payment. Participating Contractors have also advised that a simpler program design would reduce the need for training on certain non-technical skill sets (e.g., energy modeling training for contractors is not necessary if the burden for this work is shifted to program administrators).

- **Develop new business models to increase the range of contractor credentials/licenses eligible for participation in the program.** Specialty contractors (e.g., solar and HVAC) offer some of the best lead generation or trigger-point opportunities for whole house upgrades. CPUC and PG&E should work with regional and local program partners who are well positioned to coordinate the development of business models that integrate these contractors and their related services into Energy Upgrade California, which will provide homeowners with easier access to a broader range of services (e.g., HVAC contractors can participate as subcontractors to a Participating Contractor or expand their business model to include an in-house home performance service that is offered to their HVAC customers).
- **Work in coordination with local and regional partners to develop new business models to increase range of contractor credentials/licenses eligible for participation in the program.** Specialty contractors (e.g., solar and HVAC) offer some of the best lead generation opportunities for whole house upgrades. Models designed to integrate these contractors and their related services into Energy Upgrade need to be developed while avoiding consumer confusion (e.g., the integration of the HERS Whole House rating into the PG&E Whole House Rebate program created confusion among homeowners, some of who thought HERS Whole House ratings were required for the PG&E Whole House Rebate Program, and extra work for raters and Participating Contractors, who had to explain to customers the complex relationship between raters and rating rebates and whole house contractors and the whole house incentive program).

Regionally:

- **Conduct research to document the value add benefit of participating in Energy Upgrade.** This is critical to inform non-participating contractors and help them overcome the perceived cost barrier for participation in Energy Upgrade.
- **Provide centralized on-line information resources on available workforce training initiatives.** Initial program efforts compiled and centralized information on aligned Energy Upgrade workforce development initiatives from workforce development agencies, community colleges, and private/non-profit training organizations. Housed on Bay Area county pages within the Energy Upgrade statewide website, these existing resources need to be made more robust and promoted more extensively among workforce partners to

allow existing and aspiring building professionals to connect with the training opportunities that will allow for their continued professional growth within the industry.

- **Promote the workforce resources amongst workforce partners and the building professionals they are training.** Promote the regional job board, centralized on-line workforce information, and other workforce resources for home performance and renewable energy industry trainings.

Locally:

- **Introduce local contractors to the program through local stakeholder groups.** Local government program partners need to work closely with local contractor stakeholder groups to: provide clear and accurate information about how and why contractors should participate in Energy Upgrade; connect contractors with the best current resources to assist their enrollment in Energy Upgrade programs; and dispel misinformation. Local efforts that convey these critical issues are necessary to effectively recruit new contractors to Energy Upgrade programs and promote local economic activity.
- **Provide connection to local workforce, community college, and high school training initiatives.** In conjunction with CPUC/PG&E program design and training efforts, local government program partners are best positioned to maintain consistent communication to and from local workforce trainings initiatives. Such local channels could inform research needs at the regional level and provide communication back to local workforce initiatives on research findings (e.g., workforce gap analysis findings).

D. Financing — Make Upgrades Accessible and Affordable

The average energy upgrade project (using the whole-building approach) costs between \$5,000 and \$20,000 making it a “considered purchase” that requires most homeowners to make an investment of personal or outside financing. For most homeowners, their home value and home equity constitute a *nest egg* against which they can borrow. Since the mortgage industry collapse and onset of the recession, the value of that nest egg has declined by 32 percent from the 2006 housing market peak leading to a significant decrease in household borrowing capacity¹³ (e.g., during this period two-thirds of middle income households have experienced an average 45 percent decline in personal wealth). In addition, many households leveraged their rising home value during the housing boom to incur other debt. Additional factors affecting household borrowing capacity include a decline in reasonable expectation of future earnings and tighter lending rules for underwriting, credit score requirements, and debt-to-income (DTI) ratios. Given the overall erosion of homeowner borrowing capacity (e.g., 30 percent of California households are underwater on their mortgage), homeowners are “more likely to behave like renters, under-investing in improving and maintaining their homes,” according to the March 2012 Clean Energy Financing Policy Brief from Lawrence Berkeley National Laboratory.¹⁴

The following recommendations are focused on providing solutions that address the decreased borrowing capacity of the average homeowner risks posed to lenders by the affect of homeowner wealth erosion on his/her capacity to service new debt, and the need for affordable financing options. Private capital partners should provide the needed lending capacity, and government partners should provide structures and targeted funding to improve the affordability of lending options. These recommendations also address the need for large scale financing capacity to serve California’s 12+ million homeowners and meet State energy goals.

Engage Private Capital to Develop Innovative Options for Affordable Financing and Scalable Financing Capacity

Federally:

- **Provide simplified home purchase and refinancing mechanisms for energy upgrades (e.g., Energy Efficient and 203K Rehabilitation mortgages), increase the number of mortgage professionals qualified to support these programs, and educate homeowners.** One of the most affordable financing options is integrating energy upgrade costs into an existing or new mortgage through programs such as the Federal Housing Administration’s (FHA) Energy Efficient and 203K Rehabilitation mortgage programs. These programs have been available for a number of years, but have had low to modest uptake because they add another step

¹⁴ *Scaling Energy Efficiency in the Heart of the Residential Market: Increasing Middle America’s Access to Capital for Energy Improvements*, Clean Energy Financing Policy Brief, Lawrence Berkeley National Laboratory, March 6, 2012.

to the mortgage process and require a mortgage professional who is knowledgeable about the programs' protocols to navigate the application. Working with national partners to address options for simplifying and promoting these mortgage programs and training additional mortgage professionals would allow more homeowners to access these affordable financing tools. Energy Upgrade California partners could work with regional mortgage and real estate stakeholders to access opportunities simplifying the energy mortgage process and develop a proposal that can be used to engage additional supporters and engage the FHA in discussions for mortgage program improvements.

At the level of the CPUC/PG&E:

- **Provide on-bill repayment programs.** Initiate a residential on-bill repayment pilot that allows the homeowner to pay off an energy improvement loan on his/her utility bill and can accommodate meter-based, secured, or unsecured financing. On-bill repayment programs that are attached to the utility meter also allow transfer any remaining debt to the new meter account-holder in the event the original homeowner moves. This financing structure makes it easy for homeowners to repay the loan, connect energy savings with energy investment, and offers a mechanism that could serve multiple lenders or lending programs.
- **Provide on-bill financing programs.** Provide an on-bill repayment structure with clear terms that can be financed by either utility/government or private capital lenders. One or both financing provider types can play a role. Partnering with private capital lenders provides greater financing capacity over time as energy efficiency financing gains wider acceptance in the financing industry. In addition, working with private capital lenders offers a range of financing strategies from small to medium loans from banks/credit unions to multi-million dollar funds that leverage large institutional lenders and include capacity to lower interest rates and absorb large scale lending amounts. Recent research for the Better Building Program On-Water-Bill Financing pilot has revealed several scalable financing options for this model; it is recommended these options be explored to ascertain their benefits and applications.

Regionally:

- **Implement regional local government managed affordable-financing strategies such as credit enhancement tools (e.g., loan loss reserve) and interest rate buy-down programs.**

Loan Loss Reserves. A primary credit enhancement tool, loan loss reserves provide partial risk mitigation to lenders that offer efficiency/renewable financing products, can be used to buy-down interest rates, can be funded with public dollars, and support a variety of efficiency/ renewable energy financing tools. Loan loss reserves can be used to lower credit score requirements, increase debt-to-income ratios, support longer loan terms, support

larger unsecured loans, increase or eliminate loan-to-value ratio, lower required homeowner investment, and lower interest rate — all of which support the homeowner’s borrowing capacity for energy improvements. Loan loss reserve funds can come from American Recovery and Reinvestment Act (ARRA) funds or other public sources, and contributions from local vendors/contractors, utility rate-payer funds, and other donors interested in energy efficiency/renewable energy residential improvements. Additional credit enhancement tools include loan guarantees and subordinated capital programs.

Interest Rate Buy-Down Programs. The California Energy Efficiency Strategic Plan (January 2011 Update) notes that “non-utility partners (such as regional entities and local governments) may well be better positioned to drive the ‘push’ of new technologies to market, or the ‘pull’ for customers and businesses to adopt available efficiency technologies or practices.” The application of loan loss reserve funds to interest rate buy down also offers a unique opportunity to tie the “pull” of an interest rate buy down to the “push” of energy performance requirements that protect the household budget. Interest rate buy down can be offered on a slide scale with increasing energy performance criteria similar to the IOU whole house rebates that increase with greater energy savings. This tool can also be used to incentivize renewable companies to include efficiency measures in their projects in order to get a better financing rate for their customers. Potential applications include residential Property Assessed Clean Energy (PACE) financing programs (either public or private) and possibly on-bill financing programs.

Additional Options to Increase Affordable Financing. Low-interest deferred loan programs (e.g., 3 percent) can be useful in situations where a homeowner is undertaking rehabilitation improvements that include energy efficiency but may lead to uncertain cash flow (e.g., health and safety-related improvements for fixed income seniors with equity in their homes). Used by housing and economic development agencies, deferred loans allow the homeowner to defer monthly payments while a lien is attached to the home that must be paid off at time of sale or ownership transfer. With Paycheck-Deducted Loans, an energy upgrade loan is paid through regular automatic deductions from an employee’s post-tax paycheck. In partnership with the employer (using energy savings from a commercial upgrade to fund employee loans) or a local credit union, unsecured loans are made available to company employees. Typically the payroll deduction process allows the lender to use a simpler underwriting process and offer a lower interest rate than for a standard unsecured loan.

- **Encourage development of Property Assessed Clean Energy (PACE) programs and support national, state, and local initiatives to confirm viability of PACE model.** PACE programs use the property tax assessment system to create an assessment district and issue bonds

secured by the real property to fund energy efficiency and renewable energy improvements to residential and commercial buildings. Homeowner participation in PACE is 100 percent voluntary, the assessment stays with the property when the residential or commercial property is sold, and projects must consist of pre-qualified clean energy improvements for energy efficiency, water conservation, and renewable energy generation. Despite current legal challenges to the residential application of this model, it is being successfully implemented by the Sonoma County Energy Independence Program as a pilot program for the California Energy Commission. PACE offers property owners affordable local financing by accessing the tax assessment power of local governments, which they have traditionally used to provide solutions for challenges to community health and safety (e.g., safe water supply, fire protection services).

- **Increase the number of mortgage professionals qualified to support Energy Efficiency and 203K Rehabilitation mortgages and educate homeowners about the mortgage financing options.** While 30 percent of homeowners statewide are underwater on their mortgages, many homeowners are in a position to use this resource. To make this option more attractive, Energy Upgrade California will need to work with the mortgage industry to increase the numbers of mortgage brokers skilled in these products and education homeowners about their availability and use. By generating more demand for these energy-related mortgage products, local government partners can expedite delivery of financing resources mitigate the decline in homeowner borrowing capacity caused by home equity losses. Local government partners can facilitate trainings for mortgage professional in coordination with the Federal Housing Administration, which runs the mortgage programs, and conduct homeowner workshops in conjunction with FHA certified mortgage specialists to explain the energy mortgage process and benefits.
- **Develop financing/growth capital resources to support Participating Contractors in obtaining required technical training business development training), and equipment, and manage cash flow.** As market demand increases, efficiency and renewable companies also need financing to underwrite business expansion to cover the cost of training (e.g., Building Performance Institute, HERS Building Performance Contractor, and combustion safety testing) and certifying new employees, upgrading staff business development skills, purchasing of new equipment and software programs, and establishing capital reserves to manage cash flow fluctuations during project implementation. The establishment of a regional growth capital fund or a coalition of business loan lenders would allow contractors to manage their growth as their client base increases and, in the case of a capital reserve fund, protect against cash flow crunches when project costs overtake project payments because of financing program rules. A growth capital fund might be created using existing

business lenders such as the Small Business Administration, a coalition of local lenders, public funds, or a combination of all three.

Locally:

- **Enlist local government partners to communicate the benefits of PG&E whole house incentives and Energy Upgrade financing options to local cities, non-program contractors, community stakeholders, and homeowners.** Energy Upgrade’s local government partners deliver the Energy Upgrade message directly to consumers with State-branded local marketing campaigns that leverage the state-of-the-art multiple-touch approach using local communication channels, local opinion leaders, and local education events. Creating market demand also involves enlisting the support of local city governments; engaging stakeholders in business, community, and faith-based groups; and building on relationships with trusted community leaders, all delivered through local marketing and word-of-mouth testimonials at home, at work, at church, and at play.

Local government partners also deliver significant contractor support through regional training programs offering support for home performance certification, Home Energy Rating System certification, and solar installation training; sales and marketing; combustion appliance zone testing; and energy modeling; as well as ongoing dialogue with Participating Contractors about program progress and needed improvements.

Among the Energy Upgrade partners, local governments fill a unique role as a trusted local advocate for transformation of not only the market place, but for a transformation of community values and priorities that is needed to meet our significant climate protection goals.

Conclusions

To achieve the ambitious goal of market transformation to expedite fulfillment of State energy goals requires multiple partners and sufficient time to change how property owners think about and act on energy-saving options. The following conclusions and recommendations are designed to inform State policy makers supervising program design revisions and energy-related funding about opportunities to capitalize on the Energy Upgrade California infrastructure built by local government partners with federal stimulus funding. In addition, these recommendations offer insight into successful program elements and strategies that can be used to inform decisions about future funding programs and request-for-proposals (RFPs). Finally, these recommendations identify core program services and infrastructures that need to be maintained in order to preserve the market transformation progress achieved to date.

Priorities below are listed in order of importance and immediate need. The Retrofit Bay Area two-year grant was adequate to establish the basic infrastructure for long-term sustainability and initial ramp-up of energy upgrades; however, substantial additional funding is necessary to achieve the volume of energy upgrade projects needed to meet environmental, job creation, and economic recovery goals.

A. Major Strategic Findings

The **Program Design** is too complicated for homeowner ease of understanding and contractor ease of use; a new, simpler program design with less administrative burden for these critical program participants would improve program success. To make Energy Upgrade a more complete “one-stop-shop”, program designers and implementers should work behind the scenes to integrate, and offer easy access to, a full range of strategies and program offerings, from behavioral changes to income-qualified services to deep upgrades. Such program design changes would reduce the financial threshold for homeowner participation and allow for more effective program delivery. The program design should also push for deeper energy savings necessary to reach the statewide energy and greenhouse gas reduction goals. Additional research and pilot testing of a measures package option, and how to integrate renewable energy generation and HVAC contractor point of contact, is required.

Successful **Program Implementation and Marketing and Outreach** depend on a robust partnership between Participating Contractors and regional/local government partners. Government partners play a key role by implementing uniform regional and local programs, streamlining the administrative burden, serving as trusted independent guides, mobilizing community awareness and market demand through mass media and marketing campaigns, engaging existing community networks and infrastructures, and delivering the program message to property owners where they live, work, and play through local and targeted marketing efforts. As local energy experts, experienced and knowledgeable Participating Contractors are vital marketing partners at educational events (e.g., Home Energy Workshops) and at the kitchen table talking with customers; in their educational role, Participating Contractors benefit from program support to enhance their effectiveness as program and industry spokespersons.

Effective **Workforce Development** needs to offer greater program support to contractors including subsidized financing for the investments contractors must make to adjust and scale their business. Efforts to recruit new contractors to the program and support training initiatives need to be timed to align with marketing efforts and increased demand for energy retrofits. Regional and local governments provide a critical means to provide contractor feedback on the program. When program design modifications are necessary, they should be implemented with attention paid to mitigating the impact that mid-course changes have on Participating Contractors seeking to perform upgrades.

Incentives and affordable Financing Mechanisms are necessary to increase uptake in the program because of impact of the depressed economic market on homeowner borrowing capacity, the lack of low interest loans, and the investment-grade (i.e., considered purchase) cost of upgrades.

B. Summary of Top Priorities for -Program Partners

In addition to the top recommendations offered in the executive summary for local government implementation, Retrofit Bay Area local governments have prioritized the following recommendations for program partner implementation in support of Energy Upgrade.

Federally:

Financing

- Encourage simplified home purchase and refinancing mechanisms for energy upgrades.

At the level of the CPUC/PG&E:

Program Design

- Provide short-term funding to support existing regional and local government program infrastructure and activities through 2012.
- Clarify regional and local government priorities and funding commitment for 2013 and beyond.
- Gain high-level regulatory and utility management backing for a more flexible and practical program design. Develop CPUC, IOU, and other funding agency long term commitments to incentive structures.
- Implement affective local government pilot programs and rebate initiatives such as multifamily incentive programs and menu of energy-savings-based point-weight measures.
- Develop and implement a plan for data capture, mining, and distribution to program partners.
- Drastically streamline paperwork and other administrative burdens tied to program participation including rebate processing and duplicative data entry.

- Drastically streamline technical burdens tied to program participation including QA/QC protocols and site visits and the need to improve accuracy and capacity of simulation modeling or replace with other means of savings estimation.
- Modify the program design to promote deeper energy savings by including more energy efficiency measures (e.g., pool pumps) and combining efficiency upgrades with renewables energy system.
- Keep home energy ratings, such as HERS Whole House, independent of utility retrofit incentive program operations.
- Intensify the study and implementation of a cost-effectiveness metrics system that acknowledges a broader range of program benefits.
- Base IOU rebates on energy-savings-based point-scores of measures designed to support loading order protocols in order to reduce or eliminate the need for project specific energy modeling.
- Use SmartMeter data with streamlined diagnostics and analysis to identify home problems without modeling and improve accuracy of savings estimates.
- Improve HERS Whole House Rating or alternative system for high-volume energy ratings feasibility.
- Continue program reassessment and modification, as needed, through 2020.

Marketing and Outreach

- Continue funding regional and local government partnerships to preserve outreach to local stakeholders and industry partners to communicate program benefits, generate market demand, and obtain feedback.
- Maintain the Energy Upgrade California website as the one-stop-shop; make it more accessible and expand the functionality of the Action Planning Tool.
- Integrate whole house retrofits with all other residential programs in public education efforts, and increase overall outreach.
- Incorporate all CPUC/CEC initiatives under the Energy Upgrade California umbrella.
- Redesign the Energy Upgrade website to be user friendly and easier to navigate for all participants.

Workforce Development

- Allow immediate job approvals with streamlined QA/QC protocols by using random sampling to confirm energy savings on an aggregate basis.

- Increase program support to contractors, notably by offering subsidized financing for necessary contractor investments (see financing priorities below).
- Fund more widespread and more broadly defined contractor training/mentoring including business management, sales and report generation, and marketing.
- Achieve better coordination between workforce development programs, market demand for labor/workforce needs, and program communication channels (e.g., job boards, workforce development agency listings on the Energy Upgrade website).
- Develop new business models to increase the range of contractor credentials/licenses eligible for participation in the program.
- Increase the functionality of the Energy Upgrade website to effectively incorporate contractors working with new business models within Contractor Directory.

Financing

- Provide on-bill repayment programs.
- Provide on-bill financing programs.

Addendum

A. Elected Officials and Key Decision Makers

a) Presentation

B. Retrofit Bay Area Final Report

C. County Agency Final Reports

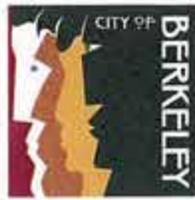
D. PAC Feedback

E. Contractor Feedback

a) Tara Hobbs, Solar City

b) Brett Knox, Green Homes America

F. BKi Policy Recommendations on Energy Upgrade California



Increasing Energy Efficiency in Existing Multifamily Buildings

An Overview of Challenges,
Opportunities, and Policy Tools
Executive Summary

Prepared by the Cities of Berkeley, Oakland, and Emeryville
October 2011



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Executive Summary

This report is designed primarily for local government policy makers. It is one component of a joint project between the cities of Berkeley, Oakland, and Emeryville aimed at developing effective strategies to increase energy efficiency in our communities' multifamily properties, including apartment buildings, cooperatives, and condos. The project, called *Building Energy Efficiency Solutions* (BEES), seeks to develop local solutions to the formidable barriers tenants and building owners face when trying to lower their energy and water consumption and reduce their utility bills. Solutions to address these barriers must not only be designed to increase energy efficiency, but must also be consistent with our communities' existing commitments to diversity and to providing healthy, affordable housing for residents.

Common barriers to increasing energy efficiency in existing multifamily buildings include:

- *Misaligned incentives between property owner and tenant.* When units are individually metered, the building owner has no direct financial incentive to make investments in in-unit energy upgrades. When a building is master-metered, tenants have no direct financial incentive to conserve energy.
- *High initial costs.* Many property owners do not have access to the upfront capital needed to invest in energy upgrades.
- *High transaction costs.* Property owners often feel overwhelmed by the process of identifying relevant upgrade opportunities and matching incentive programs.
- *Uncertain return on investment.* A range of variables affect the actual energy and money savings realized from a property owner's investment in energy efficiency. Many property owners lack access to technical assistance services that can help them to identify cost effective energy efficiency strategies and to calculate the payback.
- *Limited knowledge and motivation.* Property owners and tenants often have limited knowledge of the potential benefits and process of making energy improvements, and limited motivation for engaging in this work.

While government and utility efforts to reduce energy use in existing multifamily buildings remain relatively limited compared to resources aimed at the single-family residential and commercial sectors, there are a growing number of government agencies and utilities across the country that are leveraging ratepayer dollars, onetime stimulus funds, and other resources with private sector investment to remove barriers to energy efficiency in existing multifamily buildings. The ultimate goal is sustained transformation in how the market functions, so that energy efficiency is business-as-usual amongst multifamily property owners, property managers, and tenants.

A fundamental takeaway from interviews with policy makers and multifamily property owners and managers that informed the study for this report is that achieving market transformation requires policy mechanisms that enable property owners to realize an economic return on investments in energy efficiency. Put

another way, unless energy-related capital investments result in increased revenues or increased property value/equity, there is limited economic rationale for a multifamily building owner to make such an investment. Increased revenues can come in several forms, including:

- Increased building sale valuation
- Cost savings due to reduced energy use
- Less tenant turnover and the associated transaction costs and interruptions in rent payments
- Higher rents

This report outlines a range of policy mechanisms local and state governments and utilities are employing to achieve market transformation in existing multifamily buildings:

- *Mandatory improvement and disclosure requirements* designed to capture a baseline level of energy savings across a community's existing multifamily building stock and to make energy efficiency an explicit component of a building or unit's value
- *Rebates* to lower the cost of energy upgrades and to help property owners go beyond the minimum
- *Financing programs* to minimize the upfront cost of energy upgrades and to amortize costs over time
- *Tax-based incentives* to encourage private investment in energy efficiency
- *Strategies that help calculate benefits and align incentives for the affordable multifamily housing sector*, with potential relevance to rent controlled housing
- *Tools for removing the split incentive barrier* by increasing the capacity of property owners to make energy improvements and recoup their costs in a manner that enables appropriate, equitable sharing of costs and benefits between owners and tenants
- *Streamlined technical assistance* designed to minimize property owners' transaction costs associated with identifying upgrade opportunities and matching incentives and financing
- *Workforce development* tailored to the existing multifamily building context
- *Marketing, outreach, and education programs* used to connect multifamily stakeholders with the services available to them and to encourage the behavior changes necessary to achieve increased energy efficiency

The intent of this report is to identify these policy mechanisms and to derive lessons learned that may inform multifamily energy efficiency policy design in the cities of Berkeley, Oakland, Emeryville, and beyond. These lessons will be considered in developing policy recommendations in later phases of the BEES project.

The two-year BEES project is funded by California utility customers and administered by Pacific Gas and Electric Company (PG&E) under the auspices of the California Public Utilities Commission.

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Characterization and Analysis of Small Business Energy Costs

by

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for



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Characterization and Analysis of Small Business Energy Costs

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When viewed at the macroeconomic level, even substantial energy price increases may not entail significant firm-level impacts because energy costs are a relatively small proportion of total overall production costs. However, energy expenditures are a much higher percentage of total input costs in certain industry sectors, and small entities often face unique challenges that affect their ability to absorb price increases.

To add to the state of knowledge on small entity impacts of energy price increases, this report compiles available information to (1) characterize the potential impact of energy price increases on small entities in individual industry sectors; and (2) identify whether, and to what extent, small entities face higher energy prices by major economic sector. The study results indicate that small entities in the manufacturing and commercial sectors have the greatest exposure to energy price rises.

Overall Findings

An analysis of sector-level energy price information indicates that small entities in the manufacturing and construction sectors pay higher prices for most, but not all, fuels. These price disparities are most pronounced for electricity and natural gas, with electricity in the manufacturing sector responsible for the greatest price differential. The smallest size establishment category (under 50 employees) pays 35 percent more for electricity than the sector average, while the largest establishment category (1,000 or more employees) pays 17 percent less than the sector average. Therefore, small manufacturing sector entities that use substantial amounts of electricity face a significant competitive disadvantage.

Highlights

The analysis found significant price differentials between what the smallest and largest entities paid for energy in the commercial and manufacturing sectors. Small businesses in the commercial sector faced a 30 percent price differential for electricity and a 20 percent price differential for natural gas. In the manufacturing sector, small businesses faced a 28 percent price differential for distillate fuel oil, a 27 percent price differential for natural gas, and a 14 percent price differential for coal.

Discussion

Of the 17 manufacturing sector industries for which 2002 data were available, small entities in 10 of these sectors spent considerably more on energy than larger entities when measured on the basis of expenditures per value of industry shipments. Three manufacturing sector industries had energy costs per dollar of output that were more than double those incurred by larger entities (food manufacturing; leather and allied products manufacturing; and computer and electronic product manufacturing). Profitability data further illustrate the challenges that small entities face from price increases in energy and other production inputs—13 of the 19 manufacturing sector industries with available profit data have profit margins that are lower for small entities than their larger counterparts.

Similarly, small entities have higher energy expenditures per dollar of sales than larger entities in 26 of the 31 commercial sector industries studied. The median commercial sector industry has a small entity energy cost per sales ratio that is 2.7 times the ratio

of large entities. General merchandise stores; food and beverage stores; and couriers and messengers are three of the commercial sector industries with the highest small entity energy cost per sales ratios relative to those of their larger counterparts. The couriers and messengers industry is particularly affected; its small entity energy expenditures add up to more than 10 percent of total small entity sales. As with manufacturing industries, a majority of commercial sector industries have lower small entity baseline profit margins than their larger industry counterparts.

Although the results for other economic sectors (agriculture, mining, construction, electric generation) show a more equal distribution of small and large entity baseline profit margins and energy expenditures per unit of output, all but the electric generation sector has one or more individual industries for which available data suggest that energy price increases are expected to result in greater impacts on small entities than large entities.¹

This study highlights some of the unique challenges that confront small entities when energy prices rise, and identifies the economic sectors and specific industries in which small entities are most vulnerable to such price increases. Given continuing energy price trends, it is reasonable to assume that more and more small firms will see their competitive positions weakened, leading to impacts on capital availability and profitability, and the potential for small business closures.

Scope and Methodology

The researchers used publicly available data on energy costs from the Economic Census conducted by the U.S. Bureau of the Census in the Department of Commerce, the Department of Energy's Energy Information Administration (EIA), and the U.S. Department of Agriculture. All surveys measured expenditures by firms of various sizes on an array of energy goods, including fuels and electricity. The EIA surveys included considerably greater detail, but only covered the manufacturing, commercial, and electricity generation industries. Further data on firm size and revenues were taken from the Economic Census of 2002. Firm size, revenue, and energy use

¹ Data do not suggest that small entities in the Electric Generation sector face disproportionate energy price impacts—the likely cause for this phenomenon is the relative lack of competition in this sector (e.g., most jurisdictions grant monopolies to electricity providers, with retail electricity rates generally requiring the approval of the local public service commission).

data were synthesized into industry tables and firms were compared across size categories to ascertain whether small firms pay proportionately more or less than their larger counterparts within an industry.

This report was peer reviewed consistent with the Office of Advocacy's data quality guidelines. More information on this process can be obtained by contacting the director of economic research at advocacy@sba.gov or (202) 205-6533.

Ordering Information

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A. EXECUTIVE SUMMARY

When viewed at the macroeconomic level, even substantial energy price increases may not imply significant firm-level impacts because energy costs are a relatively small proportion of total overall production costs. However, energy expenditures are a much higher percentage of total input costs for many industry sectors, and small entities often face unique challenges that affect their ability to absorb price increases. This study provides information for understanding the significance of energy costs to small entities in individual industry sectors, and by extension, the potential for energy price increases to negatively impact these entities.

A literature review indicated a general lack of information characterizing the significance of energy prices to small entities; however, the limited information available suggests that rising energy prices and/or price uncertainty have more significant effects on smaller size firms. In addition, industry surveys of small entities in the manufacturing and construction sectors indicate that energy price increases are of growing concern to small businesses, and moreover, past price increases have had an impact on the earnings and profitability of a significant proportion of survey respondents.

To add to the state of knowledge on the impacts of energy price increases on small entities, the author compiled available information to (1) characterize each industry's potential for energy price increases to impact small entities and (2) identify whether, and to what extent, small entities face higher energy prices by major economic sector. The results indicate that the manufacturing and commercial sectors have the greatest potential for small entity energy price impacts. Of the 17 manufacturing sector industries for which 2002 data were available, small entities in 10 industries spent considerably more on energy than larger entities when measured on the basis of expenditures per value of industry shipments. In three manufacturing sector industries, the energy costs per dollar of output for small firms were more than double those incurred by larger entities (food manufacturing; leather and allied products manufacturing; and computer and electronic product manufacturing). Profitability data further illustrate the challenges that small entities face from energy (and other production input) price increases: 13 of

the 19 manufacturing sector industries with available profit data have lower profit margins among small entities than among their larger counterparts.

Similarly, small entities have higher energy expenditures per dollar of sales than larger entities for 26 of the 31 commercial sector industries studied. The median commercial sector industry has a small entity energy cost per sales ratio that is 2.7 times the ratio for large entities. General merchandise stores; food and beverage stores; and couriers and messengers are three of the commercial sector industries with the highest small entity energy cost per sales ratios relative to those of their larger counterparts. The couriers and messengers industry is particularly noteworthy in that small entity energy costs are more than 10 percent of the value of total small entity sales. As with manufacturing industries, a majority of commercial sector industries have lower small entity baseline profit margins than their larger counterparts.

Although the results for other economic sectors (agriculture, mining, construction, electric generation) show a more even distribution of small and large entity baseline profit margins and energy expenditures per unit of output, all but the electric generation sector have one or more individual industries for which available data suggest that energy price increases are expected to result in greater impacts on small entities than large entities.¹

An analysis of sector-level energy price information indicates that small entities in the manufacturing and construction sectors pay higher prices for most, but not all, fuels. These price disparities are most pronounced for electricity and natural gas, with electricity in the manufacturing sector responsible for the greatest price differential; the smallest size establishment category (under 50 employees) pays 35 percent more than the sector average for electricity, while the largest category (1,000 or more employees) pays 17 percent less than the sector average. Therefore, small manufacturing entities that use substantial amounts of electricity face a significant competitive disadvantage. In addition, significant price differentials between smallest and largest entities were found in these sectors:

¹ Data do not suggest that small entities in the electric generation sector face disproportionate energy price impacts. The likely cause of this phenomenon is the relative lack of competition in this sector (e.g., most jurisdictions grant monopolies to electricity providers, with retail electricity rates generally requiring the approval of the local public service commission).

- 30 percent price differential for electricity used in the commercial sector;
- 28 percent price differential for distillate fuel oil used in the manufacturing sector;
- 27 percent price differential for natural gas used in the manufacturing sector;
- 20 percent price differential for natural gas used in the commercial sector; and
- 14 percent price differential for coal used in the manufacturing sector.

This study highlights some of the unique challenges that confront small entities when energy prices rise, and it identifies the economic sectors and specific industries in which small entities are most vulnerable to such price increases. Given continuing energy price trends, it is reasonable to assume that a growing number of small firms will see their competitive positions weakened, with ramifications for their ability to raise capital and their profitability, as well as the potential for small business closures.

B. INTRODUCTION

The purpose of this study was to compile available energy data from federal government and other sources to characterize the impact of energy costs by industry sector, firm size, and fuel type.² This study provides key information for understanding the potential for energy cost increases to negatively affect small entities by industry sector.

When firms are forced to absorb energy price increases, profit margins will be reduced or potentially eliminated. Given the prevalence of economic globalization, increased energy costs in the United States can result in domestic plant closures in cases where firms are no longer able to compete with foreign plants with lower cost structures. More generally, reduced profits may result in cash flow impacts, which may affect firms' access to capital for investments, a particular concern for small firms, which tend to have greater difficulty raising capital than larger firms. Furthermore, energy cost increases will result in reduced product demand and reduced revenues to the extent that such costs are passed through to consumers.³ For sectors that use energy both as a fuel and raw material (e.g., plastics), the impact of energy price increases can be compounded.

When viewed at a broad level, energy costs are a relatively small proportion of total intermediate production inputs. Even fairly large energy price increases may not suggest a significant effect when viewed at this aggregate level. However, energy expenditures are a much higher percentage of total input costs for certain industry sectors.

To assist in understanding the issue, the author performed a review of the literature on small firm energy costs and energy price increase impacts. Much of the literature either dates to the energy crises of the 1970s/early 1980s, or is not specific to small businesses. Many of the most recent studies rely on data that predates energy price shocks that followed in the aftermath of the Gulf Coast hurricanes of 2005. There were two different types of relevant studies identified via the

² The author also sought to characterize energy costs by geographic region, but the available data were deemed too limited to allow such characterization.

³ Additional reductions in demand will occur via energy price increases at the consumer level (e.g., gasoline and residential heating and cooling costs), which strain household energy budgets.

literature review: (1) quantitative analysis papers from the academic literature; and (2) reports summarizing the results of surveys conducted by industry trade associations. While the first group presents theoretical analyses of energy cost-related concepts (e.g., uncertainty, variable input costs, and returns to scale) on small firm decision-making, the second group uses survey data to draw conclusions about the impact of increased energy prices on small businesses. A synthesis of these different studies leads towards the general conclusion that, all else being equal, energy price increases and price uncertainty are of greater concern to small businesses than large businesses.

1. Review of Academic Literature

Given the paucity of small business energy price impact literature, the focus of the review of academic literature is necessarily limited to the impact of price increases for general production inputs. It is reasonable to assume, however, that the results from these studies can be applied to energy inputs. The following three studies suggest that energy price increases, as well as increased energy price uncertainty, have larger impacts on smaller size firms.

Nguyen and Lee (2002)

Nguyen and Lee recently assessed the potential disparity in economies of scale between U.S. manufacturing companies of different sizes. Using 1991 data from the Manufacturing Energy Consumption Survey (MECS) and the Annual Survey of Manufacturers, Nguyen and Lee found that there is no statistically significant difference in production efficiency between establishments of different sizes—that is, small establishments were determined to produce as much output for a given level of inputs as large establishments (Nguyen and Lee, 2002). Output in this study was measured as value of shipments, and capital, labor, materials, and energy were the inputs included in the establishment size production functions.

The study's applicability to the issue at hand is limited in that: (1) data constraints restricted the analysis to establishments with at least 20 employees; (2) it did not investigate the potential for industry-specific economy of scale differences existing within the Manufacturing sector; and (3)

it solely focused on the manufacturing sector (while the majority of small firms are found in other industry sectors).

In addition, the study does not state whether the analysis incorporated establishment size energy price differentials that appear to exist.⁴ If large and small manufacturers pay similar prices for energy (and/or face similar energy price increases), then the study suggests that increased energy prices do not differentially impact small manufacturers' ability to competitively produce goods because they are no less efficient in converting inputs (of which energy is one) into production. Given their similar estimated production efficiencies, however, any production input price disadvantages that smaller manufacturers may experience (including energy costs), would be expected to place them at a competitive disadvantage relative to their larger counterparts. [Section D.2 of this report describes data indicating that small manufacturing sector entities pay substantially higher prices for electricity, natural gas, and distillate fuel oil than large entities.]

Ghosal and Loungani (2000)

Uncertainty about the price of production inputs such as energy can cause firms to become more averse to risking investments in capital. Ghosal and Loungani establish a negative investment-uncertainty relationship among manufacturing firms in the United States (Ghosal and Loungani, 2000), and the ratio is greater for smaller firms. Therefore, increases in the uncertainty of energy cost inputs are expected to result in less overall capital investment by businesses, with smaller firms experiencing greater reductions.

Koetse, *et al.*, 2006

In a study that yielded a similar result to that of Ghosal and Loungani (2000), Koetse *et al.* (2006) further identifies the impact of energy price uncertainty on capital investment. In this case, the authors studied the impact of perceived wage and energy price uncertainty on capital

⁴ In particular, the paper only describes how energy quantity estimates were developed by establishment size—no information is provided on how quantities were converted to expenditures (i.e., whether an overall average fuel price was applied or whether the existence of establishment size category-specific prices was investigated/incorporated).

investment and investment in energy-saving technologies. They find that “especially for investment in energy-saving technologies, there is strong evidence of structural differences between small and large firms. Specifically, uncertainty appears to have a larger influence on decision making in small firms than in large firms” (Koetse *et al.*, 2006). They cite the ability of larger firms to hedge against risk and absorb investments with longer payback periods as key reasons for the disparity in the investment-uncertainty ratio between small and large firms.

These studies suggest likely capital investment impacts from the large energy price fluctuations experienced recently, including impacts on investments in energy efficiency improvements. They further indicate that such impacts are likely to be more pronounced for smaller firms.

2. Review of Industry Literature

The four reports discussed below provide the results of targeted surveys to identify issues of greatest concern to small firms. The reports generally focus on small firms in a specific sector (either construction or manufacturing). The surveys indicate that rising energy prices are of increasing concern to small businesses and that past increases have led to earnings and profitability impacts for a significant share of respondents.

Associated General Contractors of America

A November 2005 Associated General Contractors (AGC) report focuses on construction sector costs, including energy costs (AGC, 2005). The report notes that diesel fuel cost increases affect the construction sector in multiple ways since diesel fuel is used to operate off-road equipment (e.g., earthmovers and tower cranes), to run motors for construction vehicles (e.g., concrete mixers, pumpers, and dump trucks), and as fuel for transporting construction material deliveries and construction debris. The report finds that diesel fuel prices paid by U.S. construction firms rose by an average of 47 cents per gallon, or 22 percent between 2004 and 2005.

The report also notes that natural gas prices directly affect the cost of a variety of construction plastics that use natural gas as a feedstock, pointing to a recent increase in the price for polyvinyl

chloride (PVC) pipe of 20 to 100 percent. Given supply interruptions from the 2005 Gulf Coast hurricanes, coupled with an explosion at a key plastics factory in Texas and the potential for weather-related demand increases for natural gas, AGC indicated that other hydrocarbon-based products such as insulation, roofing materials, and membranes will likely see a near-term price of increase of 20 to 50 percent.

The report does not delve into how construction businesses are coping with increased diesel fuel and natural gas costs (nor price uncertainty for other key inputs such as cement and concrete, steel, gypsum, and wood products).

International Profit Associates' Small Business Research Board

Early in 2006, the International Profit Associates' Small Business Research Board performed a survey of small businesses, with particular emphasis on the construction industry. The survey asked respondents what the single most important issue was for their small businesses. Twenty-five percent of Construction industry respondents cited the cost of materials as the most important issue; 10 percent of respondents in non-construction businesses cited these costs as most important. Only 3 percent of small construction businesses cited energy and fuel costs as the most important issue, while 16 percent of small non-construction businesses identified these costs as most important.

In a survey conducted in the second quarter of 2007, small businesses across all surveyed industries listed energy and fuel costs as the third most important issue of concern, while small Construction and Contracting industry firms listed these costs as the second most important issue (IPA, 2007).⁵ Although not directly comparable, the results of these two surveys suggest a shift in attention to energy costs.

⁵ Taxes were considered to be the most important issue by both groups of small business owners.

National Federation of Independent Businesses

In 2001, the National Federation of Independent Businesses (NFIB) conducted a poll of approximately 750 small businesses to determine how these firms adjust to price (including energy price) increases (NFIB, 2006). The survey results indicated the following with respect to actions taken in response to energy price increases in the first half of 2001:

- Three types of energy – gasoline, electricity, and natural gas – were responsible for nearly all concerns about energy prices, with most respondents identifying gasoline price increases as impacting their small businesses;
- The most prevalent way of offsetting increasing energy costs was reducing earnings; 76 percent of small business owners reported adjustment via lower earnings or profits; the second most frequently taken way of adjusting was energy conservation measures (57 percent); only 29 percent of owners indicated implementing price increases;
- Actions taken to adjust for cost increases were heavily influenced by the size of the increase and the amount of advance notice the owner had that a price increase was forthcoming; and
- About one quarter of respondents indicated that it is likely or highly likely that cost increases with no notice will force them to borrow to ease the adjustment to the price increase.

One shortcoming acknowledged by NFIB researchers was that the survey data did not indicate levels of baseline profitability. Therefore, they were unable to determine whether particular responses were more likely based on firm financial health.

National Association of Manufacturers

In a 2001 report, the National Association of Manufacturers (NAM) notes that small and medium-size manufacturers consumed about 38 percent of all energy used in manufacturing, but paid approximately 52 percent of the total cost of manufacturing energy (NAM, 2001).⁶ These data suggest that smaller manufacturing firms face considerably higher energy prices than larger firms. The report also notes that the energy costs of small- and medium-sized manufacturers increased by \$115 billion in 1999, or 1 percent of total U.S. gross domestic product.

A survey of NAM members indicated that a 58 percent increase in natural gas prices between 1999 and 2000 reduced profits by an average of 13 percent. However, some companies saw profits reduced by as much as 150 percent. More than half of the businesses surveyed asserted that an investment tax credit would provide a sufficient incentive for them to upgrade to more energy efficient boilers, the piece of equipment responsible for the greatest energy use in manufacturing plants.

C. SUMMARY OF STUDY METHODS AND DATA SOURCES

The author compiled energy data from federal government and other sources to characterize the impact of energy costs by industry sector, entity size, and fuel type.⁷ Table 1 displays a summary of the energy expenditure data developed by major sector, including the level of industry sector detail and specific fuel types for which costs were developed. This table highlights the data limitations that constrain the ability to develop consistent expenditure data across all sectors.

⁶ For this study, NAM defined small manufacturers as firms that employ 500 or fewer employees, and medium manufacturers as those employing between 500 and 2,000 employees.

⁷ The data analysis may assist future researchers in understanding how energy cost increases affect small entities in specific industries; and it may help identify key industry sectors for focusing a survey to understand the actions that they have taken to address past energy price increases, and the challenges associated with potential future price increases.

Table 1. Summary of Small Entity Energy Expenditure Estimation

Sector	NAICS Code Level	Reflect Potential Price Differential Between Small and Large Entities?	Electricity/Fuel Types for which Estimates Developed	Comments
Agriculture	4-digit or 5-digit	Yes – by sales category: <\$100k; \$100k-\$249,999; \$250k-\$499,999; \$500k-\$999,999; and \$1+ million	Electricity; gasoline and gasohol; diesel fuel; natural gas; and "LP gas, fuel oil, kerosene, motor oil, grease, etc."	Energy expenditure data not available for NAICS codes: 1133 (logging); 1141 (fishing); 1142 (hunting and trapping); 1151 (support activities for crop production); 1152 (support activities for animal production); and 1153 (support activities for forestry)
Mining	3-digit	No	None, although data are available to estimate electricity expenditures	Assumes the same energy cost/total cost of supplies ratio for all size categories.
Construction	3-digit	No	Electricity; natural/manufactured gas; gasoline/diesel obtained from other establishments of company or purchased from other companies; purchased on-highway fuel; purchased off-highway fuel; and "all other fuels/lube" (above only available at NAICS code-level, not receipts size category-level)	Assumes the same energy cost/total cost of supplies ratio for all revenue size categories (and fuel type estimates assume same proportion of total energy cost from each fuel type for all size categories).
Electric Generation	NAICS 2211	Yes for all 223 public utilities and about one-third of private utility fuel records	10 fuel types, but only for private utilities	Estimates computed for each individual utility. Energy expenditure data not available for NAICS codes: 2212 (natural gas distribution) and 2213 (water sewage & other systems)
Manufacturing	3-digit	Yes – by employment size category: <50; 50-99; 100-249; 250-499; 500-999; and 1000+	Depends on NAICS code—may include: electricity; residual fuel oil; distillate fuel oil; natural gas; liquefied petroleum gas and natural gas liquids; coal; and coke & breeze.	Regional data were available in some, but not all, cases; only national data are reported.
Commercial	3-digit	Yes – by employment size category: <5; 5-9; 10-19; 20-49; 50-99; 100+	Electricity, natural gas, and fuel oil	No available information on commercial sector motor fuel expenditures. Energy expenditure data are not available for all commercial sector industries.

1. Energy Expenditure Data

Detailed economic information is available every five years from the Economic Census conducted by the U.S. Department of Commerce's Bureau of the Census. Economic Census publications provide useful information characterizing energy expenditures for most economic sectors (e.g., the 2002 Census publication Business Expenses Survey reports the total cost of materials, and the cost of electricity and fuels for many industry sectors). The last Economic Census was conducted for 2002 – a year that did not experience unusually high or low energy prices. Therefore, 2002 Economic Census data should be representative of long-run energy costs.

For three sectors, detailed energy data were available from the Department of Energy's Energy Information Administration (EIA):

- **Electric Generation** – 2002 data from Form EIA-861 (“Annual Electric Power Industry Report”) database; Schedule 7 (“Electric Operation and Maintenance Costs”) of Form EIA-412 (“Annual Electric Industry Financial Report”) database; Form EIA-906 (“Power Plant Report”) database; Form EIA-423 (“Monthly Cost and Quality of Fuels for Electric Plants Report”) database; and the report *Cost and Quality of Fuels for Electric Plants, 2002 and 2003*;
- **Manufacturing** – 2002 Manufacturing Energy Consumption Survey (MECS); and
- **Commercial** – 2003 Commercial Buildings Energy Consumption Survey (CBECS).

In addition to the above EIA sources and the Economic Census publications, the author also compiled agriculture sector energy expenditure data from the U.S. Department of Agriculture (USDA)'s 2005, 2002, and 1997 Census of Agriculture and the USDA's Farm and Operator Households database.

To evaluate the relative impact of energy costs on small entities in these sectors, we used the above data sources to develop energy costs for specific establishment size categories.⁸ Table 2 reports all of the size categories for which the author estimated energy expenditures, and the size categories that were aggregated to represent small entities in each major sector.

Appendix A provides further details on the data sources and procedures used to estimate energy expenditures by sector and size category.

2. Revenue Data

Guidance published by the U.S. Small Business Administration's Office of Advocacy suggests that costs as a percentage of total revenues is a metric for evaluating the burden of cost increases on small entities in relation to the burden for large entities (SBA, 2003). To facilitate calculation of energy cost-to-revenue percentages, the author compiled revenue data by size category that match the size categories for which energy expenditure data were developed. These revenue data were generally compiled from the appropriate sector publication of the 2002 Economic Census:

- Agriculture – 2002 Census of Agriculture;
- Mining – 2002 Census of Mining;
- Construction – 2002 Census of Construction; and
- Manufacturing – 2002 Census of Manufacturing.

⁸ Because energy cost impacts are ultimately determined by firms rather than establishments, firm-level energy data were preferred. However, these data are not generally available.

Table 2. Energy Expenditure Estimate Size Categories

Sector	Unit of Measure	Size Categories	Small Size Category
Agriculture	Revenue per Farm	Less than \$100,000 \$100,000 to \$249,999 \$250,000 to \$499,999 \$500,000 to \$999,999 \$1 million or more	Farms with less than \$500,000 in revenue
Mining	Employees per Establishment	0 to 4 5 to 9 10 to 19 20 to 49 50 to 99 100 to 249 250 to 499 500 to 999 1,000 to 2,499 2,500 or more	Establishments with less than 500 employees
Construction	Sales or Receipts per Establishment	Less than \$25,000 \$25,000 to \$49,999 \$50,000 to \$99,999 \$100,000 to \$249,999 \$250,000 to \$499,999 \$500,000 to \$999,999 \$1 million to \$2,499,999 \$2,500,000 to \$4,999,999 \$5 million to \$9,999,999 \$10 million or more	Establishments with sales or receipts less than \$10 million
Electric Generation		Each individual utility	Utilities with net electric generation of 4 million megawatthours or less
Manufacturing	Employees per establishment	1 to 4 5 to 9 10 to 19 20 to 49 50 to 99 100 to 249 250 to 499 500 to 999 1,000 to 2,499 2,500 or more	Establishments with less than 500 employees
Commercial	Employees per establishment	1 to 4 5 to 9 10 to 19 20 to 49 50 to 99 100 or more	Establishments with less than 100 employees

For the commercial sector, revenue data were first compiled from Economic Census data available from the Bureau of the Census's AmericanFactFinder weblink.⁹ In cases where revenue data were reported in the Bureau of Census's 2002 Business Expense Survey with different values than the Economic Census estimates, the author adjusted the Census values to match the Business Expense Survey. These adjustments were implemented to ensure consistency with the energy expenditure data compiled from the Business Expense Survey. (See Appendix A for details.) For the electric generation sector, the author compiled 2002 revenue data for each individual utility from EIA's *Annual Electricity Industry Financial Report*, based on the 2002 Form EIA-861 database.

3. Profit Data

The author compiled profitability data (pre-tax profits as a percentage of sales) by North American Industrial Classification System (NAICS) code and firm size from Risk Management Association's online version of *Annual Statement Studies* (RMA, 2007). These data assist in identifying sectors for which small entities' baseline profit margins are particularly slim, indicating the potential for relatively small energy price increases to negatively impact small firm health. Risk Management Association's firm size profitability data were available for the following sales ranges: \$0 to \$1 million; \$1 million to \$3 million; \$3 million to \$5 million; \$5 million to \$10 million; \$10 million to \$25 million; and more than \$25 million. To develop NAICS code-level estimates of average profits as a percentage of sales for small and large firms, the author identified a representative small firm threshold for each major sector. Table 3 identifies this threshold, which was selected to most closely match SBA's small firm threshold.¹⁰ Table 3 also repeats the small entity threshold used in compiling small establishment energy

⁹ AmericanFactFinder, which is located at <http://factfinder.census.gov/>, is a repository for Economic Census data, including revenue data that appear in the following publications covering the commercial sector: wholesale trade; retail trade; transportation and warehousing; information; finance and insurance; real estate and rental and leasing; professional, scientific, and technical services; management of companies and enterprises; administrative and support and waste management and remediation services; educational services; health care and social assistance; arts, entertainment, and recreation; accommodation and food services; and other services (except public administration).

¹⁰ The SBA designates small business size standards at the 6-digit NAICS code level. Because revenue and energy expenditure data by size category were generally not available at this level of detail, the author identified a major sector-level firm size threshold reflecting the predominant industry size standard within each sector.

expenditure data as reported in Table 2 above. To estimate average small and large firm profitability within each NAICS code, the author weighted the pre-tax profit margins for each of the appropriate firm size categories by the *Annual Statement Studies* reported sales data for each size category.

Table 3. Comparison of Small Size Category Definitions

Sector	Predominant SBA Small Firm Size Threshold	Energy Expenditure Data Small Size Category	Profitability Data Small Size Category	Rationale for Selection of Small Firm Profitability Sales Category
Agriculture	\$750,000 in revenue	Farms with less than \$500,000 in revenue	Firms with less than \$1 million in sales	Smallest size category available
Mining	500 employees	Establishments with less than 500 employees	Firms with less than \$10 million in sales	Overall mining sector average revenues of \$5.7 million for establishments with 500 or less employees
Construction	\$13 million in revenue	Establishments with sales or receipts less than \$10 million	Firms with less than \$10 million in sales	\$10 million is closest available category to SBA small firm threshold
Electric Generation	Net electric generation of 4 million megawatt-hours	Utilities with net electric generation of 4 million megawatt-hours or less	(no profitability data available)	
Manufacturing	500 employees	Establishments with less than 500 employees	Firms with less than \$25 million in sales	\$25+ million is largest available size category (\$92.0 million is average value of shipments for manufacturing sector establishments with 250-499 employees)
Commercial	100 employees	Establishments with less than 100 employees	Firms with less than \$10 million in sales	Approximately \$9.7 million in sales for commercial sector establishments with 50 to 99 employees

D. RESULTS

The following two sections present the results of the analyses performed in this study—the first section characterizes energy cost impacts by industry sector, entity size, and fuel type. This is followed by a section that identifies manufacturing, commercial, and electric generation sector energy price differentials by establishment size category and fuel type.

1. Energy Expenditure Impacts

Table 4 presents total estimated 2002 small entity energy expenditures by major sector. This table indicates that more than 85 percent of total small entity energy expenditures occurred in the commercial and manufacturing sectors.

Table 4. Summary of 2002 Small Entity Energy Expenditures by Major Sector

Major Sector	NAICS Codes	Estimated Small Entity Energy Expenditures (\$million)	Share of Total Small Entity Energy Expenditures (percent)
Commercial	423 thru 813	52,343	41.0
Manufacturing	311 thru 339	45,629	35.7
Construction	236 thru 238	14,011	11.0
Agriculture	111 thru 112	7,876	6.2
Mining	211 thru 213	5,443	4.3
Electricity Generation	2211	2,482	1.9
SUBTOTAL		127,784	100

Tables 5 through 10 present the following information for each major sector NAICS code for which energy expenditure data were available:

- Total small entity energy expenditures (in millions of dollars);
- Small entity energy expenditures as a percentage of small entity revenue;¹¹
- The ratio of small entity energy expenditures as a percentage of small entity revenue to large entity energy expenditures as a percentage of large entity revenue;
- Small entity pre-tax profit margin; and
- The ratio of the small entity pre-tax profit margin to the large entity pre-tax profit margin.

Measures 1 and 2 provide direct information for evaluating the significance of energy costs to small entities in each NAICS code; higher values indicating greater importance within that industry. Measure 3 evaluates whether energy costs are of greater significance to small entities than large entities within that NAICS codes; larger values suggest that energy costs disproportionately impact small entities in that sector (i.e., for a given dollar of revenue, small entities spent more on energy than large entities). Smaller values for measure 4 indicate that small entities have lower profit margins, indicating the potential for relatively small energy price increases to negatively impact small firm health. The final measure (ratio of the small entity pre-tax profit margin to the large entity pre-tax profit margin) shows whether small entity baseline profitability is higher or lower than that of large entities. Values below 1.0 suggest that smaller entities have less ability than larger entities to absorb energy price increases via reductions in profits.

Tables 11 through 13 identify the sectors in which energy costs are of greatest concern to small entities. Table 11 lists the ten sectors with the highest total small entity energy costs; Table 12 lists the ten sectors in which small entities have the highest ratios of energy expenditures to revenue; and Table 13 lists the ten sectors in which energy costs, measured as a percentage of sector revenue, are of greater significance to small entities than large entities.

¹¹ For the construction sector, percentages are relative to total value of business done; for the manufacturing sector, percentages are relative to value of shipments; for the commercial sector, percentages are relative to sales.

Table 14 identifies the five sectors in which small entities appear to be most vulnerable to energy price increases. These sectors were chosen because they appear the most often in Tables 11-13; they have low small entity profit margins; and the small entities in these sectors generally have lower profitability levels than the sector's large entities (suggesting that small entities in these sectors have a less ability to absorb energy price increases than large entities).

For the five sectors identified in Table 14, Table 15 reports the percentage of 2002 total small entity energy expenditures by type of energy.¹² This table clearly indicates that the importance of each energy type varies by sector. For example, electricity accounted for more than 92 percent of 2002 small entity energy expenditures in the general merchandise stores sector, but only 3 percent of total energy expenditures in the truck transportation sector. Similarly, natural gas was responsible for more than one-quarter of the small entity energy expenditures in the durable goods merchant wholesalers sector, but less than 1 percent of total energy expenditures in the truck transportation sector. As expected, the two transportation-related priority sectors identified in Table 15 (truck transportation and couriers and messengers) have the greatest percentage of total expenditures from motor fuels (96 percent and 83 percent, respectively). Of the priority sectors, the dairy cattle and milk production sector is unique in that electricity and motor fuels are responsible for similar percentages of total energy expenditures.

¹² Because size category-specific motor fuel expenditure data were not available for the couriers and messengers and truck transportation sectors, Table 15 reports overall sector percentages for these sectors rather than small entity percentages

Table 5. Summary of Small Entity Energy Expenditures in the Agriculture Sector

NAICS Code	Small Entity Energy Expenditures (million \$)	Energy Expenditures as % of Revenue		Pre-Tax Profit Margin	
		Small Entity (%)	Small Entity/ Large Entity	Small Entity (%)	Small Entity/ Large Entity
1111 – Oilseed and Grain Farming	2,175	8.0	2.6	13.8	3.1
1112 – Vegetable and Melon Farming	261	15.0	0.6	N/A	N/A
1113 – Fruit and Tree Nut Farming	260	6.6	1.0	4.0	0.5
1114 – Greenhouse, Nursery, & Floriculture Production	293	9.9	0.7	4.6	2.9
11191 – Tobacco Farming	91	8.3	1.1	N/A	N/A
11192 – Cotton Farming	218	13.5	0.6	N/A	N/A
11193 – Sugarcane Farming	760	14.4	0.7	N/A	N/A
11194 – Hay Farming	760	14.4	0.7	N/A	N/A
11199 – All Other Crop Farming	760	14.4	0.7	7.8	2.2
11211 – Beef Cattle Ranching & Farming, including Feedlots	2,077	12.7	0.2	10.0	4.2
11212 – Dairy Cattle and Milk Production	632	7.2	0.8	1.7	0.2
1122 – Hog and Pig Farming	196	7.8	0.4	11.5	0.8
1123 – Poultry and Egg Production	463	10.5	0.6	N/A	N/A
1124 – Sheep and Goat Farming	53	17.3	0.6	N/A	N/A
1125 – Animal Aquaculture	395	20.8	1.3	N/A	N/A
1129 – Other Animal Production	395	20.8	1.3	N/A	N/A

Notes: N/A - not available.
 Shaded cells indicate that available data for these NAICS codes were reported as a combined total of individual NAICS codes.

Table 6. Summary of Small Entity Energy Expenditures in the Mining Sector

NAICS Code	Small Entity Energy Expenditures (million \$)	Energy Expenditures as % of Revenue		Pre-Tax Profit Margin	
		Small Entity (%)	Small Entity/ Large Entity	Small Entity (%)	Small Entity/ Large Entity
211 – Oil and Gas Extraction	2,350	2.4	1.3	24.0	1.1
212 – Mining, Except Oil and Gas	2,641	6.7	0.9	7.5	1.0
213 – Support Activities for Mining	452	2.7	1.0	16.1	1.4

Table 7. Summary of Small Entity Energy Expenditures in the Electric Generation Sector

NAICS Code	Small Entity Energy Expenditures (million \$)	Energy Expenditures as % of Revenue		Pre-Tax Profit Margin	
		Small Entity (%)	Small Entity/ Large Entity	Small Entity (%)	Small Entity/ Large Entity
2211 - Electric Power Generation, Transmission & Distribution	2,482	7.3	0.7	N/A	N/A
2211 Public Utilities	1,766	10.0	0.7	N/A	N/A
2211 Private Utilities	716	4.4	0.4	N/A	N/A

Notes: N/A - not available [however, electric distribution sector (NAICS 221122) data generally indicate higher profit margins for smaller-sized firms].

Table 8. Summary of Small Entity Energy Expenditures in the Construction Sector

NAICS Code	Small Entity Energy Expenditures (million \$)	Energy Expenditures as % of Total Value of Business Done		Pre-Tax Profit Margin	
		Small Entity (%)	Small Entity/ Large Entity	Small Entity (%)	Small Entity/ Large Entity
236 – Construction of Buildings	3,190	1.6	1.6	4.7	0.9
237 – Heavy and Civil Engineering Construction	1,985	3.3	1.0	9.4	1.4
238 – Specialty Trade Contractors	8,836	2.8	1.1	4.0	1.0

Table 9. Summary of Small Entity Energy Expenditures in the Manufacturing Sector

NAICS Code	Small Entity Energy Expenditures (million \$)	Energy Expenditures as % of Value of Shipments		Pre-Tax Profit Margin	
		Small Entity (%)	Small Entity/ Large Entity	Small Entity (%)	Small Entity/ Large Entity
311 - Food Manufacturing	5,744	1.9	2.4	4.1	1.4
312 - Beverage & Tobacco Product Mfg	511	N/A	N/A	8.0	1.2
313 - Textile Mills	1,089	3.3	0.9	1.7	1.2
314 - Textile Product Mills	247	1.0	0.6	3.0	0.8
315 - Apparel Mfg	284	0.8	1.6	2.1	0.4
316 - Leather & Allied Product Mfg	65	1.2	2.4	5.0	1.8
321 - Wood Product Mfg	1,965	2.4	0.9	3.7	0.8
322 - Paper Mfg	N/A	N/A	N/A	2.9	1.0
323 - Printing & Related Support Activities	1,012	1.2	0.8	2.6	0.7
324 - Petroleum & Coal Products Mfg	2,204	2.4	0.8	3.1	0.6
325 - Chemical Mfg	19,439	7.6	1.2	4.8	0.9
326 - Plastics & Rubber Products Mfg	N/A	N/A	N/A	3.1	0.9
327 - Nonmetallic Mineral Product Mfg	4,504	5.2	1.2	4.5	0.7
331 - Primary Metal Mfg	2,976	3.8	0.3	5.2	1.0
332 - Fabricated Metal Product Mfg	N/A	N/A	N/A	4.6	0.9
333 - Machinery Mfg	1,414	0.9	1.5	4.3	0.8
334 - Computer & Electronic Product Mfg	1,583	1.2	2.3	4.8	1.0
335 - Electrical Equipment, Appliance, & Component Mfg	777	1.2	1.9	5.7	1.2
336 - Transportation Equipment Mfg	1,203	0.9	1.9	3.5	0.9
337 - Furniture & Related Product Mfg	437	0.8	0.8	2.7	0.9
339 - Miscellaneous Mfg	687	0.8	1.4	4.5	0.9

Notes: N/A - not available.

Table 10. Summary of Small Entity Energy Expenditures in the Commercial Sector

NAICS Code	Small Entity Energy Expenditures (million \$)	Energy Expenditures as % of Sales		Pre-Tax Profit Margin	
		Small Entity (%)	Small Entity/ Large Entity	Small Entity (%)	Small Entity/ Large Entity
423 - Durable Goods Merchant Wholesalers	2,446	0.3	1.9	0.1	0.03
424 - Nondurable Goods Merchant Wholesalers	2,487	0.3	2.8	1.6	0.8
441 - Motor Vehicle & Parts Dealers	1,564	0.3	3.2	1.3	0.9
442 - Furniture & Home Furnishings Stores	656	0.8	0.7	2.1	1.0
443 - Electronics & Appliance Stores	342	0.6	2.5	2.7	0.9
444 - Building Material & Garden Equipment & Supplies Dealers	1,451	0.9	4.8	2.3	0.6
445 - Food & Beverage Stores	5,578	2.1	53.3	1.8	1.1
446 - Health & Personal Care Stores	N/A	N/A	N/A	3.3	1.6
447 - Gasoline Stations	1,354	0.5	1.2	N/A	0.9
448 - Clothing & Clothing Accessories Stores	N/A	N/A	N/A	2.8	0.7
451 - Sporting Goods; Hobby, Book, & Music Stores	551	0.8	0.4	1.0	0.4
452 - General Merchandise Stores	2,514	4.1	42.5	1.3	0.4
453 - Miscellaneous Store Retailers	742	0.7	0.1	3.2	0.9
454 - Nonstore Retailers	346	0.4	3.0	1.9	0.9
484 - Truck Transportation	15,231	12.3	11.9	4.3	1.2
492 - Couriers & Messengers	1,704	10.8	56.9	2.0	0.9
493 - Warehousing & Storage	122	1.0	1.5	9.2	1.6
511 - Publishing Industries (Except Internet)	61	0.1	7.8	4.7	0.8
512 - Motion Picture & Sound Recording Industries	32	N/A	N/A	4.8	1.0
532 - Rental & Leasing Services	88	0.1	2.5	11.7	1.7
541 - Professional, Scientific, & Technical Services	304	0.1	1.6	7.9	0.7
561 - Administrative & Support Services	377	0.2	2.7	5.6	1.2
562 - Waste management & Remediation Services	116	0.3	2.0	5.1	1.1

Table 10 (continued)

NAICS Code	Small Entity Energy Expenditures (million \$)	Energy Expenditures as % of Sales		Pre-Tax Profit Margin	
		Small Entity (%)	Small Entity/ Large Entity	Small Entity (%)	Small Entity/ Large Entity
621 - Ambulatory Health Care Services	301	0.1	1.0	9.4	1.5
622 - Hospitals	160	4.7	21.3	9.2	2.4
623 - Nursing & Residential Care Facilities	409	0.8	3.7	4.3	1.2
624 - Social Assistance	181	0.2	1.0	3.9	1.9
711 - Performing Arts, Spectator Sports, & Related Industries	49	0.1	3.7	1.9	0.7
712 - Museums, Historical Sites, & Similar Institutions	34	0.8	3.9	0.7	0.1
713 - Amusement, Gambling, & Recreation Industries	273	0.6	2.1	2.8	0.2
721 - Accommodation	3,260	7.1	4.6	8.1	0.7
722 - Food Services & Drinking Places	8,414	2.8	4.9	3.7	1.2
811 - Repair & Maintenance	297	0.2	0.5	3.6	0.8
812 - Personal & Laundry Services	513	0.6	0.9	5.1	1.2
813 - Religious/Grantmaking/Civic/Professional & Similar Org	386	0.4	9.1	6.8	1.1

Notes: N/A - not available

Table 11. Top 10 Sectors with the Highest Small Entity Energy Expenditures

NAICS Code	Small Entity Energy Expenditures (million \$)	Energy Expenditures as % of Sales		Pre-Tax Profit Margin	
		Small Entity (%)	Small Entity/ Large Entity	Small Entity (%)	Small Entity/ Large Entity
325 – Chemical Manufacturing	19,439	7.6	1.2	4.8	0.9
484 – Truck Transportation	15,231	12.3	11.9	3.7	1.0
238 – Specialty Trade Contractors	8,836	2.8	1.1	4.0	1.0
722 – Food Services & Drinking Places	8,414	2.8	4.9	3.7	1.2
311 – Food Manufacturing	5,744	1.9	2.4	4.1	1.4
445 – Food & Beverage Stores	5,578	2.1	53.3	1.8	1.1
327 – Nonmetallic Mineral Product Manufacturing	4,504	5.2	1.2	4.5	0.7
721 – Accommodation	3,260	7.1	4.6	7.2	0.6
236 – Construction of Buildings	3,190	1.6	1.6	4.7	0.9
331 – Primary Metal Manufacturing	2,976	3.8	0.3	5.2	1.0

Table 12. Top 10 Sectors with the Highest Small Entity Energy Expenditures as a Percentage of Sales

NAICS Code	Small Entity Energy Expenditures (million \$)	Energy Expenditures as % of Sales		Pre-Tax Profit Margin	
		Small Entity (%)	Small Entity/ Large Entity	Small Entity (%)	Small Entity/ Large Entity
1125 & 1129 – Animal Aquaculture & Other Animal Production	395	20.8	1.3	N/A	N/A
1124 – Sheep and Goat Farming	53	17.3	0.6	N/A	N/A
1112 – Vegetable and Melon Farming	261	15.0	0.6	N/A	N/A
11193, 1194, & 1199 – Sugarcane, Hay, & All Other Crop Farming	760	14.4	0.7	N/A	N/A
11192 – Cotton Farming	218	13.5	0.6	N/A	N/A
11211 – Beef Cattle Ranching and Farming, including Feedlots	2,077	12.7	0.2	N/A	N/A
484 – Truck Transportation	15,231	12.3	11.9	3.7	1.0
492 – Couriers and Messengers	1,704	10.8	56.9	2.3	1.0
1123 – Poultry and Egg Production	463	10.5	0.6	N/A	N/A
1114 – Greenhouse, Nursery, and Floriculture Production	293	9.9	0.7	4.6	2.9

Notes: N/A – not available.

Table 13. Top 10 Sectors with the Highest Ratio of Small Entity to Large Entity Energy Expenditures to Sales

NAICS Code	Small Entity Energy Expenditures (million \$)	Energy Expenditures as % of Sales		Pre-Tax Profit Margin	
		Small Entity (%)	Small Entity/ Large Entity	Small Entity (%)	Small Entity/ Large Entity
492 – Couriers and Messengers	1,704	10.8	56.9	2.3	1.0
445 – Food & Beverage Stores	5,578	2.1	53.3	1.8	1.1
452 – General Merchandise Stores	2,514	4.1	42.5	1.3	0.4
622 – Hospitals	160	4.7	21.3	7.4	2.0
484 – Truck Transportation	15,231	12.3	11.9	3.7	1.0
813 – Religious/Grantmaking/Civic/ Professional & Similar Org.	386	0.4	9.1	6.6	1.1
511 – Publishing Industries (except Internet)	61	0.1	7.8	5.2	0.9
722 – Food Services and Drinking Places	8,414	2.8	4.9	3.7	1.2
444 – Building Material & Garden Equipment & Supplies Dealers	1,451	0.9	4.8	2.2	0.5
721 – Accommodation	3,260	7.1	4.6	7.2	0.6

Table 14. Top 5 Sectors in Which Small Entities Are Most Vulnerable to Energy Cost Impacts

NAICS Code	Small Entity Energy Expenditures (million \$)	Energy Expenditures as % of Sales		Pre-Tax Profit Margin	
		Small Entity (%)	Small Entity/ Large Entity	Small Entity (%)	Small Entity/ Large Entity
492 – Couriers and Messengers	1,704	10.8	56.9	2.3	1.0
11212 – Dairy Cattle and Milk Production	632	7.2	0.8	1.7	0.2
452 – General Merchandise Stores	2,514	4.1	42.5	1.3	0.4
423 – Durable Goods Merchant Wholesalers	2,446	0.3	1.9	0.3	0.08
484 – Truck Transportation	15,231	12.3	11.9	3.7	1.0

Table 15. Total Energy Expenditure Percentages by Fuel Type for Most Vulnerable Sectors

NAICS Code	Small Entity Energy Expenditures (million \$)	Percentage of Total Energy Expenditures					
		Electricity	All Fuels	Motor Fuels	Non-Motor Fuels		
					Total	Natural Gas	Other
492 – Couriers and Messengers*	1,704	13.9	86.1	83.3	2.8	2.5	0.4
11212 – Dairy Cattle and Milk Production^	632	43.9	56.1	45.8	10.3	1.3	9.1
452 – General Merchandise Stores	2,514	92.2	7.8	N/A	7.8	6.7	1.1
423 – Durable Goods Merchant Wholesalers	2,446	72.4	27.6	N/A	27.6	25.6	2.0
484 – Truck Transportation*	15,231	3.1	96.9	96.4	0.5	0.5	0.1

* - due to lack of motor fuel expenditure data by size category, NAICS code 484 and 492 data are estimates for the total sector rather than for small entities.

^ - separate motor fuel expenditure estimates are available for diesel (17.2) and gasoline/gasohol (28.6).

N/A - not available.

The study results indicate that the manufacturing and commercial sectors have the greatest potential for small entity energy price impacts. *When measured on the basis of expenditures per value of industry shipments, small entities spent considerably more on energy in 2002 than larger entities in a majority (10 of 17) of the manufacturing sector industries with available data.* The data reveal three manufacturing sector industries as having energy costs per dollar of output that are more than double those incurred by larger entities: food manufacturing; leather and allied products manufacturing; and computer and electronic product manufacturing. Profitability data further indicate the challenges that small entities face from increases in energy and other production input prices: *13 of the 19 manufacturing sector industries with available data have lower baseline profit margins among small entities than large ones.*

Similarly, small entities have higher energy expenditures per dollar of sales than larger entities in 26 of the 31 commercial sector industries studied. The median commercial sector industry has a small entity energy cost per sales ratio that is 2.7 times the ratio of large entities. General merchandise stores; food and beverage stores; and couriers and messengers are three of the commercial sector industries where small entity energy costs per sales ratios are highest relative to their large entity counterparts. The couriers and messengers industry is particularly

noteworthy in that small entity energy expenditures amount to more than 10 percent of total small entity sales. *In addition, data indicate that a majority of commercial sector industries have smaller small entity baseline profit margins than their larger industry counterparts.*

Although the results for other economic sectors (agriculture, mining, construction, electric generation) show a more equal distribution of small and large entity baseline profit margins and energy expenditures per unit of output, all but the electric generation sector have one or more individual industries for which available data suggest that energy price increases are expected to result in greater impacts on small entities than large entities

2. Energy Price Disparities

As noted earlier in the Section B.1 discussion, it appears that the Nguyen and Lee (2002) analysis did not evaluate the possibility that smaller manufacturing sector establishments may face higher energy prices than their larger counterparts. This section provides energy price information by entity size as compiled in this study for the manufacturing, commercial, and electric generation sectors.

Table 16 displays 2002 energy price information by fuel type and employment size category from the 2002 Manufacturing Energy Sector Consumption Survey (MECS). Table 17 converts this information into ratios representing how each employment size category's energy price relates to the overall sector average energy price. This table clearly shows small manufacturing establishments faced higher than average prices in 2002 for electricity, distillate fuel oil, and natural gas. (Coal prices also appear to be higher than average for most of the smaller establishment size categories.)

Table 16. Energy Prices in the Manufacturing Sector by Fuel Type and Establishment Size Category, 2002

Employment Size Category	Dollars per Million Btu					
	Electricity	Residual Fuel Oil	Distillate Fuel Oil	Natural Gas	LPG and NGL	Coal
Under 50	19.11	3.64	7.38	4.63	5.19	2.15
50-99	17.76	3.62	7.07	4.13	7.07	N/A
100-249	15.51	4.05	6.48	4.1	5.16	1.92
250-499	13.08	3.91	6.43	3.83	6.36	1.77
500-999	12.35	3.51	5.43	3.78	5.75	2.04
1,000 or more	11.72	3.89	5.58	3.6	5.96	1.89
Sector average	14.13	3.78	6.56	3.9	5.84	1.87

Source: E.H. Pechan based on Manufacturing Energy Sector Consumption Survey.

N/A - not available.

LPG and NGL = liquefied petroleum gas and natural gas liquids

Table 17. Comparison of Size Category Price and Average Sector Price in the Manufacturing Sector, 2002

Employment Size Category	Ratio of Employment Size Category Price to Average Sector Price					
	Electricity	Residual Fuel Oil	Distillate Fuel Oil	Natural Gas	LPG and NGL	Coal
Under 50	1.35	0.96	1.13	1.19	0.89	1.15
50-99	1.26	0.96	1.08	1.06	1.21	N/A
100-249	1.10	1.07	0.99	1.05	0.88	1.03
250-499	0.93	1.03	0.98	0.98	1.09	0.95
500-999	0.87	0.93	0.83	0.97	0.98	1.09
1000 and Over	0.83	1.03	0.85	0.92	1.02	1.01

Source: E.H. Pechan based on Manufacturing Energy Sector Consumption Survey.

Notes: N/A - not available.

LPG and NGL = liquefied petroleum gas and natural gas liquids

Table 18 presents energy prices by fuel type and employment size category as computed from 2003 CBECS microdata.¹³ Table 19 displays this information as ratios of each employment size category's average price to the overall commercial sector average price. This table indicates that

¹³ See the Commercial Buildings Energy Consumption Survey (CBECS) microdata section of Appendix A for discussion of this data set.

smaller commercial sector entities face higher electricity and natural gas prices than their larger counterparts, with electricity prices up to 30 percent higher for the smallest entities relative to the prices paid by the largest entities.

Table 18. Energy Prices by Fuel Type and Establishment Size Category in the Commercial Sector, 2003

Employment Size Category	Dollars per Million Btu		
	Electricity	Fuel Oil	Natural Gas
0 to 4	32.72	9.94	10.32
5 to 9	30.00	9.21	11.06
10 to 19	27.88	8.79	9.00
20 to 49	26.78	9.79	8.84
50 to 99	24.53	6.57	8.47
100 or more	23.58	9.80	8.29
Sector average	30.98	9.71	10.04

Source: E.H. Pechan based on the Commercial Buildings Energy Consumption Survey.

Table 19. Comparison of Size Category Price and Average Sector Price in the Commercial Sector, 2003

Employment Size Category	Ratio of Employment Size Category Price to Average Sector Price		
	Electricity	Fuel Oil	Natural Gas
0 to 4	1.06	1.02	1.03
5 to 9	0.97	0.95	1.10
10 to 19	0.90	0.91	0.90
20 to 49	0.86	1.01	0.88
50 to 99	0.79	0.99	0.84
100 or more	0.76	1.01	0.83

Source: E.H. Pechan based on the Commercial Buildings Energy Consumption Survey.

Tables 20 and 21 present 2002 energy price information for small and large electric generation sector facilities as developed from EIA data sources.¹⁴ These tables indicate that small utilities in this sector did not generally face energy price disadvantages. (Although a small price disadvantage existed for coal purchases, average natural gas prices were slightly lower for small utilities.)

Table 20. Energy Prices by Fuel Type and Size Category in the Electric Generation Sector, 2002

Size Category	Cents per Million Btu			
	Bituminous Coal	Subbituminous Coal	Distillate Fuel Oil	Natural Gas
Small	167.6	119.0	544.3	345.3
Large	146.0	110.6	537.9	384.4
Sector average	146.3	110.7	538.0	383.7

Notes: Small entities are defined as those that generate no more than 4 million megawatt hours of electricity. Source: E.H. Pechan based on the U.S. Department of Energy, Energy Information Administration.

Table 21. Comparison of Size Category Price and Average Sector Price in the Electric Generation Sector, 2002

Size Category	Ratio of Size Category Price to Average Sector Price			
	Bituminous Coal	Subbituminous Coal	Distillate Fuel Oil	Natural Gas
Small	1.15	1.07	1.01	0.90
Large	1.00	1.00	1.00	1.00

Notes: Small entities are defined as those that generate no more than 4 million megawatt hours of electricity. Source: E.H. Pechan based on the U.S. Department of Energy, Energy Information Administration.

¹⁴ See the electric generation (NAICS code 2211) section of Appendix A for a discussion of the development of utility energy prices.

E. SUMMARY/RECOMMENDATIONS FOR FUTURE RESEARCH

Profit margins will be reduced or even eliminated when firms are forced to absorb energy price increases. Reduced profits generally result in cash flow impacts, which may in turn affect firms' access to capital for investments. This is likely to be a particular concern for small firms which have more difficulty in obtaining necessary capital.

This study identifies the industries and energy types for which energy price increases are likely to result in the largest small entity impacts. It finds that small energy price impacts are expected to be most significant in the manufacturing and commercial sectors; the data also indicate that small entities pay substantially higher prices for the major types of energy used in these sectors.

A suggested area for future research is a survey of representative firms in the sectors that have been identified as most severely affected by potential energy price increases. Such a study would seek to determine how firms coped with past energy price increases, what challenges they see ahead from potential future price increases, and how they would plan to respond to various hypothetical percentage increases in energy prices. Such information would provide a better understanding of the unique challenges that small businesses face during times of rising energy prices.

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¹⁵ See the Appendix for the references used to compile this study's energy expenditure estimates.

APPENDIX. ENERGY EXPENDITURE ESTIMATION PROCEDURES

This appendix provides a detailed discussion of the data sources and methods used to characterize energy costs by NAICS code. This discussion is organized by major economic sector.

Agriculture (NAICS codes 111 - 112)

Unlike the manufacturing and commercial sectors, which tend to use number of employees to determine small business status, agricultural NAICS codes generally use revenue data. Therefore, the author computed energy data by revenue size category rather than employee size category.

Steps

- (1) Using data from Table 57 (Summary of Combined Government Payments and Market Value of Agricultural Products Sold: 2002) from the 2002 Census of Agriculture, the author computed the proportion of sales by individual revenue category for each reported agricultural sector (e.g., “grains, oilseeds, dry beans, and dry peas” for the \$1 million+ revenue category = \$5.2 billion / \$39.9 billion = 0.1304). Before calculating proportions for the “horses, ponies, mules, burros, and donkeys” sector, the author first added the 2005 total sales values for animal aquaculture from the 2005 Census of Agriculture. (The 2002 Census did not report these data.) This was necessary because the next step requires linking the 2002 Census of Agriculture Table 57 data to Table 59 NAICS code revenue data, and the Table 59 data is reported for the sum of NAICS code 1129 (horses, ponies, mules, burros, and donkeys) and NAICS code 1125 (animal aquaculture) rather than for each individual NAICS code.
- (2) The proportions from step 1 were applied to the total revenue estimates by NAICS code found in Table 59 of the 2002 Census of Agriculture. Step 2 results in revenue estimates by agricultural NAICS code for each of 11 revenue size categories.
- (3) Compiled NAICS code-level expenditure data representing “total farm production expenses” and “gasoline, fuels, and oils” from Table 59 of the 2002 Census of Agriculture.
- (4) Compiled the following data by each of 12 reported farm production specialties (e.g., general cash grains) and economic class (\$1 million or greater) from the U.S. Department of Agriculture (USDA)’s “Farm & Operator Households: Structure & Finance,” (downloaded from <http://www.ers.usda.gov/Data/ARMS/app/Farm.aspx>), which is a compilation of data obtained from the Agricultural Resource Management Survey (ARMS): (a) number of farms; (b) gross cash income (\$); (c) total cash expenses (\$); (d) utilities (\$); and (e) fuels and oils (\$). the income and expenditure values are reported on a per farm basis.

- (5) Using the data compiled in step 4, calculated production specialty/economic class totals by multiplying each per farm income/expenditure value by the applicable number of farms (a).
- (6) Summed the income and expenditure category value totals computed in step 5 across economic class to yield income/expense category totals by production specialty.
- (7) Where necessary, the author next summed the production specialty-level income and expenditure category estimates computed in step 6 to the Census of Agriculture–reported NAICS code level.
- (8) Computed the proportion of total fuels and oils expenditures in each economic class (e.g., 1 million or greater) as computed in step 5 to total fuels and oils expenditures as computed in step 6. For example, assuming that total fuels and oils expenditures are \$100 million for the “tobacco, cotton, peanuts” production specialty, and that expenditures from the \$500,000 to \$999,999 economic class for this specialty are \$23 million, then $\$23 \text{ million} / \$100 \text{ million} = 0.23$ would be the proportion for the \$500,000 to \$999,999 economic class for the “tobacco, cotton, peanuts” production specialty.
- (9) Computed similar economic class proportions to those in step 8 using the “total cash expenses” data computed in step 5.
- (10) Applied the proportions computed in step 8 to the “gasoline, fuels, and oils” expenditure totals by NAICS compiled in step 3 to yield estimated expenditures for fuels and oils by NAICS and each of five economic classes. Also, applied the proportions computed in step 9 to the “total farm production expenses” totals by NAICS code as computed in step 3. This yielded estimates for total farm expenses by each of 70 Agricultural Census category/economic class combinations (14 Census categories x 5 economic classes = 70 combinations).
- (11) Using the data from step 7, for each Census category/economic class combination, computed the proportion of “total cash expenses” that are “utilities” expenses. This step yielded five economic class proportions for each of the fourteen Census of Agriculture categories.
- (12) Applied the proportions from step 11 to the “total farm production expenses” by Census category/economic class combination as computed in step 10 to yield estimates of “utilities” expenditures by Census category/economic class combination.
- (13) Summed the NAICS code-level revenue estimates for each of eleven revenue size categories computed in step 2 to match the five economic classes ARMS data first described in step 4.
- (14) Computed the following percentages for each Agricultural Census category and economic class combination: (a) total farm production expenses as a percentage of total

revenue; (b) “gasoline, fuels, and oils” expenditures as a percentage of total revenue; and (c) “utilities” expenditures as a percentage of total revenue. Also, prepared the following additional values: total electricity expenditures and the proportion of fuels/oils expenditures by type of fuel/oil.

In addition, the author estimated electricity expenditures by NAICS and economic size class using the following steps:

- (1) Compiled the following data for each Agricultural sector NAICS code from the 1997 Census of Agriculture (1997 Census data were used because 2002 Census did not report the necessary data): (a) electricity expenditures (\$1,000s); and (b) petroleum products expenditures (\$1,000s).
- (2) Computed the ratio of electricity expenditures/petroleum product expenditures for each NAICS code.
- (3) Multiplied the ratios computed in step 2 by the gas, fuels, and oils expenditures values by NAICS code that were compiled earlier from the 2002 Census of Agriculture. This step yields 2002 estimates of electricity expenditures by NAICS code.
- (4) Computed proportions by economic size class from the “utilities” expenditure values that were previously compiled in steps 4 through 6 of the earlier agricultural sector instructions described above.
- (5) Multiplied the 2002 electricity expenditure estimates by NAICS code from step 3 by the utilities expenditure proportions from step 4 to yield estimates of electricity expenditures by economic class.

Furthermore, the author estimated fuels/oils expenditures by type of fuel/oil using the following steps:

- (1) From the 1997 Census of Agriculture, compiled NAICS-level expenditures for each of the petroleum product subcategories -- i.e.: (a) gasoline and gasohol; (b) diesel fuel; (c) natural gas; and (d) LP gas, fuel oil, kerosene, motor oil, grease, etc. and computed the proportion of total expenditures by subcategory by NAICS code.
- (2) For each NAICS code, multiplied the step 1 proportions by the total petroleum products expenditures compiled in step 1 of the electricity expenditures calculation steps.

Mining (NAICS codes 211 - 213)

For 3-digit NAICS code in the mining sector (211, 212, 213), the author:

- (1) Compiled the following values by employment size category from the 2002 Census of Mining: (a) total shipments & receipts for services, and (b) total cost of supplies.
- (2) Compiled the following values from the 2002 Census of Mining: (a) total cost of supplies, (b) purchased fuels consumed, and (c) purchased electricity. Summed the purchased fuels and purchased electricity values to represent “total energy costs.”
- (3) Computed the proportion of total cost of supplies that are total energy costs.
- (4) Multiplied the proportions from step 3 by the cost of supplies values by employment size category as compiled from step 1. The result is estimated total energy cost by 3-digit NAICS code and employment size category.
- (5) Computed the ratios of total energy cost (step 4) to total shipments & receipts for services (from step 1) for each NAICS code/employment size category.

Construction (NAICS codes 236 - 238)

For 3-digit NAICS codes in the Construction sector (236, 237, 238):

- (1) Compiled the following values by receipts size category from the 2002 Census of Construction: (a) value of business done, and (b) cost of materials, components, supplies, and fuels.
- (2) Compiled the following values by NAICS code from the 2002 Census of Construction: (a) cost of materials, components, and supplies, (b) total cost of power/fuels/lube (this entry does not include cost of on-highway or off-highway fuel), (c) on-highway fuel, and (d) off-highway fuel. values for (a) and (b) were summed together to yield values that match the step 1 receipts size category values reported as “cost of materials, components, supplies, and fuels.”
- (3) Using the data from step 2, computed the proportion of total cost of power/fuels/lube to total cost of materials, components, supplies and fuels for each NAICS code.
- (4) Multiplied the proportions from step 3 by the cost of materials, components, supplies, and fuels values by employment size category as compiled from step 1. This step estimates initial total energy cost (excluding on- and off-highway fuel) by 3-digit NAICS code and receipts size category.
- (5) Summed total cost of power/fuels/lube with on-highway fuel and off-highway fuel expenditures from data compiled in step 2, and computed the ratio of total cost of power/fuels/lube to the sum of these three values (hereafter referred to as final total energy cost) for each NAICS code.
- (6) Multiplied the ratios from step 5 by the initial total energy cost (excluding on- and off-highway fuel) by NAICS code and receipts size category computed in step 4 to yield final total energy cost by NAICS code and receipts size category.
- (7) Computed the ratios of final total energy cost (from step 6) to total value of business done from step 1 for each NAICS code/receipts size category.
- (8) Compiled available detailed energy expenditure data from the 2002 Census of Construction by NAICS code, and computed the proportion of final total energy cost by NAICS code for the following (note that data are not available to identify potential energy cost differences by receipts size category): purchased electricity; natural/manufactured gas; gasoline/diesel from other establishments/companies; on-highway fuel; and off-highway fuel.

Electric Generation (NAICS code 2211)

The author computed fuel cost estimates for each individual utility with net electricity generation greater than zero. For public utilities, reflects municipalities, political subdivisions, States, and Federal entities engaged in the generation of electricity that had at least 150,000 megawatthours (MWh) of sales to ultimate consumers and/or at least 150,000 MWh of sales for resale for each of two years prior to 2002. For private utilities, reflects all power plants with a generating capacity of at least one megawatt.

Public and Private Utilities

For utilities with net generation values >0 , compiled utility ownership, net generation, and total revenues for 2002 from the Energy Information Administration's Form EIA-861 ("Annual Electric Power Industry Report") database for 2002, accessed from <http://www.eia.doe.gov/cneaf/electricity/page/eia861.html>.

Public Utilities

- (1) Compiled from Form EIA-412 ("Annual Electric Industry Financial Report") database, Schedule 7 ("Electric Operation and Maintenance Costs"), accessed from <http://www.eia.doe.gov/cneaf/electricity/page/eia412.html>, the following 2002 data: (a) steam power generation fuel cost, and (b) other power generation fuel cost (did not compile nuclear fuel cost information for consistency with private utility data, which does not have this information available).
- (2) For each public utility, summed the steam power generation fuel cost with the other power generation fuel cost to yield total fuel cost.
- (3) Summed the utility-specific revenue and fuel cost information into two totals: one for utilities with net generation >0 but no more than 4 million megawatthours (SBA definition of small entity for NAICS 2211), and one with utilities >4 million megawatthours. Computed a cost-to-revenue ratio for small utilities and a cost-revenue for large utilities. [Also, computed cost-to-revenue ratios for each individual public utility.]

Private Utilities

- (1) Compiled from Form EIA-906 ("Power Plant Report) database (accessed from http://www.eia.doe.gov/cneaf/electricity/page/eia906_920.html), monthly and annual fuel consumption by fuel type for each private utility.
- (2) Compiled from Form EIA-423 ("Monthly Cost and Quality of Fuels for Electric Plants Report") monthly fuel cost data for each electric power producer (this form is used to obtain data for each electric generating plants whose total steam turbine electric generating capacity and/or combined-cycle generating capacity is 50 or more megawatts.)

- (3) Computed the average annual price by utility for the fuel types reported on Form EIA-906 by calculating the average as a weighted average of the Form EIA-423 monthly price values, where the monthly prices are weighted by the Form EIA-423 quantity purchased in each month. In some cases, there was some judgment necessary to assign Form EIA-423 fuel types to Form EIA-906 fuel types.
- (4) For Form EIA-906 utility/fuel type combinations for which Form EIA-423 price information was not available, the author developed price estimates. In particular, the author defaulted to price information from one of two sources, listed in order of preference: the June 29, 2006 EIA report “Cost and Quality of Fuels for Electric Plants, 2002 and 2003” or average prices computed from the Form EIA-423 utility specific price data. When the EIA report was used, the author assigned the average fuel price for the state in which the utility is located unless state-level price information was not available, in which case, a regional average price was assigned. If both a state and a regional price were not available, then the author assigned the national average reported price. In cases where no price information was available in the EIA report, the author developed and applied a State-level average price from the Form EIA-423 database information. If the appropriate State was not available from the Form EIA-423 database, the author developed and applied a National-level average price computed from the Form EIA-423 database.
- (5) Multiplied the annual fuel price information developed in steps (3) and (4) by the annual fuel consumption estimates compiled in step 1. This step yields fuel costs by utility/fuel type.
- (6) Summed the utility-specific revenue and fuel cost information into two totals: one for utilities with net generation >0 but no more than 4 million megawatthours (SBA definition of small entity for NAICS 2211), and one with utilities >4 million megawatthours. Computed a cost-to-revenue ratio for small utilities and a cost-revenue for large utilities. (Also, computed cost-to-revenue ratios for each individual public utility.)

Using the utility-specific cost-to-revenue ratios computed as described above in the Public Utilities and Private Utilities subsections, the author also computed overall electric generation sector cost-to-revenue ratios for the following size categories: (a) 4 million megawatthours or less; and (b) >4 million megawatthours.

Manufacturing (NAICS codes 311 - 339)

Steps used to characterize Manufacturing sector energy costs for 3-digit NAICS codes in the Manufacturing sector (311 - 319):

- (1) Compiled data from Table 5 of the 2002 Census of Manufacturers (Census) on the number of employees, value added, value of shipments, and number of establishments by employment size category (1 to 4; 5 to 9; 10 to 19; 20 to 49; 50 to 99; 100 to 249; 250 to 499; 500 to 999; 1,000 to 2,499; 2,500 or more; and total) by 3-digit NAICS code.
- (2) Compiled NAICS level data from Table 6.4 of 2002 Manufacturing Energy Consumption Survey (MECS) on total fuel consumption (in Btu) per employee, per dollar of value added, and per value of shipments by employment size category (< 50; 50 to 99; 100 to 249; 250 to 499; 500 to 999; 1,000 and above; and total).
- (3) Multiplied each of the fuel use estimates from step 2 by the number of employees, value added, and value of shipments estimates from step 1. Calculated the average of the three estimates and used as the estimate of total fuel use (in Btu) by each of the employment size categories listed above in step 1. For NAICS codes where employment data were withheld, only used the MECS per employee fuel data to estimate fuel consumption (see discussion below of steps used to estimate withheld data).

Estimation of Withheld Employment Data: The Census reports “All Establishments” totals. For all the missing employment categories except the 2,500+ category, the author multiplied the reported number of establishments by the midpoint of the employment range (e.g., NAICS 322 for employment category 1 to 4 employees--multiplied 814 establishments by 2.5 employees = 2,035). For the 2,500+ category, the author used the mid-point associated with the Census’s “Number of employees flag” (e.g., NAICS code 322 = 7,499.5). Next, the author subtracted the employment for the employment size categories for which there is no withheld data from the total employees for the NAICS code. This calculation yields total employment for the missing categories. This employment value was then allocated to the missing categories in proportion to the initial employment estimates calculated from the midpoint procedures noted above.

For example, if total employment for NAICS code 322 was 100,000 and the employment for all the categories that are not withheld is 90,000, then 10,000 employees are associated with the withheld employment categories. For the 1 to 4 employment category, 0.213435 of the 10,000 employees would be allocated to this category based on the proportion of employees calculated from the initial employment estimates from each size category [i.e., $2,035 / (2,035 + 7,499.5)$]. This procedure would result in an estimated 2,134.35 employees ($10,000 * 0.213435 = 2,134.35$, rounded = 2,134).

- (4) Adjusted the Total fuel consumption estimates computed in step 3 to match the PURCHASED QUANTITY estimates reported in the first column in MECS Table 7.6.

This step was accomplished by multiplying the values in step 3 by the NAICS-level ratios of Table 7.6 "Total Purchased Quantity" values to the NAICS-level sum of total fuel consumption values calculated in step 3.

- (5) Estimated Table 7.6 PURCHASED QUANTITY values for each fuel type in trillion Btu terms by multiplying the Table 7.6 physical unit-based values by Btu conversion factors. These Btu conversion factors were as follows: electricity - 0.00342; residual fuel oil - 6.287; distillate fuel oil - 5.825; natural gas - 1.029; LPG and NGL - 3.612; coal - 22.489; and coke and breeze - 22.3. before applying these factors, first estimated the withheld Table 7.6 PURCHASED QUANTITY electricity values (i.e., for NAICS codes 311, 322, 331, 335, and 336) by allocating the total electricity withheld across all NAICS (342,114 million kWh) to these five NAICS based on the proportions represented by the First Use of Energy Net Electricity Btu values reported in MECS Table 1.2.
- (6) Computed the proportions of total NAICS-level PURCHASED QUANTITY values for each fuel type from the Btu-based values computed in step 5. In cases where these values are reported as * or W or Q, treated as if 0.
- (7) Multiplied the values from step 4 by the proportions from step 6 by linking on NAICS code to estimate NAICS/Fuel Type/Employment Category level fuel PURCHASED QUANTITY estimates in Btu terms.
- (8) Estimated the dollars spent on each fuel type by NAICS/Fuel Type/Employment Category using the price per Btu by employment size category data from Table 7.5 in the 2002 MECS.
- (9) Using the estimates from step 8, computed proportions by NAICS/fuel type combination of the \$ spent by each Employment Size Category.
- (10) Multiplied the proportions from step 9 by the Expenditures for Purchased Energy data in Table 7.9 by linking the two data sets on NAICS code and fuel type.

Commercial (NAICS codes 423 - 813)

Economic Census Data

From the various sector specific publications for NAICS codes 42-81 (e.g., Wholesale Trade), the author compiled from AmericanFactFinder (http://factfinder.census.gov/servlet/IBQTable?_bm=y&-ds_name=BE0200I101&-lang=en) by 3-digit NAICS code and following employment size categories: All; All operated entire year, 1, 2, 3 or 4, 5 or 6, 7 to 9, 10 to 14, 15 to 19, 20 to 49, 50 to 99, 100+ employees, and establishments not operated all year (all but NAICS code 55 have data reported for these categories), the following data: (1) Number of Establishments; (2) Sales; and (3) Number of paid employees for pay period including March 12. The author then aggregated/retained these data for the following employment size categories: a) All operated entire year; b) 0 to 4 employees; c) 5-9 employees; d) 10-19 employees; e) 20-49 employees; f) 50-99 employees; and g) 100+ employees.

The author developed energy cost per sales ratios for the NAICS code/employment size categories where Census data were withheld. The author also compiled from the 2002 *Business Expenses Survey* (<http://www.census.gov/csd/bes/>), values by 3-digit NAICS code for:

- (1) Sales
- (2) Total Operating Expenses
- (3) Cost of purchased electricity
- (4) Cost of purchased fuels, excluding motor fuels

Next, the author compared the total sales data between the two data sets to ensure they matched (note that the author did not develop small establishment energy cost information for any NAICS where sales data were provided in the Census, but not in the BES, nor the one case - NAICS 514, where we had sales information from BES, but not from Census). To address discrepancies between sales estimates reported in the 2002 Economic Census and those reported in the 2002 Business Expense Survey (BES), the author adjusted the Census sales estimates to match the BES estimates since the total expenditure and energy expenditure estimates reflect the values reported in the BES. The following identifies the reasons for/approaches used to address these discrepancies.

- (a) NAICS codes 423 and 424 - the reason for the large discrepancy is that BES excludes data from manufacturer sales branches and offices (MSBO), while the Census includes these data. Therefore, the author applied the ratio of BES total sales to Census total sales by NAICS code to the Census's employment size category sales estimates (i.e., sales for 0 to 4 employees; c) 5-9 employees; d) 10-19 employees; e) 20-49 employees; f) 50-99 employees; and g) 100+ employees).
- (b) With exception of NAICS code 813, all other NAICS codes where sales data are reported in both the Census and the BES have somewhat higher sales estimates in BES than the Census. The reason is that the BES includes establishments without payroll, while the Census does not include these establishments. Again, the author applied the ratio of BES

total sales to Census total sales by NAICS code to the Census's employment size category sales estimates to yield sales estimates that match the BES reported values. The resulting values will be somewhat higher than the Census values.

- (c) NAICS code 813 – as a conservative assumption, the author did not make an adjustment to the Census estimates -- even though, unlike Census, BES includes establishments without payroll, Census reported sales greater than BES reported sales (there may have been a revision to estimates that was reflected in one publication, but not the other).
- d) All other NAICS codes have sales estimates reported in one publication, but not the other--in all but one case, values are reported in the Census, but not BES. This is generally because either the BES did not include the NAICS within its scope or the BES expenditure estimates did not meet the Bureau of Census's standards. The one exception is NAICS code 514 -- reason why it is in BES, but not Census is because the NAICS was substantially changed between 1997 and 2002, and NAICS code 514 is now comprised of NAICS 51 (partial), 518 (all), and 519 (all). the author did not apply the BES data for 514 to NAICS 516, 518, 519 because it is not an exact match and because these NAICS have very small energy costs as percentage of total operating expenses (electricity is 0.37 percent of total; purchased fuels is 0.03 percent).

Note that after performing the above, and comparing the results to the total BES sales data (which should match), there were four NAICS codes that were not matching (492, 622, 623, 624). This is due to there being withheld data at the employment size category level. The author estimated the sales/establishment for a given employment size category via interpolation or extrapolation of surrounding values, and multiplied this ratio by the reported number of establishments in the size category to yield initial estimated sales by withheld category, and then adjusted these initial estimates to yield values that sum to the total NAICS code sales value.

Commercial Buildings Energy Consumption Survey (CBECS) Microdata

The author compiled detailed data from files 01, 15, and 16 of the 2003 CBECS, which is available from:

http://www.eia.doe.gov/emeu/cbecs/cbecs2003/public_use_2003/cbecs_pudata2003.html.

Because these data provide records that report estimates from a surveyed group of buildings, and the ADJWT8 field contains weighting factors to represent the national number of buildings associated with each record, the author multiplied the reported data for a given record by the value in the ADJWT8 field (e.g., national electricity expenditures are obtained by multiplying the ELEXP8 field values by the ADJWT8 field values). The individual CBECS files are linked together using values in the PUBID8 field.

The author analyzed the CBECS microdata as follows:

- (1) The author added two new fields to the File 01 data -- (1) to contain the estimated number of employees per establishment rounded to the nearest integer; and (2) a flag field to identify employment size per establishment category. For any values from step 1 that may result in errors because NOCC8 field values are 0, the author set the number of

employees per establishment to 0. Next, the author entered the following codes to reflect the values calculated in the first step: 1 = <5 employees/establishment; 2 = 5 to 9 employees/establishment; 3 = 10 to 19 employees/establishment; 4 = 20 to 49 employees/establishment; 5 = 50 to 99 employees/establishment; 6 = 100 or more employees/establishment.

- (2) Calculated price per unit of energy by the employment/establishment size categories noted above. Specifically, calculated from File 15 – ELEXP8/ELBTU8 (\$ per thousand Btu of electricity); from File 16 – NGEXP8/NGBTU8 (\$ per thousand Btu of natural gas), FKEXP8/FKBTU8 (\$ per thousand Btu of fuel oil), and DHEXP8/DHBTU8 (\$ per thousand Btu of district heat) by employment size category.
- (3) Deleted all vacant building records (where the PBA8 field equal to ‘01’), and all records that report “0” in the number of businesses field (NOCC8).
- (4) Calculated the proportion of electricity expenditures by employment size category within each primary business activity (PBA). The author then applied these proportions to the NAICS-level electricity values compiled from the *Business Expenses Survey* (linked PBAs to NAICS codes via the crosswalk table displayed at the end of these steps—using the PBA identified with an ‘*’ to identify the PBA for each 3-digit NAICS code). The result is electricity expenditures by NAICS and employment size category.
- (5) Calculated the proportion of the sum of (natural gas expenditures + fuel oil expenditures) by employment size category within each PBA. Multiplied these proportions to the NAICS code-level cost of purchased fuels, excluding motor fuels data compiled from the Business Expenses Survey (note that because CBECS excludes coal, LPG, and biomass, this allocation procedure does not reflect about 5 percent of total commercial sector cost of purchased non-motor fuels). Result is the cost of non-motor fuels by NAICS code and employment size category.
- (6) Calculated the proportion of the sum of (natural gas expenditures + fuel oil expenditures) from natural gas expenditures and fuel oil expenditures by PBA. After linking the PBA’s to NAICS codes, The author multiplied the estimates from step 5 by these proportions to estimate natural gas expenditures by NAICS code and employment size category, and fuel oil expenditures by NAICS code and employment size category (note that national commercial sector fuel oil expenditures are 85.81 percent distillate; 10.14 percent residual fuel; and 4.04 percent kerosene).
- (7) Developed commercial sector energy expenditure estimates by NAICS code and employment size category, and by NAICS code, fuel type, and employment size category.
- (8) Developed commercial sector energy consumption expenditures per dollar of sales by NAICS code and employment size category.

Table A-1. Crosswalk Between CBECS Building Types and NAICS Industries

NAICS Code/Description	CBECS Principal Building Activity (PBA) [Category with Asterisk Indicates Most Likely]														
	Education	Food Sales	Food Service	Inpatient Health Care	Outpatient Health Care	Lodging	Retail (non-mall)	Retail (mall)	Office	Public Assembly	Public Order/Safety	Religious Worship	Service	Warehouse/Storage	Other
423/durables wholesalers									X					X*	
424/nondurables wholesalers		X							X					X*	
441/motor vehicles & parts dealers							X*	X	X				X	X	
442/furniture/home furnishings stores							X*	X						X	
443/electronics & appliance stores							X*	X						X	
444/building & garden eqpt./supplies							X*	X						X	
445/food & beverage stores		X*													
446/health & personal care stores							X	X*							
447/gasoline stations		X											X*		
448/clothing & accessories stores							X	X*							
451/sports, hobby, book, music stores							X*	X							
452/general merchandise stores							X*	X							
453/other store retailers							X*	X						X	
454/nonstore retailers									X*					X	X
481/air transportation									X	X*			X	X	X
482/rail transportation									X	X*			X	X	X
483/water transportation									X	X			X*	X	
484/truck transportation									X	X			X*	X	
485/transit & ground passenger									X	X*			X	X	
486/pipeline transportation									X*				X	X	
487/scenic & sightseeing transport									X	X*			X	X	
488/transportation support activities									X	X			X*	X	X
491/postal service													X*		
492/couriers and messengers									X				X*	X	
493/warehousing and storage									X				X*	X	
511/publishing industries									X*				X	X	
512/motion picture & sound recording									X	X*			X	X	X
515/broadcasting excluding internet									X	X*			X	X	X
516/internet publishing and broadcasting									X*				X	X	X
517/telecommunications							X	X	X*				X	X	X
518/internet service providers, etc							X	X	X*				X	X	X

Table A-1. Crosswalk Between CBECS Building Types and NAICS Industries

NAICS Code/Description	CBECS Principal Building Activity (PBA) [Category with Asterisk Indicates Most Likely]														
	Education	Food Sales	Food Service	Inpatient Health Care	Outpatient Health Care	Lodging	Retail (non-mall)	Retail (mall)	Office	Public Assembly	Public Order/Safety	Religious Worship	Service	Warehouse/Storage	Other
519/other information services									X*	X				X	
521/central bank									X*					X	
522/credit intermediation etc.									X*						
523/securities, investments, contracts									X*						
524/insurance carriers etc.									X*						
525/funds, trusts, and other financial									X*					X	
531/real estate									X*					X	
532/rental & leasing services							X*		X				X	X	
533/lessors of nonfinancial intangibles									X*						
541/professional, scientific, tech services									X*				X		X
551/management of companies etc.									X*						
561/administrative & support services									X*						
562/waste management & remediation									X*						
611/educational services	X*	X	X	X	X	X	X	X	X	X	X	X	X	X	X*
621/ambulatory health care services				X	X*				X				X	X	X
622/hospitals				X*											
623/nursing & residential care facilities						X*									
624/social assistance	X		X		X	X			X*						
711/performing arts, spectator sports etc									X	X*					
712/museums, historical sites, etc.		X	X				X		X	X*					
713/amusement, gambling, recreation		X	X			X	X		X	X*					
721/accommodation			X			X*			X						
722/food services and drinking places			X*												
811/repair and maintenance									X				X*	X	
812/personal and laundry services									X	X			X*		
813/religious, grantmaking, civic, etc.									X			X*			
814/private households															
921/executive, legislative, other gov't.									X*	X	X			X	
922/justice, order, and safety activities									X		X*				
923/administration of programs									X*						
924/administration of environ. programs									X*						

Table A-1. Crosswalk Between CBECS Building Types and NAICS Industries

NAICS Code/Description	CBECS Principal Building Activity (PBA) [Category with Asterisk Indicates Most Likely]														
	Education	Food Sales	Food Service	Inpatient Health Care	Outpatient Health Care	Lodging	Retail (non-mall)	Retail (mall)	Office	Public Assembly	Public Order/Safety	Religious Worship	Service	Warehouse/Storage	Other
925/administration of HUD									X*						
926/administration of economic programs									X*						
927/space research and technology									X					X	X*
928/national security & int'l affairs	X	X	X		X				X*					X	X

The fastest way to reduce residential utility demand

By V. Rory Jones and Stephen Malloy

2009

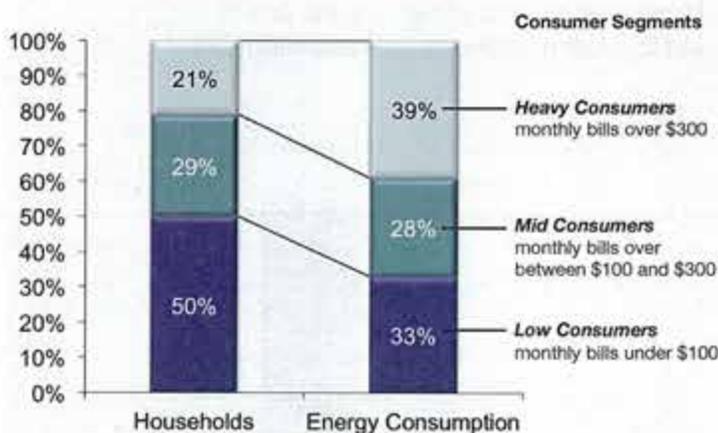


How do you get a consumer to take action? Of course, you make it in their *overwhelming* interest to act, and you enable them with guidance and a few tools. Clearly, if you have an outcome in mind, it is critical to understand what is actually in the consumer's best interest, and to arrange motivators to deliver the desired action.

Such thinking – seeing things from the consumer's viewpoint – needs to be applied to the way policy-makers are approaching the California residential utility markets, where much effort is going into initiatives that curtail energy demand from utilities like PG&E and SoCalEd. While good progress has been made in the quest to unlock wide-scale residential energy demand reductions, California is still many steps short of its goals. The game-plan for these last steps can be borrowed from the private sector, where they have been tested in countless markets.

Know what will drive action in each customer group

Of course, electricity and gas price increases over the last 6 years have received the attention of many consumers, particularly the heaviest energy consuming ones, with bills doubling in many cases since 2004. However, others have seen little change, and to get the most of our consumption reduction investments and efforts we need to distinguish between consumers.



First, it is key to recognize that the top 20% of residential energy consumers (in Sonoma county, these folks have monthly bills exceeding \$300) consume about 40% of all energy and, conversely, the lowest 50% of energy consumers (with monthly bills under \$100 in Sonoma) consume barely 30% of energy; see the chart above. This presents an amazing opportunity; pursuing relatively few consumers is likely to deliver disproportionate results. A prioritized return-on-effort

approach is warranted. The good news is that *it's actually easier to get heavy energy consumers to undertake demand reduction measures:*

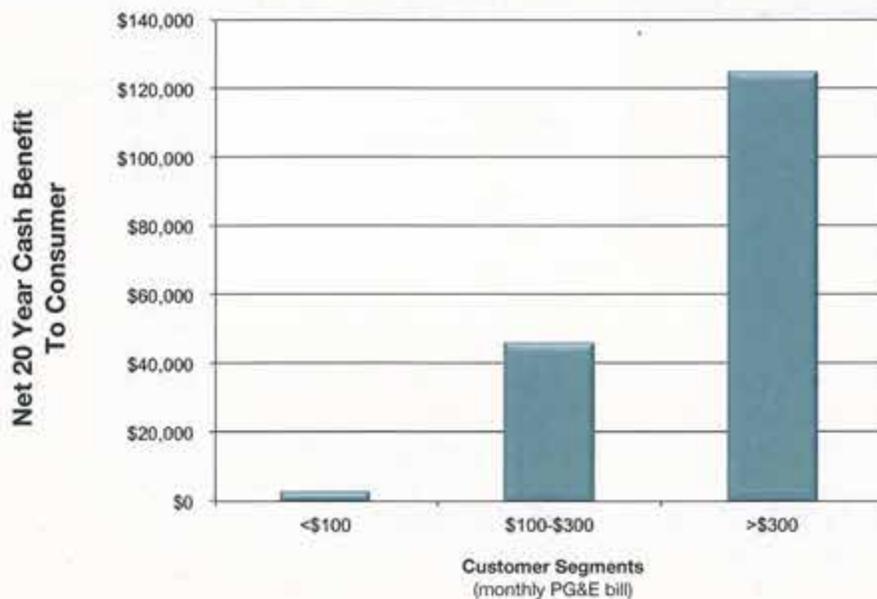
i. Efficiency matters more to heavy energy consumers - as they use a lot of fuel. If one spends \$1,000 on home heating fuel annually, a 30% efficiency improvement is worth \$300 per year. A \$3,000 replacement high-efficiency heater will be paid-off over its 20 year life. But, if you spend only \$100 in heating annually, \$30 in savings will not support any efficiency investment.

ii. Heavy energy consumers pay much higher energy prices (especially for electricity, where the marginal price is four times that for low energy consumers; \$0.40/kWh versus \$0.11/kWh). The result is even mid-energy consumers are thrust into the high bill amounts of (i.) above.

iii. Heavy energy consumers have a clear economic motivation to undertake efficiency investments, as they are usually homeowners. Low energy consumers tend to be renters, and rely on landlords to upgrade energy system efficiencies (alas, landlords rarely pay utility bills).

Money is what really motivates action

Nothing motivates consumers as much as their pocketbooks. Most citizens want to operate environmentally responsibly, but if action requires a net cash outflow there is always hesitation – almost always resulting in inaction (especially true when investment needs are in thousands of dollars; the case for most non-trivial demand reduction measures).



The chart above summarizes a study of nearly 200 households in Sonoma County. It shows the average 20-year benefit of undertaking only economically positive measures for the three segments of households; low consumers with monthly bills under \$100, mid consumers paying between \$100 and \$300, and heavy consumers paying over \$300. An economically positive demand reduction measure is any retrofit, behavior change or energy generation that will pay for itself after all costs (equipment, installation and 7% financing, and assuming fuel prices increase at historic rates). This detailed study has a clear message; low energy consumers have little to gain investing to reduce demand, while **heavy energy consumers have much to gain; more than enough to motivate action** – enough to pay for a college education!

So, what magnitude of reductions in energy demand is associated with such enormous economic benefits? The potential is staggering. With the proper guidance, using combinations of efficiency retrofits, minor behavioral changes and solar generation, heavy consumers would profitably reduce electricity consumption over 60%, and gas nearly 30% (see discussion below).

On the other hand, the opportunity to profitably reduce demand among the low energy consumers is very limited, owing to the lower prices enjoyed today by this customer segment, and their lower fuel throughput.

Positive-Return Demand Reduction Potential, By Customer Segment

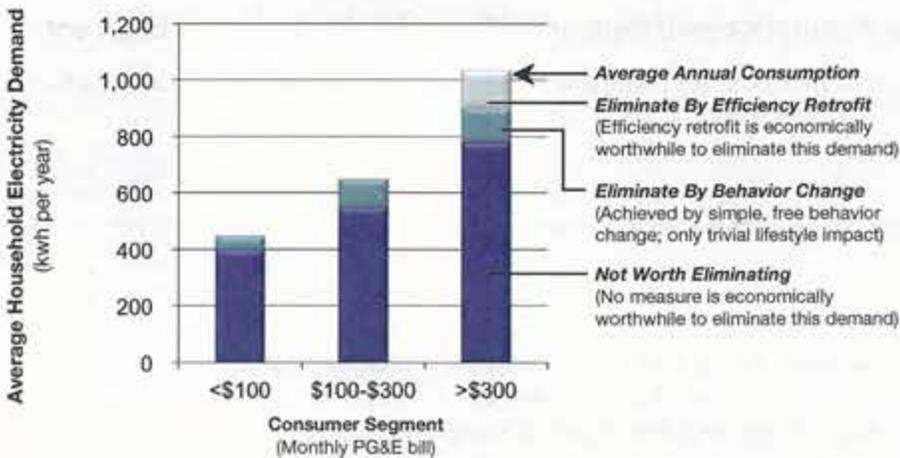
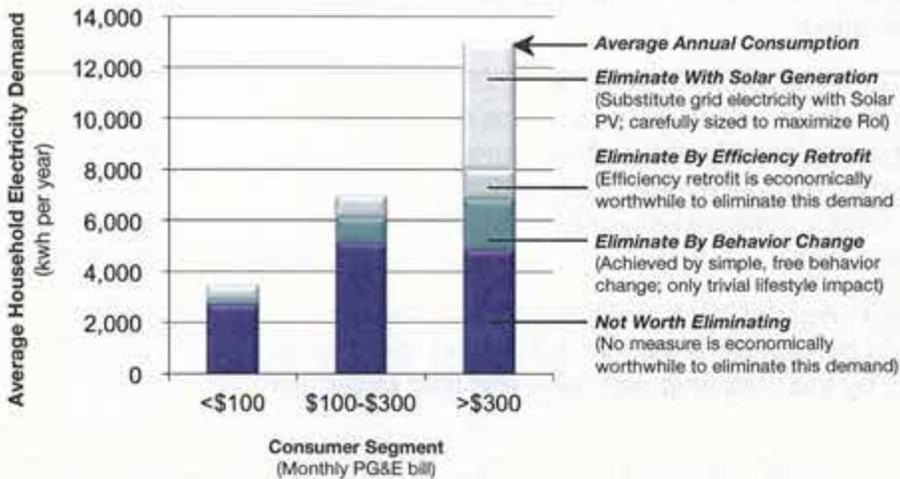
Consumer Segment	PG&E Bill (per month)	Potential Demand Reduction /Home /Yr		Potential California Demand Reduction /Yr	
		Electricity (kWh)	Gas (therms)	Electricity (billion kWh)	Gas (million therms)
Low	<\$100	800 (22%)	50 (11%)	5.1	340
Mid	\$100-\$300	1,800 (26%)	100 (15%)	7.2	390
Heavy	>\$300	8,100 (62%)	255 (28%)	23.0	720
				35.3	1,450

So what does California have to gain by embarking on a program to get consumers to act in their own economic interest? Again, the opportunity is staggering. Projecting this study's Sonoma County figures to the rest of the state (notably, Sonoma's potential is likely lower than other counties in California, owing to its mild coastal climate), the back-of-the-envelope calculations in the table above shows 35 billion kWhs are at stake, along with 1.5 billion therms, every year!

Want success? Attack each customer type differently - use what works!

The nature of the demand reduction opportunity is very different between consumer segments, as illustrated in the charts below for typical electricity and gas customers in each segment.

Positive-Return Demand Elimination Potential, By Customer Segment



The huge differences in the nature of these opportunities demand a different approach, tailored to the needs of each customer segment:

Most Effective Public-Policy Approach, By Customer Segment

Consumer Segment	Approach	Message	Cost (/ kWh eliminated)
Low	<ul style="list-style-type: none"> Media campaign 	<ul style="list-style-type: none"> Change light bulbs to high-efficiency bulbs, etc. Limited weatherization 	Unknown, likely negligible
Mid	<ul style="list-style-type: none"> Media campaign Self-help and web tools 	<ul style="list-style-type: none"> Low cost actions; bulbs, fridges, duct sealing, etc. Behavioral changes deliver more as more fuel is used 	\$0.02 / kWh \$0.80 / therm
Heavy	<ul style="list-style-type: none"> Custom, in-home solution planning 	<ul style="list-style-type: none"> Wide range of measures viable: Changing bulbs, appliances, equipment, behavior and generation 	\$0.02 / kWh \$0.80 / therm

Low energy consumers: The economic viability of demand reduction investments by low energy customers is limited. Professionally installed solar electricity generation is never worthwhile, and much the same is true for most other measures. The majority of the opportunity in electricity demand is, by far, only achievable by light bulb replacement and a few behavior changes. With this in mind, the most efficient approach for the state to drive demand reduction in this segment is, unquestionably, a broad-based educational media campaign focused on 3 or 4 simple messages; the positive economics of light bulb replacement and behavioral tips.

Mid / heavy energy consumers: These California households offer an opportunity to reduce the state's utility-supplied energy by 30 billion kWh and 1,100 million therms annually –and each will receive a huge economic gain in the process. The state just needs to tip the cart slightly and allow self-interest to take over.

The Sonoma county study found that homeowners rarely take action because they have no idea what investments will pay-off, and are most afraid of losing money in erroneous investments. They need help figuring out what to do, but cannot find anyone able give them an action plan that is assured to reduce their energy-related spending. The only potential source of help is the energy audit industry, but they

are currently going down a path focused on calculating HERS scores for homes – not in delivering optimized plans for homeowner action. Moreover, even if they started to come up with such plans, homeowners would still not take action as they are so risk-averse they refuse to spend anything on energy audits in the first place.

There is an ultra-low cost solution...

The solution is quite simple, and was successfully used in the Sonoma county study. There are two parts to it: First, software is needed to automate the complex utility/energy-economics optimization calculation for each unique home; only with such automation can several person-months of analysis be whittled down to a millisecond. Second, California's energy-audit system, currently oriented around giving structures a "HERS" energy score (a number seemingly dreamed up by engineers), needs to be re-focused on the consumer's viewpoint of home energy-economics¹, and simplified to actions that drive down spending.

The software for the utility/energy-economics diagnostic was developed and used in the Sonoma county study (go to planetecosystems.com), such that after a few minutes of effort, each home in the study received a custom action-plan that delivered up gains for the homeowners concerned from \$0 to \$650,000 (again, net of all costs, including capital/financing costs)!

If all the heavy energy consuming households in California undertook such a diagnostic, paid for by the state to ensure widespread coverage, the cost to the state would be \$250 million. Now, if only 50% of those households undertook the prescribed action plans, the savings would be 11.5 billion kWh and 360 million therms each year. That's 2 cents per kWh saved and 80 cents per therm saved annually – a cost far lower than any initiative the State of California is currently paying for, and one that is likely to deliver wide-scale results very quickly, since consumers act in their own interest.

PlanetEcosystems is on the web at www.planetecosystems.com.

¹For a more on home energy economics, also see "*Don't Go Broke Going Green*" by PlanetEcosystems.

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Scaling Energy Efficiency in the Heart of the Residential Market: Increasing Middle America's Access to Capital for Energy Improvements

Middle income American households – broadly defined here as the middle third of U.S. households by income – are struggling. Energy improvements have the potential to provide significant benefits to these households – by lowering bills, increasing the integrity of their homes, improving their health and comfort, and reducing their exposure to volatile, and rising, energy prices. Middle income households are also responsible for a third of U.S. residential energy use, suggesting that increasing the energy efficiency of their homes is important to deliver public benefits such as reducing power system costs, easing congestion on the grid, and avoiding emissions of greenhouse gases and other pollutants.

While middle income Americans have historically invested in improvements that maintain and increase the value of their homes, they have seen an important source of financing – the equity in their properties – evaporate at the same time that their access to other loan products has been restricted. A number of energy efficiency programs are deploying credit enhancements, novel underwriting criteria, and innovative financing tools to reduce risks for both financiers and borrowers in an effort to increase the availability of energy efficiency financing for middle income households. While many of these programs are income-targeted, the challenges, opportunities, and emerging models for providing access to capital may apply more broadly across income groups in the residential sector.

Challenges to Accessing Capital

The upfront cost of comprehensive home energy improvements is a barrier to investment. Many middle income households need financing to overcome this barrier – and capital access has plummeted in the wake of the recession.

Using Home Equity to Finance Home Improvements

Middle income homeowners have historically invested in improving their homes. In 2001, these households accounted for almost a third of all home improvements made in the U.S., and they financed more than 35 percent of their home improvement investments (Guerrero 2003).¹ Compared to other households that financed improvements, middle income households were more inclined than other income groups to finance home improvements by borrowing against housing equity – two thirds of their financing was home-secured (see Figure 1).²

This is both good and bad news. The good news is that middle income households have historically invested in home improvements, and many (57 percent) have not needed financing to do so. The bad news is that the recession

¹ In 2001, middle income households spent an average of \$8,700 when using home-secured financing to pay for home improvements (Guerrero 2003). The level of home improvement spending impacted homeowner financing patterns. For improvements of \$5,000 to \$20,000, middle income households used home secured financing for 22% of expenditures, less than their overall average, but 10% more than their wealthier peers for the same expenditure range (Guerrero 2003).

² Home-secured financing includes home equity loans, home equity lines of credit and cash out refinancing. Unsecured financing includes unsecured loans and credit cards.

has eroded household savings – suggesting that more households will need financing to make improvements – at the same time that housing wealth, the primary asset against which middle income households borrow, has declined.



Figure 1. Home improvement financing patterns by income in 2001 (Guerrero 2003)

The Housing Collapse

A number of factors contributed to the enormous speculative housing bubble in the mid-2000s (Lansing 2011). By 2007, primary residences accounted for approximately one third of U.S. household assets. For middle income households, these primary residences represented an even greater share of their assets – almost 50 percent (Bucks 2009).³ The financial crisis and ensuing recession have since caused a sharp decline in housing values across the United States. Single family home prices have declined by 32 percent from the housing market's 2006 peak and carried household wealth down as well (see Figure 2) (S&P 2011).

This data masks more dramatic regional declines in housing values and the concentration of these price declines in low and middle value properties – those most likely to be owned by middle income Americans.⁴ For example, the Case-Shiller Home Price Index indicates that low tier properties in Atlanta have lost 55 percent of their value since peaking at the end of 2006 – almost double the average 23 percent property value decline in the city over that time (see Figure 2).^{5,6} In other words, not only did middle income households have more of their wealth invested in their

³ The Federal Reserve Board data uses percentile of income. We use the 40th-70th percentiles (\$29,680 to \$79,100) to approximate middle income. In 2007, the overall average primary residence asset value as a percentage of wealth was 31.8 percent across all income groups, versus 48.4 percent for middle income households.

⁴ The median middle income home value in 2007 was \$150,000 (U.S. Census). Assuming a value decline of approximately one third, this median value is likely to be approximately \$100,000 today. This value falls into the low tier of the 3-tiered Case-Shiller housing value pricing index across all of the index's 20 major metropolitan statistical areas (MSAs) except for Phoenix (where properties under \$95,901 are in the low tier).

⁵ In Atlanta, as of June 2011, low tier properties are those valued under \$130,356, middle tier are those valued \$130,357-\$241,832 and high tier are those valued over \$241,832.

⁶ Case-Shiller Seasonally-Adjusted Home Price Tiered Index Data. June 2011

primary residences heading into the recession, but their primary residences have lost a greater percentage of their value than those of their wealthier peers.



Figure 2. Case-Shiller 20-City Composite Home Price Index of single family home values January 2007 to June 2011 in three major U.S. cities, tiered by initial property value⁷ (S&P 2011)

While property values (across tiers) nationally have returned to 2003 levels,⁸ it would be incorrect to assume that the housing decline has only set middle income families back eight years. Many homeowners took advantage of rising property values by borrowing aggressively against their growing equity – leaving them with significant debt burdens that are, for some, larger than their home values. In fact, more than a quarter of all single family residential properties (13.3 million households) are now underwater or have near negative equity (<5% equity) (Corelogic 2011). This negative equity is concentrated regionally – the top five states have 38 percent of all negative equity properties.⁹ It is reasonable to assume that many of these underwater properties are owned by middle income Americans – these households took on significant debt to purchase and improve properties, are more vulnerable to financial stress during a recession, and lost more of their home's value than their wealthier peers. These underwater households are more likely to behave like renters, under-investing in improving and maintaining their homes.

The news is not all bad though. While a majority of families across income groups have recently experienced declines in income and wealth – and middle income households have been hit harder than their wealthier peers – a large minority of the middle income population has maintained or increased their levels of wealth. From 2007 to 2009, most families (63 percent) experienced wealth declines – for those whose wealth declined, the median loss was substantial, 45 percent (Bricker 2011). However, more than a third of households (37 percent) have not

⁷ *Ibid.* In Las Vegas, Low Tier properties are those valued under \$118,226, Middle Tier are \$118,226- \$178,664 and High Tier are those valued over \$178,664. In San Francisco, Low Tier properties are those valued under \$325,457, Middle Tier are \$325,457- \$601,276 and High Tier are those valued over \$601,276.

⁸ *Ibid.*

⁹ *Ibid.* The top five states are Nevada (60 percent underwater), Arizona (49 percent underwater), Florida (45 percent underwater), Michigan (36 percent underwater) and California (30 percent underwater).

experienced wealth declines or have seen only small changes in wealth. This makes it difficult to make universal conclusions about the state of middle income household finances. While many households are unquestionably suffering – and are likely unwilling or unable to make significant investments in energy efficiency without substantial financial incentives – a large minority of middle income households may be able to invest.

Household Savings & Employment

Many American households feel insecure about their economic futures. Uncertainty about future earnings is high – in 2007, 31.4 percent of all families (across income groups) reported that they did not have a good idea of what their income would be for the next year (Bucks 2009). This uncertainty may well be even higher today as the U.S. unemployment rate has almost doubled since mid-2007. In 2009, almost nine percent of middle income households were unemployed while another 5.5 percent were underemployed (workers that take part-time jobs due to lack of available of full-time jobs) (Sum and Khatiwada 2010).¹⁰

For those households who have a reasonable expectation of future earnings, the recession has decreased their expectations of annual income growth from around two to three percent before the recession to less than half a percent in its wake – the lowest level in more than 30 years (Dunne and Fee 2011). Lower future earnings expectations are a function of both the recession and longer term trends – over the last 30 years, wages have not kept up with worker productivity gains.¹¹ Uncertainty and pessimism about future earnings are making households increasingly cautious with their finances as many households report higher levels of desired savings to buffer themselves from economic and other emergencies (Bricker 2011). These homeowners are likely to make fewer proactive home improvements, like energy upgrades, in favor of preserving limited savings and access to credit for unforeseen hardships.

Qualifying for Credit

For those middle income households motivated to pursue energy efficiency, access to low-cost capital is often a significant barrier to investment. Many of the largest energy efficiency loan programs have application decline rates in the 30 to 50 percent range. Household ability to obtain secured financing has declined as housing prices have eroded and lenders have tightened underwriting standards and credit limits (NAR 2011).¹² Similar tightening trends are occurring in unsecured lending as personal creditworthiness has weakened and lenders have responded by increasing the minimum credit scores required to qualify for financing products and reducing the amount of overall credit available to each qualified borrower. Many households turn to high interest credit cards to finance expenditures as their options dwindle. These high-cost financing products are ill-suited to energy improvements – particularly those for which the motivation is to save money – as they worsen the payback period of these investments.

Since 2009, approximately 10,000 households have applied for financing through Pennsylvania's Keystone Home Energy Loan Program (HELP)¹³. About 40 percent of these households earn 80 percent of AMI or less, suggesting

¹⁰ As of Q2 2011, the unemployment and underemployment rates have dropped by approximately 0.5 percent across income groups.

¹¹ For a detailed discussion on wage stagnation, visit the Employment Policy Research Network: http://www.employmentpolicy.org/sites/www.employmentpolicy.org/files/field-content-file/pdf/Mike%20Lillich/EPRN%20WagesMay%2020%20-%20FL%20Edits_0.pdf

¹² Requirements to obtain conventional mortgages have been tightened, with the average credit score rising to about 760 in the current market from nearly 720 in 2007; for FHA loans the average credit score is around 700, up from just over 630 in 2007.

¹³ Keystone HELP offers unsecured loans and loans secured by a subordinate lien mortgage at various interest rates. The specific offering depends on the measures financed and loan size. Underwriting includes a minimum credit score of 640, no bankruptcy,

that many middle income households are attracted to the program.¹⁴ However, the program's early experience shows that middle income households are more difficult to serve – 57 percent of households earning \leq 80 percent AMI do not meet the program's underwriting standards compared to 31 percent for households earning $>$ 80 percent AMI (see Table 1).¹⁵

In addition to this higher rejection rate, fewer lower income households move forward with financing than their wealthier peers (58 percent of approved households earning \leq 80 percent AMI fund loans compared to 73 percent of higher income households) – supporting the idea that, for many reasons, even when financing is available, it is more difficult to motivate middle income households to invest. Still, this data shows some promise as these middle income households account for about a quarter of all Keystone HELP loan volume.

Household Income	# Applications (% of Total Applications)	Applications Approved (Approval Rate %)	Loans Funded (Approval \rightarrow Loan Conversion Rate %)	Average Loan Size
$<$ 80% AMI	~4,000 (40%)	~1,720 (43%)	~1,000 (58%)	~\$7,500
\geq 80% AMI	~6,000 (60%)	~4,140 (69%)	~3,000 (73%)	~\$9,500

Table 1. Keystone HELP loan application, approval, and loan size rates by income, January 2010 to August 2011. (AFC First)

According to the Indianapolis Neighborhood Housing Partnership (INHP), the homeowners that they serve typically have little access to anything but credit card financing – often at annual rates from 15 to 25 percent, so INHP's new EcoHouse Project's mid-single digit fixed-interest rate loans¹⁶ are an attractive tool for enabling energy improvements among households who are otherwise unlikely to be able to access affordable financing. With relatively lenient underwriting standards including credit scores as low as 580,¹⁷ INHP is able to accommodate a wider range of applicants.¹⁸

Credit scores estimate an individual's likelihood of repaying certain types of debt relative to one's peers. Credit scores are a key metric for most lenders in evaluating consumer creditworthiness. Because credit scores are relative measures, a large shift in bill payment trends, like that caused by the recession, has triggered an increased likelihood of loan default for each "band" or range of credit scores. In other words, a credit score of 720 today reflects a higher estimated risk of loan non-payment than a credit score of 720 in 2005. For example, in the case of VantageScore,¹⁹

foreclosure or repossession in the last seven years, no outstanding collections, judgments or tax liens exceeding \$2,500 and a 50 percent maximum DTI.

¹⁴ 80 percent State Median Income (SMI) in PA is \$39,600 – suggesting that despite variance of AMI across regions in the U.S., many households who apply for Keystone HELP meet our middle income definition.

¹⁵ Program underwriting is based on these criteria: Minimum FICO Score 640; no Bankruptcy, Foreclosure, Repossession in past seven years; no Unpaid Collection Accounts, Judgments, Tax Liens $>$ \$2,500

¹⁶ Loan interest rates are based on U.S. Treasuries. In July 2011, interest rates on secured loans were 5.97 percent and on unsecured loans were 6.66 percent.

¹⁷ Households with credit scores as low as 580 can qualify for secured financing through INHP's EcoHouse Project loan program. Most national lending products require a minimum credit score of 640 to 680.

¹⁸ For more information on the Indianapolis Neighborhood Housing Partnership EcoHouse Loan Program, see the Policy Brief posted here: <http://middleincome.lbl.gov/>

¹⁹ VantageScore is a one of a number of consumer credit risk scores that use credit data and analytics as one measure of consumer creditworthiness. Many score models exist in the marketplace (others, like Fair Isaac (FICO) are mentioned elsewhere in this report). However the score values from one model are not comparable to the values of other score models – that is, a 650 score from one model is not comparable to a score value of 650 from a different model.

This Policy Brief is an excerpt from the report: "Delivering Energy Efficiency to Middle Income Single Family Households." For the full report and other resources visit: <http://middleincome.lbl.gov>

the delinquency rate on a new loan issued to a person with a 720 score between 2008 and 2010 is expected to be twice as high as on a new loan issued between 2003 and 2005 (see Table 2).

VantageScore	Loan Delinquency Rate		Delinquency Rate Increase
	2003-2005	2008-2010 (Anticipated)	% increase in rates btw 2003-2005 and 2008-2010
591-610	21.50%	25.44%	3.9%
611-630	17.11%	21.18%	4.1%
631-650	13.63%	17.81%	4.2%
651-670	10.90%	14.62%	3.7%
671-690	8.24%	11.74%	3.5%
691-710	5.99%	9.74%	3.8%
711-730	4.27%	8.11%	3.8%
731-750	3.21%	6.64%	3.4%
751-770	2.22%	5.28%	3.1%
771-790	1.67%	4.29%	2.6%
791-810	1.15%	3.33%	2.2%
811-830	0.80%	2.57%	1.8%
831-850	0.49%	1.78%	1.3%
851-870	0.38%	1.40%	1.0%
871-890	0.24%	0.90%	0.7%
891-910	0.19%	0.63%	0.4%
911-930	0.19%	0.53%	0.3%

Table 2. Changes in VantageScore loan delinquency rates for new loans originated from 2003-2005 compared to loans originated from 2008-2010 (anticipated).²⁰ (VantageScore)

Although credit scores do not explicitly take income into account, middle income households are likely to have lower credit scores than their wealthier peers (see Figure 3). These lower scores may be in part due to creditworthiness and in part due to the way in which scores are calculated, notwithstanding issues about how middle income households manage their credit. For example, a key factor in calculating credit scores is one's ratio of credit utilization to credit availability – many middle income households have less overall credit availability than their wealthier peers, often causing their credit utilization rate to be higher and their credit scores to be lower. This lower credit access may be a function of many things, including lower absolute levels of home equity and post-recession reductions in the maximum loan sizes lenders offer to customers. In other words, income implicitly impacts some credit scores – even in cases of identical loan repayment histories, middle income households may be assigned lower credit scores than their wealthier peers.

²⁰ Credit score models, including the VantageScore model, do not predict absolute delinquency rates. Rather, these models predict the "likelihood" of default for each consumer whose score falls within the indicated range.

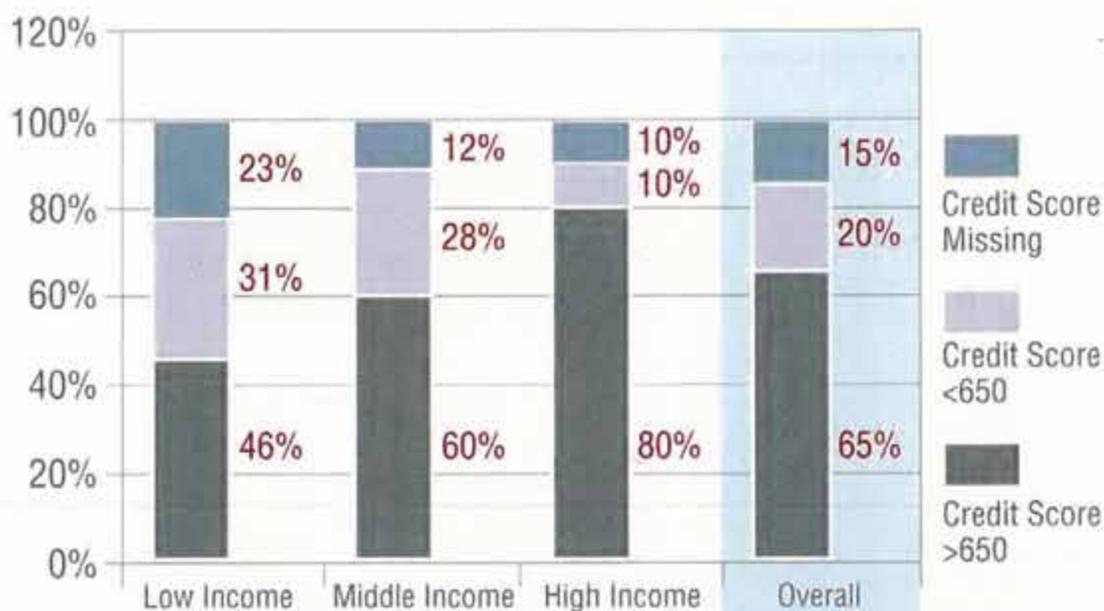


Figure 3. Homeowner credit scores above and below 650 by income in Q4 2010²¹ (Energy Programs Consortium)

Most lenders use credit scores as just one of several metrics for evaluating consumer creditworthiness. Underwriting standards for loan products, including those for home improvements, frequently include both a minimum credit score and a maximum debt-to-income (DTI) ratio.²² A Federal Reserve Board study found that more than 20 percent of all households with home-secured debt had net DTI ratios higher than 40 percent, suggesting that as many as one in five households may not qualify for financing programs that include a maximum DTI underwriting requirement (Bucks 2009).²³ These numbers are higher among middle income households – more than one in three middle income households (35 percent) had net DTIs exceeding 40 percent.²⁴

Program experiences to date suggest that maximum DTI underwriting requirements are significant barriers to capital access. For example, NYSERDA has declined more loan applications because household DTI ratios exceed the allowable limit than for any other reason. Forty-three percent of NSYERDA's loan application declines (17 percent of loan applicants) have been caused by excessive DTI ratios while just 23 percent of declines were triggered by low household credit scores (See Figure 4). Major credit events like bankruptcy, foreclosure, repossession and outstanding collections account for more loan denials (33 percent) than low credit scores – these loan applicants will be very difficult to serve moving forward.

²¹ Due to data limitations, for the purposes of the credit score analysis we use household income of \$30,000 to \$70,000 to define middle income. Credit score data from Energy Programs Consortium; based on analysis of TransUnion credit data from Intellidyn.

²² The debt-to-income (DTI) ratio is a measure that reflects a household's ability to service its existing debt with current gross income. A household with a DTI ratio of 50 percent has annual debt service payments that equal 50 percent of the household's annual gross income. A maximum DTI is intended to ensure that borrowers have sufficient cash flow to make loan interest and principal payments.

²³ The Federal Reserve Board study's net DTI ratio calculation is not directly comparable to the way in which energy loan programs calculate DTIs. This calculation considered income net of taxes while loan underwriters use gross (e.g. before tax) income. These numbers may, therefore, overstate the problem. However, middle income households typically face lower effective tax rates than their higher income peers, suggesting that the gap between middle and higher income households with excessive DTI ratios may be larger than these numbers show.

²⁴ This includes both owners and renters.

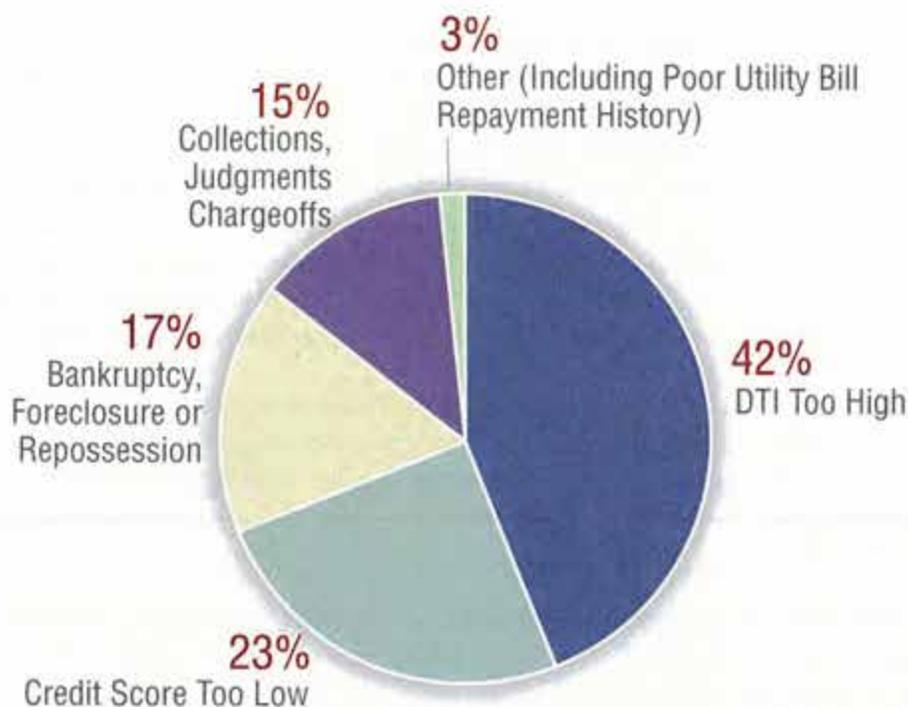


Figure 4. Reasons for application rejection in NYSEERDA's residential energy efficiency loan program November 2010-October 30, 2011 (NYSEERDA)

FICO Score Range ²⁵	Delinquency Projection (% Likelihood)
300-499	87
500-549	71
550-599	51
600-649	31
650-699	15
700-749	5
750-799	2
800-850	1

Table 3. Credit score and corresponding delinquency projections. (Transunion 2011 in SEE Action Financing WG).

Opportunities for Increasing Access to Capital

Middle income households clearly need new ways of accessing affordable credit if they are to make home energy upgrades. However, it is important to acknowledge that there can be negative consequences to promoting loans and other products to particularly vulnerable segments of the population. Especially if programs are not ensuring savings, care needs to be taken with regard to who is given access to credit and what claims are being made about the benefits of energy improvements.

²⁵ These scores are not directly comparable to the VantageScore scores previously referenced, due to different credit calculation methodologies.

Underwriting criteria exist for a reason – to ensure that those that get access to financing are willing and able to make required monthly payments. For credit scores, the majority of middle income homeowners (60 percent) have scores of 650 or higher. For those with scores below 650, default risk skyrockets – the projected delinquency rate on unsecured loans more than doubles from 15 to 31 percent for individuals with FICO scores from 600-650 compared to their peers in the 650-700 score band (see Table 3).²⁶ This raises important questions about how to expand energy efficiency financing – particularly in the absence of certainty that the dollar value of energy savings will be sufficient to cover the full cost of the improvements over the measure's expected lifetime. Debt to income constraints raise similar issues – households with high DTIs are unlikely to have significant cash flow buffers at their disposal should energy improvements not deliver sufficient energy bill reductions to offset financing costs.

With those precautions acknowledged, there are ways that capital can be made more accessible and affordable in appropriate ways, and with prudent safeguards. This section describes options for using credit enhancements, alternative underwriting criteria, and other financing mechanisms that might better serve middle income households.

Credit Enhancements

By reducing lender risk, publicly-supported credit enhancements can leverage these limited public monies and attract additional capital for residential loans.²⁷ Credit enhancements are used to reduce a lender's risk by sharing in the cost of losses in the event that loans default. These enhancements can take the form of loan loss reserves (LLRs), subordinated debt, and guarantees.²⁸ LLRs, often funded with ARRA or utility-customer funds, are the most commonly used credit enhancement, and they are frequently deployed to reduce borrowing costs or extend borrowing terms for program participants that would likely qualify for other (more expensive) loan products. Rather than simply lowering interest rates, a few innovative programs are using credit enhancements to incentivize their financial partners to offer energy improvement loans to households who would otherwise not have to access capital. Indianapolis is using a large LLR – with 50 percent²⁹ of losses covered – to households in its target income demographic,³⁰ and the cities of Madison and Milwaukee used part of their DOE Better Buildings grant to structure a \$3 million LLR to expand access to their loan product. This five percent loss reserve reduces the lender's losses in the event of loan defaults and supports a loan pool of up to \$60 million. It has been structured so that the cities' financial partner, Summit Credit Union, can recover more funds from the LLR on each loan default for lower credit quality consumers. Typically, a lender must absorb a fixed portion of each loss from any single loan to ensure it is appropriately motivated to lend responsibly. By allowing lenders to collect a greater percentage of their loss on loans to customers with low credit scores, the two cities were able to lower the minimum qualifying credit score to 540 – well below typical loan product eligibility (see Table 4).

²⁶ One reason for this significantly higher default rate among lower credit score customers may not be lack of creditworthiness, but instead that these households are only offered high interest rate loan products that are more difficult to pay off.

²⁷ Loan loss reserves (LLRs) (see next footnote) reduce lender risk by providing first loss protection in the event of loan defaults. For example, a 5 percent LLR allows a private lender to recover up to 5 percent of its portfolio of loans from the LLR. A \$20 million fund of private capital would need a \$1 million public LLR (5 percent coverage), leveraging each public dollar 20 to 1. On any single loan default, the LLR often pays only a percent of the loss (often 80 percent) to ensure the lender is incentivized to originate loans responsibly.

²⁸ Loan loss reserves are held in an account and protect a lender against a specific level of loan losses. Subordinated debt stakes are similar to LLRs – instead of being held in an account, subordinated debt is lent out to customers, and the subordinated debt stake absorbs all losses up to a specified level. Loan guarantee protection can vary depending on the agreement, but can cover all or part of a lender's losses.

²⁹ In comparison, most LLRs for Recovery Act-funded programs have covered 5 to 10 percent of a portfolio's losses.

³⁰ INHP is targeting 80 percent of its EcoHouse lending to households at or below 80 percent of AMI and the remaining 20 percent to households earning between 80 percent and 120 percent of AMI. 120 percent of AMI for Indianapolis household of four is \$79,200, households and 80% AMI for an Indianapolis household of four is \$52,800.

FICO Score Range	% of Each Loss Covered By LLR	% of Each Loss Absorbed by Credit Union
690+	70%	30%
650-689	80%	20%
610-649	90%	10%
540-610	95%	5%

Table 4. Milwaukee/Madison-Summit Credit Union loan loss reserve agreement. (Wisconsin Energy Conservation Corporation)

One issue that this type of arrangement raises is whether the lender will continue to be appropriately motivated to responsibly underwrite loans. In the Milwaukee/Madison case, this concern is mitigated by Summit Credit Union's demonstrated commitment to responsible lending to low and moderate income households. Summit's Chief Lending Officer, Dan Milbrandt, pointed out that expanding access to financing is difficult and that it takes effort on the part of the credit union to understand applicants' credit situations and figure out where, on the margin, less creditworthy households are willing and able to take on debt. "You have got to be willing to move beyond automated underwriting. There is a gray area, and Summit has experience examining mitigating factors so that we can responsibly lend to less credit qualified customers."

Alternative Underwriting Criteria

Rather than using credit enhancements to expand financing to "riskier" borrowers, a number of energy efficiency financing programs are deploying alternative underwriting criteria to identify creditworthy borrowers that do not meet traditional lending standards. NYSERDA's recently-launched Green Jobs-Green New York (GJGNY) initiative is using a Two-tiered underwriting process to expand access to financing for its Home Performance with ENERGY STAR® (HPwES) program.³¹ Tier One underwriting uses standard credit score (minimum 640)³² and DTI (maximum 50 percent) metrics to evaluate creditworthiness; 48 percent of applicants are rejected for this financing. NYSERDA is trying to reduce this decline rate with its Tier Two standards that offer households with low FICO scores or high DTIs a second opportunity to qualify for GJGNY financing (see Table 5 for a description of Tier Two underwriting standards). For those households with FICO scores below 640, NYSERDA Tier Two standards increase the maximum DTI to 55 percent and use utility bill repayment history in lieu of credit score to assess creditworthiness. For households with a FICO score above 680 that were rejected from Tier One because they had a DTI ratio above 50 percent, Tier Two standards increase the maximum DTI to 70 percent and use utility bill repayment history.³³

³¹ Households earning less than 80 percent of AMI are eligible for NY's AHPwES program, which provides a 50 percent rebate up to \$5,000.

³² Minimum FICO score is 640, unless self-employed – minimum 680 if self-employed for at least 2 years, or minimum 720 if self-employed less than two years.

³³ There are many ways to calculate debt to income (DTI) ratios. Most programs use gross income. It is not clear, therefore, that a 70 percent DTI maximum is a meaningful metric for assessing creditworthiness (e.g. many households pay close to a third of gross income in taxes, suggesting that this metric might exclude very few households as debt service could include 100 percent of household net income). NYSERDA already assesses DTI ratios as part of its Tier 1 evaluation, but programs considering a different underwriting process should consider this issue.

Since its November 2010 launch, over \$7.8 million has been loaned to 908 households through the GJGNY initiative, of which 48 loans (\$417,888) have been issued to households qualifying under the new Tier Two standards. Tier Two underwriting criteria have increased access to capital on the margin, increasing NYSERDA's overall loan application approval rate by over two percent. This increase may underestimate the impacts of using utility bill repayment history as a means of assessing creditworthiness – a multi-step application process appears to have been a significant hurdle for many potential Tier Two participants and NYSERDA only launched the "High DTI" underwriting criteria in July 2011³⁴ (See Figure 5 for a summary of NYSERDA's GJGNY loan application data).

Eligibility Requirements		Participant Benefits
Tier 1 FICO≥640 DTI≤50%		3.99% financing Up to \$25,000 (3.49% with Automated Clearinghouse (ACH) payment)
Tier 2 (Problem = Low FICO) FICO≤640 DTI≤55% Strong Utility Bill & Mortgage Repayment History	Tier 2 (Problem = High DTI) FICO≥680 50≤DTI≤70% Strong Utility Bill & Mortgage Repayment History	

Table 5. New York's Green Jobs-Green New York financing underwriting criteria. (NYSERDA)

NYSERDA has already made several changes to the Tier Two underwriting criteria since the initiative launched in 2010, which is indicative of the flexibility that is essential to experiment with increasing access to financing. One key challenge has been gaining access to customer utility bills for Tier Two consideration. Many programs around the country have struggled to access customer utility bills. In NYSERDA's case, better access to utility billing information is important to deploying alternative underwriting criteria.

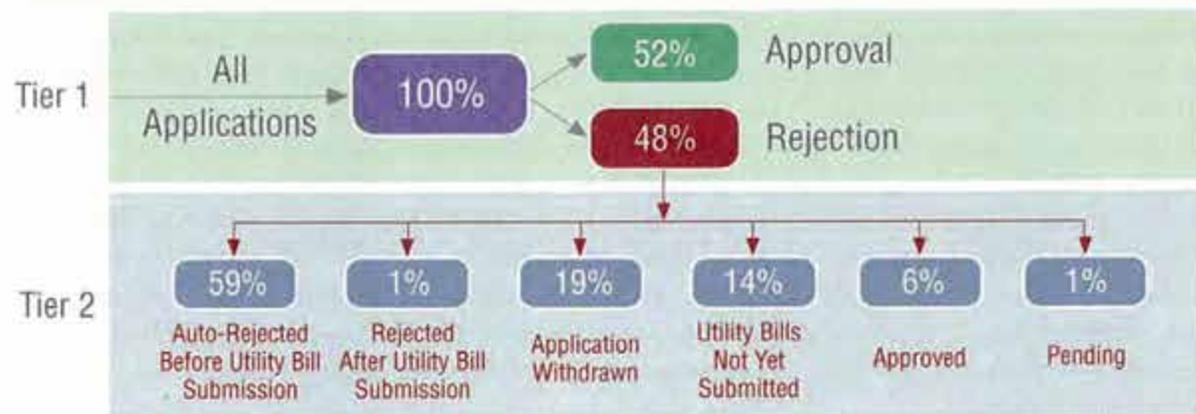


Figure 5. Summary of NYSERDA's GJGNY loan application process and data (November 2010 to December 2011) (NYSERDA)

³⁴ GJGNY requires that applicants not qualified under Tier One but not initially disqualified from Tier Two for reasons unrelated to utility bill repayment history (e.g. recent bankruptcy, high DTI) to proactively submit utility bills. This step has been a barrier as more than 80 percent of applicants have failed to follow-up with bill submission. While the overall loan application approval rate increased by just 2.6 percent, this may underestimate the impacts of using utility bill repayment history as other underwriting criteria and the multi-step application process appear to be barriers. For example, if 84 percent (the rate of loan approval for applicants that submitted utility bills) of all households not automatically disqualified from the Tier Two track (e.g. those that failed to submit their utility bills) had been approved, GJGNY's approval rate would have increased by 16 percent.

Other programs, including Midwest Energy and Clean Energy Works Oregon (CEWO), also use utility bill repayment history to evaluate creditworthiness. CEWO's underwriting process is notable for its low cost – while it includes a credit score check, instead of analyzing an applicant's DTI, CEWO examines utility bill repayment history. Using utility bill repayment history in lieu of DTI's significantly reduces loan underwriting expenses, and because more households in many programs are rejected for financing due to high DTIs than low credit scores, it may be an effective approach. The early data are promising – CEWO's application decline rate is just 10 percent since the program's 2009 launch – well below that of other energy efficiency loan programs. CEWO's financing partner, Craft3 (formerly known as Enterprise Cascadia), has dispersed \$14.7 million for 1,180 loans as of January 31, 2012.³⁵

These initiatives are relatively new, so it is too early to draw firm conclusions about whether these criteria will be effective at identifying households who can afford to take on debt to invest in energy improvements.³⁶ While there is reason for some skepticism about the predictive power of utility bill repayment history on loan performance,³⁷ if on-time utility bill payment turns out to be a good borrower risk assessment tool, it has the potential to increase financing access – and is especially appealing if loan repayments are made on the utility bill as the CEWO program offers. Using on-bill repayment is likely to reduce loan delinquencies, especially where nonpayment can result in disconnection (which is not the case for CEWO).

Innovative Financing Tools

In addition to making standard loan products more accessible, a number of new financial products may be more effective at serving middle income households. Here, we highlight four of these financing tools: OBF loan products that are paid off when properties transfer, employer-offered financing that is deducted from paychecks, and property assessed clean energy (PACE).

On-Bill Financing (OBF)

On-bill financing is a tool through which a customer's utility bill is used to collect loan payments for energy improvements. Utilities or third parties can provide the up-front capital for the energy upgrades and the loan can be structured as an unsecured consumer loan, a secured loan, or can be attached to the meter (as opposed to the individual).³⁸ Some utilities have expressed reservations about performing lending functions in-house, suggesting that third party-funded on-bill models in which financial institutions have core lending responsibilities (e.g.

³⁵ Thus far three loans have defaulted totaling \$39,674 in charge-offs. Their current criticized assets equal 3.87 percent of the outstanding portfolio, including watch list assets at 2.89 percent and problem assets at 0.98 percent. However, it is also important to note that most applicants – both those declined and those approved – have strong credit scores, most above 700.

³⁶ Ultimately, the viability of these alternative underwriting approaches must be assessed not based on how many loans additional loans are made, but whether such loans exhibit payment performance that justifies approving borrowers who would otherwise not qualify for financing.

³⁷ Households are uniquely motivated to pay utility bills to ensure that their power stays on. This motivation may not hold for unsecured loans, where the penalty for non-payment is a credit score reduction.

³⁸ If the repayment obligation is attached to a household's utility meter (meter attached), the obligation to pay the loan can stay with the property if a tenant or homeowner moves. In some programs, nonpayment of the bill can trigger utility shut-off of service, a powerful customer incentive to make interest and principal payments.³⁸ Because of this enhanced security, a household's credit characteristics become less important to underwriting. However, the same consumer protections that guard against utility service cancellation in the event of utility bill nonpayment also protect on-bill financing borrowers from meter shutoff in the event of loan nonpayment. Some utility commissions have expressed support for facilitating the convenience and messaging of on-bill repayment but are not inclined to support meter attachment which could lead to service disconnection. The extent to which meter-attached financing might influence real estate transactions properties also remains an open question.

managing credit risk, hedging interest rate risk) and utilities manage customer interactions (e.g. demand creation, quality assurance).

Because many households have long histories of paying their utility bills regularly, some financial experts believe that on bill repayment will reduce loan delinquency. On-bill financing for energy improvements is the most integrated with the savings those improvements are expected to deliver – which may help to alleviate consumer reluctance to take on debt to pay for them. Midwest Energy in Kansas operates a meter-attached residential loan program. If an individual doesn't pay their bill and leaves the property, only the late payments at that point are uncollectible. Any remaining monthly payments transfer to the next customer at that meter. Over three years, the Midwest Energy program has issued about 600 loans for a total of more than \$3.3 million in funding, and to date less than one percent of loans have been uncollectible (in line with the uncollectible rate of their other utility revenue).

Loan products that are paid off when properties transfer (Deferred Loans)

Some middle income households simply do not have the financial capacity to make consistent principal and interest payments on debt. This is especially true when the financed improvements lead to uncertain cash flow, or if building rehab needs to be funded in addition to energy upgrades, increasing net monthly payments. There are many housing and economic development agencies around the country that will fund home improvements through deferred loans – often health and safety-related rehab for fixed income seniors that have equity in their homes. No monthly payments are required, but a lien is attached to the property that must be paid off when the property is sold or otherwise transferred.

The Opportunity Council in Washington uses these deferred loans for repairs needed before free weatherization services to low income families. In Camden, New Jersey the city is using Recovery Act funds to create a revolving loan fund to offer residents a home energy upgrade, paid for with a deferred loan. The Wyoming Energy Savers (WES) loan program offers both amortized and deferred loans based on participant income.³⁹ Those households earning less than 50 percent of AMI qualify for deferred loans, while those households earning 50-80 percent of AMI qualify for amortizing loans.⁴⁰ Income-qualified households who are current on their mortgage are eligible for loans up to \$15,000 for a list of pre-approved measures including heating equipment and weatherization measures. Deferred loans are offered at 3 percent interest due at time of home property transfer or sale.⁴¹ One key disadvantage to this product type is that borrowed funds are likely to revolve very slowly.

Paycheck-Deducted Loans

Paycheck-deducted financing involves repaying a loan through regular, automatic deductions from an employee's post-tax paycheck. The Clinton Climate Initiative (CCI) is piloting a program called the Home Energy Affordability Loan (HEAL) in Arkansas,⁴² which allows employees of participating companies to finance energy upgrades with repayment through a payroll deduction. Originally, the model entailed CCI providing technical assistance for companies to make energy efficiency improvements to their own facilities. These companies would then put a portion of the savings from these improvements into a revolving loan fund for employees. The employer-assisted

³⁹ An amortizing loan is one in which loan principal is paid down over the course of the loan. A deferred loan is one in which principal and/or interest payments are postponed for a specific period of time or until a specific trigger (e.g. property transfer).

⁴⁰ Depending on the county, 50 percent of AMI ranges from \$33,700 to \$47,450 for families of 4, and 80 percent of AMI ranges from \$53,900 to \$64,200.

⁴¹ For more information, visit <http://www.wyomingeda.com/files/WESDes.pdf>

⁴² The Clinton Climate Initiative plans to replicate the program in other states beginning in 2012. More information on the program is available here: www.clintonfoundation.org/what-we-do/clinton-climate-initiative/cci-arkansas.

model is still available, but CCI found that employee demand for financing was larger than the energy savings companies were realizing, and some companies have policies that preclude lending to employees. CCI developed a second model in partnership with local credit unions, in which a credit union, rather than the employer, provides the loan capital and loan repayment is deducted through payroll and automatically transferred to the credit union. For one pilot with the largest hospital in Arkansas, the hospital's credit union is offering 5.75 percent interest for up to three years for unsecured loans to employees who have worked at the hospital for at least three years. The loans are unsecured, but the payroll deduction allows the credit union to do lighter underwriting and offer a lower interest rate than they would otherwise offer for standard unsecured loans.⁴³ Beyond this security, some experts believe that households may be more likely to pay these loans because they are offered through — or are supported by — their employer, and they want to be seen as responsible employees and members of the company's social community.

Property Assessed Clean Energy (PACE)

For those middle income households who have equity in their homes, PACE may be a promising financing tool if it gets past the current regulatory hurdles. PACE programs place tax assessments in the amount of the improvement on participating properties, and property owners pay back this assessment on their property tax bills. Like other property taxes, these assessments are treated as senior liens — which makes them very secure. PACE is debt of the property, which suggests that underwriting need not be based on a borrower's personal creditworthiness (and that the financing can be transferred with the property) — potentially getting around the credit score and debt-to-income issues highlighted in this chapter. Residential PACE currently faces significant regulatory hurdles, which have largely eliminated its use around the country, pending court rulings or federal legislation.⁴⁴

Loan Pool Aggregation versus Loan Pool Separation

As energy efficiency markets scale, and billions of dollars of private capital become necessary to meet household demand, program administrators and/or their financial partners will likely need to sell energy efficiency loans to “secondary market” purchasers.⁴⁵ One important issue to consider as energy efficiency financing markets scale is whether, before being sold into secondary markets, pools of loans made to lower credit quality households should be separated from pools of loans issued using “conforming” underwriting standards to higher credit quality households.⁴⁶ Some experts suggest that blended pools of loans, in which strong credits mitigate the risk of weaker credits, will be necessary to deliver attractive loan capital to middle income households at scale. These experts argue that credit enhancements should be deployed to reduce investor risk until a sufficient data set has been accumulated to evaluate the risk of these blended pools.

Others suggest that separate pools are more appropriate, because conforming loan pools would be easier to sell into secondary markets and because these pools would attract the lowest-cost capital available — enabling programs and financial institutions to pass on low-cost financing to these higher-credit households. They suggest that less creditworthy households should be offered public funding or that their loans should be heavily credit-enhanced if sold to private investors. The path forward may, ultimately, be a function of what risks secondary market investors are willing to bear, and whether policymakers deem the credit enhancements necessary to incentivize greater risk-

⁴³ In some states, a direct lender or employer deduction from the paycheck may not be legal as employees must maintain personal control over their income. These states include: Illinois, Indiana, New Hampshire, New Jersey, New York, Washington, D.C. and West Virginia. However, this is generally viewed as a technical obstacle, and customers may voluntarily setup automated paycheck allocations to personal accounts, which are then automatically transferred to lenders or employers

⁴⁴ For more information, visit <http://www.Eere.energy.gov/wjp/pace.html>

⁴⁵ A secondary market is a market into which previously issued financial instruments (e.g. loans, stocks, bonds) can be sold.

⁴⁶ A conforming loan is a loan whose structure (e.g. security, term) and underwriting criteria (e.g. minimum credit score) meet specific guidelines. The bellwether of conformity for energy efficiency loans is the Fannie Mae Energy Loan.

taking to be a reasonable use of limited public monies. Today, it is not clear that demand is at the requisite scale that developing secondary market access should be a national priority. Local, often socially-interested financial institutions (e.g. credit unions, CDFIs, coops) are often offering more attractive loan terms to customers than regional and national lenders (and holding these loans on their balance sheets).⁴⁷

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⁴⁷ These financial institutions often see energy efficiency lending as serving their social missions. In addition, efficiency lending often offers them a low-cost marketing tool, which warrants attractive lending terms. In Austin, Texas, Velocity Credit Union approved, funded and cross-sold energy efficiency loans at a higher rate than its other lending products. For more information, visit LBNL's policy brief on Austin Energy's Home Performance with ENERGY STAR® program: http://eetd.lbl.gov/ea/emp/reports/ee-policybrief_032211.pdf

**THE ROLE OF LOCAL GOVERNMENTS AND
COMMUNITY ORGANIZATIONS AS ENERGY EFFICIENCY
IMPLEMENTATION PARTNERS:
CASE STUDIES AND A REVIEW OF TRENDS**

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ABSTRACT

Local governments have the authority to implement discrete enabling policies that influence the real estate market and drive demand for utility energy efficiency programs. Many local governments and local organizations are also developing programs and plans to meet energy needs while addressing other community priorities, such as economic development, job creation, or sustainability. At the same time, utility programs are seeking to target the communities and sectors with the greatest efficiency opportunity and to cost-effectively scale up programs to serve more participants. Rather than competing, local actors and utilities can offer each other unique skills and tools, which when combined through sustained program partnerships can provide a significant program delivery opportunity. Well-designed partnerships can leverage the skills and resources of utilities, governments, and nonprofits, while tailoring programs to local needs and goals.

This paper describes the characteristics and potential contributions of both local actors and utilities as they relate to implementing energy efficiency. Next it describes two different roles for local governments and civil society in implementing energy efficiency: (1) enabling policies and (2) program partnerships—including several detailed case studies for each. Finally, this piece concludes by describing some of the trends and challenges in local implementation of energy efficiency.

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INTRODUCTION

Recent federal programs, most notably the Energy Efficiency and Conservation Block Grant (EECBG) funded through the 2009 economic stimulus, have provided unprecedented funding to local governments for energy efficiency. While funding for EECBG is expiring in 2012, many local jurisdictions have gained experience in the field and are looking for opportunities to refine, expand, and sustain their efforts regarding energy efficiency. Local governments have the authority to implement discrete enabling policies that influence the real estate market and drive demand for utility energy efficiency programs. Many local governments and organizations are also developing programs and plans to meet energy needs while addressing other community priorities, such as economic development, job creation, or sustainability. At the same time, utility programs are seeking to target the communities and sectors with the greatest efficiency opportunity and to cost-effectively scale up programs to serve more participants. Rather than competing, local actors and utilities can offer each other unique skills and tools, which when combined through sustained program partnerships can provide a significant program delivery opportunity.

The goal of this paper is to, first, briefly describe the characteristics and potential contributions of both local actors and utilities as they relate to implementing energy efficiency. Next it describes two different roles for local governments and civil society in implementing energy efficiency—(1) enabling policies and (2) program partnerships—including several detailed case studies for each. Finally, this piece concludes by describing some of the trends and challenges in local implementation of energy efficiency. This paper is not comprehensive in its discussion of opportunities for local implementation of energy efficiency or related partnerships. Rather, it is a brief introduction to the concept, a collection of case studies, and reflections on lessons learned and trends of potential importance.

ACTOR ATTRIBUTES AND ENERGY EFFICIENCY IMPLEMENTATION

In most states in the United States, energy utilities are the primary providers of energy efficiency services. This prominence is primarily the result of the public regulation of utilities and the interpretation by regulators of energy efficiency as an important component of ensuring that utilities meet their public service mandate. Many utilities have become very effective at delivering energy efficiency. However, there is still a role for other public or private actors to enable or deliver energy efficiency, particularly in pushing beyond the relatively modest level of savings achieved through utility programs to date compared to the cost-effective savings available.¹ At the metropolitan, municipal, or community scale, many local governments and nonprofit organizations have begun efforts to improve energy efficiency. Many states have implemented programs or policies to enable action by local governments and communities to improve energy efficiency (Sciortino 2011; Reul and Michaels 2011). As more actors enter the field of energy efficiency, it is important to identify what attributes and competencies different actors contribute to the goal of improving energy efficiency and, where appropriate, to identify opportunities for collaboration that may help to achieve greater energy and economic saving, as well as other non-energy benefits.

There are characteristics of local actors—including their authorities, competencies, human and financial resources, information, and relationships—which are of value to energy utilities, and vice versa. In many cases, greater collaboration between local actors and utilities and the coordinated application of the attributes and competencies of both institutions may lead to better program and policy implementation and greater energy savings.²

¹ See Nowak et al. (2011) for a discussion of strategies that can allow utilities to achieve greater energy savings through efficiency. For information on the long-term cost-effective savings available from efficiency in the United States, see Laitner et al. (2012). Neubauer et al. (2011) and the other individual state studies from ACEEE's State Clean Energy Resource Project (aceee.org/sector/state-policy/scerp) provide a more detailed look at the economic potential of efficiency and the policies and programs that will help to achieve the identified potential savings.

² This concept has been previously identified in MIT EEP (2009), in which it is termed the Utility-Community Energy Efficiency "Deal."

Local Governments and Community Organizations

Local governments and civil society organizations have three general attribute types that can contribute to energy efficiency implementation: regulatory mechanisms; financial incentives; and local relationships. Local governments have direct influence over policies in their community and also have strong local relationships in many communities. Local non-governmental organizations only have indirect influence over policy, but have direct abilities to leverage relationships within the community for outreach and workforce purposes. There are many community and economic development benefits that result from energy efficiency that, in many cases, may be of greater interest to local actors than the energy savings themselves.³ Specific examples of the attributes of local government or local organizations include:

- *Energy codes and upgrade requirements*—Many local jurisdictions have adopted building energy codes that exceed state policies. Likewise, several communities require energy performance improvements in existing buildings at time-of-sale or other trigger points.
- *Disclosure and information requirements*—Some localities require energy performance assessments (audits, benchmarking, or ratings) and energy use disclosure (either publicly or to parties to real estate transactions) of residential and commercial buildings. Energy information can influence market values and encourage participation in utility programs.
- *Regulatory and tax incentives*—Non-financial incentives, such as expedited permitting or prioritization in access to public services, have little cost to the public sector but financial value to the real estate industry. In some communities, there may also be state or regional policies to encourage local efficiency policy adoption.
- *Existing networks/outreach*—Local governments and organizations are often trusted messengers in their communities and have access to low-cost communications channels that result in high participation for the investment.
- *Skilled residents*—Employment is a top issue in many communities. Incorporating local employees into utility program delivery can provide opportunities for job training and employment, improve trust in the community, and increase participation of hard-to-reach populations.

Energy Utilities

While many states have established energy efficiency programs run by regulated utilities and as a result have the skills and resources needed to advance energy efficiency efforts, many other utilities in the country have little or no experience or resources for providing energy efficiency services. The local policy and program environment for energy efficiency varies from state to state and sometimes from community to community.⁴ Because of their regulatory environment and their responsibilities to maintain reasonable energy rates for their customers, the cost-effectiveness of energy saving from efficiency programs is usually a top priority for utilities.⁵ Several specific resources provided by utilities that are involved in energy efficiency implementation include:

- *Program delivery*—Utilities with established energy efficiency programs have financial resources and an infrastructure for program delivery. These programs are a valuable starting point for localities implementing their own energy efficiency programs, but may not be entirely appropriate for local needs without customization or partnership.
- *Program/marketing funds*—Funds for marketing, outreach, and program implementation are available from public benefit funds, and sometimes directly through rates. In some cases these

³ For a discussion of the variety of non-energy benefits from energy efficiency and how they are accounted for in some efficiency programs, see Amann (2006).

⁴ For details on the energy efficiency activities of utilities on a state-by-state basis, see Chapter 1 of Sciortino et al. (2011a) or the Utility Policies section of the ACEEE State Energy Efficiency Policy Database (aceee.org/node/174/all).

⁵ For a detailed discussion of utility energy efficiency cost tests and related issues, see NAPEE (2008).

funds may be able to be used more cost effectively by local partners and result in higher program participation.

- *Incentive funds*—Utility budgets for decreasing the private cost of energy efficiency measures can be aligned with, and leveraged by, local policies to better target buildings and measures with the largest and most cost-effective energy saving potentials. An example of such a local policy is assigning a level of utility incentive eligibility based on the building energy ratings that result from locally mandated benchmarking.
- *Energy efficiency targets*—Many states have set utility energy efficiency savings goals, also known as Energy Efficiency Resource Standards or tailored utility targets (Sciortino et al. 2011b). Helping to contribute to these goals can focus and motivate local efforts. Targets can also provide motivation for utilities working with local governments and organizations.

CASE STUDIES

To provide a more tangible understanding of the variety of initiatives being undertaken by local governments and community organizations, we have developed short case studies of eight different local efforts. For each case we briefly describe the policy or program, its management, the public and private costs and benefits associated with the policy, the impact of the policy, and lessons and best practices identified in the case.⁶

We have organized these cases into two categories: enabling policies and program partnerships. *Enabling policies* are typically regulatory requirements or incentives put in place by a local government to improve market conditions for energy efficiency investments. The policies can be implemented with or without coordination with utilities. *Program partnerships* are arrangements between one (or more) energy utility and one (or more) local government or community organization to implement an energy efficiency program. Partnerships usually identify specific contributions and roles for each of the parties involved that, when applied to the program, may improve program delivery, participation, and energy savings beyond a utility-only program.

The location of each of the case studies is identified in Figure 1. The jurisdictions and names of the policies or programs in the case studies are as follows:

Enabling Policies

- A. New York City, NY—Green Codes Task Force
- B. Berkeley, CA—Residential Energy Conservation Ordinance (RECO)
- C. Austin, TX—Energy Conservation Audit and Disclosure (ECAD) Ordinance
- D. Washington, DC—Energy Benchmarking and Disclosure for Public and Large Commercial Buildings

Program Partnerships

- E. Portland, OR—Clean Energy Works Portland
- F. Chicago area, IL—Energy Savers multifamily existing buildings program
- G. New Bedford, MA—Community Mobilization Initiative
- H. Marshfield, MA—Marshfield Energy Challenge

⁶ Five of these case studies—New York, Berkeley, Austin, Portland, and Chicago—were derived from more detailed case studies, which are available on the ACEEE website at aceee.org/sector/local-policy/case-studies.

Figure 1. Map of Case Study Locations



Summary

Each of these case studies is described in more detail in the following sections. By way of summary, Table 1 presents the characteristics exhibited in each of the case studies as compared to the list of actor attributes described in the previous section. Each of the initiatives exhibited at least three of the attributes. Existing local actor networks or outreach capacity, utility financial incentive funds, and utility energy efficiency targets were applied in all or nearly all of the cases. The two initiatives that leveraged the largest number of attributes to their work—Austin ECAD and Clean Energy Works Portland—are also, arguably, the two initiatives that have made the most progress toward market transformation in their regions. While these two initiatives are still young, they have made considerable progress toward developing a policy and market environment that encourages systematic and sustained improvement of energy efficiency. This relationship is not coincidental. In both cases, utility, local government, and civil society organizations have combined efforts and applied their institutional attributes toward a common goal of improving efficiency.

Table 1. Actor Attributes Exhibited in Case Studies

		<i>Enabling Policies</i>				<i>Program Partnerships</i>			
		A. NYC Green Codes Task Force	B. Berkeley RECO	C. Austin ECAD Ordinance	D. DC Benchmarking	E. Clean Energy Works Portland	F. Chicago Energy Savers	G. New Bedford Community Mobilization	H. Marshfield Energy Challenge
<i>Local Gov't or Org</i>	Energy codes and upgrade requirements	X	X	X					
	Disclosure & information requirements			X	X				
	Regulatory and tax incentives	X		X		X			
	Existing networks/outreach	X	X	X	X	X	X	X	X
	Skilled residents					X		X	
<i>Energy Utility</i>	Program delivery			X		X			X
	Program/marketing funds			X		X		X	X
	Incentive funds	X	X	X	X	X	X	X	X
	Energy efficiency targets	X	X	X		X	X	X	X

Enabling Policies

NYC Green Codes Task Force

Location: New York City, New York

Lead Organization: Mayor and City Council Chair in partnership with the Urban Green Council

Start Date: 2008

Policy Type(s): Building Codes, Building Rating and Disclosure, Retrofits

Sector: Residential, Commercial, Industrial

Policy: A comprehensive review of city codes, resulting in 111 recommendations to reduce greenhouse gas emissions and energy use, and improve environmental health. Nearly half of the recommendations relate directly to energy and energy efficiency

Management: The Task Force was charged with identifying changes to NYC codes that could bring buildings to the next level of energy and sustainability performance. The Urban Green Council assembled more than 200 leading thinkers to make recommendations related to building codes, zoning, health, environmental, and other codes. Each of the 111 proposals includes sample statutory language, an explanation of the background issues and rationale, analysis of costs and savings, precedents from other jurisdictions, comparison to LEED credits, and implementation information.

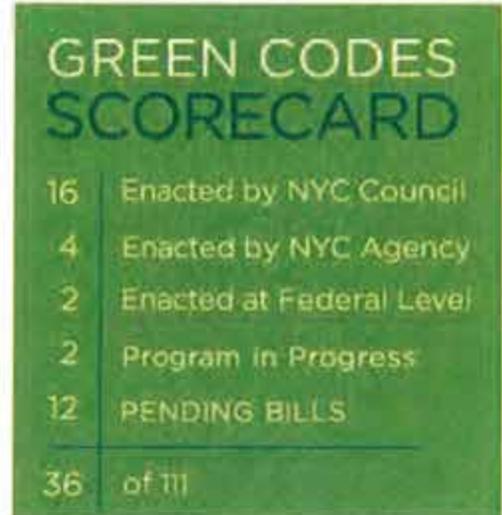
Public Cost/Benefit: The Task Force's efforts, entailing eighteen months of work and more than 70 meetings, was funded entirely by private and nonprofit sources, including the Mertz Gilmore Foundation, New York Community Trust, and the Steven L. Newman Real Estate Institute. Fried, Frank, Harris, Shriver & Jacobson LLP provided pro-bono legal review of the recommendations. Bovis Lend Lease analyzed the cost and payback period for each proposal.

Private Cost/Benefit: The total cost of implementing all recommendations was not analyzed because they influence different buildings and activities over different time periods. However, nearly all of the policies adopted have low or no upfront cost with considerable energy and monetary savings potential.

Impact: One year after the release of the report, 36 recommendations have been implemented or are actively under consideration. These include 16 enacted by the New York City Council, 4 enacted by a New York City agency, 2 enacted at the federal level, 2 programs in progress, and 12 pending bills.

Lessons and Best Practices:

- *Partnerships between government, nonprofit organizations, and industry maximize resources and bring credibility*—Because the project was initiated by the Mayor and City Council Speaker, it obtained legitimacy, recognition, and industry buy-in from the outset. The Urban Green Council was critical as an independent advisor and convener for the project because it has strong ties with both government and industry, and is seen as having a practical approach. As a result, the Council's report was able to identify many changes that city agencies or the real estate industry may not have considered. In addition, the Technical



Committee and Industry Advisory Committee members ensured that the recommendations were feasible and executable. While architects and engineers identified potential changes, the real estate industry provided important feedback relating to the feasibility of implementing changes in construction and ongoing building operations.

- *The recommendations' a-la-carte design enables changes to be implemented incrementally as feasible*—The Urban Green Council recognized that each recommendation would be considered independently by the city, so the report provides a justification and explanation for each recommendation, along with statutory language and implementation guidance. This last step of developing easily understandable explanations along with code-level language was one of the most resource-intensive, yet valuable, steps in the process.

Berkeley Residential Energy Conservation Ordinance (RECO)

Location: Berkeley, California

Lead Organization: City of Berkeley

Start Date: 1987

Policy Type(s): Energy Improvement Requirement, Building Energy Disclosure, Building Codes

Sector: Residential, including all single-family and multifamily, and rental and owner-occupied units sold, transferred, or undergoing substantial renovations in Berkeley

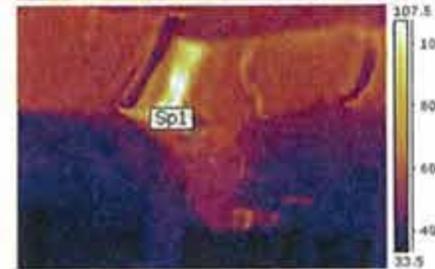
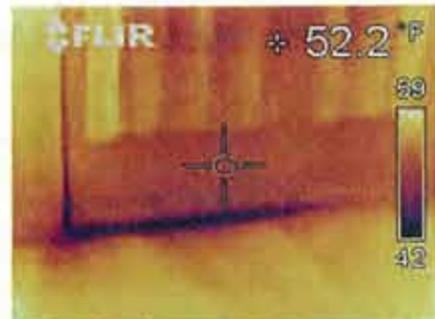
Policy: RECO prescribes ten compliance measures required of homeowners that reduce energy used for space heating, hot water, and lighting.

Management: The City of Berkeley administers the program compliance, and the Community Energy Services Corporation (CESC), a nonprofit licensed general contractor, is the only authorized RECO auditor.

Private Cost/Benefit: The average cost of compliance, not including labor or attic insulation, is \$800. Costs of meeting RECO requirements are capped at 0.75% of the home's final purchase price. Average annual cost savings are estimated at \$698.76. RECO compliance audits cost \$100 for the first unit and \$50 for each unit thereafter in multifamily buildings. Federal, state, local, and utility programs offer a variety of loan, rebate, and assistance programs to help cover the costs of compliance measures.

Public Cost/Benefit: Staff time is the sole public cost of operating and maintaining RECO, much of which is recouped by a \$20 form filing fee.

Impact: Total savings over the past 22 years are estimated at 811,800 therms of natural gas, 1.32 MWh of electricity, and 132 million gallons of water.



Infrared images of common home energy problems in a Berkeley home, each of which can be addressed through the RECO. Top: Heat loss under an exterior door. Middle: poorly insulated attic. Bottom: leaky forced air HVAC ducts.

Lessons and Best Practices:

- *Involvement of an independent auditor*—The program is structured so that there is no opportunity for the auditor to receive financial gains from selling additional services.
- *Working with realtors*—Realtors have been key to program success as they help clients to identify when compliance activity is needed and find funding.
- *Regional market consistency*—A hybrid approach, combining prescriptive and performance building measures, is being studied now in cooperation with neighboring jurisdictions. If adopted, it would be implemented in Berkeley, Oakland, and San Francisco to offer greater regulatory consistency in the area's housing market to the benefit of realtors, contractors, and residents.
- *Prescriptive- vs. performance-based*—RECO's prescriptive nature emphasizes adoption of the same measures in every home. However, a shift to a performance-based approach could result in greater energy savings and participant satisfaction. A more comprehensive, whole-house approach, such as that promoted by the Building Performance Institute (BPI), with a focus on the installation of the best energy savings measures as custom-identified for each home, could include additional measures not currently covered by RECO such as energy-efficient windows, wall insulation, floor insulation, etc.
- *Start with commercial buildings*—Berkeley first implemented a Commercial Energy Conservation Ordinance (CECO) in 1984 that requires thirty-two energy conservation measures upon sale or renovation. The CECO's energy-saving success helped build support for the RECO.

Austin Energy Conservation Audit and Disclosure (ECAD) Ordinance

Location: Austin, Texas

Lead Organization(s): City of Austin and Austin Energy

Start Date: June 2009

Policy Type(s): Building Rating and Disclosure, Building Codes, Retrofits, Utility Regulation and Policy, Multi-Family Homes

Sector: Residential, including single-family and multi-family residential properties and both owner- and renter-occupied, and commercial properties

Policy: ECAD requires properties within Austin and served by Austin Energy, the municipal utility, to undergo energy audits or ratings before the sale of the property or at other specified trigger points (Coleman 2011).

Management: For single-family residential properties, an energy audit must be performed before being sold and disclosed to potential buyers. For multifamily residential properties, ECAD requires an energy audit to be performed and results posted in the buildings, disseminated to tenants, and sent to Austin Energy in the calendar year in which the property is ten years old. If the multifamily property has a high energy use per square foot (exceeds 150% of average energy use of multifamily properties), owners have 18 months from the date of the notification to make energy efficiency improvements. Commercial properties ten years or older are required to determine an energy rating annually and submit it to the City of Austin. Austin Energy maintains records of energy audits and energy efficiency improvements made by registered Austin Energy contractors.

Private Cost/Benefit: The price of residential audits is established by the auditor and is dependent on the size of the property. The estimated cost of an ECAD audit is \$200–300 for a typical single-family



home of 1,800 square feet or less with a single air-conditioning system. Each instance of violation is a separate offense and is subject to a fine of \$500–2,000.

Public Cost/Benefit: To provide a smooth transition between requiring improved information on energy use and voluntary action by owners to improve energy efficiency, Austin Energy makes available energy efficiency rebates and education for residential, multifamily, and commercial property owners. Since ECAD was enacted, Austin Energy has increased its budget for building energy improvement rebates and low-cost loans by \$1 million. The average rebate varies by improvement, but may cover up to 60% in single-family homes. For multi-family buildings, rebates will cover up to 80% of the installed cost of air duct sealing, ceiling insulation, and solar screen or window films for a limited time.

Impact: The average potential annual savings from the measures identified in the ECAD residential audits include savings of \$723,650, 7,788,000 kWh, and 4,897 tons of carbon dioxide.

Lessons and Best Practices:

- *Working with a peer learning network*—ECAD took advantage of knowledge gained through discussions with other jurisdictions that have implemented energy disclosure laws (such as Seattle; Washington, DC; Washington State; New York City; and San Francisco), which identified the amendments below to improve the ordinance.
- *Understanding of real estate transactions*—Originally, ECAD required audit results of single-family properties to be provided “before the time of sale.” This resulted in energy disclosures at the end of a real estate transaction, often too far into the transaction process to negotiate prices or purchase improvements. As a result, the City Council made an amendment to require sellers of single-family homes to provide audit results at least three days before the end of the “option period” during which a potential buyer can cancel the contract to purchase the home.
- *Clear definitions of policy scope*—Amendments were made to include condominiums, which were originally not addressed in the ordinance. Owners of four or fewer condominiums must meet the requirements for single-family homes. Owners of condominiums of five or more units at one location must meet requirements for multifamily properties.

Washington, DC: Energy Benchmarking Requirement

Location: Washington, DC

Lead Organization: District (of Columbia) Department of the Environment (DDOE)

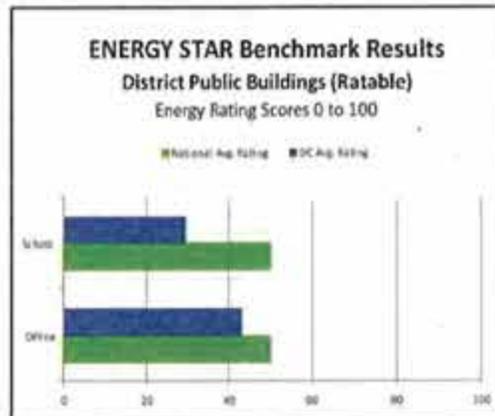
Start Date: 2010

Policy Type(s): Building Rating and Disclosure, Public Buildings

Sector: Commercial buildings, including public buildings over 10,000 square feet and private buildings over 50,000 square feet

Policy: The Green Building Act of 2006 and the Clean and Affordable Energy Act of 2008 require that owners of large commercial buildings in the District of Columbia annually rate and disclose their building energy performance on a public website.

Management: Building owners are expected to use the ENERGY STAR® Portfolio Manager (for existing buildings) or ENERGY STAR Target Finder (for new construction) to conduct building energy



assessments. The District Department of the Environment (DDOE) is responsible for publishing the resulting Statements of Performance on the Internet. Public building benchmarking results were first disclosed in November 2010. The largest private buildings (200,000 ft² or more) are required to begin reporting in 2011 and performance disclosure begins in 2012. The reporting and disclosure requirements for buildings as small as 50,000 ft² will be phased in by 2015 (Burr et al. 2011).

Private Cost/Benefit: Building owners are responsible for covering all costs associated with rating and disclosure. Now that energy performance information is publically available, parties can consider building energy consumption before even entering a transaction, whereas previously energy information was not available until well into negotiations, if at all. Shareholders, institutional investors, and other financial actors will have a better idea about how their buildings compare to similar buildings in terms of energy costs. Ultimately, property values should come to account for energy performance.

Public Cost/Benefit: The primary costs to the District government will be the maintenance of the disclosure database. Energy benchmarking also creates demand for many of the district's other energy efficiency initiatives such as the newly formed DC Sustainable Energy Utility (SEU). Funds for training building owners on the benchmarking requirement may be made available by the SEU and it may tie ratings to incentive funds for energy improvements. In 2012, DC will begin requiring all new public and private commercial buildings to meet LEED green building standards; benchmarking will allow more competition between new high-performance buildings and existing buildings.

Impact: Energy assessments completed for public buildings show that the District has plenty of room for energy improvements. FY2009 data for 194 district government buildings show that they were overall less efficient than similar buildings on average in the United States. The benchmarking revealed DC's schools are in the 29th percentile in comparison to schools across the country and that libraries and offices are close to, but still under, their average counterparts across the country. The District is currently conducting more detailed audits to identify the most appropriate energy savings measures for individual buildings.

Lessons and Best Practices:

- *Engage the real estate industry from the start*—Though building owners were initially skeptical of the policy, because of effective engagement in the process they are now vital partners in the implementation. DDOE is partnering with the regional Apartment and Office Building Association to provide trainings to owners on their responsibilities.
- *Additional measurement and verification of ENERGY STAR scores is needed*—Portfolio Manager was initially designed as a voluntary self-analysis tool, but now that its use is mandated by law in some jurisdictions, some adjustments have been needed. These adjustments include ENERGY STAR staff creating an automated reporting tool for use by building owners in DC.

Program Partnerships

Clean Energy Works Portland

Location: Portland, Oregon

Lead Organization: Portland Clean Energy Works

Start Date: 2009



Policy Type(s): Behavior & Human Dimensions, Energy Efficiency Financing, Energy Efficiency Workforce, Financial Incentives for Energy Efficiency, Local & Community Initiatives, Low-Income Programs, Retrofits, Utility Regulation & Policy

Sector: Single-family residential

Policy: Clean Energy Works provides personal guidance and bundled services to simplify the process of energy efficiency improvements. The program provides an Energy Advocate to assist each homeowner, schedules a diagnostic audit, provides access to low-interest financing, and oversees implementation of whole-home energy upgrades designed to reduce energy consumption between 10 and 30%.

Management: Clean Energy Works was started by a sizable public-private partnership between the City of Portland Bureau of Planning and Sustainability (BPS), with the Energy Trust of Oregon (the state's energy efficiency entity), Enterprise Cascadia (a CDFI), the three investor-owned utilities that serve Portland residents, Portland Development Commission, Portland Housing Bureau, home performance contractors, and local labor unions and community-based organizations.

Private Cost/Benefit: The average loan size is \$12,500, with monthly payments around \$70. Depending on the size of the project, the rate is typically 4–6% for a 20-year term.

Public Cost/Benefit: The city's initial \$2.5 million investment (using \$1.1M EECEBG funds and other city resources) leveraged additional funds, resulting in an \$8 million pilot loan portfolio to serve 500 homes. In 2010, the city received an additional \$20 million from the DOE's EECEBG program to expand to other areas of the state. Clean Energy Works Oregon now aims to serve 6,000 homes in the next three years.

Impact: As of February 2011, more than 500 loans have been signed, representing a 66% conversion rate from audits to implementation. The approximate annual savings include: electricity savings of 700,000 kWh; natural gas savings of 180,000 therms; total household utility bill savings of \$312,000; and avoided greenhouse gas emissions of 1,350 metric tons of carbon dioxide.

Lessons and Best Practices:

- *One-stop-shops help ensure audits turn into projects*—Participants receive intensive handholding from Energy Advocates with credible technical expertise. Energy Advocates pre-screen potential participants for basic feasibility requirements, then help them through each step of the process and use the highest quality vetted contractors.
- *Simple, affordable financing enables implementation*—The program eliminates upfront costs and offers loans based on packages of improvements (such as "basic weatherization," "extended weatherization," and "extended weatherization + space heat or hot water"), which use basic assumptions to simplify payback analysis. The loan is then repaid through the monthly utility bill.
- *Community Workforce Agreements can effectively spur local job growth*—PCEW's CWA lays out clear job-quality and access requirements for all participating contractors. It also provides support to disadvantaged businesses and to training programs targeting disadvantaged populations. None of the original contractors were women or minority-owned businesses. As of February 2011, five of sixteen participating contractors are minority- or women-owned, and over half of the field workforce hours have been performed by individuals from historically disadvantaged populations. Contractors report hiring 27 entry-level weatherization workers from designated training pools and over 344 workers have drawn a paycheck from working on Clean Energy Works projects.

Chicago Area Energy Savers Program

Location: Chicago area, Illinois

Lead Organization: CNT Energy

Start Date: 2007

Policy Type(s): Energy Efficiency Financing, Low-Income Programs, Multi-Family Homes, Retrofits

Sector: Multi-Family Residential, Affordable Housing.

Policy: The Energy Savers program offers free energy audits, custom technical support, and retrofit financing for building owners of affordable, multi-family residential buildings.

Management: CNT Energy, a Chicago-based nonprofit, administers the program with the Community Investment Corporation as its primary partner.

Private Cost/Benefit: CNT Energy Savers is funded by a combination of sources, including private foundations and local natural gas utilities. The building retrofits are privately financed through the Community Investment Corporation or other lending institutions. Participants also take advantage of incentives offered through the gas and electric utilities. Each retrofit project yields an average savings of \$10,000 per year.

Public Cost/Benefit: The program is also supported by the City of Chicago and the Chicago Region Initiative for Better Buildings. The program will help the City achieve the stated goal of retrofitting 400,000 units by 2020, as written in the Chicago Climate Action Plan.

Impact: Over 5,000 rental apartment units in the Chicago region have been retrofitted through the program. On average, improvements have cut energy costs by 30% and saved building owners and tenants \$10,000 per year. Other results include 1,000,000 therms saved, 5,000 metric tons of carbon dioxide emissions avoided, direct creation of 75 jobs, and preservation of affordable rental housing through reducing utility bills.

Lessons and Best Practices:

- *Relationship management is key*—Program managers must be good communicators and sympathetic to the needs of owners. The program managers must have the right temperament to shepherd owners through the many phases of making technical decisions.
- *Prioritize cost effectiveness*—In low-income properties, even those that are cash flow positive, there is not as much money available to make improvements, so program managers and analysts must focus on communicating to owners about what is cost-effective, rather than the latest or most efficient technology.



Energy improvements made through Energy Savers improve the comfort of affordable apartment buildings such as this one on South Parnell Avenue in Chicago



- *Partner with an expert lender*—The Community Investment Corporation maintains its commitment to making rehab deals that work for multifamily owners. The CIC's investment in the program has been important for ensuring that the process doesn't die after the audit.
- *Diversify funding sources*—The program has demonstrated success in lowering energy consumption, maintaining affordable housing, and returning value to investors; as a result, it receives utility, public, and philanthropic support. These varied supports make the platform more robust and allows program managers to bundle services and incentives in order to meet each building owner's needs.

New Bedford Community Mobilization Initiative

Location: New Bedford, MA

Lead Organization: Marion Institute and NSTAR

Dates: July 2010 – April 2011

Policy Type(s): Energy Efficiency Workforce, Financial Incentives for Energy Efficiency, Local & Community Initiatives, Low-Income Programs, Retrofits

Sector: Residential and Commercial

Policy: The New Bedford Community Mobilization Initiative (CMI) was a pilot program that aimed to increase energy efficiency efforts for households that had incomes between 60% and 120% of state median income, and create green jobs in New Bedford.

Management: The main sponsor, NSTAR, facilitated program design and implementation. NSTAR was responsible for bringing all of the program partners together, including the local contractors (New Bedford

YouthBuild), the primary program manager (CSG), and the various community leaders (City of New Bedford and the Marion Institute). NSTAR designated community representatives from Marion Institute's POWER Project to be responsible for designing the program outreach strategies and coordinating basic training sessions.

Private Cost/Benefit: The New Bedford CMI offered the energy efficiency services and incentives that NSTAR already offered its customers through the state efficiency program, MassSave, and through NSTAR's existing commercial programs. NSTAR did not provide any additional services or incentives.

Public Cost/Benefit: All residents who participated in the program contributed to MassSave through a systems benefits charge on their monthly utility bills. Out-of-pocket expenses for residents varied depending on the type of retrofit work completed and pre-weatherization (non-energy building code compliance) issues.

Impact: The New Bedford CMI aimed to weatherize 50 residential homes, 25 small business, and 4 multi-unit buildings. The program exceeded its small business goal by weatherizing 33 small

Outreach Flyer in Portuguese



businesses and came close to meeting its multi-family goal with 3 multi-family weatherization projects. Although the New Bedford CMI was less successful in the residential sector, with just 16 residential weatherization projects, the program was influential in that it informed stakeholders of the multifaceted challenges to weatherization in the residential sector, which include pre-weatherization barriers, financial barriers, and program logistic barriers. The pilot helped shape New Bedford Energy Now, the next phase of weatherization efforts in New Bedford, which includes all of the CMI partners, has more than 20 new program partners, and has the goal of weatherizing 5,000 units by 2015 (Lydgate 2011). Further, as a result of the CMI pilot, state policymakers and utilities have launched a review of pre-weatherization barriers with the goal of adjusting policies and programs to address them.

Lessons and Best Practices:

- *Making it local*—Local leaders helped to develop and implement program marketing. Through the Marion Institute's P.O.W.E.R. project, New Bedford residents were hired to lead outreach efforts in two low-income neighborhoods. All weatherization work generated by the CMI leaders' outreach went directly to New Bedford YouthBuild, a nonprofit organization that provides construction training and jobs to local youth.
- *Community outreach*—Door-to-door canvassing was P.O.W.E.R.'s primary outreach strategy; however, other outreach methods included: making phone calls to residents; participating in community events and meetings; and advertising on local radio stations, the local public access television channel, and social network websites.
- *Strong stakeholder partnerships*—Program partners had a productive and cordial relationship. However, the team had to deal with program complications, including a scheduling backlog and general misinformation and miscommunication regarding outcome expectations and how barriers to weatherization would be addressed.
- *Awareness of barriers and resources*—Program partners in the CMI were not adequately aware of potential program barriers, such as pre-weatherization needs, or the amount of funds need to address such barriers.
- *Measuring success*—Although the program did not realize its participation goals, the program was successful in developing an effective outreach strategy for making contact with residents who are often considered hard to reach, including those households with incomes between 60% and 120% of state median income. Further, the program shed light on the additional barriers that program partners must address, such as pre-weatherization costs and scheduling/logistic problems that prevent weatherization work from moving forward (Brandt 2011).

Marshfield Energy Challenge

Location: Marshfield, MA

Lead Organization: NSTAR

Dates: Spring 2008 – Fall 2009

Policy Type(s): Financial Incentives for Energy Efficiency, Local & Community Initiatives, Retrofits

Sector: Residential and Commercial



Policy: The Marshfield Energy Challenge was developed to address increasing electricity demand in Marshfield and to relieve peak loads in the town by using demand-side resources, including energy efficiency, renewable energy, and direct load control.

Management: The program was sponsored by NSTAR, the electric utility servicing Marshfield, and the Massachusetts Technology Collaborative, a public economic development agency. NSTAR

oversaw the program's design and implementation. Conservation Services Group was the residential program delivery contractor responsible for formalizing and implementing the marketing strategies conceptualized by program partners. NSTAR worked closely with consultants, as well as municipal and community leaders, to develop and implement the program's community outreach component.

Private Cost/Benefit: The Marshfield Energy Challenge built upon the energy efficiency services and incentives that NSTAR already offered its customers through the state efficiency program, MassSave, and existing commercial and industrial programs. NSTAR further expanded its service and incentive offerings, including paying for the purchase and installation of three photovoltaic panels on town facilities, covering the MassSave co-payment for residential customers, and offering a 70% rebate on energy efficiency measures for businesses and a 100% rebate for schools. The program undertook extensive outreach and marketing, which cost \$195,000 more than its standard programs.

Public Cost/Benefit: All residents who participated in the program contributed to MassSave through a systems benefits charge on their monthly utility bills. Out-of-pocket expenses for residents varied depending on the type of retrofit work completed, as discussed above.

Impact: The Marshfield Energy Challenge sought to deliver 2 MW of peak demand savings (728 kW in the residential sector and 1,274 kW in the commercial sector). However, the realized savings from efficiency, direct load control, and solar photovoltaic installations were only 385 kW in the residential sector and 450 kW in the commercial sector, little more than 40% of the program's original energy reduction goal. Participation rates for the residential program were high compared to traditional programs, with 15% of all households in the community receiving an audit. Ninety percent of participating households made lighting improvements, 20% improved insulation, 19% received air conditioning tune-ups, 16% improved air sealing, and 14% installed heating measures. Reasons for such shortfalls in realized savings include a lack of large commercial customer participation in the direct load control program and that lighting measures were predicted to achieve greater energy efficiency in the residential sector than was realized. Annual electric savings are estimated to be 1.5 million to 2.1 million kWh from commercial customers and 0.6 million kWh from residential customers, representing about 1.7% of Marshfield's electric use (Brandt 2011).



Direct mail flyer

Lessons and Best Practices:

- **Community marketing**—The marketing campaign promoted a theme of “community” and used both traditional (e.g., direct mail) and non-traditional outreach strategies (e.g., tabling at community events, offering a community incentive) to increase program participation. Branding helped create a buzz about the program.
- **Engaging community leaders**—Community members (such as Marshfield selectmen, the school committee chair, a public librarian, the town planner, environmental group local representatives, a church minister/pastor, and a radio station owner) lacked formal power in the program, yet still played an important role by serving as “Program Ambassadors.” They increased the program’s exposure and legitimacy and helped address residents’ concerns or questions about the program. As a result of the program, the Marshfield Energy Committee was established to expand local energy efforts.
- **The high cost of effective outreach**—Nevertheless, evaluators found that the main barrier to participation was lack of awareness, with 78% of the non-participants noting that they had not heard of the challenge. No formal analysis of the costs of the program was made public, but

the known costs of marketing and the level of lack of awareness suggests that it would likely not be financially feasible to replicate this program on a wide scale.

CONCLUSION

An increasing number of local governments and organizations are undertaking policies and initiatives to promote energy efficiency, but are not necessarily coordinating with utilities. At the same time, utilities are looking for methods to increase program participation and energy savings. Well-designed partnerships can leverage the skills and resources of utilities, governments, and nonprofits, while tailoring programs to local needs and goals. Some findings and best practices to consider for future enabling policies and program partnerships include:

- *Public utilities leading the way*—Jurisdictions with municipal utilities (Austin Energy in Austin) or energy efficiency utilities (the Energy Trust of Oregon in Portland and the Sustainable Energy Utility in DC) have been more active in leveraging the institutional attributes of both utility and local actors. More efforts toward sustained partnerships between investor-owned utilities and communities (such as the Massachusetts examples) are needed.
- *Leveraging existing community resources*—Partnerships with local governments, nonprofits, and businesses bring credibility, momentum, access to existing social networks, and often greater participation.
- *Incentives and mandates for greater efficiency and partnerships* – Nearly every jurisdiction we looked at was covered by some form of energy efficiency target at the state level. These targets encourage utilities to adjust their business model and invest in efficiency systematically. Even in most states with efficiency targets, incentives and enabling policies for local partnerships are not yet in place. Utility regulators may need to make policy adjustments to encourage an ecosystem of collaboration and innovation.
- *Innovative funding models*—True partnerships may require utilities to view local actors as contractors and pay, or otherwise reward, them for their contributions toward fulfilling utilities' energy efficiency responsibilities. Further experimentation with these models is needed.
- *Understanding the real estate market*—Implementing policies that help to integrate energy efficiency characteristics into property values or through intervening at key transaction points (such as sale, finance, or rent) can increase adoption.
- *Balancing innovation with consistency across jurisdictions*—Programs must strike a balance between tailoring to each locality and developing scalable programs. Therefore metropolitan area or state initiatives may be preferable to municipal efforts to maximize policy impacts and to make management less expensive and/or compliance simpler. Alternatively, program structure could be statewide, while marketing and outreach can be localized.

The reflections and lessons from the case studies included in this paper are only a sampling of the opportunities and challenges provided by local energy efficiency implementation. Some of the other existing research on this topic is summarized in Michaels et al. (2011). But more research and practice are still needed in this area. There is an appetite among utilities and communities for new approaches to efficiency. As a result, regular innovations are being made around the country, should be documented, and, where appropriate, should be broadly integrated into energy efficiency practices elsewhere.

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