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LOCAL GOVERNMENT CLIMATE AND ENERGY STRATEGY SERIES

Energy Efficiency in Affordable Housing

A Guide to Developing and Implementing Greenhouse Gas Reduction Programs

Energy Efficiency

U.S. ENVIRONMENTAL PROTECTION AGENCY
2011

EPA's Local Government Climate and Energy Strategy Series

The *Local Government Climate and Energy Strategy Series* provides a comprehensive, straightforward overview of greenhouse gas (GHG) emissions reduction strategies for local governments. Topics include energy efficiency, transportation, community planning and design, solid waste and materials management, and renewable energy. City, county, territorial, tribal, and regional government staff, and elected officials can use these guides to plan, implement, and evaluate their climate change mitigation and energy projects.

Each guide provides an overview of project benefits, policy mechanisms, investments, key stakeholders, and other implementation considerations. Examples and case studies highlighting achievable results from programs implemented in communities across the United States are incorporated throughout the guides.

While each guide stands on its own, the entire series contains many interrelated strategies that can be combined to create comprehensive, cost-effective programs that generate multiple benefits. For example, efforts to improve energy efficiency can be combined with transportation and community planning programs to reduce GHG emissions, decrease energy and transportation costs, improve air quality and public health, and enhance quality of life.

LOCAL GOVERNMENT CLIMATE AND ENERGY STRATEGY SERIES

All documents are available at: ***www.epa.gov/statelocalclimate/resources/strategy-guides.html***.

ENERGY EFFICIENCY

- Energy Efficiency in Local Government Operations
- Energy Efficiency in K–12 Schools
- Energy Efficiency in Affordable Housing
- Energy-Efficient Product Procurement
- Combined Heat and Power
- Energy Efficiency in Water and Wastewater Facilities

TRANSPORTATION

- Transportation Control Measures

COMMUNITY PLANNING AND DESIGN

- Smart Growth

SOLID WASTE AND MATERIALS MANAGEMENT

- Resource Conservation and Recovery

RENEWABLE ENERGY

- Green Power Procurement
- On-Site Renewable Energy Generation
- Landfill Gas Energy

Please note: All Web addresses in this document were working as of the time of publication, but links may break over time as sites are reorganized and content is moved.

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EXECUTIVE SUMMARY

Developing and Implementing Energy Efficiency Programs

Saving energy through energy efficiency improvements can cost less than generating, transmitting, and distributing energy from power plants, and provides multiple economic and environmental benefits. As President Obama said in June 2009, "By bringing more energy efficient technologies to American homes and businesses, we won't just significantly reduce our energy demand–we'll put more money back in the pockets of hardworking Americans." Energy efficiency also helps reduce air pollution and greenhouse gas emissions, improves energy security and independence, and creates jobs.

Local governments can promote energy efficiency in their jurisdictions by developing and implementing strategies that improve the efficiency of municipal facilities and operations and/or encourage energy efficiency improvements in residential, commercial, and industrial sectors. The energy efficiency guides in this series describe the process of developing and implementing strategies, using real-world examples, for improving energy efficiency in local government operations (see the guides on local government operations, K-12 schools, energy-efficient product procurement, combined heat and power, and water and wastewater facilities), as well as in the community.

Energy Efficiency in Affordable Housing

With the help of local governments, many low-income households are reducing housing costs and GHG emissions by improving their energy efficiency. Energy costs can contribute substantially to the overall financial burden of housing, and can make housing unaffordable for many families. This guide describes how local governments have planned and implemented programs to reduce the energy-cost burden on low-income households while also generating other energy, environmental, and economic benefits for the local community and region. It is designed to be used by public housing authorities, other public and private entities that provide affordable housing assistance, local government staff, elected officials, and citizen groups.

RELATED GUIDES IN THIS SERIES

- **Community Planning and Design: *Smart Growth***

  Smart growth involves development that benefits the economy, the community, the environment, and public health. Smart growth principles favor the strategic location of transit services, residences, and commercial development, which can reduce the transportation costs of low-income households and improve housing affordability.

- **Community Planning and Design: *Urban Heat Island Reduction***

  Dark-colored buildings, paved surfaces, and reduced tree cover in urban areas create "islands" of warmth, with impacts on air quality, energy use, and public health. Low-income residents are among the most vulnerable to these impacts, and measures to reduce urban heat islands can help reduce home energy use while providing other environmental and health benefits.

- **Transportation: *Transportation Control Measures***

  Transportation control measures are strategies that reduce vehicle miles traveled and improve roadway operations to reduce air pollution, GHG emissions, and fuel use from transportation. Measures such as public transportation improvements and expanded commuter choices can provide additional reductions in the energy-cost burden of low-income households.

- **Energy Efficiency: *Combined Heat and Power***

  Combined heat and power (CHP), also known as cogeneration, refers to the simultaneous production of electricity and thermal energy from a single fuel source. Utilizing CHP systems in affordable housing can significantly improve home energy efficiency and help to reduce GHG emissions.

- **Energy Efficiency: *Energy-Efficient Product Procurement***

  Many local governments are saving energy by requiring that the energy-using products they purchase meet energy efficiency criteria. By promoting the use of energy-efficient products in affordable housing, local governments can help reduce energy loads and increase the cost-effectiveness of other energy efficiency activities, benefiting both low-income residents and building owners.

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Readers of the guide should come away with an understanding of options for improving energy efficiency in affordable housing, a clear idea of the steps and considerations involved in developing and implementing the various options, and an awareness of expected investment and funding opportunities.

The guide describes energy, environmental, and economic benefits of energy efficiency in affordable housing (Section 2); planning and design approaches (Section 3); key participants and their roles (Section 4); policy mechanisms that local governments have used to support programs for energy efficiency in affordable housing (Section 5); implementation strategies for effective programs (Section 6); investment and financing opportunities (Section 7); federal, state, and other programs that may be able to help local governments with information or financial and technical assistance (Section 8); and finally, two case studies of successful local government programs for improving energy efficiency in affordable housing (Section 9). Additional examples of successful implementation are provided throughout the guide.

Relationships to Other Guides in the Series

Local governments can use other guides in this series to develop robust climate and energy programs that incorporate complementary strategies. For example, local governments can combine energy efficiency improvements in affordable housing with **smart growth** strategies, **urban heat island reduction** techniques, and **transportation control measures** to develop integrated plans for community development that maximize improvements to the economic and social well-being of low-income residents while reducing GHG emissions and air pollution. Local governments can also integrate combined heat and power systems and energy efficient products into affordable housing to ensure ongoing energy and costs savings and to promote climate change mitigation.

See the box on page vii for more information about strategies that complement energy efficiency improvements in affordable housing. Additional connections to related strategies are highlighted in the guide.

1. OVERVIEW

Households across the nation spend more than $160 billion on energy to heat, cool, light, and live in their homes each year, and residential energy consumption accounts for more than 20 percent of the nation's total energy consumption (U.S. EPA, 2006b). These energy costs contribute to the overall financial burden of housing, and can make housing unaffordable for many families. In 2006, close to 40 million households spent 30 percent or more of their incomes on housing—the threshold used by the U.S. Department Housing and Urban Development (HUD) to identify affordability (see text box at right) (Brennan and Lipman, 2008). To help make housing more affordable, HUD and other public and private entities administer a number of assistance programs. For example, in 2008, HUD provided support to approximately 5 million low-income households through its public housing, rental assistance, and other housing assistance programs (U.S. HUD, 2008a).

Improving energy efficiency in housing can help make homes more affordable by reducing the energy cost burden on low-income households. Approaching efficiency improvements from a comprehensive, whole-house, systems perspective can generate other energy, environmental, and economic benefits for the local community and region, such as increased employment and reduced demand for federal assistance program resources. Combining energy efficiency improvements and green building techniques, while taking an approach that views housing as integrated with surrounding land uses, can help maximize these benefits.

Local governments can work with a range of stakeholders to improve energy efficiency in affordable housing. Some local governments own and develop their own affordable housing, and can take direct action to implement energy efficiency projects in this housing. However, most local governments do not own affordable housing units. These governments can take advantage of relationships with developers, homeowners, and other public and private organizations to leverage efforts to improve energy efficiency in existing affordable housing and design new affordable housing to achieve superior energy performance.

This guide is designed to encourage local governments to take an active role in improving energy efficiency in affordable housing units they own and develop, and promoting energy efficiency in affordable housing owned and developed by other public and private entities, such as community development corporations and public housing authorities (PHA).[1] It provides information on the benefits of improving energy efficiency in affordable housing, expected investment and funding opportunities, and case studies. Additional examples and sources for more information are provided in Section 10, *Additional Examples and Information Resources*.

Local governments can combine energy efficiency improvements in affordable housing with other strategies covered in the *Local Government Climate and Energy Strategy Series* to develop comprehensive, robust programs that provide integrated social and environmental benefits. For example, local governments can integrate their efforts in affordable housing with smart growth strategies and transportation control measures (TCMs) to put development in locations that are well connected to the region by public transit, take advantage of existing infrastructure, and are affordable for residents with a range of incomes. The cost of living in these

AFFORDABLE HOUSING

The affordable housing market is an amalgamation of different programs operated by various federal and state agencies and government-sponsored enterprises, each with its own set of rules, including income limits. Specifically, HUD defines affordability as meaning that no more than 30% of a household's annual income is spent on housing (U.S. HUD, 2007b).

Affordable housing is promoted using a variety of instruments including competitive and formula grants, interest subsidies, rental assistance, and mortgage guarantees. It spans all climate zones, rural and urban locations, and all building types from single family detached to high-rise elevator structures to mixed use developments.

This guide specifically looks at affordable housing that is subsidized, including units owned and developed by:

- Local governments;
- Community development corporations;
- Public housing authorities (PHAs); and
- Other public and private entities.

[1] *This guide refers to these various stakeholders generally as "developers."*

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locations is lower because they offer more transportation options and are closer to housing, jobs, and services. Development in these locations allows people to drive less, which reduces GHG emissions and air pollution. Please see the guides on smart growth and TCMs for more information on these complementary strategies.

2. BENEFITS OF ENERGY EFFICIENCY IN AFFORDABLE HOUSING

Improving energy efficiency in affordable housing can have many energy, environmental, and economic benefits. These benefits generally accrue to the homeowner or renter, but can also extend to the local community and region. Local governments can promote energy efficiency in affordable housing to:

- **Reduce GHG emissions and other environmental impacts.** Improving energy efficiency in affordable housing can help reduce emissions of GHGs and criteria air pollutants by decreasing consumption of fossil-fuel-based energy. Fossil fuel combustion for electricity generation accounts for 40 percent of the nation's carbon dioxide (CO_2) emissions, a principal GHG, and 67 percent and 23 percent of the nation's sulfur dioxide (SO_2) and nitrogen oxide (NO_x) emissions, respectively, which can lead to smog, acid rain, and trace amounts of airborne particulate matter that can cause respiratory problems for many people (U.S. EPA, 2008x; U.S. EPA, 2008a). An ENERGY STAR labeled new home can achieve GHG emissions reductions of up to 2 metric tons each year (U.S. EPA, 2008o).[2]

The Denver Housing Authority (DHA) in Colorado has contracted with an energy service company (ESCO) to implement energy efficiency projects in its affordable housing units. DHA expects to reduce its annual energy consumption by 25 percent and annual CO_2 emissions by approximately 2,540 metric tons. DHA's efforts are contributing to the city's overall goal of reducing GHG emissions by 10 percent by 2012 (Honeywell, 2007).

Reducing energy consumption can also contribute to other local government environmental objectives, such as resource conservation and pollution prevention. For example, purchasing an ENERGY STAR labeled energy-efficient clothes washer to reduce energy costs can also help reduce water utility bills and decrease the amount of used water that enters the wastewater system (U.S. EPA and U.S. DOE, 2008).

- **Reduce energy costs.** According to HUD, energy costs consume 19 percent of total annual income for single, elderly, poor, and disabled persons living on social security (compared with a national average of only 4 percent) (U.S. HUD, 2007h). Reducing energy costs is an effective way to ensure that housing remains affordable for these individuals. The federal government's Partnership for Home Energy Efficiency (PHEE), a collaborative effort between EPA, the U.S. Department of Energy (DOE), and HUD, estimates that many households can save between 20 and 30 percent on energy costs by improving energy efficiency (Energy Savers, 2007). According to EPA, an ENERGY STAR labeled new home is at least 15 percent more energy efficient than a home built to the 2004 International Residential Code (IRC) and includes additional energy-saving measures that typically make it 20-30 percent more energy efficient than standard homes (U.S. EPA,

COST SAVINGS BENEFITS ARE ACCRUING TO RESIDENTS AND BUILDING OWNERS

A study conducted by New Ecology, Inc. found that both residents and building owners can reap direct benefits from reduced utility costs in new, green, affordable multiple-family housing developments that incorporate energy efficiency.*

The study found that resident utility cost savings averaged more than $12,600 per home over a 30-year building life-cycle. In addition, the study found that approximately half of the building owners studied were also achieving cost savings, with the average building owner saving approximately $2,700 in reduced utility costs over a 30-year building life-cycle, typically as a result of reduced energy consumption in common areas in each building.

* In the developments included in the study, affordable housing residents pay their own utility bills.

Source: New Ecology, Inc., 2006.

[2] *Energy use in the residential sector accounts for 20 percent of all U.S. GHG emissions from fossil fuel combustion (U.S. EPA, 2008x).*

2008p). An ENERGY STAR home can save homeowners between $200 and $400 per year on their utility bills on average (U.S. EPA, 2008d).[3]

In rented affordable housing units, energy cost savings can accrue to the renter or the building owner (Shafer, 2003).[4] In some affordable housing units, utility costs are embedded in rent payments, whereby the building owner will reap the direct benefits of energy efficiency improvements, with the resident benefiting indirectly from a lower risk of rent increase. In such cases, residents may have no obvious incentive to reduce their energy use and education is critical. When residents pay utility bills directly, they are the direct beneficiaries of much of the energy cost savings; building owners can still benefit directly from reduced energy consumption in building common areas and indirectly from reduced utility allowances and energy assistance program costs.

- **Increase economic benefits through job creation and market development.** Investing in energy efficiency can stimulate the local economy and encourage development of energy efficiency service markets. Across the nation, energy efficiency technologies and services are estimated to have created 8.5 million jobs in 2006 (ASES, 2007). In addition, incentives for affordable housing developers can encourage businesses to relocate to the region, bringing increased tax revenues and jobs (Nebraska DED, 2007).

- **Demonstrate leadership.** Promoting energy efficiency in affordable housing can help raise public awareness about the energy conservation, environmental, health and wellness, economic, and other benefits of energy efficiency by making these benefits tangible for affordable housing residents. Increased awareness of the benefits of energy efficiency can lead to broader adoption of energy-efficient and green practices throughout the community.

The Philadelphia Housing Authority in Pennsylvania has initiated a campaign to replace every light bulb in its affordable housing units with energy-efficient compact fluorescent light bulbs (CFLs) with a goal of encouraging "other government agencies and the general public [to] follow the example" (PHA, 2006a).

In addition, by providing incentives for developers to incorporate energy efficiency in affordable housing design and renovation, local governments promote broader use of energy-efficient practices by local businesses, including developers, architects, contractors, property management firms, and retailers. Businesses may look to differentiate themselves by enhancing their energy efficiency expertise, which can result in accelerated development of the market and delivery infrastructure for energy-efficient products and services (AHEE, 2007). For more information on how local governments can lead by example through energy-efficient product procurement, see EPA's *Energy-Efficient Product Procurement* guide in the *Local Government Climate and Energy Strategy Series*.

- **Improve indoor air quality.** Improving energy efficiency in affordable housing can have the indirect effect of enhancing indoor air quality when adequate ventilation systems are in use. Properly installing insulation and sealing air leaks in a home's envelope and duct system, for example, can reduce heating and cooling energy costs and improve indoor air quality by ensuring an adequate supply of fresh air, minimizing infiltration of dust and pollen from attics and basements into living areas, and reducing noise and odor intrusion from the outside environment (U.S. EPA, 2008f). These benefits can be especially significant for seniors or other populations particularly susceptible to poor air quality. One review of building performance found that improving air quality in buildings can reduce the incidence of colds and flu by 51 percent, on average (Carnegie Mellon, 2005).

- **Increase comfort.** Improving energy efficiency in affordable housing can increase indoor comfort for residents by mitigating several conditions that contribute to poor indoor comfort, including:

  - ***Damp basements,*** which are caused by moisture migrating through the foundation. Damp basements can result in increased indoor humidity, structural damage, and mold proliferation. Improving home energy efficiency through proper insulation, proper duct sealing, and other measures helps to control the air entering and exiting the home, thereby controlling moisture levels and ensuring better air quality.

[3] *The average household utility bill is approximately $1,900 per year (U.S. EPA, 2008d).*

[4] *Some PHAs provide subsidies to private landowners to develop and manage public affordable housing units.*

- ***Cold floors and drafty rooms in the winter,*** which can be the result of insufficient insulation, unwanted air infiltration, or poor duct performance.

- ***Moisture on windows,*** which can result from having inefficient windows or high indoor humidity levels. Moisture on windows can lead to mold growth and damage to window sills (U.S. EPA, 2008f).

- **Increase home value.** Implementing energy efficiency projects in affordable housing can increase home value. An energy-efficient home often commands a higher sale price on the market, due to an anticipation of reduced utility costs for prospective buyers. In addition, energy-efficient features can often mitigate structural damage, preserving a home's value. For example, sealing and insulating a home can reduce energy costs and prevent the formation of ice dams. Ice dams, which can cause damage to roof drainage systems, are formed when warm air inside the home leaks into the attic, warming the underside of the roof and causing snow and ice to melt and refreeze as it runs off the roof (U.S. EPA, 2008f).

- **Reduce reliance on energy assistance programs.** Improving energy efficiency in affordable housing can have the indirect benefit of reducing residents' reliance on energy assistance programs offered by utilities and state and federal government authorities. As a result, improved energy efficiency can reduce residents' vulnerability to changes in assistance program terms, and can increase the assisting authorities' ability to fund other programs. For example, utility costs comprise 23 percent of the typical PHA's annual operating expenses, causing HUD's annual energy costs for public housing units to exceed $1.2 billion. Savings in this area could be used to increase allocations to other housing and economic and community development programs (U.S. HUD, 2007g; 2007k). Overall, HUD spends approximately $4 billion annually (10 percent of its budget) on utility costs through subsidies to state and local governments, renters, private firms, and not-for-profit organizations, in addition to PHAs (U.S. EPA, 2006a).

- **Reduce risk of eviction.** Reducing the energy cost burden on affordable housing residents can help reduce a resident's risk of eviction. According to HUD, 26 percent of evictions in St. Paul, Minnesota, in 1997 were precipitated by electric and gas utility service termination (U.S. HUD, 2004).

- **Preserve affordability.** Utility costs, in addition to rent, are an important factor in determining a home's affordability, meaning that building low-cost homes is not necessarily the same as building affordable homes (AHEE, 2007). Reducing energy costs can help to ensure that low-rent housing remains affordable. According to one report, a 25 percent reduction in energy costs can reduce combined rent and energy costs in the average housing unit by 8 percent. This reduction could potentially bring nearly 1.2 million additional housing units within the national standard for affordability (U.S. HUD, 2007k).

The Kitsap County, Washington, Consolidated Housing Authority's Rehabilitation Program was created to ensure that public housing in the county remains affordable by helping tenants reduce their energy and water bills (KCCHA, 2000).

3. PLANNING AND DESIGN APPROACHES FOR ENERGY EFFICIENCY IN AFFORDABLE HOUSING

This section describes approaches to improving energy efficiency in existing affordable housing units and incorporating energy efficiency in new affordable housing designs (including green homes). While most local governments do not own or develop affordable housing, many work closely with the developers who do. Consequently, these local governments can be key contributors in efforts to improve energy efficiency in affordable housing, and can use the approaches outlined in this section as a reference when collaborating with other affordable housing stakeholders (e.g., developers, community-based outreach agencies and non-profits, and other organizations) to improve energy efficiency in affordable housing.

EPA's ENERGY STAR program has developed a number of resources and tools that can be helpful to local governments as they plan and implement programs to improve energy efficiency in affordable housing. These resources and tools are summarized in Table 1, *ENERGY STAR Program Resources*.

It is advisable to plan and design a comprehensive, whole-house approach to energy efficiency in affordable housing. While a single energy efficiency improvement, such as upgrading to a more efficient HVAC system, can have a positive effect, the maximum benefits of the investment may not be realized if, for example, the duct work is leaky or the windows and doors are drafty. At the same time, incorporating energy modeling or diagnostic tools into the planning process can help identify the most cost-effective and complementary opportunities for investment. A whole-house approach may have the added benefit of helping to provide green jobs in the community for home energy auditors, equipment installers, and those responsible for measuring and verifying that the work is done properly. The Home Performance with ENERGY STAR and ENERGY STAR New Homes programs both feature a whole-house approach to energy efficiency for existing homes and new construction, respectively.

PINELLAS COUNTY, FLORIDA, REQUIRES AFFORDABLE HOUSING NEW CONSTRUCTION TO MEET ENERGY STAR SPECIFICATIONS

The Pinellas County Department of Community Development (PCDCD) promotes the production of energy efficient affordable housing through its Model Homes program. With zero-interest construction loans and access to low-cost infill land as incentives, participating builders and non-profits construct and certify new homes to meet ENERGY STAR specifications. The PCDCD partners with the local utility, Progress Energy, to provide no-cost inspections and testing, and also reimburses builders for certification costs.

Homes include energy efficient HVAC systems, properly installed insulation, energy-efficient windows, ENERGY STAR labeled appliances, and compact fluorescent lighting. The utility costs for a Model Homes Program house is estimated at $60-$100 per month, around half of the county average.

Source: U.S. EPA, 2007g.

TABLE 1. ENERGY STAR PROGRAM RESOURCES

Title/Description	Web Site
ENERGY STAR Tools and Guidance for Existing Homes	
Home Improvement with ENERGY STAR. This Web site provides information and resources on the benefits of, and approaches to, improving energy efficiency in homes.	*http://www.energystar.gov/index.cfm?c=home_improvement.hm_improvement_index*
Home Performance with ENERGY STAR. EPA and DOE's Home Performance with ENERGY STAR program provides a comprehensive, whole-house approach to improving energy efficiency. Through this program, participating contractors offer whole-home diagnoses and develop home-specific recommendations for improving energy efficiency.	*http://www.energystar.gov/index.cfm?fuseaction=hpwes_profiles.showSplash*
ENERGY STAR Home Advisor. The Home Advisor tool can provide homeowners with recommended projects to improve energy efficiency based on where the home is located, how the home is cooled and heated, and what type of water heater it has.	*http://www.energystar.gov/index.cfm?fuseaction=home_energy_advisor.showGetInput*
ENERGY STAR Yardstick. This tool can be used to compare a home's energy efficiency to similar homes across the country. It can also provide recommendations for energy efficiency upgrades.	*http://www.energystar.gov/index.cfm?fuseaction=HOME_ENERGY_YARDSTICK.showGetStarted*
ENERGY STAR Labeled Products. EPA develops energy efficiency specifications for more than 60 product categories. Relative to conventional products, ENERGY STAR labeled products typically use 10–75% less energy and can offer consumers energy cost savings of as much as 75%.	*http://www.energystar.gov/index.cfm?fuseaction=find_a_product.*
ENERGY STAR Common Home Problems. EPA has compiled a list of common home problems that can be addressed by improving energy efficiency.	*http://www.energystar.gov/index.cfm?c=home_improvement.hm_improvement_solutions*

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Title/Description	Web Site
ENERGY STAR Tips for Selecting Contractors. EPA has developed a set of tips for selecting a heating and cooling contractor.	*http://www.energystar.gov/index.cfm?c=heat_cool.pr_contractors_10tips*
ENERGY STAR Home Energy Raters. EPA has compiled a list of certified home energy raters that can help developers and homeowners ensure their homes perform as intended.	*http://www.energystar.gov/index.cfm?fuseaction=new_homes_partners.showHomesSearch*
ENERGY STAR Tools and Guidance for New Homes	
ENERGY STAR Labeled New Homes. EPA has developed specifications for labeled new homes. Meeting these specifications can save a household between 20% and 30% on energy costs, and earn a new home the ENERGY STAR label for superior energy performance.	*http://www.energystar.gov/index.cfm?c=new_homes.hm_index*
Features of ENERGY STAR Labeled New Homes. This Web site provides information on the six features of ENERGY STAR Labeled New Homes, and includes links to fact sheets about each feature.	*http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_features*
ENERGY STAR Indoor Air Package. EPA developed the ENERGY STAR Indoor Air Package as a resource to help builders meet homeowner demands for improved indoor air quality and energy efficiency. Implementing the requirements in this package is the second step in developing green homes, after achieving the ENERGY STAR label.	*http://www.energystar.gov/ia/partners/bldrs_lenders_raters/downloads/IAPConsm508.pdf*
Green Building Begins with ENERGY STAR Blue. This Web site provides information on how to incorporate energy efficiency into green home designs.	*http://www.energystar.gov/index.cfm?c=new_homes.nh_greenbuilding*
ENERGY STAR Resources for Affordable Housing	
ENERGY STAR for Affordable Housing. This Web site provides information on improving energy efficiency in affordable housing, including several examples, external resources, and funding programs.	*http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.pt_affordable_housing*
ENERGY STAR and Affordable Housing. This Web site provides links to tools resources that can be useful when planning energy efficiency improvements in affordable housing.	*http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.pt_affordable_housing_tools_res*
ENERGY STAR in Affordable Housing Success Stories. EPA has collected a series of case studies on affordable housing programs that provide helpful information on how developers have improved energy efficiency in existing affordable housing and incorporated energy efficiency in new affordable housing designs.	*http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.pt_affordable_housing_success_stories*
ENERGY STAR for Habitat for Humanity. This Web site provides information on ENERGY STAR's relationship with Habitat for Humanity. ENERGY STAR's residential construction guidelines are part of Habitat for Humanity's construction guidelines in the United States.	*http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.pt_affordable_housing_hab_hum*
Funding Sources for Energy Efficiency in Affordable Housing. EPA has compiled a list of sources that can provide the funding necessary to pay for energy efficiency improvements in affordable housing.	*http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.pt_affordable_housing_funding*
White Paper on Utility Opportunities to Promote Energy Efficiency in Affordable Housing. This white paper describes opportunities for utilities to develop and implement energy efficiency programs to support affordable housing.	*http://www.energystar.gov/ia/partners/bldrs_lenders_raters/downloads/Utility_White_Paper_102206.pdf*

Title/Description	Web Site
ENERGY STAR Financial Calculators	
Cash Flow Opportunity Calculator. This tool can be used to determine how much new energy-efficient equipment can be purchased based on estimated cost savings; determine whether equipment should be purchased now using financing, or if it is better to wait and use cash from a future year's budget; and determine whether money is being lost by waiting for lower interest rates.	*http://www.energystar.gov/index.cfm?c=assess_value.financial_tools*
Financial Value Calculator. This tool presents energy efficiency investment opportunities in terms of key financial metrics. It can be used to determine how energy efficiency improvements can affect organizational profit margins and returns on investments.	*http://www.energystar.gov/index.cfm?c=assess_value.financial_tools*
Building Upgrade Value Calculator. This calculator can be used to estimate the financial benefits of improving energy efficiency in office buildings.	*http://www.energystar.gov/index.cfm?c=assess_value.financial_tools*
Savings Calculators. These calculators can be used to estimate the life-cycle and annual costs and savings of a variety of ENERGY STAR labeled products.	*http://www.energystar.gov/index.cfm?c=bulk_purchasing. bus_purchasing*
Additional ENERGY STAR Resources and Tools	
ENERGY STAR for Government. This Web site provides resources for state and local governments to use as they plan energy efficiency activities, including energy management guidelines, information on financing options, and tools and resources to measure and track energy use.	*http://www.energystar.gov/index.cfm?c=government.bus_government*
The ENERGY STAR Challenge. The *ENERGY STAR Challenge*—Build a Better World 10% at a Time program calls on governments, schools, and businesses across the country to identify energy efficiency improvements in their facilities and improve energy efficiency by 10% or more. EPA estimates that if each building owner accepts this challenge, by 2015 Americans would save about $10 billion and reduce GHG emissions by more than 20 million metric tons of carbon equivalent—equivalent to the emissions from 15 million vehicles.	*http://www.energystar.gov/index.cfm?c=challenge.bus_challenge*
Change the World, Start with ENERGY STAR Campaign. This campaign encourages participants across the country to replace energy-inefficient lights with efficient ones, and to achieve additional benefits by implementing other household measures. Many affordable housing developers are participating in this campaign.	*http://www.energystar.gov/index.cfm?fuseaction=globalwarming.showPledgeHome*
ENERGY STAR Partner Finder. This tool can be used to locate home builders and developers that have experience developing ENERGY STAR labeled new homes. It can also be used to locate lenders that offer energy-efficient mortgages, utilities that offer incentives to homebuyers, and home energy raters.	*http://www.energystar.gov/index.cfm?fuseaction=new_homes_partners.locator*
ENERGY STAR Bulk Purchasing. This Web site provides purchasing organizations with contact information for ENERGY STAR product suppliers that offer energy-efficient products in bulk.	*http://www.quantityquotes.net/*
ENERGY STAR Free Online Training. EPA offers free online training sessions on a variety of energy performance topics.	*http://www.energystar.gov/index.cfm?c=business.bus_internet_presentations*
Off the Charts. *Off the Charts* is EPA's ENERGY STAR e-newsletter on energy management developments and activities.	*http://www.energystar.gov/ia/business/guidelines/assess_value/Off_the_Charts_Summer_2007.pdf*

US EPA ARCHIVE DOCUMENT

Improving Energy Efficiency in Existing Affordable Housing

The most effective way to achieve the benefits described in Section 2, *Benefits of Energy Efficiency in Affordable Housing*, is to engage in a systematic approach for improving energy efficiency in affordable housing that involves evaluating how energy is used and developing an action plan that considers the interactions of a home's energy-using systems. This subsection, which is based on the recommendations of EPA's ENERGY STAR Home Improvement program, describes such an approach.

Affordable housing units come in various sizes and layouts, which can result in varying energy consumption characteristics. For example, a four-story, multiple-family affordable housing building will have different energy demands than a single-story, single-family home. While the information provided in this subsection is directed primarily at improving energy efficiency in smaller single-family affordable homes, many of the basic concepts of the approach described below are relevant to improving energy efficiency in large multiple-family buildings.

In addition, because large multiple-family buildings sometimes exhibit energy consumption characteristics similar to those of commercial buildings, local governments and affordable housing developers can consider the steps outlined in EPA's *ENERGY STAR Guidelines for Energy Management*. While these guidelines describe a systematic approach for achieving superior energy management in commercial buildings, many of the concepts addressed are appropriate for large, multiple-family residential buildings.[5] EPA's *Energy Efficiency in Local Government Operations* guide in the *Local Government Climate and Energy Strategy Series* describes how local government have planned and implemented activities to improve energy efficiency in their facilities and operations, and includes an overview of how local governments can apply the ENERGY STAR guidelines.

5 See http://www.energystar.gov/index.cfm?c=business.bus_index for more information on ENERGY STAR resources for buildings and plants.

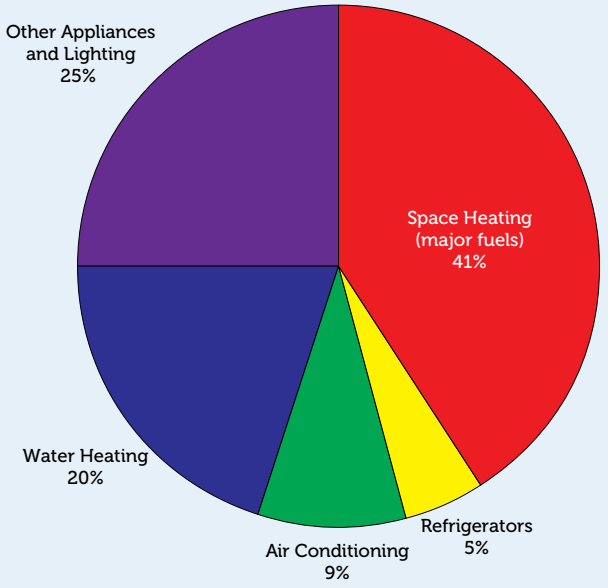
EVALUATE HOME ENERGY CONSUMPTION

The first step in improving energy efficiency in affordable housing is to gather energy consumption information. This subsection provides information that local governments can consider when working with affordable housing homeowners or renters to evaluate energy consumption in their homes, or when collaborating with other affordable housing stakeholders (e.g., low-income assistance organizations) that work directly with homeowners and renters. Figures 1 and 2 on page 9 show how energy is consumed by different end uses in a typical single-family and multiple-family building, respectively.

- **Assistance for do-it-yourself evaluations.** Local governments can work with homeowners and renters, or collaborate with other stakeholders who do, to provide them with the information and tools to perform do-it-yourself energy evaluations, including:
  - ***ENERGY STAR Yardstick.*** Homeowners can use this tool to compare a home's energy efficiency to similar homes across the country. In addition, the Yardstick provides homeowners with customized recommendations for energy efficiency upgrades based on a home's unique features, such as energy fuel source, location, occupancy, and square footage. See *http://www.energystar.gov/index.cfm?fuseaction=HOME_ENERGY_YARDSTICK.showGetStarted* for more information on this tool.
  - ***ENERGY STAR Home Advisor.*** The ENERGY STAR Home Advisor is another resource that homeowners can use to improve energy efficiency in their homes. The Home Advisor tool can provide homeowners with recommended projects with product and system specifications, based on where the home is, how the home is cooled and heated, and what type of water heater it has. The recommendations include links to additional information resources. Additional information on this tool is available at *http://www.energystar.gov/index.cfm?fuseaction=home_energy_advisor.showGetInput*.
- **Comprehensive energy audits.** While a simple do-it-yourself approach to evaluating energy consumption can help identify opportunities to reduce energy consumption, a comprehensive energy audit conducted by a professional auditor can reveal additional opportunities to enhance the benefits of energy efficiency improvements. These auditors use a variety of techniques and advanced equipment to identify even small leaks in a home's envelope that can lead to wasted energy.

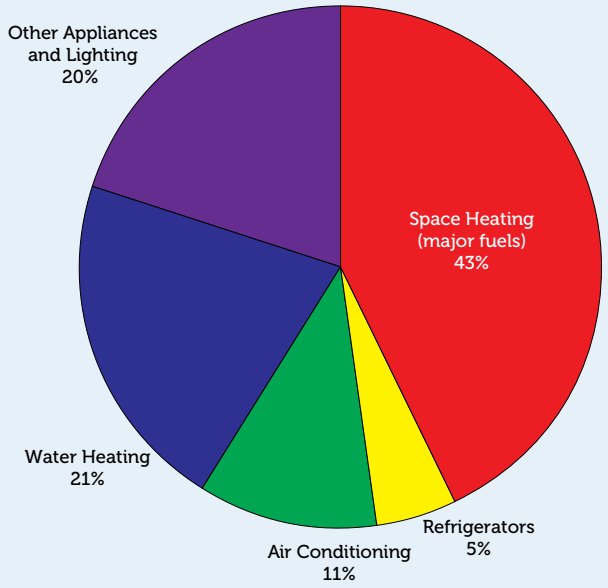
US EPA ARCHIVE DOCUMENT

FIGURE 1. BREAKDOWN OF ENERGY CONSUMPTION IN A TYPICAL SINGLE-FAMILY BUILDING



Source: U.S. EIA, 2008

FIGURE 2. BREAKDOWN OF ENERGY CONSUMPTION IN A TYPICAL MULTI-FAMILY BUILDING



Source: U.S. EIA, 2008

A number of local governments have established home energy assistance programs through which they work directly with homeowners and renters or indirectly through other stakeholders to conduct comprehensive home energy evaluations. These programs are often funded by DOE's Weatherization Program, which provides funding and technical guidance to state agencies, which in turn allocate the funding to local governments, non-profit organizations, and developers, according to their own rules.

The Seattle, Washington, Office of Housing administers a HomeWise program that offers a free home energy audit to residents who meet certain low-income qualifications. Following the energy audit, the city will implement a weatherization package of energy efficiency projects to improve home insulation, venting, and envelope sealing. The program receives its funding from the DOE Weatherization Assistance Program through the Washington Department of Community, Trade, and Economic Development (Seattle, 2008).

In addition to government-funded audits through weatherization programs, local governments and developers can often obtain assistance from the many municipally owned utilities that offer free or discounted home energy audits.[6]

In Tallahassee, Florida, the *Your Own Utilities* program offers free energy audits to all local utility customers. Customers can use the information gathered through the free energy audit as the basis for energy efficiency projects, many of which can be funded through a variety of rebates and financial incentives the utility offers. The program is administered by the local utility, which is owned and operated by city employees and is responsive to the city's publicly elected governing body (Tallahassee, 2008).

One highly effective way to evaluate energy consumption is to work with the Home Performance with ENERGY STAR program. This EPA and DOE program provides a comprehensive, whole-house approach to improving energy efficiency. Through this program,

6 See http://www.energystar.gov/index.cfm?c=home_improvement.hm_improvement_audits for information on ENERGY STAR-approved auditors.

participating contractors offer whole-home diagnoses and develop home-specific recommendations for improving energy efficiency. The quality of these diagnoses and recommendations are guaranteed by program sponsors (often state energy offices, utilities, or non-profit energy efficiency organizations). These sponsors often provide training for participating contractors and conduct inspections to verify that contractors' work meets ENERGY STAR standards.[7]

DEVELOP AN ACTION PLAN TO IMPROVE ENERGY EFFICIENCY

After evaluating home energy consumption, the next step is to develop and implement an energy efficiency action plan for existing homes using recommended practices, such as those outlined by ENERGY STAR. This subsection provides information that local governments can consider when working directly with homeowners and renters to implement projects in their homes, or when collaborating with other stakeholders who work with homeowners and renters.

A comprehensive action plan considers the interactions of a home's energy-using systems (e.g., lighting, air distribution, heating, and cooling systems). Because the interactions are complicated, a best option for local governments might be to help homeowners, and other stakeholders who work with homeowners, access certified home energy raters who have energy efficiency expertise and can ensure that energy efficiency projects achieve the intended results. In addition, local governments can encourage homeowners, renters, and other stakeholders to participate in the Home Performance with ENERGY STAR program when planning energy efficiency projects.

The ENERGY STAR approach to improving energy efficiency in homes generally involves the following practices:

- **Purchase energy-efficient equipment and appliances.** Through ENERGY STAR, EPA develops energy efficiency specifications for more than 60 product categories. Relative to conventional products, ENERGY STAR labeled products typically use 10 to 75 percent less energy and can offer consumer energy cost savings of as much as 75 percent (U.S. EPA, 2009; U.S. EPA, 2008v). Energy-efficient products can also reduce energy costs indirectly during the warmer months of the year, since they do not generate as much unwanted heat as conventional products, thus lowering cooling energy loads.

- **Seal and insulate efficiently.** Sealing and insulating a home's envelope is often the most cost-effective way to improve energy efficiency. Steps for sealing and insulating involve:

  1. Seal air leaks through the home to stop drafts.
  2. Add insulation to block heat loss in winter and heat gain in summer.
  3. Install ENERGY STAR labeled windows when replacing windows.

  EPA estimates that following this approach to sealing and insulating a home's envelope can lead to heating and cooling energy cost savings of up to 20 percent (approximately 10 percent of a home's total annual energy bill) (U.S. EPA, 2008b).

- **Heat and cool efficiently.** Heating and cooling demand accounts for up to 50 percent of a home's energy consumption. EPA has identified the following steps for improving energy efficiency of heating and cooling systems once a home has been sealed and insulated efficiently (U.S. EPA, 2008j):

  1. ***Change air filters regularly.*** Air filters should be checked monthly and changed at least every three months, since dirty filters restrict air flow and force heating and cooling systems to work harder.
  2. ***Tune up HVAC equipment yearly.*** Heating and cooling contractors can identify opportunities to improve HVAC system performance, which can reduce energy costs. EPA has collected a set of tips for selecting a heating and cooling contractor, available at *http://www.energystar.gov/index.cfm?c=heat_cool.pr_contractors_10tips*.
  3. ***Install a programmable thermostat.*** A thermostat that can be programmed to increase or decrease home temperatures in sync with the times that the home is occupied can save as much as $180 in energy costs annually (U.S. EPA, 2008j).

7 ENERGY STAR has collected a list of local program sponsors, available at http://www.energystar.gov/index.cfm?c=home_improvement.hm_improvement_hpwes_partners.

4. ***Seal heating and cooling ducts.*** Leaks in heating and cooling ducts can lead to significant wasted energy. It is important to focus on sealing ducts that run through the attic, crawlspaces, unheated basements, and garages first before wrapping the ducts in insulation. These areas are unconditioned spaces where residents of the home spend little time, making leaks in these areas especially wasteful. Ducts inside the homes should be sealed and insulated next.

5. ***Install ENERGY STAR labeled heating and cooling equipment.*** HVAC contractors can help homeowners identify appropriate heating and cooling equipment that is "right-sized" for the home (i.e., sized to meet the home's energy demands exactly).

Local governments can refer homeowners and renters and other affordable housing stakeholders to additional information sources for guidance on improving energy efficiency in affordable housing units, including:

- **U.S. DOE programs.** DOE's Energy Savers program offers homeowners guidance on reducing energy costs in homes through various energy efficiency and conservation measures. These measures include actions that homeowners can take in the short term (e.g., behavioral changes to reduce energy costs in the winter), and long-term energy efficiency investments that can lead to significant energy cost savings over several years (U.S. DOE, 2008a).

KING COUNTY HOUSING AUTHORITY—WEATHERIZATION PROGRAM

Since 2002, the King County Housing Authority (KCHA) has invested more than $2 million in weatherizing and repairing affordable housing units in King County, Washington. Weatherization can improve comfort and significantly reduce wasted energy. Weatherization measures include adding insulation, retrofitting HVAC systems, and weather-stripping exterior doors.

One of these weatherization and repair projects, a solar power demonstration project at its 300-unit Coronado Springs affordable housing development, was financed using funds from DOE, the Washington Community and Economic Development Department, and the Seattle City Light program.

Source: KCHA, 2008.

The DOE Weatherization Assistance Program enables low-income families to reduce their utility bills by improving energy efficiency in their homes. Since 1976, the program has provided weatherization assistance to more than 6.3 million families. This assistance, on average, has reduced gas space heating by 32 percent (U.S. DOE, 2008c).

- **U.S. HUD energy programs.** HUD's energy programs aim to reduce energy costs in HUD-assisted housing, including public housing and affordable housing in many areas. These programs provide new homeowners with guidance on improving energy efficiency, and identify opportunities for HUD-assisted housing units to incorporate ENERGY STAR products and services (U.S. HUD, 2008b). HUD has developed several energy-saving guidance documents for public affordable housing, available at *http://www.hud.gov/offices/pih/programs/ph/phecc/resources.cfm*.

HUD's Mark to Market (M2) Green Initiative for Affordable Multifamily Housing is a nationwide pilot initiative to encourage owners and purchasers of affordable, multifamily properties to rehabilitate and operate their properties using sustainable Green Building principles. These principles comprise sustainability, energy efficiency, recycling, and indoor air quality, and incorporate the "Healthy Housing" approach pioneered by HUD. The Green Initiative focuses on properties within HUD's Section 8 portfolio, specifically properties in the M2M Program administered by the Office of Affordable Housing Preservation (OAHP). Additional information may be accessed at *http://www.solutionsforremodeling.com/2009/05/huds-mark-to-market-m2m-green.html.*

Energy Efficiency in New Affordable Housing

In addition to working directly with homeowners and renters—and indirectly through other stakeholders—to improve energy efficiency in existing affordable housing, many local governments work with affordable housing developers to encourage energy efficiency in new affordable housing. This subsection describes an approach to incorporating energy efficiency in new affordable housing that local governments can refer to when developing new affordable housing on their own, or when collaborating with developers to encourage energy efficiency in their buildings.

HUD-DOE AGREEMENT TO STREAMLINE WEATHERIZATION PROCESS

In 2009, HUD and DOE established a partnership to support coordination of the use of $16 billion in funds appropriated by Congress through the American Recovery and Reinvestment Act. This partnership included a Memorandum of Understanding (MOU) aimed at lowering barriers that have historically existed to the use of weatherization funds in public and assisted multifamily housing. The MOU is intended to streamline the weatherization eligibility process for residents in approximately 1.1 million public housing units, another 1.2 million privately owned federally assisted units, and some 950,000 units financed with Low Income Housing Tax Credits. The new process will help minimize the administrative barriers and simplify the process for residents of HUD public and assisted housing that are seeking to increase the energy efficiency of their homes through DOE's Weatherization Assistance Program.

Sources: U.S. HUD and U.S. DOE, 2009; U.S. DOE, 2010.

ENERGY-EFFICIENT NEW HOME FEATURES

Energy-efficient new homes include six principal energy-efficient features, including:

- **Effective insulation.** Effectively insulating a home's floors, walls, and attic ensures consistent temperatures throughout the building and prevents unwanted heat loss/gain, which can increase energy costs (U.S. EPA, 2008h).

- **High-performance windows.** Installing high-performance windows that include advanced energy efficiency technologies, such as protective coatings and tight-sealing frames, can keep heat in during the winter and prevent unwanted heat from entering the home in the summer (U.S. EPA, 2008r).

- **Tight construction and ducts.** Sealing holes and seams in the building's envelope and heating and cooling systems can help reduce heating and cooling loads and thus decrease the amount of energy required for these loads. Tight construction and ducts will enable homeowners to purchase smaller heating and cooling equipment, while still meeting heating and cooling loads (U.S. EPA, 2008i).

- **Energy-efficient heating and cooling equipment.** Energy-efficient heating and cooling equipment can be quieter than conventional equipment and reduce indoor humidity, in addition to reducing the amount of energy required to heat and cool a home (U.S. EPA, 2008k; 2008g; 2008n). Using combined heat and power (CHP) systems that produce heat and electricity from a single fuel source can be an additional way to efficiently meet energy demands in multiple-family housing developments. (See the text box below and EPA's *Combined Heat and Power* guide in the *Local Government Climate and Energy Strategy Series* for more information on CHP technologies.)

- **Energy-efficient products.** Purchasing and installing energy-efficient products helps to reduce a home's supplemental energy loads. ENERGY STAR offers a range of products for residential use, including lighting fixtures, ventilation fans, and common household appliances (U.S. EPA, 2008q).

- **Third-party verification.** Independent home energy raters can provide energy-efficient design guidance and conduct on-site testing and inspections to verify that energy-efficient products and systems achieve function as intended (U.S. EPA, 2008l).

PLANNING AND DESIGNING ENERGY-EFFICIENT NEW AFFORDABLE HOUSING

The features described above will achieve the greatest benefits when integrated in a comprehensive fashion

COMBINED HEAT AND POWER

Multiple-family affordable housing units can achieve improved energy efficiency by installing CHP systems that produce heat and electricity from a single fuel source. In conventional electricity and heat production systems, byproduct heat from electricity production is wasted and heat needs are met using a separate fuel source. By capturing byproduct heat, CHP systems achieve overall efficiencies 50% greater than separate heat and power production.

HUD and DOE have developed two guide books describing opportunities for CHP in multiple-family housing and a screening tool to evaluate the potential for CHP systems in multiple-family housing. http://www.hud.gov/offices/cpd/library/energy/index.cfm

Sources: U.S. EPA, 2007b; U.S. HUD, 2007i.

that accounts for all the interactions between a home's energy-using systems. Affordable housing developers can obtain guidance on using a comprehensive, systematic approach to designing new homes for energy efficiency from several sources, including:

- **ENERGY STAR.** EPA has developed resources to guide developers through the process of designing and constructing energy-efficient new homes. Through the ENERGY STAR Labeled New Homes[8] program, EPA has issued energy efficiency standards that specify that homes be built to exceed the 2004 IRC energy efficiency requirements by 15 percent. Homes built to ENERGY STAR standards typically produce energy cost savings of approximately 20 to 30 percent (U.S. EPA, 2008p). Across the nation, more than 840,000 homes have been designed to meet these standards. When purchasing affordable housing units, local governments and other affordable housing stakeholders can give priority to homes that have either earned the ENERGY STAR label, or have been *Designed to Earn* the ENERGY STAR (U.S. EPA, 2008c). For more information on the ENERGY STAR Labeled New Homes standards, see the text box below.

In 2007, Springfield, Illinois, completed three new affordable housing units designed to meet ENERGY STAR standards as part of its ENERGY STAR Affordable Housing Initiative demonstration (U.S. HUD, 2007e).

- **DOE's Building Technologies Program.** Through its Building Technologies Program, DOE provides information on best practices for building homes that achieve energy savings ranging as high as 30 percent compared with conventional homes. DOE's guidelines are based on the findings of the Rebuild America program, and cover all steps in the home building process, from planning and designing to operations and maintenance (U.S. DOE, 2008b).

Energy Efficiency in Green Affordable Housing

The new and renovated home planning, design, and construction processes offer opportunities to integrate energy efficiency with other "green" features (e.g., lowering GHG emissions, improving indoor air quality, and sustainable site selection) that provide

ENERGY STAR LABELED NEW HOMES

ENERGY STAR labeled homes are at least 15% more energy efficient in southern climates than the 2004 International Residential Code (IRC) requires, and 20% more energy efficient in northern climates. ENERGY STAR uses the Home Energy Rating System (HERS) to determine whether a home meets this requirement. This system produces a HERS Index score between 0 and 100 and uses computer software to evaluate the energy efficiency of a home compared with a computer reference home of identical size and shape. The computer reference home, which is assumed to meet the minimum requirements of the 2006 International Energy Conservation Code (IECC),* is assigned a HERS Index score of 100. For every percent reduction in energy consumption compared to the reference home, the evaluated home receives a one point decrease in its HERS Index score, with a score of 0 being assigned to a home that uses no energy. The 15% and 20% requirements established by ENERGY STAR correspond to HERS Index scores of 85 and 80, respectively. Other ENERGY STAR labeled home guideline requirements include:

- Completion of a thermal bypass inspection checklist;
- Incorporation of energy-efficient duct systems that restrict leakage to no more than six cubic feet per minute per 100 square feet; and
- Inclusion of either ENERGY STAR labeled heating and cooling equipment, ENERGY STAR labeled windows, or a combination of five or more ENERGY STAR labeled light fixtures, appliances, ceiling fans equipped with lighting fixtures, and/or ventilation fans.

EPA is developing new guidelines for ENERGY STAR labeled homes to ensure that ENERGY STAR continues to deliver homes that are high-quality and meaningfully more energy efficient than standard new construction. The new specification is planned to be launched in 2011.

*The IECC is similar to the energy-related components of the IRC, and is referenced in the IRC, but the two are not identical. The IRC is a stand-alone residential code that addresses plumbing, mechanical, fuel gas, and other home features in addition to energy.

Sources: U.S. EPA, 2008p; 2008y; 2008m.

8 Homes eligible for ENERGY STAR qualification include single-family residences and multiple-family residences of three stories or less.

"GREEN BUILDINGS"

Many terms are used to describe buildings that incorporate energy efficiency and other environmental features, including green buildings, high performance buildings, and sustainable buildings. Regardless of the definitions, there is often a public perception that energy efficiency and "green" are interchangeable, and that green buildings are energy efficient. However, this is not always the case; some "green" buildings do not adequately incorporate energy efficiency.

This section uses the term "green building" as an all-encompassing description of buildings that incorporate energy efficiency plus other energy and environmental features where cost-effective and practical, including:

- Renewable energy supply
- Combined Heat and Power
- Sustainable site design that minimizes stress on the local landscape
- Water efficiency and quality
- Green materials and resources that minimize consumption and waste
- Indoor air quality

additional environmental, resource conservation, and health benefits. In addition to enhancing a home's environmental profile, incorporating energy efficiency can improve the cost-effectiveness of green building. Because of this, energy efficiency is often considered first in green building design.

An energy-efficient green home design should first of all incorporate the same six features as new energy-efficient homes (as described on page 12). The second step in designing energy-efficient green homes is to ensure an adequate indoor air environment. EPA's Indoor Air Package addresses both the energy efficiency and indoor air quality components of green buildings. These specifications require that a building first be labeled as ENERGY STAR compliant, and then meet 60 additional home design and construction features that help to control moisture and improve ventilation and filtration, among other things (U.S. EPA, 2008m).

Once energy efficiency and indoor air quality are incorporated into a green home design, developers can look to other green building programs to add additional environmental features, including water efficiency, recycling, and site sustainability (U.S. EPA, 2008t). Such programs include the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) rating system for homes, EarthCraft Affordable Housing Initiative, Enterprise Green Communities, and the National Association of Home Builder's Green Building Program (U.S. GBC, 2008; EarthCraft House, 2008; Enterprise Green Communities, 2010; NAHB, 2008). For more information on these programs see Section 8, *Federal, State, and Other Program Resources.*

In Boston, Massachusetts, the city's Department of Neighborhood Development (DND) has issued development design standards for new housing construction. The design standards require that new homes of three stories or less that receive DND funding or assistance be designed to meet both ENERGY STAR Labeled New Homes standards and the LEED-Silver rating for homes (Boston, 2008).

RECYCLING—ENERGY RELATIONSHIP

- Recycling one pound of steel saves 5,450 Btu of energy, enough to light a 60-watt bulb for more than 26 hours.
- Recycling one ton of glass saves the equivalent of nine gallons of fuel oil.
- Recycling aluminum cans requires only 5% of the energy needed to produce aluminum from bauxite. Recycling just one can saves enough electricity to light a 100-watt bulb for 3½ hours.

Source: Pennsylvania, 2007.

EPA WATERSENSE LABEL

The EPA WaterSense label is for products that are independently tested to meet water efficiency and performance criteria. Labeling criteria have been established for plumbing fixtures (toilets, faucets, showerheads, and urinals), new homes, and training programs for irrigation professionals. In general, products that receive the WaterSense label are 20% more water-efficient than conventional products. In addition to conserving water, these products can reduce the amount of energy required to deliver and treat water.

Source: U.S. EPA, 2007e.

4. KEY PARTICIPANTS

Local governments work with a range of participants to plan and implement programs to improve energy efficiency in affordable housing. This section provides information on the types of participants who are involved in these programs, and includes descriptions and examples of how each can contribute unique authority or expertise. Additional information on how many of these participants have been involved in initiating programs for improving energy efficiency in affordable housing is provided in Section 5, *Foundations for Program Development*.

- **Mayor or county executives.** Many affordable housing energy-efficiency programs are initiated by a local government executive. In some localities, the executive has the authority to appoint members to the local PHA's board and can work with these members to promote energy efficiency in public affordable housing.

The mayor of Schenectady, New York, announced in 2006 that the city would be using $1 million of its HUD HOME funds to pay for the costs of replacing old affordable housing units with new, energy-efficient ones (Schenectady, 2006).

- **City or county councils.** A number of city and county councils have been responsible for adopting local energy efficiency standards for the design and renovation of affordable housing. Like local executives, these representative bodies can have the authority to appoint members to the local PHA's board, facilitating coordination between the local government and the PHA, including collaboration on energy efficiency activities.

- **Local and regional planning organizations.** Local governments often involve staff from a variety of government agencies when planning and implementing programs to improve energy efficiency in affordable housing. Staff from energy, environment, and community planning and development departments, in particular, can contribute their expertise on the issues involved in improving energy efficiency in affordable housing, including working with local developers, communicating environmental benefits to homeowners and the public, and collaborating with electric and gas utilities.

Local government planners, who are responsible for creating the plans that determine how and where development occurs, often serve as advisors to the policy makers who develop local energy efficiency policies, especially when such policies involve code amendments. Planners can directly affect housing energy consumption through developing energy-efficient building standards, enforcing local energy efficiency ordinances, and developing long-term plans that address clean energy and climate action issues, including action steps for improving energy efficiency in affordable housing.

Metropolitan planning organizations (MPOs) are regional transportation planning bodies in urbanized areas that can play an important role in helping local governments develop integrated approaches to energy-efficient affordable housing and public transportation. MPOs are composed of local officials in the metropolitan region and are responsible for coordinating with state and local governments, transit agencies, and the public to fulfill specific regional transportation planning requirements (established by federal law) in the provision of transportation facilities and services. Local governments should ensure that the siting of new and redeveloped affordable housing is considered by MPOs to increase the efficiency of transportation options, thus maximizing affordability.

- **Private developers and non-profit organizations.** By working with private developers that develop and own affordable housing, local governments can use these firms' resources and technical expertise to maximize the effectiveness of energy efficiency improvements and achieve substantial economic benefits for the entire community. In addition, many local governments also work closely with non-profit organizations that develop and manage affordable housing—such as community development corporations (CDCs)—to ensure that local affordable housing needs are met.

The Community Corporation of Santa Monica, California, has installed motion sensors to reduce the amount of electricity wasted from leaving lights on in unoccupied rooms in its 44-unit Colorado Court complex (U.S. DOE, 2007b).

Local governments use a variety of mechanisms to establish energy efficiency standards for affordable housing and to encourage stakeholders to include energy efficiency features in affordable housing (e.g., providing subsidies for projects that meet certain energy efficiency criteria). For more information on mechanisms to encourage private developers and other organizations to incorporate energy efficiency into affordable housing that they own and develop, see Section 5, *Foundations for Program Development.*

BOSTON HOUSING AUTHORITY PARTNERS WITH NON-PROFIT ESCO ASSOCIATION

In 1999, the Boston Housing Authority initiated two energy performance contracts to improve energy efficiency in its affordable housing. The improvements were funded in part using assistance from the Rebuild Boston Energy Initiative. Rebuild Boston is a non-profit association that seeks to encourage energy efficiency investments in public housing. The association includes partners from the housing authority, city government, the New England Energy Efficiency council, the Massachusetts Department of Housing and Community Development, the Massachusetts Division of Energy Resources, as well as a group of ESCOs.

Combined, both performance contracts provided $17 million in much-needed capital improvements, financed entirely through the energy and water savings resulting from the enhanced performance of the new systems. In 2001, through a partnership with area utilities and the Department of Housing and Community Development, BHA released the "Energy and Water Efficiency Master Report," which identified $52 million in savings achieved through upgrades to 33 properties.

BHA has since embarked on a third energy performance contract, which will touch 13 communities. A fourth contract is also under consideration.

Source: BHA, 2010.

- **PHA executive directors and board members.** These individuals can provide high-level support for energy efficiency improvements in PHAs that can be critical for mobilizing resources, sustaining momentum, and creating links to other local government clean energy activities.

In 2006, the executive director of the Philadelphia Housing Authority in Pennsylvania initiated a campaign to replace every incandescent light bulb in more than 1,600 PHA units with CFLs (PHA, 2006a; 2007b).

- **State Housing Finance Authorities (HFAs).** HFAs are state-chartered entities that are responsible for ensuring adequate affordable housing in their states by distributing federal funds, usually obtained from HUD. Most HFAs are headed by a board of directors appointed by the state, but otherwise operate independently of state government. Other HFAs exist as agencies or departments within the state government. Many HFAs offer incentive programs for local governments and provide opportunities for qualifying PHAs to obtain funds for energy efficiency improvements. (For more information on funding opportunities available through HFAs, see Section 7, *Investment and Financing Opportunities.*)

- **State energy offices and public utility commissions.** State energy offices and public utility commissions can help local governments and developers evaluate the cost-effectiveness of energy efficiency programs for affordable housing. These agencies can also assist affordable housing developers by offering energy efficiency rebates and low-cost energy financing opportunities, and providing targeted technical assistance that links state government energy efficiency decisions and housing operations programs.

- **U.S. HUD.** Federal government agencies provide numerous technical and financial resources to affordable housing developers and owners, including local governments, private developers, and PHAs, for improving energy efficiency in affordable housing. HUD, in particular, administers a broad range of programs to assist low-income affordable housing residents and to encourage private affordable housing developers to use energy-efficient practices. These programs sometimes provide direct assistance to private affordable housing developers, but more often, HUD's programs are implemented through state and local governments, PHAs, and HFAs. HUD also offers a number of energy efficiency guidance documents for developers, including a guide to *Incorporating Energy Efficiency into HOME-Funded Affordable Housing Development* (for more information, see the text box below).

INCORPORATING ENERGY EFFICIENCY INTO HOME-FUNDED AFFORDABLE HOUSING DEVELOPMENT

The HUD manual, Incorporating Energy Efficiency into HOME-Funded Affordable Housing Development, provides developers and jurisdictions participating in the HOME program with technical and operational information assistance for incorporating energy efficiency into affordable housing. The manual includes strategies and approaches for incorporating energy efficiency into existing and new affordable housing developments and provides information on how local governments can require or encourage these strategies and approaches.

The manual can be accessed at http://www.icfi.com/Markets/Community_Development/doc_files/energy-efficiency-HOME.pdf

For more information on HUD's HOME program, see Section 7, *Investment and Financing Opportunities*.

- **Certified home energy raters.** Certified home energy raters are trained to provide independent, quality verification of home energy performance. These professionals can also provide technical assistance on selection of design measures in the planning phase. Once construction or renovation is nearly completed, home energy raters can be employed to perform a final energy efficiency inspection to determine whether a new home meets energy efficiency criteria, such as ENERGY STAR's labeled new homes standard.

- **Energy service companies (ESCOs).** Many affordable housing developers and owners have worked with ESCOs to improve energy efficiency in affordable housing. These companies provide technical expertise on energy efficiency projects and often offer performance contracting options. These contracts can include a performance guarantee that payments not exceed the savings generated.[9] (For more information on energy performance contracting, see Section 7, *Investment and Financing Opportunities*.)

The Boulder Housing Authority in Colorado entered into a six-year performance contract with an ESCO that produced greater than $3,000 in energy cost savings annually. The cost of the project ($12,000) was paid off in less than five years (ESC, 2007).

BURLINGTON HOUSING AUTHORITY REQUIRES ESCO COMMISSIONING

When the Burlington (Vermont) Housing Authority used an energy performance contract to retrofit 51 affordable housing units, it required the ESCO to build during a specified degree-day (12°F). Requiring that building take place in such low temperatures enabled the ESCO to ensure that building systems would operate efficiently, even in extreme conditions. Ultimately, the performance of the homes met expectations and the investor was able to return a profit. The housing authority is investing the savings from reduced energy use in new energy improvements, such as solar thermal technologies.

Source: ORNL, 2000, 2010.

[9] *HUD regulations govern how and when a federally funded PHA may enter into a performance contract with an ESCO.*

- **Utilities and other energy efficiency program administrators.** Many investor-owned utilities and other energy efficiency program administrators (e.g., independent or non-profit energy services providers) offer technical and financial assistance (such as free energy audits and energy-efficient product rebates) to customers through programs that promote investments in energy efficiency. In addition, affordable housing developers sometimes work with utilities to obtain technical assistance on incorporating energy-efficient features into housing designs.

The gas and electric utility in Madison, Wisconsin, administers a Neighborhood Revitalization program through which it works with local organizations to assist low-income residents in reducing energy costs (MGE, 2008).

Partnering with the New York Power Authority, the Buffalo Municipal Housing Authority replaced 900 refrigerators in affordable housing units with smaller, energy-efficient ones. The new refrigerators use about one-third as much energy as the older models, and are expected to save the PHA about $30,000 in annual energy costs. The activity is expected to cost the PHA approximately $370,000 and will be paid for over a 10-year period using energy savings (NYPA, 2003).

In addition, a number of municipally owned utilities provide energy efficiency assistance to affordable housing residents. Local governments and developers can often work with these utilities to provide information to affordable housing renters and owners on rebates or other incentives for energy efficiency investments in residential buildings.

PHILADELPHIA HOUSING AUTHORITY PARTNERS WITH UTILITY

The Philadelphia Housing Authority worked with the Philadelphia Electric and Gas Company to conduct energy conservation seminars and training sessions for affordable housing residents and maintenance staff. Seminar attendees learned how to lower energy use, and how to access utility energy assistance programs such as the Low Income Home Energy Assistance Program (LIHEAP).

Sources: Pennsylvania PUC, 2003.

- **Property management companies.** Affordable housing owners sometimes contract with private firms that manage housing developments. Because property management companies are responsible for ensuring proper operations and maintenance, it is important to involve these companies in discussions of planned energy efficiency improvements and to educate company staff in how to ensure that energy efficiency measures remain effective. Training maintenance personnel can be a particularly helpful strategy for ensuring that energy efficiency investments continue to produce the intended results.

- **Professional services firms.** Nearly all affordable housing projects require the expertise of professional service providers, such as licensed architects, engineers, contractors, and specialized consultants. These participants can assist in selecting energy efficiency features, and can provide guidance on ensuring that energy efficiency performance goals are met. Involving professional service firms can have the added benefit of contributing to regional employment.

When developing the city's Home Investment Partnership program in 1998, staff from the Lubbock, Texas, Community Development department, including the senior building inspector, coordinated with building industry representatives to discuss potential energy-efficient designs for affordable housing units. Over the past several years, 30 inefficient homes have been demolished, and many have been replaced with new energy-efficient homes that are achieving between 30 and 50 percent energy savings (PATH, 2006b).

5. FOUNDATIONS FOR PROGRAM DEVELOPMENT

Local governments have employed a variety of mechanisms to initiate programs for improving energy efficiency in affordable housing. This section provides information on several of these mechanisms, including descriptions and examples of how participants have used them to motivate the creation or development of affordable housing energy efficiency programs and policies.

- **Executive initiatives.** Some affordable housing energy efficiency programs have been initiated by the mayor or county executive. Making energy efficiency an integral part of a mayor or county executive's affordable housing priorities can be an effective method for mobilizing resources and sustaining momentum.

In Chicago, Illinois, the mayor issued an ordinance that approved the use of $3.5 million in Illinois Clean Energy Community Foundation grant funds to improve energy efficiency in the city Green Bungalow Blocks affordable housing development (Chicago, 2003).

SAN FRANCISCO ADOPTS GREEN STANDARD FOR AFFORDABLE HOUSING

In 2005, the mayor of San Francisco announced that the city would be the first in the country to use a green construction standard for all new affordable housing units. The standard chosen was the Green Communities Criteria established by the Enterprise Foundation's Green Communities organization, which provided a $300,000 grant to local non-profit developers. The first development constructed using the guidelines, the nine-story Plaza Apartments, was designed to exceed California's Title 24 energy code by 18%.

Sources: Design Advisor, Undated; Enterprise, 2006.

- **Local government resolutions.** City and county councils are often involved in initiating energy efficiency in affordable housing programs, especially when additional local funds must be allocated to fund these programs. In some localities, council resolutions have mandated energy-efficient design and/or performance for affordable housing.

The city council of Aspen, Colorado established the Aspen Pitkin Efficient Building (APEB) Program in 2003. The program was designed with flexibility to promote a range of green building alternatives, such as renewable resources, energy efficient building technology and practices, water conservation, indoor air quality, and the reduction of construction waste. The program's guidelines for new city/county-supported facilities prescribe specific energy efficiency criteria for affordable housing units, including requirements that units exceed the existing local energy code and be built to achieve Colorado E-Star energy rating certification, and that crawlspaces be designed to meet ASHRAE ventilation standards (Aspen, 2003; 2010).

- **Local development agency standards or requirements.** A number of local government development or community planning departments have initiated improvements in energy efficiency in affordable housing by adopting design standards or requirements for new construction and major renovation to affordable housing that include energy efficiency specifications.

The Denver, Colorado, Office of Economic Development adopted the Enterprise Green Communities standard for city-funded affordable housing in 2007. The criteria in this standard are based on the LEED for Homes rating system and include specifications for energy efficiency, as well as site location and neighborhood fabric considerations that maximize affordability by reducing the need to use personal vehicles (Denver, 2007).

North Miami, Florida, has adopted Green Housing Rehabilitation Guidelines for developers. These guidelines require that 100 percent of funds received by local developers through the HUD-sponsored Community Development Block Grant Program and Home Ownership Opportunities Program, and the Florida State Housing Initiatives Program, must be used for rehabilitation, redevelopment, or construction projects that meet energy-efficient and green standards. For example, the guidelines require that incandescent bulbs be replaced with ENERGY STAR labeled fluorescent bulbs (North Miami, 2008).

- **PHA resolutions.** Some PHAs have adopted resolutions or similar measures that establish energy efficiency programs or require energy-efficient practices in public affordable housing units.

The board members of the Chicago Housing Authority in Illinois issued a resolution directing the PHA chief executive officer to develop a list of pre-qualified ESCOs and to arrange energy performance contracts to implement energy efficiency measures, including retrofits for lighting, water, building envelope, and HVAC systems in the PHA's residences (CHA, 2003).

WYANDOTTE COUNTY, KANSAS—STANDARD OPERATING PROCEDURE FOR AFFORDABLE HOUSING

In 2006, the Wyandotte County Division of Housing and Community Development began a pilot project to study the costs, construction practices, and products required to construct energy-efficient affordable housing. The division aimed to test multiple construction options to determine the most efficient home design.

The pilot project provided local builders with an understanding of energy-efficient building techniques and resulted in the construction of three ENERGY STAR labeled affordable homes. These homes consume an average of 22% less energy, and produce an average of 24% fewer GHGs, than a home built to the 2004 IECC standard.

Following the pilot project, the division established a standard for construction and renovation of affordable housing that requires residential construction and renovation projects funded through the divisions programs to meet ENERGY STAR qualification.

Source: Wyandotte County, 2007

- **Local government planning processes.** Many local governments have used the planning process to establish goals or requirements for improving energy efficiency in affordable housing. These goals and requirements are sometimes incorporated into broader plans, such as local climate action plans and smart growth plans, which may include mixed-use transit-oriented development to reduce personal vehicle use.

The city council of Urbana, Illinois, for example, included in its Comprehensive Plan a goal for the city to contract with a local developer to construct a model affordable housing development on city-owned property that uses 10 percent of the energy of a conventionally designed development (Urbana, 2006).

In its Strategy for Achieving Sustainability, Fresno, California, established a goal of designing 20 percent of city-sponsored affordable housing units in accordance with a green design standard to be determined by city staff (Fresno, 2007).

- **Incentives for developers.** Many local governments have established incentives to encourage developers to incorporate energy efficiency in their designs for affordable housing. These incentives typically fall within the following categories:

  - ***Conditional land donations.*** Some local governments have offered to donate land to developers in return for the developers incorporating advanced energy efficiency features into their designs.

In 2007, the city council in Issaquah, Washington, authorized the city to request developer qualifications for a sustainable affordable housing project in the Issaquah Highlands community that will include 146 energy-efficient affordable housing units, a community center, a childcare center serving 150 children, and the YWCA regional offices and education center. As an incentive to developers, the city not only offered the land for no cost, but offered to forgo any permit-related fees for both land use and building permit. Construction began on the community in early 2010. Through comprehensive energy efficiency and renewable energy measures, the homes are planned to achieve about 27 percent energy savings, with potential for up to 47 percent. (Handy, 2010).

In 2005, New York City donated land to a non-profit organization for an affordable housing development in the Bronx that was designed to include a variety of energy efficiency and environmental features, including energy-efficient elevators and an 11 kW combination green/solar roof funded by the New York State Energy Research and Development Authority (Green Buildings NYC, 2007).

  - ***Specialized grants and loans.*** A number of local governments offer specialized grants and loans to developers who design affordable housing units to achieve superior energy efficiency. Other local governments, such as Asheville, North Carolina, include credits for meeting energy efficiency criteria when scoring and selecting development design proposals to receive low-interest loans from the local government (Asheville, 2007).

Portland, Oregon, has used its five-year, $2.5 million Green Investment Fund to provide grants for demonstration affordable housing units that incorporate energy efficiency and environmental features (Portland OSD, 2002).

  - ***Fee waivers.*** Some local governments have elected to waive permit review fees and other costs for affordable housing projects if developers meet certain energy efficiency, environmental, or transit-oriented development criteria.

In Chicago, Illinois, the Department of Construction and Permits offers developers consultant review fee rebates of up to $25,000 and expedited permitting for affordable housing developments that meet the Chicago Green Homes certification, an evaluation that includes specific energy efficiency requirements (Chicago DCAP, 2007).

Colorado Springs, Colorado, waives development plan review fees if affordable housing plans meet energy efficiency requirements for insulation, water heater and furnace efficiency, and water efficiency (U.S. HUD, 2002).

The City of Austin, Texas, has created a special program to promote both affordable housing and transit-oriented development. The S.M.A.R.T. (Safe, Mixed-income, Accessible, Reasonably priced, Transit-oriented) Housing program provides developers with sliding-scale fee waivers and expedited permit reviews for projects with affordable homes. Multi-family homes must be within a quarter-mile of a bus route, or the developer must provide a strategy for alternative transportation (Austin, 2008).

  - ***Local ordinance variances.*** Many local governments have adopted zoning ordinances that allow zoning exemptions for housing developments that include affordable units. These exemptions, which typically include density bonuses and increased design flexibility, are sometimes contingent on the development meeting specific energy efficiency requirements.

In Seattle, Washington, an ordinance was passed in 2006 that allows height and density bonuses to be awarded for residential developments that are affordable and achieve LEED-Silver certification (which includes energy efficiency specifications) (Seattle, 2007).

6. STRATEGIES FOR EFFECTIVE PROGRAM IMPLEMENTATION

Once programs and policies to improve energy efficiency in affordable housing have been initiated via the mechanisms described in Section 5, *Foundations for Program Development*, local governments can use a variety of strategies to ensure that their programs are effectively and efficiently implemented.

These strategies can help local governments and developers overcome the numerous barriers that can potentially hinder effective implementation of energy efficiency projects, including:

- Higher upfront costs for energy-efficient equipment and appliances;
- Uncertainty about the credibility of benefits claims;
- Insufficient information about product-specific incremental benefits;
- Split incentives when the developer or landlord does not have a stake in the home's eventual energy performance;
- Lack of information about financing opportunities; and
- Lack of availability of energy-efficient products or services (U.S. EPA, 2005).

This section provides examples of various implementation strategies that local governments have used to address these barriers and to enhance the benefits of their energy efficiency programs. These strategies are categorized as 1) strategies for developing and enhancing energy efficiency programs by working with local developers and other local stakeholders in the immediate community, and 2) strategies that involve working with federal, state, and local government agencies. Strategies to help overcome financial obstacles are discussed in Section 7, *Investment and Financing Opportunities*.

Strategies for Working with Developers and Other Affordable Housing Stakeholders in the Community

In addition to the strategies described below, a number of organizations and programs offer criteria, expertise, and in some cases funding to help local agencies work with developers to improve energy efficiency in affordable housing. Please see Section 8, *Federal, State and Other Program Resources*, for more information.

- **Use a team approach.** Many local governments have helped improve energy efficiency in affordable housing by bringing together a team of interested stakeholders. By taking advantage of existing relationships with federal and state government agencies, private developers, utilities, and other organizations, local governments can create linkages between these parties that can lead to better decisions when it comes to incorporating energy efficiency in existing and new affordable homes.

- **Provide guidelines to developers.** Several local governments have adopted guidelines for developers to aid them in incorporating energy efficiency and green features in affordable housing. Guidelines can provide information on additional sources of assistance and funding opportunities. For example, local governments can provide developers with information on state and local financial incentives for purchasing ENERGY STAR labeled equipment and appliances (see EPA's ENERGY STAR product rebate finder at *http://www.energystar.gov/index.cfm?fuseaction=rebate.rebate_locator*). Guidelines for developers can also serve as communications material to inform the public of the local government's efforts to improve energy efficiency in local affordable housing.

In 2002, Seattle, Washington, developed a green affordable housing guide that included resources and information on energy efficiency and other green features that can be used to reduce operational costs in city-funded affordable housing. Since that time, the city has developed additional technical resources for affordable housing managers to support cost-effective "green" building maintenance and operations, including a Green Operations and Maintenance Plan template and video (Seattle, 2010).

The Portland, Oregon, Office of Sustainable Development has created green affordable housing guidelines for the local Development Commission to be distributed to prospective developers, as well as other green building publications and case studies posted on its website: *http://www.portlandonline.com/bps/index.cfm?c=48817*. The case studies include residential, commercial, and non-profit green buildings projects, and provide details on costs and benefits, operations, construction, design, overview, and keys to success in each phase (Portland, 2002, 2010).

- **Obtain third-party verification.** Home Energy Rating System (HERS)[10] raters can provide independent verification of home energy efficiency for homeowners and renters, and can help affordable housing developers during the design and construction phases by performing plan reviews, recommending energy efficiency measures, conducting onsite energy efficiency testing, and ensuring that homes meet ENERGY STAR's standards (U.S. EPA, 2008p). Obtaining a HERS rating is a requirement for the ENERGY STAR label for new homes.

The Philadelphia Housing Authority in Pennsylvania earned the ENERGY STAR label for 60 new units after a third-party rater conducted onsite testing to verify that they achieved the required HERS rating of 85 (PHA, 2007a).

- **Purchase energy-efficient products in bulk.** Affordable housing developers often purchase products on an as-needed basis in small quantities from retailers. However, many have found that they can often save money by purchasing products directly from product manufacturers or wholesalers, some of which offer discounts on bulk purchases (U.S. HUD, Undated). DOE provides information on manufacturers and retailers that offer bulk purchase discounts at *http://www.quantityquotes.net/*.

- **Sponsor or coordinate training sessions for developers, agency staff, and maintenance teams.** A number of local governments have sponsored or coordinated training sessions to provide local contractors, housing organizations, and local government staff with information on energy efficiency features for homes and overall approaches to improving energy efficiency in affordable housing.

Many affordable housing developers rely on facility management teams to ensure that energy efficiency measures in multiple-family affordable housing developments continue to produce results. Some local governments, private developers, and PHAs provide these teams with training in maintaining and operating equipment and systems in an energy-efficient manner.

Lubbock, Texas, sponsored a three-day training session for building professionals on how to use energy-efficient insulating concrete forms when constructing affordable homes (PATH, 2006a).

The local government in North Miami, Florida, arranged for several staff members from its Community Planning and Development department to participate in a HUD-coordinated Energy Broadcast Program training session (North Miami, 2008).

CHICAGO HOUSING AUTHORITY PROVIDES TRAINING TO STAFF

As part of its energy efficiency improvements in 1997, the Chicago Housing Authority provided energy efficiency training to its engineering staff. Staff attended a workshop on preventive maintenance, operations efficiencies, and boiler water treatments at a DOE national laboratory. This training resulted in an estimate operational cost savings of 5 to 6%.

Source: Ternes et al., 2000.

- **Become a Home Performance with ENERGY STAR sponsor.** EPA and DOE's Home Performance with ENERGY STAR program provides a comprehensive, whole-house approach to improving energy efficiency. Through this program, participating contractors offer homeowners and renters whole-home diagnoses and develop home-specific recommendations for improving energy efficiency. Local governments can become local program sponsors, meaning they take responsibility for ensuring that contractors are providing quality services to homeowners, often through training sessions and site inspections. Some municipally owned utilities, including Austin Energy in Austin, Texas, and Anaheim Public Utilities in Anaheim, California, serve as local sponsors (U.S. EPA, 2008u).

[10] *Standards for HERS ratings are developed by the Residential Energy Services Network (RESNET). For more information, see www.resnet.us.*

- **Engage affordable housing residents.** Local governments, affordable housing developers, building owners, and other stakeholders can help homeowners and renters maximize the benefits of energy efficiency improvements by offering educational opportunities on how to properly operate a home to minimize utility costs. This approach is especially critical for influencing the behavior of residents whose energy costs are paid by the building owner, since the renters themselves have little financial incentive to use less energy.

In Wilmington, Delaware, the Wilmington Housing Authority organizes semi-annual energy efficiency seminars for its resident councils. These seminars are expected to help lower operating costs, and along with the installation of energy-efficient heat-pumps, refrigerators, lighting, toilets, insulation, and thermostats, are expected to save more than $2 million in federal energy grant funds and energy costs over 12 years (Ameresco, 2002).

- **Engage the public.** Affordable housing developers can use outreach events to educate the public about the benefits of improving energy efficiency in affordable housing and the benefits of energy efficiency and GHG emission reductions (U.S. EPA, 2005). Design charrettes provide an effective means of bringing together multiple stakeholders, including the public, in the planning and design processes, and can serve as a forum for discussing goals, concerns, and strategies, and produce buildings that are energy-efficient and consistent with stakeholder interests.

The New Iberia, Louisiana, PHA complemented an information session on energy efficiency in affordable housing with entertainment for residents. The event celebrated the completion of a series of energy efficiency improvements (including installation of water-efficient plumbing fixtures, new HVAC systems, and efficient lighting) to 200 units that will save the authority nearly $200,000 annually (Water & Energy Savings Corporation, 2005).

The Louisville, Kentucky, Metro Housing Authority used a design charrette for an energy-efficient affordable housing development that included the PHA, an architectural firm, the mechanical contractors, and representatives from the state energy office (LMHA, 2006).

- **Coordinate energy efficiency programs with broader energy and environmental goals.** Many local governments are taking active roles in developing climate policy by committing to reduce GHG emissions. Incorporating energy efficiency in affordable housing into climate policies can help local governments meet their GHG emission reduction commitments and may reduce the costs of doing so. In addition, by making the link between climate change and energy efficiency, local governments are in a better position to gain support for both programs.

  In addition, investing in energy efficiency in affordable housing can contribute to community smart growth initiatives. Creating a range of housing opportunities and choices is considered one of the principles of smart growth, and the affordability of housing can have a significant impact on how communities grow. Affordability can be improved further by ensuring that housing is sited with access to a variety of transportation options (another principle of smart growth). Housing that is not constructed and sited for energy efficiency and access to public transportation can drain community resources, such as water, in addition to increasing homeowners' and renters' utility and transportation payments (U.S. EPA, 2008w). For more information on how local governments have implemented activities that encourage smart growth in their communities, see EPA's *Smart Growth* guide in the *Local Government Climate and Energy Strategy Series*.

Strategies for Working with National, State, and Local Government Agencies

- **Participate in national campaigns.** Local governments can help developers and other stakeholders enhance the visibility of energy efficiency in affordable housing programs, and obtain additional informational and funding resources, by encouraging them to participate in national campaigns to reduce energy consumption. A number of local governments, developers, and other organizations associated with affordable housing are

participating in ENERGY STAR's Change the World (formerly the Change a Light campaign) outreach campaign, which encourages participants to pledge to replace energy-inefficient products with energy-efficient ones (U.S. EPA, 2008e).

In 2007, the mayor of Miami, Florida, announced a collaborative initiative between the city, HUD, and a local energy-efficient product retailer, with the purpose of encouraging local residents to participate in the ENERGY STAR Change a Light campaign. To kick off the initiative, the city handed out 2,000 CFL bulbs to local residents (Miami, 2007).

- **Form alliances with state agencies.** Local governments can maximize the effectiveness of their energy efficiency activities by partnering with state agencies, such as public utilities commissions, state energy offices, and departments of transportation, and state HFAs that can offer additional expertise and can often help local governments provide developers with information on available incentives.

Prince George's County and Montgomery County, Maryland, conducted pilot projects to improve energy efficiency in affordable housing through a joint project initiated by the Maryland Energy Administration (MEA) and the Maryland Department of Housing and Community Development (DHCD). DHCD used a $250,000 grant from MEA to provide financial incentives for affordable homes that qualify for the ENERGY STAR label (MEA, 2007).

- **Work with other local governments.** Working with other local governments can increase the regional benefits of improving energy efficiency in affordable housing. For example, increased regional demand for energy-efficient products and services can lead to business and employment growth. In addition, working with other local governments can increase implementation effectiveness by facilitating information-sharing on a number of topics, including energy efficiency measures, behavioral factors affecting energy efficiency retrofits, costs, and funding opportunities.

The Louisville, Kentucky, Metro Housing Authority has shared information with the Lexington Housing Authority in Massachusetts on using ENERGY STAR labeling for new energy-efficient affordable housing units (LMHA, 2006).

Schenectady, New York, which joined with Troy and Colonie, New York to apply for HUD HOME funds, committed $1 million of its HOME funds to contract with CDCs to develop new energy-efficiency affordable homes (Schenectady, 2006).

BOULDER COUNTY HOUSING AUTHORITY—ENERGY CONSERVATION PROGRAM

The Boulder County (Colorado) Housing Authority has partnered with the cities of Longmont, Boulder, and Fort Collins; the state Division of Housing; and the federal Department of Health and Human Services Low-Income Energy Assistance Program (LIHEAP) Crisis Intervention Program to establish the Longs Peak Energy Conservation Program for weatherization and home rehabilitation. This program offers opportunities for adding insulation, furnace tune-ups, duct sealing, lighting retrofits, appliance replacements, and hot water heater replacements. The program is funded with a grant administered by the Colorado Office of Energy Management and Conservation that combines funds from DOE, LIHEAP, and Xcel Energy.

Source: Boulder County Housing Authority, 2004.

7. INVESTMENT AND FINANCING OPPORTUNITIES

This section provides information on the size and payback periods associated with investments in energy efficiency improvements in affordable housing. It also identifies several financing opportunities that can help local governments and developers manage the costs of these investments.

Investment

Improving energy efficiency in local government facilities and operations is an investment that earns a return over time. The size and payback period (the length of time required to recoup upfront costs) of this investment varies depending on the extensiveness of the upgrade and the resources required. While some energy efficiency improvements require substantial upfront investment, the costs can often be quickly recovered. Using life-cycle cost analysis, which measures the lifetime costs of design and construction, maintenance and replacement, and other environmental impacts, reveals the cost-effectiveness of energy efficiency upgrades.

Life-cycle cost analyses can reveal short payback periods for many energy efficiency investments. Incorporating investments with short payback periods into a comprehensive energy efficiency upgrade can help reduce the overall payback period for the entire project (Zobler and Hatcher, 2008). For example, purchasing energy-efficient products, which have short payback periods, can generate significant energy cost savings that can shorten the payback period for the building upgrade as a whole. Similarly, behavioral adjustments, such as setting thermostats at lower temperatures in the winter, can often be implemented at no cost yet produce significant savings and reduce the payback period of a comprehensive upgrade. Table 2, *ENERGY STAR Specification Overviews: Energy Savings and Payback Periods* demonstrates how purchasing many ENERGY STAR labeled products requires no cost premium compared with conventional products.

More extensive energy efficiency projects (e.g., designing new energy-efficient developments) often require greater upfront spending, but costs can vary considerably. According to a study by New Ecology, Inc., the cost premium associated with developing new energy-efficient green affordable housing units can range from about 18 percent less than a conventional affordable home to 9 percent more, with a mean of 1.7 percent more than a conventional home (New Ecology, Inc., 2006). An analysis conducted by Gregory H. Kats for the state of California found that the average cost premium for building green over just building to code is less than 2 percent, but on average, results in life cycle savings of 20 percent of total construction costs (UMass Lowell's Center for Family, Work & Community, 2006).

New York City partnered with two developers to construct energy-efficient affordable housing units at no additional cost compared with conventional homes (the units had an average construction cost of $121 per square foot) (New Ecology, Inc., 2006).

In addition to the ENERGY STAR tools available to evaluate the investment required for priority energy efficiency projects, as listed in Table 1, *ENERGY STAR Program Resources*, a number of tools exist that can help local governments and developers calculate the estimated investment required for specific energy efficiency projects. Typically, these tools can also be used to calculate the projected energy cost savings and simple payback period associated with an energy efficiency project, which can be useful when identifying priority investments and making the case for energy efficiency (e.g., if a local government wants to encourage private developers to incorporate energy efficiency into affordable housing developments). These tools include the following:

- **U.S. HUD Rehab Advisor.** HUD's Rehab Advisor is an online tool that provides users with recommended energy efficiency measures for a specific building. The tool also includes estimates of the costs of recommended energy efficiency measures, the estimated energy cost savings that can result from the measures, and the anticipated payback period. The recommendations are based on ENERGY STAR specifications, and are tailored to a building's unique characteristics and geographic location (PATH, 2008).

- **U.S. DOE Home Energy Saver Cost Calculator.** The Home Energy Saver Cost Calculator was developed by DOE's Lawrence Berkeley Laboratory to provide users with recommended energy efficiency measures and estimated costs, savings, payback periods, and rates of return for energy efficiency investments. Users obtain either basic results, by entering their zip code, or more detailed, customized results (i.e., a more tailored suite of recommendations and an overall investment strategy) by entering specific building energy use and design characteristics (LBNL, 2007).

US EPA ARCHIVE DOCUMENT

TABLE 2. ENERGY STAR SPECIFICATION OVERVIEWS: ENERGY SAVINGS AND PAYBACK PERIODS

Product Category	Percent Energy Savings Compared with Conventional Product	Payback Period
Appliances		
Dehumidifiers	15%	0 years (typically no retail cost premium)
Dishwashers	30%	2 years
Refrigerators and freezers	20% (refrigerators) 10% (freezers)	3 years
Room air cleaners	40%	0 years (typically no retail cost premium)
Room air conditioners	10%	Varies Regionally
Electronics		
Battery charging systems	30%	0 years (typically no retail cost premium)
Combination units	60%	0 years (typically no retail cost premium)
Cordless phones	55%	0 years (typically no retail cost premium)
DVD products	35%	0 years (typically no retail cost premium)
External power adapters	5%	0 years (typically no retail cost premium)
Home audio systems	30%	0 years (typically no retail cost premium)
Televisions	15%	0 years (typically no retail cost premium)
Envelope		
Roof products	NA	< 4 years
Windows, doors, and skylights	7-24%	Varies Regionally
Lighting		
Compact fluorescent lamps	75%	< 1 year
Residential-style light fixtures	75%	< 2 years
Office Products		
Computers	30%	0 years (typically no retail cost premium)
Copiers	10%	0 years (typically no retail cost premium)
Monitors	20%	0 years (typically no retail cost premium)
Multifunction Devices	15-30% (laser v. inkjet)	0 years (typically no retail cost premium)
Printers, fax machines, and mailing machines	10%	0 years (typically no retail cost premium)
Scanners	10%	0 years (typically no retail cost premium)

Product Category	Percent Energy Savings Compared with Conventional Product	Payback Period
Heating and Cooling		
Air source heat pumps	10%	Varies Regionally
Boilers	5%	< 5 years
Ceiling fans	45% (with light kit) 10% (fan only)	< 4 years
Furnaces	15%	< 3 years
Geothermal heat pumps	30%	Varies Regionally
Light commercial HVAC	5%	Varies Regionally
Ventilating fans	70%	0 years (typically no retail cost premium)
Other		
Water coolers	45 %	0 years (typically no retail cost premium)
Vending machines	40 %	0 years (typically no retail cost premium)

a ENERGY STAR develops performance-based specifications to determine the most energy-efficient products in a particular product category. These specifications, which are used as the basis for ENERGY STAR labeling, are developed using a systematic process that relies on market, engineering, and pollution savings research and input from industry stakeholders. Specifications are revised periodically to be more stringent, which has the effect of increasing overall market energy efficiency (U.S. EPA, 2007d). EPA and DOE screen all of the specifications annually to determine if any require reassessment. These assessments may lead to a specification revision, a specification being sunset, or no action being taken depending on market readiness for the next level. To view current ENERGY STAR criteria, please visit ***http://www.energystar.gov/index.cfm?c=product_specs.pt_product_specs.*** *To view specifications that are under review or revision, please visit* ***http://www.energystar.gov/index.cfm?c=prod_development.prod_development_index.***

Source: U.S. EPA, 2008v; 2009.

Financing

Upfront costs can present a barrier to improving energy efficiency in affordable housing. However, delaying cost-effective energy efficiency improvements can also be costly since an activity *not* undertaken can result in increased utility bills (Zobler and Hatcher, 2008). This subsection describes a variety of financing vehicles and funding sources that can be accessed to address financial barriers.

FINANCIAL VEHICLES

Financing refers to accessing new funds through means such as loans, bonds, energy performance contracts, lease-purchase agreements, and grants to pay for energy efficiency upgrades. Financial vehicles that can be used to finance energy efficiency improvements in affordable housing are described below.

- **Energy performance contracting.** Many affordable housing developers and owners have used energy performance contracts with ESCOs to improve energy efficiency in affordable housing at no upfront cost. An energy performance contract is an arrangement with an ESCO or energy service provider that allows a local government to finance energy-saving capital improvements—usually over a 7–15 year term—with no initial capital investment, by using money saved through reduced utility expenditures. Energy performance contracts bundle energy-saving investments (e.g., energy audits, design and specification of new equipment, ongoing maintenance, measurement and verification of product performance, indoor air quality management, and personnel training) and typically offer financing.

  An ESCO often provides a guarantee that energy cost savings will meet or exceed annual payments covering all activity costs. Such guaranteed savings agreements are the most common type of performance contract in

US EPA ARCHIVE DOCUMENT

the public sector.[11] If the savings do not occur, the ESCO pays the difference. Some performance contracts include a reserve fund to cover potential shortfalls, while others provide security enhancements in the form of performance bonds or letters of credit. In some instances, performance insurance may be available (Zobler and Hatcher, 2008).

ESCOs often offer financing as part of the performance contract. However, because ESCOs are private sector firms that typically borrow at taxable, commercial rates, it is often possible for a public sector entity to secure better financing arrangements by taking advantage of lower, tax-exempt interest rates available to government entities.

In 2006, the nation's PHAs invested an estimated $350 million in energy performance contracts, saving a total of approximately $37 million. According to HUD, the number of PHAs that have used energy performance contracts since 2000 has increased by 24 percent (U.S. HUD, 2007j).

In 2009, the Minneapolis Public Housing Authority (MPHA) in Minnesota financed an energy efficiency retrofit program for more than 40 high-rise buildings and 700 single-family residences through a 20-year energy performance contract with an ESCO that is guaranteeing energy savings. The $33.6 million program will help the housing authority improve its infrastructure, reduce its impact on the environment, and save more than $3.7 million in utility costs per year by replacing old, inefficient boilers; adding caulking and weather-stripping; and properly sealing doors, windows, and seams. The program is anticipated to reduce MPHA's annual electricity consumption by approximately 3.3 million kilowatt-hours, enough energy to power 310 homes per year on average. It is also expected to reduce CO_2 emissions by an estimated 7,890 metric tons annually, equivalent to the annual emissions of nearly 1,600 cars. The work is expected to pay for itself over the course of the contract (MPHA, 2009).

- **Energy-efficient mortgages.** An energy-efficient mortgage is a mortgage that gives borrowers the opportunity to finance cost-effective energy efficiency improvements in their homes as part of a single mortgage. This type of mortgage helps borrowers expand their debt-to-income qualifying ratios on loans, which can enable them to qualify for larger loan amounts that can lead to more extensive energy efficiency improvements. One common type of energy-efficient mortgage enables lenders to increase the borrower's annual income (and therefore the size of the loan they are eligible for) by adding the dollar amount of the expected energy savings. While these mortgages are often used to purchase new, energy-efficient homes, energy-efficient mortgages often include mortgages to improve energy efficiency in existing homes (sometimes called energy improvement mortgages) (U.S. EPA, 2007f).

- **Federal home loans.** The Federal Housing Finance Board requires its 12 district banks to allocate 10 percent of their income to fund the Board's Affordable Housing Program. This program provides targeted grants and interest rate subsidies to developers through district banks (FHFB, Undated). The funds appropriated through this program can be used to preserve affordable housing or to help pay for reconstruction and rehabilitation costs. The district banks can also assist in encouraging energy-efficient affordable housing design. The Federal Home Loan Bank of Boston, for example, awards points for compliance with ENERGY STAR design guidelines when scoring candidate projects (FHLBBoston, 2007).

In 2006, the Burlington Housing Authority in Vermont received a $519,940 subsidy and an $800,000 advance from the Federal Home Loan Bank of Boston, as well as additional funds from the Vermont Residential Energy Efficiency Program, to create 11 new affordable housing units that incorporate high-performance energy-efficient features (FHLBBoston, 2006).

ENERGY PERFORMANCE CONTRACTS FOR PHAS

When PHAs enter into energy performance contracts with ESCOs for energy efficiency improvements to affordable housing, they can negotiate to have the ESCO propose multiple packages of energy conservation measures. This allows the PHA to review a range of cost estimates and make energy efficiency investment decisions based on available resources and the relative potential benefits of each proposed package.

Source: ORNL, 2000.

[11] *Another type of agreement is an "own-operate" agreement, in which the ESCO maintains ownership of the facility, and sells back its "output" to the local government entity.*

- **Federal government grants.** Affordable housing stakeholders can apply for a variety of grants from federal government agencies, including DOE and HUD. (Information on these grants is provided in the following subsection on funding sources.) In June 2009, EPA, HUD, and the Department of Transportation (DOT) formed the Partnership for Sustainable Communities to help improve access to affordable housing, more transportation options, and lower transportation costs while protecting the environment in communities nationwide. Through a set of guiding livability principles and a partnership agreement that will guide the agencies' efforts, this partnership will coordinate funding for federal housing, transportation, and other infrastructure investments to protect the environment, promote equitable development, and help to address the challenges of climate change. One funding opportunity arising through this partnership is HUD's Sustainable Communities Regional Planning Grant Program, which will offer $100 million in competitive challenge grants to support regional planning efforts that integrate housing, land use, economic and workforce development, transportation, and infrastructure investments in a manner that empowers jurisdictions to consider the interdependent challenges of economic competitiveness and revitalization; social equity, inclusion, and access to opportunity; energy use and climate change; as well as public health and environmental impacts. Additional funding opportunities for energy efficiency in affordable housing may arise through this partnership. (See Section 8, *Federal, State, and Other Program Resources* for more information on the partnership.)

- **On-bill financing.** On-bill financing offers a means for home or building owners to overcome the high upfront capital costs of making energy efficiency upgrades, which can be both a financial as well as a psychological barrier to making investments in energy efficiency. Capital used to cover the costs of one or more efficiency measures is then paid back through charges added to monthly utility or annual property tax bills. On-bill financing tools that can help address barriers faced by low- and moderate-income home owners and renters include tariffed installation programs (TIPs) and clean energy municipal financing (CEMF). In these programs, capital is raised through bond issue, public funds, utilities, or other private funds rather than issuing lines of credit to home owners and tenants directly (U.S. HUD, 2009; UC Berkeley, 2009).

- **Property Assessed Clean Energy (PACE) financing.** PACE financing is a way of financing energy efficiency investments through loans from the local government. The loan can be repaid through special assessments on property taxes, or through other locally collected taxes or bills, such as utility, water, or sewer bills. Only participants in the program are subject to a special assessment, and the investments made are linked to the property rather than the occupant. If a property owner or tenant participating in a PACE program moves, the repayment obligation transfers to the new owner or tenant (DSIRE, 2009).

In November 2008, voters in Boulder County, Colorado, approved a ballot issue that established a PACE financing program by granting the county authority to issue bonds to be used to provide special financing options for energy efficiency and renewable energy investments. Cities within the county provide loans to homeowners, which are repaid through a special assessment of their property tax bills. Income qualifying loans are available for those making up to 115 percent of area median income. Recipients of these loans receive lower interest rates and annual assessments (Boulder County, Undated).

FUNDING SOURCES

Many sources are available to fund energy efficiency improvements in affordable housing. These sources of funding can be accessed through the financial vehicles described above, to provide the capital for energy efficiency upgrades.

- **HUD programs.** A number of HUD programs that provide funding to support affordable housing can be used to improve energy efficiency in affordable housing.
  - ***HOME.*** The HUD HOME Program, the nation's largest block grant to state and local governments for creating affordable housing, allocates approximately $2 billion annually for the purchase and rehabilitation of affordable housing units by state and local governments (called "participating jurisdictions"). The participating jurisdictions can then set their own program requirements for how these funds are distributed. State and local grantees often make these funds available to developers for new construction, rehabilitation, rental assistance, administration costs, and other uses associated with

affordable housing. Participating jurisdictions must meet a minimum eligibility of $500,000 (based on HUD's grant formula) in order to receive allocations. Jurisdictions that do not meet the $500,000 threshold can partner with neighboring localities (U.S. HUD, 2007d). Housing constructed using HOME funds must meet the 2004 IECC, but HUD permits and encourages jurisdictions to adopt more stringent standards, such as ENERGY STAR, for HOME-funded housing (U.S. HUD, 2007f).[12]

- ***Self-Help Homeownership Opportunity Program (SHOP).*** The SHOP provides funds for non-profit organizations and consortia to purchase and develop or improve affordable housing. The funds are intended to provide homeownership opportunities to low-income populations that would otherwise be unable to purchase a home. Eligible homebuyers apply through SHOP grantees and are expected to contribute time and effort during construction in lieu of financial payment. Many local governments have worked with SHOP grantees to promote affordable housing. Local governments can also work with SHOP grantees to encourage use of energy-efficient design.

HUD HOPE VI PROGRAM

The HUD HOPE VI program is one of the department's key tools for improving public housing stock. HOPE VI grants are provided to any PHA that has severely distressed public housing units. A portion of the HOPE VI Program funds are reserved for Revitalization grants that provide funding for major rehabilitation, new construction, and other building improvements in severely distressed PHAs. Applicants gain additional points for proposals that incorporate energy efficiency.

The program requirements state that PHA's using Revitalization funds for building projects must meet certain energy efficiency standards. These standards include incorporating new energy-efficient technologies, complying with the 2006 IECC, and following ENERGY STAR design guidelines where feasible.

Source: U.S. HUD, 2007a; U.S. HUD, 2007c.

In Yonkers, New York, the city donated land to the local chapter of Habitat for Humanity, a SHOP grantee, for the construction of six affordable homes that included a number of energy efficiency measures, including low-emissivity windows, high-efficiency direct-vent boilers, and 1.2 kW photovoltaic systems on each home (SWA, 2003).

HABITAT FOR HUMANITY AND ENERGY EFFICIENCY

Habitat for Humanity incorporates energy efficiency and other environmental features into many of the affordable homes it constructs. Between 1997 and 2007, the organization constructed more than 2,500 ENERGY STAR labeled homes.

The organization's Denver, Colorado, chapter incorporates a range of energy efficiency measures in each of its new homes, including energy-efficient building insulation, programmable thermostats, right-sized energy-efficient furnaces, and CFL lighting.

Source: U.S. EPA, 2007c; Habitat, 2007.

- ***Community Development Block Grant (CDBG) program.*** This program provides funding to local governments to address a range of community development needs. Funds are appropriated directly to certain local governments, called "entitlement communities," or are appropriated to states, which then allocate funds to local governments. No less than 70 percent of a local government's allocation must be used to support low- and moderate-income populations. Funds from the CDBG program can be used to finance energy efficiency improvements.

- **HFAs and other state agencies.** Developers of affordable housing can obtain funding from HFAs through a number of programs, many of which are funded through HUD. For example, through the federal Low-Income Housing Tax Credit (LIHTC) program, HFAs receive an annual allocation of housing tax credits from the Internal Revenue Service. HFAs award these tax credits to affordable housing projects that meet qualifying criteria determined by the state, but which must include specific federal requirements. The tax credits are then sold by awardees to raise equity, thus reducing the debt they would otherwise incur. This use of equity translates into lower rents for low-income residents. Many HFAs administer their own programs.

[12] *More information on promoting ENERGY STAR in HOME-funded affordable housing developments can be found at http://www.hud.gov/energystar/home.cfm.*

The California HFA has established the Housing Enabled by Local Partnerships Program to provide local government entities with low-interest loans to develop new affordable housing units and rehabilitate existing ones (CalHFA, 2006).

In some states, such as Delaware and Utah, HFA funding is contingent on the affordable housing project meeting energy efficiency criteria (Delaware State Housing Authority, 2008; U.S. EPA, 2006b). For example, in order for affordable housing units in the state of Utah to receive funding through the Olene Walker Housing Loan Fund, which manages $6.9 million per year in HUD and state funds, the units must be ENERGY STAR labeled (U.S. EPA, 2006b).

Local governments and developers can also obtain funding for energy efficiency projects in affordable housing from other state agencies, including state energy and planning agencies. Many state agencies administer energy efficiency programs that often include affordable housing components.

The Illinois Department of Commerce and Economic Opportunity administers an Energy-Efficient Affordable Housing Construction Program that provides grants to developers for incorporating energy efficiency into new and renovated affordable housing developments. The program, which has generated energy cost savings in excess of $12 million since 1988, enables developers to build affordable housing developments that typically use between 50 and 75 percent less energy than conventional developments (Illinois, 2008).

- **Affordable housing trust funds.** Affordable housing trust funds have been established by a number of state and local governments to provide financing for affordable housing. Allocation of funds is sometimes contingent on projects meeting specific energy efficiency requirements.

The Massachusetts Department of Housing and Community Development established a state Affordable Housing Trust Fund to provide funds to affordable housing projects that incorporate energy efficiency measures (Massachusetts DHCD, 2006). With funding from this fund, the City of Boston, the Enterprise Foundation, and other sources, the Nuestra Communidad CDC in Roxbury, Massachusetts, began construction in late 2009 on a $22 million mixed-use development project at the site of the former Kasanof Bakery in Roxbury. The development, with 48 units of affordable rental housing, will meet ENERGY STAR standards and include photovoltaic power, geothermal heat pumps, and green construction practices (Massachusetts DHCD, 2007).

Asheville, North Carolina, has established a Housing Trust Fund to provide a source of funding to assist in the development of affordable housing. During project scoring and selection, applicants receive credits for participating in externally monitored energy performance programs, such as ENERGY STAR (Asheville, 2007).

- **U.S. Department of Agriculture programs.** The U.S. Department of Agriculture offers several programs that distribute federal funds to rural communities. These programs are available for various affordable housing development and rehabilitation projects (U.S. Department of Agriculture, Undated). The Department's Multifamily Housing Direct Loan Program, for example, awards points to new construction and revitalization proposals that include energy-efficiency improvements through the use of the ENERGY STAR program (U.S. Department of Agriculture, 2007a; 2007b).

- **Federal tax incentives.** The Internal Revenue Service Code includes a number of tax incentives for energy efficiency investments. For example, the Energy Policy Act of 2005 authorizes several financial incentives to promote energy efficiency in residential buildings, including the Residential Energy Efficiency Tax Credit. This tax credit provides homeowners with up to 10 percent of the cost of upgrading a facility's envelope and up to 100 percent for certain qualified investments, with maximum limits. EPA's ENERGY STAR Web site includes a summary of tax credits for energy efficiency for homeowners, at *http://www.energystar.gov/index.cfm?c=tax_credits.tx_index*.

- **Non-profit organizations.** Affordable housing developers and homeowners can obtain funding for energy efficiency in homes from non-profit organizations. Local governments that have existing relationships with such organizations can facilitate collaborative projects involving non-profits and developers. Habitat for Humanity, for example, administers a grant program funded through a partnership with the Home Depot

Foundation, which awards affiliates $2,000 for each ENERGY STAR home they build, plus an additional $2,000 if the home is also built to meet green standards (e.g., Enterprise Green Communities, NAHB, or LEED) (Habitat, 2008).

The Energy Trust of Oregon assists homeowners in improving energy efficiency in their homes by promoting a range of ENERGY STAR tools and resources, along with several cash incentives and rebates for residential energy efficiency projects. In 2005, the local government in Portland, Oregon, worked with the Energy Trust to develop the $2.5 million, five-year Green Investment Fund to help local residents and businesses improve energy efficiency and reduce other environmental impacts. Among the first projects to receive grants were three multiple-family affordable housing units (Portland OSD, 2010).

- **Other federal grant opportunities.** Several federal government agencies, including DOE and HUD, offer grant programs to organizations (including local governments) that provide funds that can be used for energy efficiency programs (U.S. EPA, 2008s).

8. FEDERAL, STATE, AND OTHER PROGRAM RESOURCES

Many local governments and affordable housing developers work with federal, state, and regional agencies and organizations when planning and developing programs for improving energy efficiency in existing and new affordable housing. These agencies and organizations can provide information resources and financial and technical assistance for energy efficiency programs, as described below.

Federal Programs

- **Building America.** This DOE initiative is a private-public partnership that encourages energy efficiency in new and existing homes across the country. Building America has developed best practices guides based on a home's particular climate zone.

Web site: *http://www.eere.energy.gov/buildings/building_america/*

- **ENERGY STAR.** A number of ENERGY STAR programs provide technical assistance and guidance on improving energy efficiency in affordable housing. The Home Performance with ENERGY STAR initiative encourages use of ENERGY STAR standards to facilitate whole-building energy efficiency improvements in existing residences. The initiative's Web site includes information on whole-building design, home energy inspections, diagnostic testing and installation, and quality assurance inspections. In addition, Home Performance with ENERGY STAR offers tools, such as the Home Energy Yardstick and the Home Energy Advisor, which can be used to compare home energy performance with other homes and to develop a list of recommended energy efficiency measures.

The ENERGY STAR Label for Homes program provides certification for new energy-efficient homes, including multiple-family residential buildings. Labeled homes are at least 15 percent more energy-efficient than homes built in accordance with the 2004 IRC. For more information and on ENERGY STAR resources for energy efficiency in affordable housing, see Table 1, *ENERGY STAR Program Resources*.

Web site: *http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.pt_affordable_housing* (ENERGY STAR for Affordable Housing)

- **Partnerships for Home Energy Efficiency (PHEE).** Along with EPA and DOE, HUD has established PHEE with a goal of reducing energy consumption in U.S. households by 10 percent by 2015. PHEE's activities include building awareness of the benefits of using ENERGY STAR products; developing energy efficiency services for homeowners; providing energy efficiency opportunities to low-income housing residents; and investing in new building technologies, practices, and policies (U.S. DOE, U.S. HUD, and U.S. EPA 2006).

Web site: *http://www.energysavers.gov/*

- **Partnership for Sustainable Communities.** In June 2009, EPA, DOT, and HUD formed this partnership to coordinate their funding and better support sustainable communities. EPA, DOT, and HUD will work to assure that their programs maximize the benefits of their combined investments in communities for livability, affordability, environmental excellence, and the promotion of green jobs of the future. HUD and DOT will work together to identify opportunities to better coordinate their programs and encourage location

efficiency in housing and transportation choices. HUD, DOT, and EPA will also share information and review processes to facilitate better-informed decisions and coordinate investments.

Web site: *http://www.epa.gov/smartgrowth/partnership/index.html.*

- **U.S. DOE Weatherization Assistance Program.** This program enables low-income families to reduce their utility bills by improving energy efficiency in their homes. Over the last 30 years, the program has provided weatherization assistance to more than 5.6 million families. This assistance, on average, has reduced gas space heating by 32 percent.

  Web site: *http://apps1.eere.energy.gov/weatherization/*

- **U.S. EPA State and Local Climate and Energy Program.** This program assists state, local, and tribal governments in meeting their climate change and clean energy efforts by providing technical assistance, analytical tools, and outreach support. It includes two programs:

  - The **Local Climate and Energy Program** helps local and tribal governments meet multiple sustainability goals with cost-effective climate change mitigation and clean energy strategies. EPA provides local and tribal governments with peer exchange training opportunities and financial assistance along with planning, policy, technical, and analytical information that support reduction of greenhouse gas emissions.

  - The **State Climate and Energy Program** helps states develop policies and programs that can reduce greenhouse gas emissions, lower energy costs, improve air quality and public health, and help achieve economic development goals. EPA provides states with and advises them on proven, cost-effective best practices, peer exchange opportunities, and analytical tools.

    Web site: *http://www.epa.gov/statelocalclimate/*

- **U.S. HUD.** HUD administers a broad range of programs to support the nation's supply of affordable housing and to provide assistance to affordable housing residents. In addition to the funding programs described in Section 7, *Investment and Financing Opportunities*, HUD administers a variety of programs to disseminate information on energy efficiency and affordable housing, including:

  - ***The Public Housing Energy Conservation Clearinghouse (PHECC).*** PHECC is a source of information on energy conservation practices that can be implemented in multiple-family affordable housing units (U.S. HUD, 2007j).

    Web site: *http://www.hud.gov/offices/pih/programs/ph/phecc/*

  - ***Energy Performance Contracting.*** Through its Energy Performance Contracting program, HUD provides PHAs with information about working with ESCOs to improve energy efficiency in public affordable housing. The program offers educational materials and information on training sessions for PHA staff.

    Web site: *http://www.hud.gov/offices/pih/programs/ph/phecc/eperformance.cfm*

  - ***ENERGY STAR and HUD.*** HUD has collected information on how ENERGY STAR programs can be integrated with HUD programs. This Web site has specific information on using ENERGY STAR for HUD's HOME, CBDG, and HOPE VI programs.

    Web site: *http://www.hud.gov/energy/*

State Programs

- **HFAs.** A number of HFAs administer energy efficiency programs that PHAs can rely on as a source of information. The Greater Minnesota Housing Fund, for example, has partnered with two state agencies to develop a state Green Affordable Housing Guide to assist policy makers, developers, building designers, and homeowners (University of Minnesota, 2004). ENERGY STAR has collected a list of state programs that can provide funding for energy efficiency improvements in affordable housing, available at *http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.pt_affordable_housing_funding#hfa*.

- **Public Utility Commissions (PUCs).** Affordable housing developers can work with state PUCs to improve energy efficiency in affordable housing. Affordable housing developers can also benefit from PUC programs that provide direct assistance to affordable housing residents.

The California PUC partnered with an investor-owned utility to develop the Affordable Housing Energy Efficiency Alliance, which serves as an energy efficiency information clearinghouse for housing authorities and affordable housing developers. The initiative provides training sessions and technical design assistance for new construction and rehabilitation projects (AHEE, 2007).

The Maine PUC has partnered with the Maine HFA to administer a Low Income Appliance Replacement Program that replaces inefficient refrigerators and installs CFLs in low-income households, reducing energy costs for both residents and building owners (Efficiency Maine, Undated).

- **State Energy Offices.** Affordable housing developers can work with state energy offices to tailor energy efficiency activities to synchronize with state energy efficiency programs, develop training materials for residence maintenance staff, and organize information sessions for local residents.

ALABAMA PROGRAM FOR ENERGY EFFICIENCY IN NEW HOMES

The Alabama Department of Economic and Community Affairs is collaborating with the Home Builders Association of Alabama and Southface Energy Institute to develop the technical elements of a program for developers that provides certification for energy-efficient homes in Alabama. The Energy Key Homes program includes three levels of energy efficiency standards:

- Level 1: Advantage Energy Key, which is equivalent to the 2006 IRC/2006 IECC for energy efficiency.
- Level 2: Star Energy Key, the requirements of which are identical to those of the ENERGY STAR Qualified New Home program.
- Level 3: Green Energy Key, which includes the same requirements as the Star Energy Key certification, plus additional green features that will make it more environmentally sustainable.

Developers are required to complete an initial four-hour training course for levels 1 and 2 in order to be certified as Energy Key Builders. For level 3, they must complete an additional two-hour training course.

Source: U.S. DOE, 2007a.

The Delaware Energy Office, for example, partnered with the State Housing Authority to facilitate a brainstorming conference for state and local housing staff and other stakeholders (Delaware State Housing Authority, 2005).

In Texas, the State Energy Conservation Office offered free training sessions on energy performance contracting to public housing authorities across the state (SECO, Undated).

Other Programs

- **Affordable Housing Energy Efficiency Alliance.** The Affordable Housing Energy Efficiency Alliance serves as a clearinghouse for information on improving energy efficiency in affordable housing. The program offers training sessions and design assistance, and has developed a handbook for energy efficiency in affordable housing.

  Web site: *http://www.h-m-g.com/multifamily/AHEEA/default.htm*

- **EarthCraft House Affordable Housing Initiative.** EarthCraft House is a green building program developed by the Greater Atlanta Home Builders Association and Southface. More than 1,500 units have been built through the program in partnership with affordable housing agencies such as Habitat for Humanity. EarthCraft provides technical services such as design reviews and charrettes, energy modeling, HVAC load calculations, pressure testing of building envelopes and duct systems, energy auditing and rate analysis, mold and moisture assessment, and ENERGY STAR facilitation and certification.

  Web site: *http://www.earthcrafthouse.com/About/affordable.htm*

- **Green Communities.** The Green Communities initiative is a project by the Enterprise organization to build more than 8,500 environmentally sustainable and energy-efficient homes for low-income families over a five-year period. Green Communities provides funding and technical assistance for local projects, and has developed the Green Communities Criteria, a framework of environmental and energy efficiency standards for home design.

  Web site: *http://www.greencommunitiesonline.org/*

- **Habitat for Humanity.** Habitat for Humanity is a non-profit organization that has constructed nearly 300,000 affordable homes around the world for 1.5 million residents since 1976. Through its Environmental Initiative, Habitat promotes cost-effective construction methods that incorporate energy and environmental features and that raise awareness of energy and environmental benefits. Habitat has developed a series of energy bulletins, ENERGY STAR resources, and other technical information relating to incorporating energy efficiency in new Habitat homes.

  Web site: *http://www.habitat.org/env/energy_bulletins.aspx*

- **ICLEI Local Governments for Sustainability (ICLEI).** ICLEI is a membership association of local governments that have committed to adopting sustainable approaches for addressing climate change and other environmental threats through a range of activities, including energy efficiency. ICLEI members receive access to a suite of tools and resources for planning and implementing their energy efficiency programs, including software with training, technical and communications assistance, information-sharing, best practices, and opportunities for recognition.

  Web site: *http://www.icleiusa.org/*

- **Local Initiatives Support Coalition.** The Local Initiatives Support Coalition (LISC) is a non-profit organization that focuses on assisting communities in revitalizing distressed neighborhoods by promoting sustainable objectives, such as improving energy efficiency in affordable housing. LISC can help local governments and community members obtain access to loans, grants, and other funding sources and technical and informational assistance for neighborhood revitalization projects.

  Web site: *http://www.lisc.org/*

- **National Association of Counties (NACo) Green Government Initiative.** Through its Green Government Initiative, NACo provides local governments with resources on energy and other environmental issues related to government facilities and operations. NACo facilitates information sharing between governments and promotes collaboration with the private sector. In addition to other publications and information resources, NACo administers a Green Government Database of case studies on specific topics. NACo has also developed an information packet on county green building programs in the residential sector, including information on resources for green affordable housing programs.

  Web site: *http://www.naco.org/programs/csd/pages/greengovernmentinitiative.aspx*

- **National Association of Home Builders (NAHB).** NAHB has created a green building program to promote green building practices in the home building industry. The program has developed a number of resources for home builders, including *Model Green Home Building Guidelines* and a National Green Building Standard based on these guidelines. Developers can also use the program's *Green Scoring Tool* to assess building designs.

  Web site: *http://www.nahbgreen.org/*

- **Playbook for Green Buildings and Neighborhoods.** The *Playbook* is an online resource developed by a team of local governments, non-profit organizations, and federal government agencies that provides local governments with information, strategies, and tools for building green buildings, neighborhoods, and infrastructure. The *Playbook* provides information to assist local governments in the information gathering, planning, and implementation stages of each of these three subject areas.

  Web site: *http://www.greenplaybook.org/*

- **Regional Initiatives.** A number of local governments have used multiple-jurisdiction initiatives to mobilize resources for improving energy efficiency in affordable housing.

In southern California the Building Industry Institute's Community Energy Efficiency Program (CEEP) encourages local governments and private developers to work together to exceed local building code requirements by more than 15 percent. The program allows local governments to share technical knowledge, marketing materials, and briefing papers.

The Cape Light Compact, which represents 21 towns in the Cape Cod, Massachusetts region, has helped facilitate plans for the development of more than 60 affordable housing units for both public and private landowners. These units are to be developed in accordance with both LEED and ENERGY STAR standards (Cape Light Compact, 2007).

- **U.S. Conference of Mayors (USCM).** The USCM Climate Protection Agreement commits mayors to reduce GHG emissions in their cities to at least 7 percent below 1990 levels by 2012. The Climate Protection Center provides guidance to mayors on leading their cities' efforts to reduce GHG emissions linked to climate change, and publishes best practices, including examples of cities that are taking the lead in this effort by improving energy efficiency in their buildings and operations.

Web site: *http://www.usmayors.org/climateprotection/*

- **U.S. Green Building Council.** The U.S. Green Building Council administers a LEED for Homes Initiative for Affordable Housing that is developing building guidance materials for the affordable housing market, as well as offering educational opportunities and technical assistance.

Web site: *http://www.usgbc.org/DisplayPage.aspx?CMSPageID=147#afford*

9. CASE STUDIES

The following case studies provide descriptions of two local government programs for improving energy efficiency in affordable housing. Each case study describes the program's initiation, other features, and benefits.

Philadelphia Housing Authority—Conserve Energy-Preserve Public Housing

The Philadelphia Housing Authority's *Conserve Energy-Preserve Public Housing* program is focused on using energy efficiency to reduce the housing authority's operating costs to ensure that present and future affordable housing needs continue to be met.

PROGRAM INITIATION

In an effort to challenge rising energy costs in public housing units, the Philadelphia Housing Authority's executive director announced the authority's commitment to a campaign to *Conserve Energy-Preserve Public Housing* on Earth Day in 2006. The purpose of the campaign is to reduce the energy costs borne by the housing authority, which completely or partially subsidizes the energy consumption of approximately 80,000 residents. Addressing rising operating costs in this way has been used as a strategy for ensuring that affordable housing needs can be met without reducing the amount of affordable housing or dramatically increasing rent (PHA, 2006b).

PROFILE: PHILADELPHIA, PENNSYLVANIA

Area: 135 square miles

Population: 84,000 residents in public affordable housing

Structure: The PHA is the fourth largest housing authority in the United States and is the largest landlord in Pennsylvania. It is governed by a Board of Commissioners, with two members appointed by the Mayor of Philadelphia, two appointed by the Philadelphia City Controller, and one appointed by other members of the Board.

Program Scope: The Conserve Energy campaign involves the PHA's entire affordable housing portfolio, consisting of approximately 16,000 units. The PHA plans to install CFLs in each unit.

Program Creation: The PHA director announced the creation of the Conserve Energy campaign in April 2006.

Program Results: Recently developed ENERGY STAR qualified units save more than $500 per unit annually. The PHA received the 2007 ENERGY STAR for Excellence in Affordable Housing.

PROGRAM FEATURES

The Philadelphia Housing Authority established a goal of reducing energy consumption in its units by 3 to 5 percent. To achieve this goal, the housing authority has begun to implement a number of measures, including:

- **Installing energy-efficient equipment.** The housing authority has installed more than 1,000 water-efficient toilets in its affordable housing units. In addition, the PHA developed a plan to replace every light bulb in each of its units with CFLs (PHA, 2006a). Through 2006, the PHA had installed over 4,000 CFLs in common areas at 20 of its affordable housing developments (PHA, 2006b).

- **Conducting energy education classes for housing residents and staff.** The Housing Authority developed a resident education plan focused on energy reduction. Partnering with PECO Energy and the Pennsylvania Public Utility Commission, the housing authority has conducted seminars for residents on the use of

TRAINING DESIGN AND MAINTENANCE STAFF

The Philadelphia Housing Authority partnered with its electric utility, a non-profit organization, the state PUC, and the Drexel School of Engineering to train its staff and design team and builders on the ENERGY STAR Homes guidelines. Its staff, design team, and builders learned how to meet certification requirements for site-built and modular construction. ENERGY STAR Homes criteria were then incorporated into the design layout and specifications of new units completed under the PHA's ENERGY STAR Homes demonstration project.

Source: U.S. EPA, 2007a.

programmable thermostats at two of its developments. Additionally, PECO has trained housing authority staff in energy conservation practices and in monitoring energy consumption to track savings (U.S. EPA, 2007a).

- **Building *ENERGY STAR* labeled affordable housing units.** The Housing Authority was the first in the Commonwealth of Pennsylvania to build ENERGY STAR labeled homes. By working with a non-profit organization and ENERGY STAR, the housing authority completed 60 new homes in February 2007 that are ENERGY STAR labeled. With an $118,000 grant, the Pennsylvania Energy Development Authority is providing funding for an additional 160-home affordable housing development, of which 125 units are planned to be ENERGY STAR labeled (PHA, 2007a).

PROGRAM RESULTS

The recently completed ENERGY STAR labeled homes are expected to produce energy cost savings of more than $500 per year for each household. Because the Housing Authority assists many of its residents with their utility costs, these costs will help reduce its operating expenses and reduce the burden on residents. The Housing Authority currently has more than 1,500 units planned for completion over the next six years, with expected annual energy cost savings of $800,000 (U.S. EPA, 2007a).

In March 2007, the Housing Authority received the ENERGY STAR Excellence in Affordable Housing award to recognize its achievements. Additionally, the Housing Authority's Executive Director received the National Association of Housing and Redevelopment Officials' individual award for advocacy for improving energy efficiency in Philadelphia's affordable housing, and for increasing public awareness of the critical need for reducing utility costs to increase housing authority funding nationwide (PHA, 2007a, 2007b).

Web site: *http://www.PHA.phila.gov/*

Boston, Massachusetts—Green Affordable Housing Program

The Boston Green Affordable Housing Program was created by the city's mayor in 2007. The purpose of this program is to work within the community to develop affordable housing that incorporates energy efficiency features that reduce costs for renters and homeowners, promotes the well-being of residents, and minimizes impacts to the environment.

PROFILE: BOSTON, MASSACHUSETTS

Area: 90 square miles

Population: 600,000

Structure: Boston's local political structure is based on a mayor and 13 city council members. The city's Green Affordable Housing Program is administered by the Department of Neighborhood Development.

Program Scope: The program covers all city-funded and -assisted housing developments.

Program Creation: The mayor initiated a green building task force in 2003, which resulted in a limited-scope green building mandate in 2007. The Department of Neighborhood Development adopted green housing standards in 2008.

Program Results: In 2007, 14 green housing development applications for city funding were received. In 2008, six of these applications were accepted.

PROGRAM INITIATION

In 2003, the mayor of Boston created a Green Building Task Force to develop a strategy for greening the city. Based on the task force's findings, the mayor established a three-year timetable for the city to develop green building standards, beginning with local government facilities. In January 2007, the city's zoning commission approved several amendments to the local zoning code, including a requirement that all public and private projects over 50,000 square feet be developed in accordance with LEED rating system criteria. In response to this initiative, the

city Department of Neighborhood Development adopted green housing standards in 2008 (Boston, 2008).

PROGRAM FEATURES

The Boston Green Affordable Housing Program includes a number of energy efficiency and green features, including:

- **Energy-efficient and green design standards.** In 2008, the Department of Neighborhood Development issued design standards for affordable housing. These standards integrate the requirements of the ENERGY STAR program and the LEED-Silver rating system. To ensure that affordable housing achieves superior energy performance, the standards require that developments meet the ENERGY STAR Labeled New Homes requirements.

  When responding to city proposals, developers are required to submit a letter from the ENERGY STAR program stating that they are enrolled as ENERGY STAR-certified contractors. For buildings four stories and higher, the department requires that buildings exceed the ASHRAE 90.1-2004 standard by at least 20 percent (Boston, 2008). (ENERGY STAR's Labeled New Homes program does not apply to homes taller than three stories.)

- **Training sessions.** The Department of Neighborhood Development, through the Green Affordable Housing Program, provides training sessions for local developers. These training sessions have focused on integrated design, energy efficiency and renewable energy opportunities, and indoor air quality (Boston, 2008).

PROGRAM RESULTS

The Green Affordable Housing Program was created in the spring of 2007. Shortly after creation, the program received 14 applications for new affordable housing developments. The combined amount of money to be invested in integrated design, energy efficiency, renewable energy, and indoor air quality in these developments was greater than $5.6 million. Ultimately, six projects were selected for Department of Neighborhood Development funding. Those developments that qualify for the ENERGY STAR label can expect to achieve energy cost savings of between 20 and 30 percent compared with a conventional new housing development (BHA, 2005; Boston, 2008).

Web site: *http://www.cityofboston.gov/dnd/D_Green_Housing.asp*

10. ADDITIONAL EXAMPLES AND INFORMATION RESOURCES

Title/Description	Web Site
Examples	
Allegheny County, Pennsylvania. The Allegheny County Housing Authority has partnered with an ESCO to perform upgrades in its 3,000 units that are expected to generate energy cost savings of $145,000 annually.	*https://buildingsolutions.honeywell.com/NR/rdonlyres/3CF0AD15-D8EB-412E-A47C-48870C789B8E/56559/3cf0ad15d8eb412ea47c48870c789b8e.pdf*
Austin, Texas. The Housing Authority of the City of Austin entered into an energy performance contract in 2001. Under the performance contract, the PHA had energy-saving water-efficient fixtures installed and implemented a resident training session. Such measures will reduce annual PHA water consumption by 145 million gallons.	*http://www.hacanet.org/press/media_kit/energy.php*
Boston, Massachusetts. In 1999, the Boston Housing Authority entered into two of the largest energy performance contracts in the nation. Combined, both performance contracts provided $17 million in much-needed capital improvements. In 2001, a report was released that identified $52 million in savings achieved through upgrades to 33 properties. Additionally, the Maverick Landing development has been voted the best overall development by Affordable Housing Finance magazine.	*http://www.bostonhousing.org/detpages/press16.html* *http://www.bostonhousing.org/pdfs/PLN2005-LEED.pdf* *http://www.bostonhousing.org/detpages/press47.html*
Bronx, New York. The 1212 Martin Luther King apartment complex was the first apartment complex in the nation to earn the ENERGY STAR label.	*http://www.nyc.gov/html/hpd/html/pr2006/pr-09-29-06.shtml*

Title/Description	Web Site
Buffalo, New York. The Buffalo PHA used the New York Power Authority's refrigerator replacement project to install 900 energy-efficient refrigerators in affordable housing units. This activity will save the PHA approximately $30,000 annually.	*http://www.nysPHAda.org/HUD%20WEB/Energy/Energy.html*
Chicago, Illinois. The Chicago Housing Authority's Energy-Cost Saving Program has established a goal of reducing overall energy costs by 15 percent.	*http://www.cmhc-schl.gc.ca/en/inpr/afhoce/tore/afhoid/opma/reenco/reenco_005.cfm#full*
Cincinnati, Ohio. The Cincinnati Metropolitan Housing Authority is saving more than $875,000 annually from improving energy efficiency in more than 4,600 units. The improvements cost the PHA approximately $7.2 million.	*http://www.duke-energy.com/news/cinergy_archive/3926_383632.htm*
Jersey City, New Jersey. Jersey City partnered with the New Jersey Housing & Mortgage Finance Agency's "CHOICE" program to develop eight energy-efficient affordable homes.	*http://cityofjerseycity.com/uploadedFiles/Public_Notices/Press_Releases/PR%202007%2010%2030%20-%20Mayor%20Healy%20Breaks%20Ground%20on%20Affordable%20Housing.pdf*
King County, Washington. The King County Housing Authority invested more than $2 million in weatherizing affordable housing units. In addition, the housing authority has installed solar technologies on its White Center affordable housing development.	*http://www.kcha.org/aboutus/newsreleases/Weatherization.aspx*
Longmont, Colorado. Longmont's Community Housing Program offers a fee reduction for projects that incorporate certain building features, including energy efficiency and energy conservation measures.	*http://www.ci.longmont.co.us/cdbg/housing/dev.htm*
Madison, Wisconsin. A Madison non-profit CDC worked with the local electric utility and a non-profit state energy assistance organization to develop an energy-efficient 60-unit affordable housing residence.	*http://www.focusonenergy.com/files/Document_Management_System/Residential_Programs/yahariverview_casestudy.pdf*
Minneapolis, Minnesota. The Minneapolis PHA used HUD's Energy Performance Contracting program to improve the energy efficiency of 40 high-rise affordable housing developments.	*http://www.huduser.org/periodicals/fieldworks/0600/fworks3.html*
New Iberia, Louisiana. The Housing Authority of the City of New Iberia implemented $1.6 million in energy efficiency measures to its affordable housing stock. The measures produce annual energy savings of approximately $200,000.	*http://www.hud.gov/offices/pih/programs/ph/phecc/success/iberia.pdf*
New York, New York. The 90-unit Melrose II affordable housing development in the Bronx was designed using high-performance energy-efficient technologies. The design measures included programmable thermostats, energy-efficient HVAC systems, low-emissivity windows, and fluorescent lighting. These design features are expected to reduce annual energy costs for each unit by $988.	*http://www.pathnet.org/si.asp?id = 2652*
Pittsburgh, Pennsylvania. An energy performance contract with Custom Energy is expected to save the Housing Authority of the City of Pittsburgh more than $4 million over a 10-year period. Under the terms of the contract, Custom Energy will conduct lighting retrofits and install water-conserving fixtures, radiator control valves, boiler controls, and domestic hot water temperature controls in eight of the authority's housing communities.	*http://www.energyservicescoalition.org/resources/casestudies/stories/hacp.htm*
Santa Monica, California. The city of Santa Monica has developed a green design checklist to provide guidance to affordable housing developers.	*http://www.smgov.net/uploadedFiles/Departments/OSE/Categories/Green_Building/Green%20Affordable%20Housing%20Checklist.pdf*
Wilmington, North Carolina. The Wilmington Housing Authority provides training to residents semi-annually to assist them in reducing energy costs.	*http://www.ameresco.com/release.asp?ID=14*

US EPA ARCHIVE DOCUMENT

Title/Description	Web Site
Wyandotte County, Kansas. The Unified Government of Wyandotte County Division of Housing and Community Development has adopted a standard operating procedure for affordable housing unit construction and renovation projects that use public funds. The standard operating procedure requires that projects meet ENERGY STAR qualification.	*http://www.hud.gov/local/ks/library/archivedstories/fs2006-10-19.cfm*
HUD Performance Contracting Case Studies. The Public Housing Energy Conservation Clearinghouse, administered by HUD, maintains a collection of case studies highlighting successful implementation of energy performance contracts in public housing.	*http://www.hud.gov/offices/pih/programs/ph/phecc/eperformance/epcsuccess.cfm*
Information Resources	
Affordable Housing Development Guidelines for State and Local Government. This HUD document provides information, (including suggested code and ordinance language) for local governments on how to improve the delivery of affordable housing services.	*http://www.toolbase.org/PDF/DesignGuides/afford_housing.pdf*
Affordable Housing Energy Efficiency Alliance. This project serves as a clearinghouse for energy efficiency resources relevant to affordable housing. The project provides training and information to affordable housing developers, PHAs, and energy efficiency support agencies. The AHEEA is currently developing a handbook for energy efficiency in affordable housing.	*http://www.h-m-g.com/multifamily/aheea/default.htm*
Affordable Housing Energy Efficiency Handbook. The Affordable Housing Energy Efficiency Alliance has developed this guide to introduce energy efficiency concepts and benefits for the affordable housing market.	*http://www.h-m-g.com/multifamily/aheea/Handbook/default.htm*
Affordable Housing Ordinances/Flexible Provisions. This Web resource provides examples of local government ordinances that have been used to encourage developers to invest in affordable housing.	*http://mrsc.org/Subjects/Housing/ords.aspx*
Affordable Housing Primer. This document provides basic information on the affordable housing characteristics and needs in Illinois.	*http://www.heartlandalliance.org/whatwedo/advocacy/reports/illinois-affordable-housing-primer.html*
Best Practices for Effecting the Rehabilitation of Affordable Housing. The two volumes of this HUD guidance document provide a framework for conducting rehabilitation of affordable housing. The guidance includes technical analyses and case studies.	*http://www.huduser.org/publications/affhsg/bestpractices.html*
A Blueprint for Greening Affordable Housing. This manual provides an overview for developers and stakeholders of the benefits and concepts behind greening affordable housing.	*http://www.globalgreen.org/publications/74*
Builder Option Package for ENERGY STAR in North Carolina. This Web site provides a prescriptive method for labeling new affordable homes in North Carolina ENERGY STAR.	*http://www.energystar.gov/index.cfm?c=bop.pt_bop_northcarolina*
Building America. This DOE initiative is a private-public partnership that encourages energy efficiency in new and existing homes across the country. Building America has developed multiple best practices guides based on a home's particular climate zone.	*http://www.eere.energy.gov/buildings/building_america/*
Building Energy-Efficient Affordable Housing. This document, developed by Michigan Habitat for Humanity, provides a strategic outline of goals for improving energy efficiency in affordable housing throughout the state.	*http://www.cedp.msu.edu/researchreports/Building%20Energy%20Efficient%20Affordable%20Homes,%20final.pdf*

Title/Description	Web Site
Choosing a Green Building Professional. This Green Affordable Housing Coalition fact sheet provides tips and strategies for selecting developers of green affordable housing.	*http://www.frontierassoc.net/greenaffordablehousing/FactSheets/GAHCfactsheets/4-GreenPro.pdf*
The Cold Facts. This report describes the effect of home energy costs on low-income Americans.	*http://www.nliec.org/coldfacts.htm*
Community Guide to Creating Affordable Housing. This report by the Business and Professional People for the Public Interest provides information on how local governments can encourage private development of affordable housing.	*http://www.bpichicago.org/documents/CommunityGuidetoCreatingAffordableHousing.pdf*
Consumer Energy Information Clearinghouse. This guide serves as a clearinghouse for energy efficiency and renewable energy information resources associated with specific household components.	*http://www.eere.energy.gov/consumer/*
Database of State Incentives for Renewable Energy (DSIRE). This database provides access to a range of state and local energy efficiency and renewable energy incentives and policies.	*http://www.dsireusa.org/*
Durability and Maintenance. This Green Affordable Housing Coalition fact sheet provides suggested criteria for assessing the relative durability and maintenance benefits of green building in the affordable housing sector.	*http://www.frontierassoc.net/greenaffordablehousing/FactSheets/GAHCfactsheets/19%20Durability%20and%20Maintenance%20final.pdf*
Education Materials for Energy Saving. This HUD Web site provides a number of resources and tips for affordable housing residents that can lead to reduced energy consumption.	*http://www.hud.gov/offices/pih/programs/ph/phecc/residents.cfm*
Energy Conservation for Housing. This HUD workbook provides information on identifying cost-effective energy efficiency measures in public housing.	*http://www.nysPHAda.org/HUD%20WEB/Energy/Energy_Audit_Workbook.pdf*
Energy-Efficient Rehab Advisor. HUD and ENERGY STAR have partnered to develop this tool as a guideline for energy-efficient housing rehabilitation.	*http://rehabadvisor.pathnet.org/index.asp*
Energy Performance Contracting for Public and Indian Housing. This document provides guidance to PHAs on implementing energy performance contracts to improve energy efficiency in public and Indian housing units.	*http://www.nysPHAda.org/HUD%20WEB/Energy/EPC/EPC%20green%20book.pdf*
Energy Resources. Habitat for Humanity maintains a Web site that provides resources for energy efficiency in affordable housing.	*http://www.habitat.org/env/energy_bulletins.aspx*
ENERGY STAR for New Homes. This ENERGY STAR program provides guidance for designing ENERGY STAR labeled new homes that are at least 15% more energy-efficient than the 2004 International Residential Code.	*http://www.energystar.gov/homes*
ENERGY STAR Home Improvement. This ENERGY STAR program provides do-it-yourself strategies for homeowners to improve energy efficiency in the household.	*http://www.energystar.gov/index.cfm?c=home_improvement.hm_improvement_index*
ENERGY STAR Labeled Products Purchasing and Procurement. This Web site provides information on the costs and benefits of purchasing ENERGY STAR labeled products. It also provides information on how energy-efficient procurement programs can be developed.	*http://www.energystar.gov/index.cfm?c=bulk_purchasing.bus_purchasing*
Federal Housing Finance Agency. The Federal Housing Finance Agency regulates the nation's federal housing loan banks. These banks are required to allocate 10% of their income to fund an Affordable Housing Program that allocates funds to applicants who purchase, construct, or rehabilitate affordable housing units.	*http://www.fhfa.gov/*

US EPA ARCHIVE DOCUMENT

Title/Description	Web Site
Field Office Review Procedure for Energy Performance Contracting. This HUD document outlines the procedures that PHAs must follow when entering into performance contracts through the HUD Energy Performance Contracting Program.	*http://www.hud.gov/local/shared/working/r9/cpd/guidelines.pdf*
Financing Affordable Housing: A Primer for the State Clean Energy Funds. This Clean Energy States Alliance document provides state clean energy fund managers with information about public and private strategies for financing affordable housing projects.	*http://cleanenergystates.org/CaseStudies/Primer_on_Financing_Affordable_Housing.pdf*
Frequently Asked Questions about Energy-Efficient Mortgages. This ENERGY STAR fact sheet provides answers to common questions about how energy-efficient mortgages work.	*http://www.energystar.gov/ia/partners/bldrs_lenders_raters/downloads/EEM_faq.pdf*
Green Affordable Housing Coalition. The Coalition's Web site provides information on designing and financing green affordable housing units. The Coalition has collected many fact sheets on green initiatives in the public housing sector.	*http://www.frontierassoc.net/greenaffordablehousing/Index.shtml*
Green Buildings Checklist. The city of Santa Monica has developed a green design checklist to provide guidance to affordable housing developers.	*http://www.smgov.net/uploadedFiles/Departments/OSE/Categories/Green_Building/Green%20Affordable%20Housing%20Checklist.pdf*
The Greenbuilt Way to Affordable Housing. This document was prepared by the Wisconsin Environmental Initiative to present a series of strategies that can be employed by state and local governments to improve energy efficiency and sustainability in affordable housing.	*http://www.greenbuilthome.org/docs/GBH_AFFORDABLE.pdf*
Greening Portland's Affordable Housing. This document provides guidance for the development of all city-funded affordable housing projects managed through the Portland, Oregon, Development Commission.	*http://www.portlandonline.com/shared/cfm/image.cfm?id=122094*
Healthy Homes Initiative. This HUD program provides information on improving health and safety of the nation's housing stock. Energy efficiency improvements can have the indirect benefit of improving health and safety in homes.	*http://www.hud.gov/offices/lead/hhi/*
High Profile at Low Cost: Introducing A Multi-Family Residential Market to High-Performance Building Design and Construction. This report describes the experiences of the Louisville Metro Air Pollution Control District in its efforts to design energy-efficient affordable housing units.	*http://www.hud.gov/offices/pih/programs/ph/phecc/success/highperfbldgs.pdf*
How to Promote ENERGY STAR through CDBG. HUD has developed a Web site to provide information on how local governments can incorporate ENERGY STAR into their community development block grant-funded activities.	*http://www.hud.gov/energystar/cdbg.cfm*
How to Promote ENERGY STAR through HOME Investment Partnership Program. HUD has developed a Web site to provide information on how local governments can incorporate ENERGY STAR into their HOME-funded activities.	*http://www.hud.gov/energystar/home.cfm*
How to Promote ENERGY STAR through HOPE VI. HUD has developed a Web site to provide information on how PHAs can incorporate ENERGY STAR into their HOPE-funded activities.	*http://www.hud.gov/energystar/hope.cfm*
How to Promote ENERGY STAR through Public and Indian Housing. HUD has developed a Web site to provide information on how local governments can incorporate ENERGY STAR into their public and Indian housing.	*http://www.hud.gov/energystar/pih.cfm*

Title/Description	Web Site
HUD Energy Action Plan. HUD developed this action plan to outline its goals and strategies for promoting energy efficiency in its various programs. The action plan includes strategies for improving information dissemination and increasing training opportunities for public housing managers.	*http://www.hud.gov/offices/cpd/library/energy/library/energyactionplan.pdf*
HUD Energy Issues. The Buffalo PHA has collected multiple information resources on performance contracting in public housing.	*http://www.nysPHAda.org/HUD%20WEB/Energy/Energy.html*
Incorporating Energy Efficiency into HOME-Funded Affordable Housing Development. This manual provides guidance to jurisdictions, CDCs, and other participants on incorporating energy efficiency into affordable housing developments that receive HUD HOME funds.	*http://www.icfi.com/Markets/Community_Development/doc_files/energy-efficiency-HOME.pdf*
Incremental Costs, Measurable Savings. This Enterprise Green Communities analysis documents the costs and benefits of implementing energy and water efficiency improvements in affordable housing.	*http://www.enterprisecommunity.org/programs/green_communities/nextgen/incremental_costs_full_report.pdf*
Low-Income Home Energy Assistance Project. This Department of Health and Human Services project provides information and financial assistance to low-income households to pay for energy costs.	*http://www.acf.hhs.gov/programs/liheap/*
Low-Income Home Energy Assistance Project Clearinghouse. The LIHEAP Clearinghouse, a Department of Health and Human Service project, provides information to state, tribal, and local LIHEAP providers. The clearinghouse collects and disseminates information on low-income energy issues specifically.	*http://liheap.ncat.org/*
Massachusetts Green Affordable Housing Program. This program provides assistance to agencies and developers responsible for developing and managing the state's public housing stock.	*http://www.masstech.org/project_detail.cfm?ProjSeq=636*
Minnesota Green Affordable Housing Guide. This guide was developed in part by the Greater Minnesota Housing Fund to assist policy makers, developers, designers, and homeowners in realizing the benefits of sustainable affordable housing.	*http://www.greenhousing.umn.edu/overview.html*
National Association for Housing Redevelopment Officials. NAHRO provides housing and community development authorities with a range of information resources pertaining to providing housing for low-income citizens.	*http://www.nahro.org/*
Partnerships for Home Energy Efficiency 2006 Annual Report. This report highlights the achievements of the Partnerships for Home Energy Efficiency, a project involving HUD, DOE, and EPA. The report describes initiatives for improving energy efficiency in affordable housing units.	*http://www.energystar.gov/ia/news/downloads/PHEE2006AnnualReport.pdf*
Public Housing Authorities Directors Association. The PHADA serves as a clearinghouse of PHA experiences, including energy efficiency activities.	*http://www.PHAda.org/index.php*
The Public Housing Energy Conservation Clearinghouse (PHECC). This HUD program provides PHAs with a collection of resources for implementing energy conservation activities in public housing units.	*http://www.hud.gov/offices/pih/programs/ph/phecc/*
Rebuild America. The Rebuild America initiative served as a mechanism for improving the quality of the nation's buildings while increasing job creation in the manufacturing and service sectors. This DOE initiative is currently being revamped.	*http://apps1.eere.energy.gov/buildings/publications/pdfs/rebuild_america/essbrief1003.pdf*
Regulatory Barriers Clearinghouse. This HUD Web site provides information on regulatory barriers to developing affordable housing. For each type of barrier it provides a potential solution.	*http://www.huduser.org/rbc/categories.html*

US EPA ARCHIVE DOCUMENT

Title/Description	Web Site
Residential Energy Services Network (RESNET). RESNET is a non-profit organization dedicated to standardizing building energy performance certification. RESNET is responsible for administering the HERS rating system.	*www.resnet.us*
SeaGreen: Greening Seattle's Affordable Housing. This report is intended for the use of affordable housing owners, developers, and design teams. The guide includes a plan template to help developers identify green building measures for their designs.	*http://www.seattle.gov/housing/SeaGreen/SeaGreen.pdf*
State Housing Finance Agencies. The National Council of State Housing Agencies maintains a list of state HFAs that can provide resources to PHAs.	*http://www.ncsha.org/housing-help*
Top 15 Green Building Ideas. This Green Affordable Housing Coalition fact sheet provides 15 suggestions for greening affordable housing units.	*http://www.frontierassoc.net/greenaffordablehousing/FactSheets/GAHCfactsheets/12-GreenIdeas.pdf*
U.S. Department of Agriculture Rural Development Housing & Community Facilities Programs. This Web site provides access to multiple Department of Agriculture programs that provide financial assistance to local governments for developing public housing.	*http://www.rurdev.usda.gov/rhs/common/non_profit_intro.htm*
U.S. Department of Energy Builders Challenge. DOE has initiated a new program that calls on the nation's building industry to voluntarily build 220,000 energy-efficient homes that achieve 30% energy savings by 2012.	*http://www1.eere.energy.gov/buildings/challenge/about.html*
U.S. Department of Energy Home Energy Saver Cost Calculator. This Web site developed by DOE's Lawrence Berkeley Laboratory features a calculator that provides users with recommended home energy efficiency measures and estimated costs, savings, payback periods, and rates of return for energy efficiency investments.	*http://hes.lbl.gov/consumer/*
Washington State *Evergreen Sustainable Development Standard.* The Evergreen standard was adopted by the state of Washington to establish minimum energy efficiency and environmental criteria for affordable housing projects applying for state Housing Trust Fund assistance.	*http://www.cted.wa.gov/site/1027/default.aspx*
Weatherization Assistance Program (WAP). The DOE Weatherization Assistance Program works with local governments and residents to implement weatherizing measures that improve energy efficiency and occupant health.	*http://www.eere.energy.gov/weatherization/*

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