Energy Efficiency in Multi-Family Housing
A Profile and Analysis

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Energy Programs Consortium

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About the Energy Programs Consortium

EPC is a 501(c)(3) nonprofit organization that conducts policy research and demonstration programs sponsored by the four main organization representing state energy and regulatory agencies: the National Association of State Energy Officials; National Energy Assistance Directors' Association; National Association of Regulatory Utility Commissioners; and National Association of State and Community Services Programs.

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Executive Summary

Multi-family housing accounts for about 18 percent of the nation's housing stock. While the energy efficiency of multi-family housing stock is improving, the rate of improvement could be substantially increased by adopting systematic policies and financing models that use market data and target government policies and programs by housing type, age of housing stock, income and energy use. Increasing energy efficiency in the nation's multi-family housing will require development and refinement of current policies, incentives and financing structures.

Increasing the energy efficiency of the nation's low-income multi-family housing will also make it more affordable. Affordability is especially important since energy prices are rising faster than the overall rate of housing costs in the United States. Between 2003 and 2006, for example, overall housing costs increased by 110 percent, while energy costs increased by 126 percent.

Federal and state funding for state-administered residential energy efficiency programs totaled almost $1.4 billion in 2006 of which $825 million was for low-income residential energy efficiency and $534 million was for non-income targeted residential energy efficiency programs. Of the $824 million provided in low-income residential efficiency, $551 million was from the federal Weatherization Assistance Program (WAP) and transfer funds from the Low Income Home Energy Assistance Program (LIHEAP). WAP does not allow a match for efficiency services provided to single family homes but does allow states to require a match for multi-family housing. In practice, states require a match of between 0 and 50 percent. In 2006, states used Weatherization funds to provide energy efficiency improvements to approximately 16,000 multi-family units.

The following major points are discussed in this paper:

- Multi-family housing is concentrated by size and by region. The Northeast has only 19.8 percent of the nation's housing stock, but 28.1 percent of the multi-family housing stock and 33.8 percent of buildings with 50-plus units. The Midwest and the Southeast have the lowest ratio of multi-family to total housing stock. Despite this regional variation, multi-family housing is significant in all regions.

- Renters have considerably lower incomes than owners. About 15 percent of renters have incomes of less than $20,000 as compared to owners and 78 percent of renters have incomes of less than $50,000 as compared to 37 percent of owners. In addition, renters occupying subsidized housing units have even lower incomes. The average income for a renter in a subsidized unit was $17,961, compared to $38,463 for a non-subsidized unit (2001 American Housing Survey).

- Many assume that the low-income sector is relatively small and that the best approach for aiding this sector is to provide 100 percent grant assistance for energy efficiency improvements. This approach has many limitations. At the current rate of grant assistance funding, for example, it will take more than 100 years to make all low-income housing energy efficient.

- The energy efficiency of both single- and multi-family housing is increasing. Housing built in the 1990s is 8.5 percent more efficient than housing built in the 1980s, approximately 17 percent more

efficient than housing built in the 1970s and 1960s, and fully 23 percent more efficient than housing built before 1960. This is due in part to more efficient building technologies and appliances and in part to stronger building codes.

- Energy efficiency measures to retrofit multi-family housing can yield substantial reductions in energy use; retrofits often show energy efficiency improvements of 30 percent to as high as 75 percent, depending on the initial state of the building.

- Energy efficiency measures in new buildings can yield reductions in energy use of up to 20 percent. Depending on the energy efficiency measures, these buildings may be less expensive to design and build than a conventional building, or may require a small additional charge.

Increasing the energy efficiency of multi-family buildings is a complex issue. The following are recommendations for steps that can be taken to increase the energy efficiency of the nation's multi-family housing stock.

Energy Efficiency Measures for All Multi-Family Housing

- Consider education programs for developers, builders and architects. Such programs would focus on energy-efficient building practices as well as on financing models available to reduce the cost of energy efficiency measures.

- Compile a database of information on energy use and savings potential in multi-family housing based on age and number of units. Identify lessons learned from state energy efficiency programs in multi-family sector evaluations and energy efficiency studies.

- Develop finance models for state public benefit fund programs to support energy efficiency improvements for new and existing construction. As part of this effort, focus on performance-based programs that provide incentives targeted to developers.

- States can examine ways to require that energy efficiency measures be installed in multi-family buildings constructed with government funds.

Energy Efficiency Measures Specific to Affordable Housing

- State finance programs can examine means to combine and leverage energy efficiency or weatherization public benefit program funds with additional funding from housing finance agencies.

- States can examine methods to encourage energy efficiency through policies that allocate Low-Income Housing Tax Credits (LIHTC) among housing developers.

- Work with HUD to modify the calculation of utility allowances in the LIHTC program and with the IRS to ensure those modifications are recognized for tax purposes.

Introduction

The relationship between energy efficiency and affordability of multi-family housing in the United States has become increasingly important as energy prices continue to rise much faster than other goods and services. Table 1 shows how much fuel and utility costs have increased in relation to other household expenses. This paper describes the number and types of multi-family housing units in the country as a percentage of the total U.S. housing stock, the income level of those who inhabit multi-family buildings and whether they rent or own their units. It then describes energy use and the potential for energy efficiency in multi-family buildings. It ends with a summary of major policy issues.

Table 1. Energy Price Increases Compared to Prices of Other Household Goods

Increase in Consumer Price Index, 2003-2006

All Housing	110%
Shelter	109%
Fuels and Utilities	*126%*
All Items	110%

Source: Consumer Price Index, U.S. Department of Labor.

The data in this paper leads us to conclude that a substantial amount of energy can be saved in the multi-family housing sector. The energy savings potential is important not only because it implies potential to reduce carbon and other emissions, but also because energy savings produce better quality, more affordable homes, which is particularly important for low- to moderate-income Americans who reside in these buildings.

The paper is organized in five primary sections:

1. A Profile of Multi-Family Housing
2. Multi-Family Housing Policies and Programs
3. Energy Use in Multi-Family Housing
4. State Policy Issues in Multi-Family Housing
5. Conclusions

Definition of Multi-Family Housing

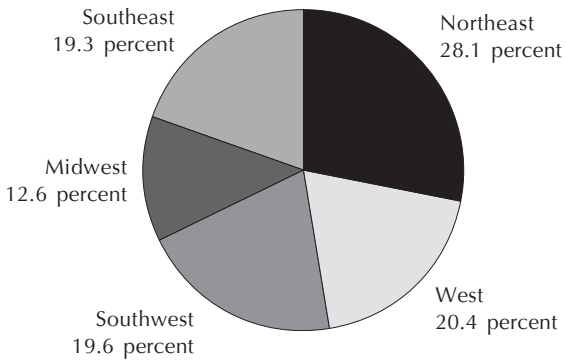
In general, this paper focuses on multi-family housing buildings with five or more units as defined by HUD and most state programs.

A Profile of Multi-Family Housing

Of the 106 million housing units in the nation, 19 million, or 18 percent, are multi-family. As shown in Appendix A-1 (page 19), multi-family housing accounts for at least 20 percent of the housing stock of the following states: Colorado, Florida, Hawaii, Illinois, Maryland, Massachusetts, Nevada, New Jersey, New York and the District of Columbia.

Multi-family housing is highly concentrated. As shown in Appendix B-1 (page 20), 10 states account for almost 64 percent of all multi-family housing, and the top five states (California, Florida, Illinois, New York and Texas) accounted for 49 percent. Rental housing, as shown in Appendix B-2 (page 21), accounted for 83 percent of all multi-family housing. Owner-occupied multi-family housing is shown in Appendix B-3 (page 22). Figure 1 shows the geographic distribution of the nation's multi-family housing stock.

Figure 1. Multi-Family Housing by Region: Total Multi-Family Units



Source: 2000 U.S. Census.

Finally, census data reveal that multi-family buildings in the Northeast tend to be larger buildings, while in the rest of the country they tend to be smaller buildings. As Table 2 illustrates, wide variations exist in the multi-family sector from one region to another.

Table 2. Size of Multi-Family Buildings by Region

Region	50 + Units	20-49 Units	5-19 Units	Percent of Multi-family Housing Located in this Region	Percent of All Housing Located in this Region
Midwest	11.6%	7.7%	9.7%	12.6%	13.8%
Northeast	33.8%	29.9%	23.1%	28.1%	19.8%
Southeast	15.4%	20.3%	21.9%	19.3%	26.3%
Southwest	20.2%	25.7%	22.3%	19.6%	15.6%
West	19.0%	16.5%	23.0%	20.4%	24.4%
Total	100.0%	100.0%	100.0%	100.0%	100.0%

Source: 2000 U.S. Census.

The Age of Multi-Family Housing

The age of multi-family housing reflects the robust population growth in parts of the Southeast and the Southwest. Appendix C-1 (page 23) shows that parts of the Northeast have a relatively old building stock compared to the rest of the country. The age of building stock is an important factor in understanding its energy efficiency. A study by the Joint Center for Housing Studies at Harvard University revealed that, on average, all housing built in the 1990s was more efficient than housing built in previous decades. Specifically, housing built in the 1990s is 8.5 percent more efficient than housing built in the 1980s, approximately 17 percent more efficient than housing built in the 1970s and 1960s, and fully 23 percent more efficient than housing built before 1960.[1] This is true despite the increasing size of single-family housing. It is due in part to the more efficient building technologies and appliances and in part to stronger building codes in both the single-family and multi-family sectors.

1. Harvard University, *State of the Nation's Housing*, "Housing Markets" (Cambridge, Mass.: Harvard University, 2006), 9.

As shown in appendices C-1, C-2 and C-3 (pages 23-25), 85 percent of rental housing stock and 92 percent of owner housing stock were built prior to 1990, and 41 percent of rental and 60 percent of owner-occupied housing stock were built prior to 1970. As suggested by the Harvard study, these buildings have considerable potential to reduce energy consumption.

Multi-family buildings are, for the most part, occupied by renters. In fact, 83 percent of all multi-family buildings are rental buildings, while only 17 percent are owner-occupied. The preponderance of rental multi-family buildings is evident in each major region of the country, although the percentage is lowest in the Southeast (Table 3).

Table 3. Number of Rental Units in Multi-Family Buildings, by Region

Region	Rental	Owner-Occupied	Percent of Units that Are Rentals
Midwest	3,203,941	495,322	87%
Northeast	4,276,810	1,105,758	79%
Southeast	2,966,732	934,978	76%
Southwest	1,802,984	110,020	94%
West	3,678,211	568,821	86%
Total	15,928,678	3,214,899	83%

Source: 2000 U.S. Census.

Renters have considerably lower incomes than owners. About 15 percent of renters have incomes of less than $20,000 as compared to owners and 78 percent of renters have incomes of less than $50,000 as compared to 37 percent of owners. In addition, renters occupying subsidized housing units have even lower incomes. The average income for a renter in a subsidized unit was $17,961, compared to $38,463 for a non-subsidized unit. (2001 American Housing Survey.)

Table 4 compares tenant incomes in subsidized and unsubsidized housing. Because renters make up the majority of multi-family tenants and tend to have lower incomes, affordable housing programs are particularly important in any discussion of rental housing in the United States.

Table 4. Rental Income of Tenants in Subsidized and Unsubsidized Housing

Household Income	Unsubsidized	Subsidized
Under $20,000	32.8%	61.1%
$20,000 to $39,999	34.0%	30.7%
$40,000 to $59,999	17.1%	5.5%
$60,000 to $79,999	8.3%	1.3%
$80,000 to $99,999	3.2%	0.6%
$100,000 or higher	4.6%	0.8%
Average Household Income	$38,463	$17,961

Source: National Association of Home Builders, based on 2001 American Housing Survey, U.S. Census and HUD.

Multi-Family Housing Policies and Programs

Various government support programs influence the multi-family housing sector. Housing support programs operated by the U.S. Department of Housing and Urban Development (HUD) subsidized 5.7 million—or approximately one-third—of all rental multi-family units in 2000, the most recent year for which this data is available. These programs include direct ownership of public housing units, tax credits and interest subsidies to public and private owners, and vouchers that provide subsidized rent for low-income families. Additional assistance to develop affordable housing is also provided through state grant and finance programs; however, there is no complete count of those units available on a national basis.

HUD programs subsidize approximately one-third of all rental multi-family units.

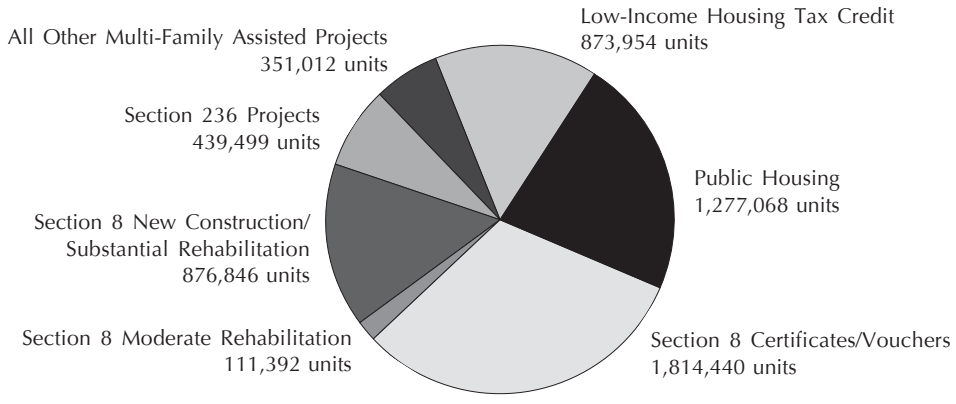
Appendix D-1 (page 26) shows, by state, the importance of government programs in all multi-family housing. In many states, HUD programs support more than 50 percent of rental multi-family housing.

Two strategies for financing affordable housing are particularly important: the use of tax-exempt financing and Low-Income Housing Tax Credits (LIHTC). Section 8 voucher subsidies have been declining, and no new government-owned public housing has been built in recent years.

The Low-Income Housing Tax Credit

The LIHTC is available to housing developers who agree that low- or moderate-income families will occupy a certain proportion of the units in their buildings. Each state can spend up to $1.90 times its population and has a minimum allocation of $2.19 million. The annual amount is indexed for inflation. Credit-financed apartments cannot be rented to anyone whose income exceeds 60 percent of the areawide median income (AMI) adjusted for family size. Each year, the LIHTC leverages about $6 billion of private investment and produces between 75,000 and 100,000 units of affordable housing. Figure 2 illustrates the comparative size of these and other HUD housing programs, again using 2000 data.

Figure 2. Low-Income Housing Tax Credit Compared to Other HUD Housing Programs



Source: U.S. Department of Housing and Urban Development, 2000.

Of these major categories, one of the most important for energy efficiency from a state perspective is the LIHTC. Through the LIHTC program, developers earn federal tax credits for building affordable housing. State governments—almost always the state housing finance agency—allocate the housing credits to developers, who then usually sell the tax credits to raise capital for construction.

The LIHTC, which has been growing steadily since 2000, now accounts for approximately 1.5 million units, more than public housing and gaining rapidly on Section 8 voucher subsidies. Appendix E-1 (page 27) shows, by state, the population and current distribution of LIHTC-financed multi-family housing units.

The federal government allocates the LIHTC to states, which, in turn, allocate the tax credit to housing developers. In most states, considerable competition exists for the tax credit funds. Thus, the factors states use to determine which developers will receive these credits are important. One report suggests that it may be common to receive four applications for every available tax credit allocation.[2] States typically use a Qualified Allocation Plan (QAP) system to decide which developers receive the credit. States use the QAP to favor certain characteristics of the buildings that receive the tax credits. These characteristics include, for example, projects that are in rural areas, contribute to community revitalization plans, leverage funding from other government programs, serve special needs residents, or extend affordability periods beyond federal minimum requirements. Energy efficiency and green building features also receive credit in some states.

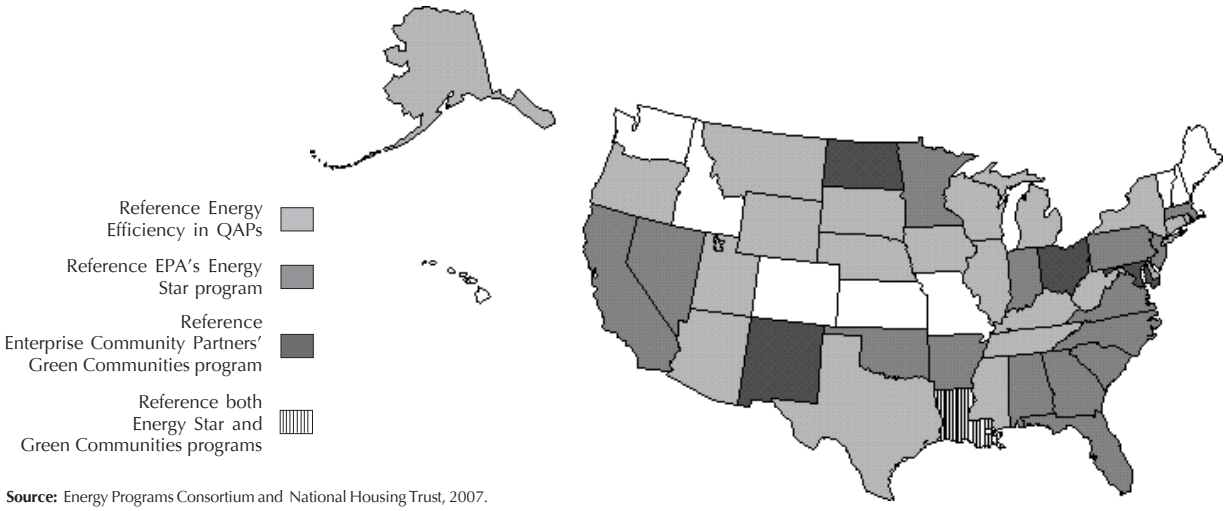
These incentives in the QAP vary a great deal. Some states, such as Colorado, Hawaii, Kentucky, Vermont, Washington, Wisconsin and the District of Columbia mention energy efficiency in general terms but do not offer incentives or specific encouragement for energy efficiency in affordable multi-family housing. Some states—Idaho, Kansas, Louisiana, Maine, Missouri, Nevada, New Jersey, South Dakota, Utah and West Virginia—mandate that affordable housing developments receiving the tax credit meet certain energy efficiency standards. Others, such as Michigan and Oregon, offer financial incentives to encourage developers to make affordable tax credit housing more energy efficient.

Thirty-nine states favor developments that invest in energy efficiency with extra points when they choose who receives the tax credit. For example, the proposed 2007 QAP in New Jersey requires most applicants' participation in their Energy Star Homes Program; exceptions are master-metered rehabilitation projects, minimum rehabilitation projects and historic preservation developments. Up to three QAP points are awarded for providing certain unit amenities, including Energy Star appliances within the units or Energy Star dishwashers. In addition, up to two points may be earned for property amenities, including Energy Star-labeled equipment in a communal laundry room. Also, one point is available to proposals that participate in the New Jersey Housing and Mortgage Finance Agency's Affordable Green Building Program or that incorporate a solar energy system of at least 20 kilowatts and is capable of covering 75 percent of the project's common area electricity needs. Developers participating in this program may be eligible for subsidies to cover the incremental costs of green building features.[3] Figure 3 shows the states that use such point systems.

2. Peregrine Energy Group and Clean Energy Group, *Clean Energy State Program Guide* (Montpelier, Vt.: Peregrine Energy Group and Clean Energy Group, February 2006), 13.

3. National Housing Trust, *Greenscan* (Washington, D.C.: National Housing Trust, 2007).

Figure 3. States that Reference Energy Efficiency in Their Qualified Allocation Plans (QAP)



Source: Energy Programs Consortium and National Housing Trust, 2007.

Of those states offering points to developments incorporating energy efficiency measures illustrated in Figure 3, 17 (Alabama, Arkansas, California, Florida, Georgia, Indiana, Louisiana, Massachusetts, Minnesota, Mississippi, New Jersey, New York, North Carolina, Oklahoma, Pennsylvania, South Carolina, Virginia) specifically reference EPA's Energy Star program and at least five (Louisiana, Maryland, New Mexico, North Dakota, Ohio) reference Enterprise Community Partners' Green Communities program.

There has been no systematic evaluation of whether the point system has had any real effect on increasing the relative investment in LIHTC-financed multi-family housing. Complicating the analysis is the question of how many potential points there are under a QAP and the extent to which winning projects are bunched at very high scores, making small point differentials between projects very significant.

State Tax-Exempt Bonds

Many states also issue tax-exempt housing bonds to finance low-interest mortgages for first-time home buyers and the acquisition, construction and rehabilitation of multi-family housing for low-income renters. Generally referred to as private activity bonds, they are tax-exempt for the purchaser and are issued by state and local governments. Multi-family housing bond-financed developments must set aside at least 40 percent of their apartments for families with incomes of less than 60 percent of AMI, or 20 percent for families with incomes of less than 50 percent of AMI.

In addition to providing tax credits to support low-income multi-family housing construction and rehabilitation, states can issue tax-exempt bonds to support affordable housing. Federal law allows states to issue bonds for a variety of "private purposes," including mortgages for first-time home buyers and low-income multi-family housing construction and rehabilitation. States can issue these bonds for up to $80 per capita (adjusted annually for inflation) with a minimum of $246.6 million per state. In 2005, states issued approximately $5.8 billion in tax-exempt bonds to finance an estimated 58,000 units for low-income multi-family housing construction and rehabilitation. Units financed with tax-exempt bonds may receive a 4 percent tax credit but are ineligible for the 9 percent LIHTC.

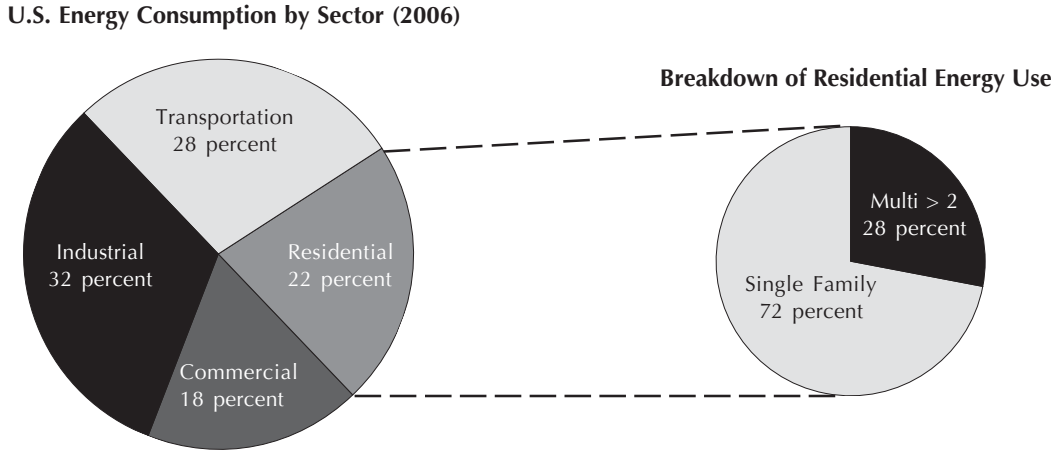
Energy Use in Multi-Family Housing

The amount of energy used in multi-family buildings varies, depending on their condition, age, original design, or controls and policies—such as whether tenants in rental buildings pay their utility bill as part of their rent or pay it separately based on their energy use. The Energy Information Administration, which tracks energy use in U.S. homes, provides figures that allow a general understanding of the energy use in single and multi-family buildings.

A 20 percent improvement in multi-family building energy efficiency could reduce U.S. residential energy use by 6 percent and total U.S. energy use by 1.3 percent.

Overall, as shown in Figure 4, residential housing accounts for 22 percent of energy use in the United States. Of that amount, 72 percent is accounted for by single-family housing and 28 percent by multi-family (more than two units).

Figure 4. Home Energy Use as a Percent of Total Energy Use

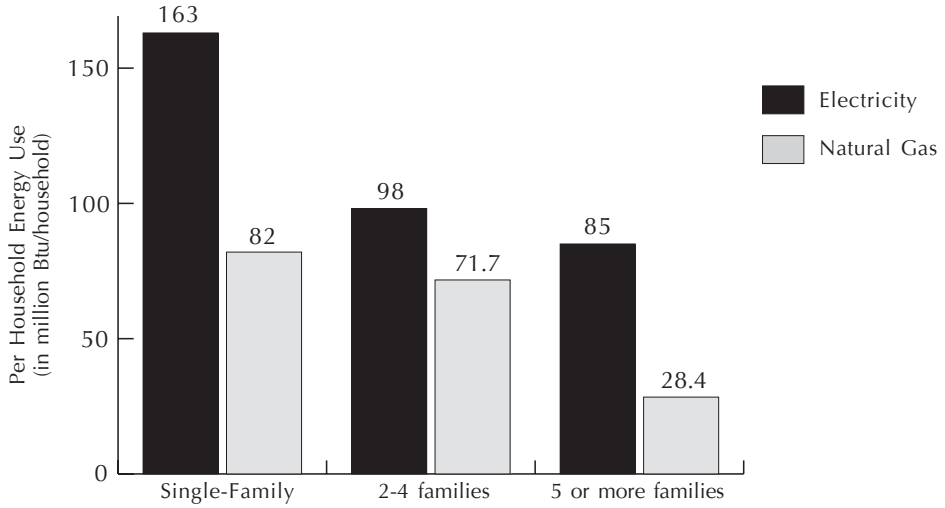


Source: DOE Energy Information Administration, *Residential Energy Consumption Survey*, Table CEI-4C, 2001.

Another way to consider such data is from the perspective of how much energy each household uses. Figure 5 illustrates that multi-family buildings tend to be less energy intensive than single-family homes. This is not surprising, given the comparatively smaller wall and roof space and the smaller size of units within multi-family buildings. These nationwide average figures give only a general idea of how much energy the multi-family sector uses. Further calculations suggest that an achievable 20 percent improvement in the energy efficiency of multi-family buildings could reduce energy consumption by 0.618 quadrillion Btu, or 6 percent of total U.S. residential energy consumption and 1.3 percent of total U.S. energy consumption.[4]

4. Total U.S. residential energy consumption is 9.86 quadrillion Btu/year. Multi-family energy (2+ units) energy consumption is 3.09 quadrillion Btu/year, and multi-family buildings with five or more units use 1.72 quadrillion Btu/year, according to EIA Residential Energy Consumption Survey statistics (www.eia.doe.gov).

Figure 5. Comparison of Energy Use Between Single-Family and Multi-Family Residences



Source: U.S. Energy Information Administration, 2001.

Relatively little data has been published to describe energy use in multi-family buildings. A number of multi-family energy efficiency programs across the country have conducted audits of energy use in multi-family buildings, however; the following includes data on multi-family use from the Illinois Department of Commerce, New York State Energy Research and Development Authority and Southface, a nonprofit organization that conducts programs to support energy efficiency in the southeastern United States.

The Southface data indicates a wide variation in energy consumption among different types of multi-family buildings. Data from its energy audits show that baseline energy use in multi-family buildings in the Southeast ranges from a high of 0.1235 million Btu per square foot to a low of 0.0360 million Btu per square foot, a 400 percent variation. Because energy use in multi-family households varies so significantly, it is difficult to determine just how much energy these households use. The following factors, among others, are significant: climate region, age of the building, condition of the building, exposure of the unit (north/south/east/west), and location of the unit within the building (top corner units tend to use more energy than mid-floor units, for example). Appendix F-1 (page 28) provides a summary of data provided by Southface that describes baseline and improved energy consumption in multi-family buildings in the southeastern United States.

Energy Efficiency Potential in Multi-Family Buildings

Data exists to describe the cost and potential for energy efficiency in multi-family buildings, although, once again, it may not always be useful to generalize the data from individual experiences to all situations. Discussion centers on two options: rehabilitation of existing buildings and new construction.

Rehabilitation of Existing Buildings

Buildings that are in poor condition typically have the greatest energy efficiency potential, partly because they were so inefficient to begin with, and partly because they often require a "gut rehab"—tearing out and

replacing much of the existing drywall and replacing heating and air conditioning systems. The energy efficiency potential of these gut rehabs can be impressive. As shown in Table 5, the Illinois Energy Efficient Housing Construction Program, managed by the Illinois Department of Commerce, documents energy efficiency improvements of approximately 50 percent to 75 percent in the buildings with which it works.

Table 5. Illinois Energy Efficient Building Practices

R21 (about 5-1/2") blown insulation in sidewalls
R43 (about 12") attic insulation
R10 (about 2") foundation insulation
High efficiency, sealed combustion furnace or boiler
Sealed combustion water heater
Exhaust ventilation in bathrooms and kitchens

Source: Illinois Department of Commerce, 2006.

Southface has documented efficiency improvements averaging 30 percent during the last several years. The difference between Southface results and those from Illinois are related to initial condition of the building. The Illinois buildings frequently were abandoned before the energy efficiency improvements were implemented, while Southface buildings were in better condition.

In general, the best and most cost-effective results can be seen in the most energy-efficient rehabs that already are under way for other reasons, such as an older apartment building that is being completely reconstructed.

New Construction

Energy efficiency in new construction differs significantly from efficiency for existing buildings. New construction involves energy-efficient design from the start, with proper sizing of heating and air conditioning systems, proper insulation, vent and other sealing, and installation of efficient lighting and appliances. Energy efficiency in new buildings can be much more cost effective per square foot than retrofitting existing inefficient buildings. The New York State Energy Research and Development Authority (NYSERDA), the state energy office, expects savings of approximately 20 percent—as compared with traditional construction—for a multi-family building participating in its Multifamily Building Performance program.

It is difficult to exactly measure the potential or cost of energy efficiency in new multi-family housing. Energy efficiency that involves simple installation of energy-efficient lighting and heating and air conditioning systems differs greatly from a complex project involving heat pumps and solar panels. One recent study[5] of "greening" affordable housing found an average cost premium of 2.4 percent (in this case, greening refers not only to energy efficiency, but also includes items such as water conservation). The study included 16 buildings with from three to 90 units and documented the energy savings and additional costs.

5. New Ecology and the Green CDCs Initiative, *The Costs and Benefits of Green Affordable Housing* (Cambridge, Mass.: New Ecology and the Green CDCs Initiative, 2005).

The cost of building to a green, energy-efficient standard varied considerably from 18 percent below to 9 percent above the costs for comparable conventional affordable housing (Table 6).

Table 6. Average "Greening" Cost Premium

	Average Cost Premium
Cost Premium	2.40 percent
Design	1.13 percent
Construction	5.29 percent

Source: *The Costs and Benefits of Green Affordable Housing* (New Ecology, 2005)

Typical energy-efficient measures include:[6]

- R-30 Attic insulation
- R-11 Wall insulation
- Dual-glazed windows
- Refurbish solar-assist hot water heater
- Programmable thermostats
- Fluorescent lighting
- Efficient kitchen ranges
- Energy Star refrigerators
- Air sealing
- Low-flow water fixtures

Energy efficiency measures can offer significant cost-effective energy savings in both rehabilitated and new construction multi-family housing. These savings reduce the operating cost for families to maintain their home and make housing more affordable.

The Role of Energy Service Companies in Multi-Family Affordable Housing

Energy service companies, commonly called ESCOs, play an important role in the energy efficiency industry in the United States. ESCOs finance and install energy efficiency improvements based on a performance guarantee of energy savings. A 2006 report from Lawrence Berkeley National Laboratory (LBNL) found that ESCOs invested some $2.5 billion, approximately 20 percent more than in 2005.

The largest ESCO markets are governmental and commercial buildings. Residential and public housing markets together account for only 5 percent of industry revenues and are targeted by only a handful of ESCOs. ESCOs have difficulty engaging in contracts with many individual homeowners or with renters who pay their own utility bills. The transaction costs and the difficulty of guaranteeing savings are high in these cases. Public housing authorities account for about 2 percent of total revenues. Affordable housing multi-family buildings do not account for a significant proportion of ESCO activity.

ESCOs are most interested in deals in which they can sign a single, large contract; a university or a hospital is an ideal client for an ESCO. A small number ESCOs work with public housing authorities; this is still a niche market. According to the LBNL report, significant project delays have arisen from inconsistencies between the U.S. Department of Housing and Urban Development (HUD) and its field offices in interpreting statutes and regulations that affect housing authority project implementation details. HUD is working to reduce these barriers through training and rule changes, however. The 2005 Energy Policy Act and subsequent HUD regulation extended allowable contract terms from 12 years to 20 years, for example. A 2007 report from Lawrence Berkeley National Laboratory (LBNL) found that ESCOs invested some $2.5 billion in 2006, which was approximately 20 percent more than in 2005.[7]

6. Ibid., 47.
7. See http://www.hud.gov/offices/pih/programs/ph/phecc/.

State Policy Issues in Multi-Family Housing

Barriers to Energy Efficiency

The data in this paper establish that significant potential exists for energy efficiency in multi-family buildings. It also demonstrates that energy efficiency in the multi-family building sector can contribute measurably and significantly to national energy efficiency. Energy efficiency improves the quality of multi-family buildings and makes them more affordable and comfortable for residents, who frequently are low- to moderate-income renters.

If energy efficiency in multi-family buildings is superior, why isn't it common practice in all buildings? Several barriers impede energy efficiency.

Perception of Higher First Cost

Although not always borne out in fact, energy efficiency construction has a reputation of being more expensive than traditional construction. A consistent program of outreach to developers and architects is required to educate them about energy-efficient construction techniques and about the true additional cost involved with these measures. Where cost is an issue, these educational efforts should be coordinated with well-designed financial incentives to help pay for energy efficiency measures.

Some energy efficiency advocates suggest that developers should consider the life cycle cost of energy efficiency investments rather than only the initial cost. Life cycle costing across a 30-year period almost always makes a convincing argument for investing in energy efficiency. Unfortunately, however, most developers and tenants do not consider 30-year financing. New program initiatives, such as Pay As You Save and EPC's Energy Efficient Mortgage, provide ways to amortize energy efficiency investments over a longer period. Adaptations of these policies may be appropriate to consider for the multi-family housing market.

The Split Incentive

Particularly in building retrofits, developers/owners of multi-family buildings do not always benefit financially from investing in energy efficiency; they pay for added insulation, duct sealing, efficient lights and appliances, but benefit only from lower heating and lighting bills in common areas. Tenants who pay their own utility bill, on the other hand, typically benefit financially but do not pay the added cost of these measures. Thus, financial incentives for developers become important, particularly for rehabilitation projects.

In Some Cases, the Utility Bill Is Included in the Rent Payment

Utilities are included in tenants' rent in approximately one-fourth of multi-family buildings. These utilities-included buildings tend to be older, since the 1978 Public Utility Regulatory Policies Act required that

new apartment buildings be individually metered. One study[8] found that tenants in these utilities-included buildings tend to set their thermostat one to three degrees higher—even when they are not at home—than tenants who pay their own utility bill. Further, the U.S. Department of Energy estimates that heating costs fall by 1 percent for every one degree that a thermostat is lowered for eight hours.[9] Tenants in utilities-included apartments do not have the financial incentive to practice energy efficiency.

Lack of Education and Understanding of Design Process, Technologies

The design process for building a new or rehabilitating an older building to be energy-efficient is not necessarily complex, but it differs from traditional practice. Many developers do not understand energy-efficient building practices, nor do they have access to information about energy-efficient design and construction.

LIHTC and Utility Allowances

The LIHTC program sets a maximum total rent that can be charged based on the sum of rent and a utility allowance. Most utility allowances are set in so that they can in fact punish the developer for investing in energy efficiency. More flexible HUD requirements on the utility allowance would remove this disincentive.

The Qualified Allocation Plan (QAP) Is Not Always Strongly Tied to Energy Efficiency

QAPs that reference energy efficiency provide a powerful incentive for developers, particularly where competition is fierce for LIHTC funds. Strong and specific energy efficiency requirements in the QAP can make a significant difference for new affordable housing construction. These requirements may be set as specific threshold requirements for any developer to receive the tax credit, or they may be set as an incentive whereby energy efficiency measures earn a significant number of points in comparison to other measures considered in the QAP tax credit allocation process.

State Funding Often May Have no Accompanying Energy Efficiency Requirement

Although some states require that any new construction involving state funds must meet certain energy efficiency standards, most have no such requirement. Combined with the QAP, this requirement could offer powerful motivation to make new affordable housing construction more energy efficient.

Lack of Communication Between Public Benefit Funds and Multi-Family Housing Sector

Public benefit funds can work with housing finance agencies to leverage their combined financial resources to promote more affordable and energy efficient homes. Public benefit fund programs may also be able to work more effectively with the affordable multi-family housing sector, yet, aside from discussions and limited programs in two or three states, this communication and joint action have not occurred.

8. Arik Levinson and Scott Niemann, *Energy Use by Apartment Tenants When Landlords Pay for Utilities* (Washington, D.C.: Georgetown University and Charles River Associates, February 2003).
9. See www.eren.doe.gov/erec/factsheets/thermo.html.

State Resources Supporting Residential Energy Efficiency

State governments devote significant money and resources to increasing single and multi-family residential energy efficiency. The sidebar at right describes certain federal multi-family energy efficiency policies as outlined in the Energy Policy Act of 2005.

While there is no specific data on the share of residential resources that were allocated for multi-family housing, there is some evidence that suggests that states have recently been focusing more heavily on multi-family housing. Oregon's multi-family program just received a 50 percent budget increase, and Wisconsin and New York are making major changes to their multi-family programs.

The Energy Policy Act of 2005 contains several provisions that aim to reduce many of the barriers to energy efficiency in public and affordable housing. Among them:

- Section 151 extends the allowable term for energy performance contracts in public housing from 12 to 20 years. This allows for longer payback periods for building retrofits, including windows, heating system replacements and wall insulation. HUD has already issued a regulation extending the term to 20 years.
- Section 152 requires that public housing agencies buy appliances that meet Energy Star requirements, unless the purchase is not cost-effective.
- Section 153 requires HUD to establish the 2003 International Energy Conservation Code as the standard for new HOPE VI projects.
- Section 154 requires HUD to develop a strategy and plan for energy efficiency in federally subsidized housing.
- Section 124 sets out energy efficiency appliance rebates and;
- Section 1331 sets out tax deductions that can apply to rental multi-family buildings of up to $1.80 per square foot when the buildings save 50 percent of their heating, cooling, ventilation, water heating and interior lighting energy use compared to an identically modeled building.

Sources of Funds Vary

In addition to federal funding, primarily for the low-income Weatherization Assistance Program (WAP), states use a number of different sources to fund their residential energy efficiency programs, including Petroleum Violation Escrow (PVE) funds, general obligation bonds, appropriations and public benefit funds. Montana, for example, uses environmental fines collected from companies with air quality violations to fund its program.

Public benefit funds often yield consistent funding for energy efficiency financing. Public benefit funds (sometimes called system benefit funds or other similar names) are accumulations of funding that result from a small surcharge placed on consumers' energy bills. Currently, 23 states[10] and the District of Columbia have some type of public benefit fund that supports energy efficiency.

PVE funds are available to states as a result of alleged oil company violations of federal oil pricing controls in place from 1973 to 1981. These funds are almost totally expended; however, a few states still have funds remaining and are using them to support various energy efficiency initiatives, such as the loan and grant programs discussed in this section.

10. The states are Arizona, California, Connecticut, Delaware, Illinois, Maine, Maryland, Massachusetts, Minnesota, Michigan, Montana, Nevada, New Hampshire, New Jersey, New Mexico, New York, Ohio, Oregon, Pennsylvania, Rhode Island, Texas, Vermont and Wisconsin.

In most cases (California, Maine, Massachusetts, New Jersey and New York, for instance) state agencies administer the public benefit funds. In some cases (Connecticut, New Hampshire, Rhode Island, for example) the utility administers the program, and in two other cases (Oregon and Vermont) a third party does so under a performance-based contract with the state.

As shown in Appendix G-1 (page 30), federal and state funding for state-administered residential energy efficiency programs totaled almost $1.4 billion in 2006 of which $825 million was for low-income residential energy efficiency and $534 million was for non-income targeted residential energy efficiency programs. Of the $824 million provided in low-income residential efficiency, $551 million was from the federal Weatherization Assistance Program (WAP) and transfer funds from the Low Income Home Energy Assistance Program (LIHEAP). WAP does not allow a match for efficiency services provided to single family homes but does allow states to require a match for multi-family housing. In practice, states require a match of between 0 and 50 percent. In 2006, states used Weatherization funds to provide energy efficiency improvements to approximately 16,000 multi-family units.

The State Multi-Family Energy Efficiency Program Model

Building Retrofits

A typical state multi-family energy efficiency program for building retrofits might follow the following six steps.

1. **Education about energy efficiency:** Most programs run some kind of outreach and education program, typically through websites and printed materials, but very often by working with trade partners to leverage the industry or nonprofits' networks in the communities.

2. **Commitment fee:** Some programs require that the building owner pay a commitment fee before beginning to receive services from the program. New York requires a $3,000 fee. If the owner leaves the program without completing the measures identified in the energy audit and agreed to after the audit, the owner sacrifices the $3,000. If the owner completes the process, the $3,000 is refunded.

3. **Energy audits:** For existing buildings, an energy audit of a building determines how much energy the building currently uses, which measures would reduce energy use in the building, their costs and the energy saved from those measures. State programs often pay 100 percent of the cost of the audit for a low-income building. A typical audit would cost $5,500 per building, and $2,500 for a small building with less than 30 units. In some cases, especially for non-low-income buildings, the state does not pay for the audit.

4. **Technical assistance to building owners:** Technical assistance often is a crucial part of state energy efficiency programs in multi-family buildings. New York has engineering firms pre-selected and on contract that are qualified in the areas of efficiency, HVAC system design, lighting and other relevant areas. The level of technical assistance that is required depends on the measures that the energy audit identifies. A lighting installation requires very little in the way of design; a new HVAC system or

roofing system requires far more intensive design work. This technical assistance provider can also help the developer to evaluate bids from lighting, HVAC or other companies that bid to install the energy efficiency measures.

The typical measures that programs focus on are:

- Lighting retrofit or, in new buildings, energy-efficient lighting system design;
- Insulation and duct sealing;
- HVAC retrofit and design;
- Hot water efficiency; and
- Refrigeration.

5. **Financing and installation of measures:** State programs take two different approaches to financing energy efficiency measures. Some pay for measures from a specifically prescribed list. Others pay based on the recommendations of an energy audit. NYSERDA's energy efficiency programs for multi-family housing, for example, have provided a typical investment of approximately $875 per housing unit, or approximately 25 percent of the energy-related improvements. The goal of these programs is to avoid overpaying (paying for measures that developers would otherwise install on their own, without the subsidy), while also paying enough to allow the developer to install the measures. Nonprofit developers often operate on tight margins, so at least some subsidy is usually necessary for this sector. Table 7 shows subsidies paid by certain states.

Table 7. Selected State Subsidies for Financing Energy Efficiency Measures

State	Subsidy
Connecticut	Up to $60,000 per multi-family building.
Minnesota	$500-$10,000 per unit.
New York	Lighting measures: 7 cents/kWh maximum A/C and Refrigeration: 20 cents/kWh maximum. Other electric: 10 cents/kWh.
Oregon	*Sample incentives:* Windows: $1.50-$3.00 per s.f., depending on efficiency and existing windows. High Efficiency Heat Pump: $150-$400, depending on efficiency and on what it replaces. Duct Insulation: 50 percent of cost up to $100.
Pennsylvania	Up to $10,000 per building.

Source: Energy Programs Consortium, 2007.

6. **Post-installation audit:** After installation of the measures in retrofitted buildings, some programs send an energy auditor to verify that the measures have been installed, are working properly and are producing the projected savings.

New Buildings

New buildings require a different kind of program, with different steps. Vermont's multi-family program offers the following steps for new buildings:

- Construction/renovation plan review;
- Development of bid package and bidder list;
- Energy-efficient product sourcing;
- Review of construction documents;
- Interim and post-construction inspections—air sealing and insulation; and
- System commissioning.

Some states are also using new and innovative approaches that leverage public benefit fund money with the low-income housing tax credits or tax-exempt bonds that support energy affordable housing. Ohio's energy office developed a joint product with the Ohio Housing Finance Agency, for example. The QAP in Ohio gave extra credit for energy-efficient affordable housing, and the Ohio energy office agreed to contribute funds—up to $500,000 per project—to write down the cost of loans taken out for efficiency upgrades.[11]

New Jersey's Board of Public Utilities (BPU), which runs the state's public benefit fund, has combined funding with the New Jersey Housing and Mortgage Finance Agency (NJHMFA) to support photovoltaics in affordable housing. The BPU funds 60 percent of the cost of the photovoltaics installation, and the NJHMFA will finance the remaining amount, as necessary. Although this is a renewable energy application, the same combined funding approach would work for energy efficiency.

The state programs show a diversity of approaches to supporting energy efficiency in the multi-family housing sector. These state programs can be significant. It is also apparent that many of the state public benefit funds for energy efficiency have not yet taken full advantage of the opportunities to leverage the vast amounts of funding now going into affordable housing through tax credits or through tax-exempt bonds. This appears to be a large, but thus far untapped, potential that is well worth developing.

Residential Energy Efficiency Loans

Sixteen states offer loan programs that support energy efficiency. While energy efficiency loans do vary in many respects, it is possible to lay out their basic characteristics by discussing seven categories: loan structure and loan caps, interest rates, term of loans, eligibility requirements, pre-approved uses of funds, requirements (or lack of requirement) for an energy audit, and sources of funds.

States typically offer loans either to builders or directly to residential homeowners. States generally cap the size of each loan, or the size of the state's contribution to the loan. The size of each loan varies a great deal, from as small as $400 to as large as $60,000 in the case of Connecticut's MultiEnergy Conservation Loan program.

11. Clean Energy Group, *Clean Energy State Program Guide* (Montpelier, Vt.: Clean Energy Group, 2006) 28.

Table 8 compares loan caps in selected states for single- and multi-family housing.

Table 8. Loan Caps in Selected States for Single- and Multi-Family Housing

State	Single-Family	Multi-Family (if applicable)
Connecticut	$400-$15,000	$60,000 (for building with more than five units)
Idaho	$1,000-$15,000	Same loan for single-family and multi-family
Massachusetts	Commonly $15,000 ($10,000 with some lenders); at least one unit must be owner-occupied	
Minnesota Rental Energy Loan Fund	$500-$10,000	Multi-family buildings eligible for same program
Montana	$40,000	Multi-family buildings eligible for same program
New York	$20,000	Lesser of $5,000/unit or $2,500,000; additional $2,500,000 available if the project incorporates advanced electric meters.
Ohio	$500-$10,000 for one- to three-unit buildings	
Oregon	$15,000 minimum	
Pennsylvania	$10,000 maximum, with larger loans available in some cases	Eligible for same program as long as owner-occupied

Source: Energy Programs Consortium, 2007.

NYSERDA, for example, provided $10 million in direct funding for multi-family housing and leveraged an additional $33.6 million in private participation last year. State energy efficiency programs for the multi-family sector vary. Some, like Illinois', focus on rehabilitating old and sometimes abandoned buildings. Others focus on new construction; still others, like New York, work with both new and old construction.

Conclusions

Increasing the energy efficiency of multi-family buildings is a complex issue. The following are recommendations for steps that can be taken to increase the energy efficiency of the nation's multi-family housing stock.

Energy Efficiency Measures for All Multi-Family Housing

- Consider education programs for developers, builders and architects. Such programs would focus on energy-efficient building practices as well as on financing models available to reduce the cost of energy efficiency measures.

- Compile a database of information on energy use and savings potential in multi-family housing based on age and number of units. Identify lessons learned from state energy efficiency programs in multi-family sector evaluations and energy efficiency studies.

- Develop finance models for state public benefit fund programs to support energy efficiency improvements for new and existing construction. As part of this effort, focus on performance-based programs that provide incentives targeted to developers.

- States can examine ways to require that energy efficiency measures be installed in multi-family buildings constructed with government funds.

Energy Efficiency Measures Specific to Affordable Housing

- State finance programs can examine means to combine and leverage energy efficiency or weatherization public benefit program funds with additional funding from housing finance agencies.

- States can examine methods to encourage energy efficiency through policies that allocate Low-Income Housing Tax Credits (LIHTC) among housing developers.

- Work with HUD to modify the calculation of utility allowances in the LIHTC program and with the IRS to ensure those modifications are recognized for tax purposes.

Appendix A-1. Percent of Multi-Family Housing by State

State	Total Housing Units	Multi-Family Units	Percent Multi-Family
Alabama	1,737,080	160,405	9%
Alaska	221,600	32,862	15%
Arizona	1,901,327	335,311	18%
Arkansas	1,042,696	79,476	8%
California	11,502,870	2,745,544	24%
Colorado	1,658,238	330,597	20%
Connecticut	1,301,670	230,764	18%
Delaware	298,736	42,461	14%
District of Columbia	248,338	138,339	56%
Florida	6,337,929	1,617,334	26%
Georgia	3,006,369	417,079	14%
Hawaii	403,240	151,763	38%
Idaho	469,645	33,984	7%
Illinois	4,591,779	1,028,850	22%
Indiana	2,336,306	267,089	11%
Iowa	1,149,276	128,696	11%
Kansas	1,037,891	110,320	11%
Kentucky	1,590,647	162,415	10%
Louisiana	1,656,053	165,818	10%
Maine	518,200	49,540	10%
Maryland	1,980,859	417,884	21%
Massachusetts	2,443,580	514,774	21%
Michigan	3,785,661	484,578	13%
Minnesota	1,895,127	354,952	19%
Mississippi	1,046,434	76,486	7%
Missouri	2,194,594	233,934	11%
Montana	358,667	28,159	8%
Nebraska	666,184	95,239	14%
Nevada	751,165	168,218	22%
New Hampshire	474,606	69,616	15%
New Jersey	3,064,645	626,828	20%
New Mexico	677,971	64,551	10%
New York	7,056,860	2,641,963	37%
North Carolina	3,132,013	316,094	10%
North Dakota	257,152	47,248	18%
Ohio	4,445,773	609,329	14%
Oklahoma	1,342,293	136,779	10%
Oregon	1,333,723	209,477	16%
Pennsylvania	4,777,003	561,507	12%
Rhode Island	408,424	66,581	16%
South Carolina	1,533,854	133,842	9%
South Dakota	290,245	36,746	13%
Tennessee	2,232,905	258,781	12%
Texas	7,393,354	1,376,363	19%
Utah	701,281	92,587	13%
Vermont	240,634	22,311	9%
Virginia	2,699,173	466,752	17%
Washington	2,271,398	438,919	19%
West Virginia	736,481	47,228	6%
Wisconsin	2,084,544	302,282	15%
Wyoming	193,608	14,922	8%
Total	106,471,863	19,143,577	18%

Source: Home Mortgage Disclosure Act data. Data accessed using DataPlace™, 2005.

Appendix B-1. Multi-Family Housing by State—Total

State	50 or more	20 to 49	5 to 19	Total	Percent of Total
Alabama	36,526	22,246	101,633	160,405	0.8%
Alaska	5,115	7,622	20,125	32,862	0.2%
Arizona	149,769	47,593	137,949	335,311	1.8%
Arkansas	16,799	12,919	49,758	79,476	0.4%
California	902,932	582,747	1,259,865	2,745,544	14.3%
Colorado	88,836	79,837	161,924	330,597	1.7%
Connecticut	71,455	41,640	117,669	230,764	1.2%
Delaware	9,631	5,778	27,052	42,461	0.2%
District of Columbia	76,422	18,535	43,382	138,339	0.7%
Florida	733,398	286,109	597,827	1,617,334	8.4%
Georgia	95,474	50,779	270,826	417,079	2.2%
Hawaii	89,031	19,682	43,050	151,763	0.8%
Idaho	6,800	7,567	19,617	33,984	0.2%
Illinois	382,069	177,294	469,487	1,028,850	5.4%
Indiana	52,970	42,958	171,161	267,089	1.4%
Iowa	20,832	32,293	75,571	128,696	0.7%
Kansas	23,788	21,256	65,276	110,320	0.6%
Kentucky	26,848	20,889	114,678	162,415	0.8%
Louisiana	56,682	26,725	82,411	165,818	0.9%
Maine	7,602	8,749	33,189	49,540	0.3%
Maryland	120,518	36,300	261,066	417,884	2.2%
Massachusetts	165,275	97,058	252,441	514,774	2.7%
Michigan	120,284	81,457	282,837	484,578	2.5%
Minnesota	139,155	94,616	121,181	354,952	1.9%
Mississippi	17,314	10,630	48,542	76,486	0.4%
Missouri	53,517	36,743	143,674	233,934	1.2%
Montana	6,078	5,506	16,575	28,159	0.1%
Nebraska	18,885	22,757	53,597	95,239	0.5%
Nevada	54,580	20,063	93,575	168,218	0.9%
New Hampshire	8,341	21,588	39,687	69,616	0.4%
New Jersey	220,443	111,913	294,472	626,828	3.3%
New Mexico	22,566	11,601	30,384	64,551	0.3%
New York	1,380,963	587,609	673,391	2,641,963	13.8%
North Carolina	48,875	40,565	226,654	316,094	1.7%
North Dakota	6,364	16,426	24,458	47,248	0.2%
Ohio	153,918	90,640	364,771	609,329	3.2%
Oklahoma	38,393	19,587	78,799	136,779	0.7%
Oregon	63,443	41,993	104,041	209,477	1.1%
Pennsylvania	196,033	89,731	275,743	561,507	2.9%
Rhode Island	22,179	10,007	34,395	66,581	0.3%
South Carolina	26,059	14,687	93,096	133,842	0.7%
South Dakota	5,508	11,158	20,080	36,746	0.2%
Tennessee	64,650	32,594	161,537	258,781	1.4%
Texas	569,466	188,695	618,202	1,376,363	7.2%
Utah	22,225	19,234	51,128	92,587	0.5%
Vermont	3,311	3,205	15,795	22,311	0.1%
Virginia	146,809	44,685	275,258	466,752	2.4%
Washington	124,496	99,270	215,153	438,919	2.3%
West Virginia	11,366	6,588	29,274	47,228	0.2%
Wisconsin	63,005	72,813	166,464	302,282	1.6%
Wyoming	2,093	4,082	8,747	14,922	0.1%
Total	6,749,091	3,457,019	8,937,467	19,143,577	100.0%
Percent of Total	35.3%	18.1%	46.7%	100.0%	

Source: 2000 U.S. Census data.

Appendix B-2. Multi-Family Housing by State—Renters

State	50 or more	20 to 49	5 to 19	Total	Percent of Total
Alabama	32,971	21,372	97,451	151,794	1.0%
Alaska	3,966	6,485	17,704	28,155	0.2%
Arizona	134,212	44,635	126,437	305,284	1.9%
Arkansas	15,457	12,618	48,352	76,427	0.5%
California	729,089	533,067	1,145,517	2,407,673	15.1%
Colorado	67,042	70,115	136,962	274,119	1.7%
Connecticut	51,721	36,147	93,051	180,919	1.1%
Delaware	7,085	4,813	25,278	37,176	0.2%
District of Columbia	48,882	14,967	39,677	103,526	0.6%
Florida	264,192	163,828	459,282	887,302	5.6%
Georgia	82,005	48,170	257,514	387,689	2.4%
Hawaii	32,861	13,956	31,126	77,943	0.5%
Idaho	6,383	7,385	18,730	32,498	0.2%
Illinois	205,891	137,205	398,122	741,218	4.7%
Indiana	49,615	41,616	166,048	257,279	1.6%
Iowa	17,717	30,234	71,470	119,421	0.7%
Kansas	22,139	20,832	63,214	106,185	0.7%
Kentucky	23,393	19,237	107,503	150,133	0.9%
Louisiana	50,854	25,692	78,605	155,151	1.0%
Maine	6,540	8,305	31,450	46,295	0.3%
Maryland	83,486	29,709	227,281	340,476	2.1%
Massachusetts	116,964	81,009	216,485	414,458	2.6%
Michigan	109,960	78,042	262,741	450,743	2.8%
Minnesota	101,038	87,973	110,771	299,782	1.9%
Mississippi	16,372	10,314	47,232	73,918	0.5%
Missouri	48,342	34,054	133,255	215,651	1.4%
Montana	5,627	5,173	15,557	26,357	0.2%
Nebraska	15,359	22,192	52,804	90,355	0.6%
Nevada	49,865	19,175	85,109	154,149	1.0%
New Hampshire	7,564	19,587	35,459	62,610	0.4%
New Jersey	157,380	100,195	249,179	506,754	3.2%
New Mexico	21,467	11,275	28,895	61,637	0.4%
New York	864,425	530,573	614,728	2,009,726	12.6%
North Carolina	43,066	38,334	211,505	292,905	1.8%
North Dakota	5,682	15,798	22,522	44,002	0.3%
Ohio	134,403	86,645	342,757	563,805	3.5%
Oklahoma	35,682	19,083	76,481	131,246	0.8%
Oregon	58,467	40,290	100,389	199,146	1.3%
Pennsylvania	152,551	83,679	257,997	494,227	3.1%
Rhode Island	20,480	9,007	31,273	60,760	0.4%
South Carolina	21,101	13,371	84,352	118,824	0.7%
South Dakota	5,032	10,950	19,239	35,221	0.2%
Tennessee	57,671	30,830	154,739	243,240	1.5%
Texas	526,780	182,204	595,833	1,304,817	8.2%
Utah	17,773	17,604	44,773	80,150	0.5%
Vermont	3,039	2,945	13,899	19,883	0.1%
Virginia	96,360	40,433	247,232	384,025	2.4%
Washington	102,202	88,493	193,010	383,705	2.4%
West Virginia	10,731	6,435	28,158	45,324	0.3%
Wisconsin	55,093	69,448	155,738	280,279	1.8%
Wyoming	2,054	3,959	8,303	14,316	0.1%
Total	4,798,031	3,049,458	8,081,189	15,928,678	100.0%
Percent of Total	30.1%	19.1%	50.7%	100.0%	

Source: 2000 U.S. Census data.

Appendix B-3. Multi-Family Housing by State—Owners

State	50 or more	20 to 49	5 to 19	Total	Percent of Total
Alabama	3,555	874	4,182	8,611	0.3%
Alaska	1149	1,137	2,421	4,707	0.1%
Arizona	15,557	2,958	11,512	30,027	0.9%
Arkansas	1342	301	1,406	3,049	0.1%
California	173,843	49,680	114,348	337,871	10.5%
Colorado	21,794	9,722	24,962	56,478	1.8%
Connecticut	19,734	5,493	24,618	49,845	1.6%
Delaware	2,546	965	1,774	5,285	0.2%
District of Columbia	27,540	3,568	3,705	34,813	1.1%
Florida	469,206	122,281	138,545	730,032	22.7%
Georgia	13,469	2,609	13,312	29,390	0.9%
Hawaii	56,170	5,726	11,924	73,820	2.3%
Idaho	417	182	887	1,486	0.0%
Illinois	176,178	40,089	71,365	287,632	8.9%
Indiana	3,355	1,342	5,113	9,810	0.3%
Iowa	3,115	2,059	4,101	9,275	0.3%
Kansas	1649	424	2,062	4,135	0.1%
Kentucky	3,455	1,652	7,175	12,282	0.4%
Louisiana	5,828	1,033	3,806	10,667	0.3%
Maine	1062	444	1,739	3,245	0.1%
Maryland	37,032	6,591	33,785	77,408	2.4%
Massachusetts	48,311	16,049	35,956	100,316	3.1%
Michigan	10,324	3,415	20,096	33,835	1.1%
Minnesota	38,117	6,643	10,410	55,170	1.7%
Mississippi	942	316	1,310	2,568	0.1%
Missouri	5,175	2,689	10,419	18,283	0.6%
Montana	451	333	1,018	1,802	0.1%
Nebraska	3,526	565	793	4,884	0.2%
Nevada	4,715	888	8,466	14,069	0.4%
New Hampshire	777	2,001	4,228	7,006	0.2%
New Jersey	63,063	11,718	45,293	120,074	3.7%
New Mexico	1099	326	1,489	2,914	0.1%
New York	516,538	57,036	58,663	632,237	19.7%
North Carolina	5,809	2,231	15,149	23,189	0.7%
North Dakota	682	628	1,936	3,246	0.1%
Ohio	19,515	3,995	22,014	45,524	1.4%
Oklahoma	2,711	504	2,318	5,533	0.2%
Oregon	4,976	1,703	3,652	10,331	0.3%
Pennsylvania	43,482	6,052	17,746	67,280	2.1%
Rhode Island	1,699	1,000	3,122	5,821	0.2%
South Carolina	4,958	1,316	8,744	15,018	0.5%
South Dakota	476	208	841	1,525	0.0%
Tennessee	6979	1,764	6,798	15,541	0.5%
Texas	42,686	6,491	22,369	71,546	2.2%
Utah	4,452	1,630	6,355	12,437	0.4%
Vermont	272	260	1,896	2,428	0.1%
Virginia	50449	4,252	28,026	82,727	2.6%
Washington	22,294	10,777	22,143	55,214	1.7%
West Virginia	635	153	1,116	1,904	0.1%
Wisconsin	7912	3,365	10,726	22,003	0.7%
Wyoming	39	123	444	606	0.0%
Total	1,951,060	407,561	856,278	3,214,899	100.0%
Percent of Total	60.7%	12.7%	26.6%	100.0%	

Source: 2000 U.S. Census data.

Appendix C-1. Multi-Family Total Housing Stock by State—by Age of Construction

State	1990-2000	1980-1989	1970-1979	1960-1969	Pre-1960	Total	Percent of Total
Alabama	33,891	42,270	43,435	18,939	21,870	160,405	0.8%
Alaska	3,021	9,427	10,459	3,994	5,961	32,862	0.2%
Arizona	77,260	117,083	76,387	33,131	31,450	335,311	1.8%
Arkansas	21,591	19,148	20,374	9,174	9,189	79,476	0.4%
California	303,243	557,436	658,640	495,891	730,334	2,745,544	14.3%
Colorado	56,485	72,431	95,831	45,253	60,597	330,597	1.7%
Connecticut	20,461	45,784	51,823	35,250	77,446	230,764	1.2%
Delaware	5,794	8,692	11,554	7,641	8,780	42,461	0.2%
District of Columbia	3,300	8,804	15,316	26,758	84,161	138,339	0.7%
Florida	263,255	377,667	390,278	165,342	420,792	1,617,334	8.4%
Georgia	113,881	113,634	88,489	47,807	53,268	417,079	2.2%
Hawaii	18,977	18,647	41,977	23,306	48,856	151,763	0.8%
Idaho	10,091	5,770	9,050	3,064	6,009	33,984	0.2%
Illinois	87,435	123,298	224,333	158,148	435,636	1,028,850	5.4%
Indiana	50,591	54,563	74,249	41,943	45,743	267,089	1.4%
Iowa	24,724	22,176	37,421	16,483	27,892	128,696	0.7%
Kansas	20,497	26,385	31,604	16,197	15,637	110,320	0.6%
Kentucky	29,955	34,329	44,083	23,380	30,668	162,415	0.8%
Louisiana	19,676	42,602	49,483	24,429	29,628	165,818	0.9%
Maine	4,210	9,457	9,020	3,854	22,999	49,540	0.3%
Maryland	61,137	71,460	103,800	86,491	94,996	417,884	2.2%
Massachusetts	29,085	75,214	111,717	68,730	230,028	514,774	2.7%
Michigan	73,691	95,518	144,724	81,207	89,438	484,578	2.5%
Minnesota	39,800	69,520	96,529	56,922	92,181	354,952	1.9%
Mississippi	17,969	19,413	21,935	9,878	7,291	76,486	0.4%
Missouri	30,998	51,025	58,989	36,077	56,845	233,934	1.2%
Montana	4,702	4,419	7,583	2,832	8,623	28,159	0.1%
Nebraska	22,072	15,274	25,179	12,934	19,780	95,239	0.5%
Nevada	64,030	42,925	32,910	15,250	13,103	168,218	0.9%
New Hampshire	6,657	18,778	16,965	5,868	21,348	69,616	0.4%
New Jersey	59,556	90,673	119,625	110,794	246,180	626,828	3.3%
New Mexico	13,434	16,735	17,702	9,062	7,618	64,551	0.3%
New York	109,976	152,964	288,782	395,276	1,694,965	2,641,963	13.8%
North Carolina	99,626	85,550	64,700	30,838	35,380	316,094	1.7%
North Dakota	10,706	9,734	15,096	4,749	6,963	47,248	0.2%
Ohio	86,203	94,569	162,617	113,390	152,550	609,329	3.2%
Oklahoma	18,048	39,432	42,070	20,745	16,484	136,779	0.7%
Oregon	61,126	31,756	48,883	26,252	41,460	209,477	1.1%
Pennsylvania	47,168	76,761	136,448	95,253	205,877	561,507	2.9%
Rhode Island	5,429	12,692	16,552	9,287	22,621	66,581	0.3%
South Carolina	33,369	39,639	34,045	11,458	15,331	133,842	0.7%
South Dakota	8,893	7,296	10,840	3,571	6,146	36,746	0.2%
Tennessee	51,839	64,678	68,681	36,454	37,129	258,781	1.4%
Texas	271,473	424,447	371,270	175,018	134,155	1,376,363	7.2%
Utah	23,700	21,041	22,870	10,102	14,874	92,587	0.5%
Vermont	2,757	4,183	4,069	1,659	9,643	22,311	0.1%
Virginia	85,917	97,404	110,795	70,698	101,938	466,752	2.4%
Washington	103,827	98,379	94,598	55,104	87,011	438,919	2.3%
West Virginia	7,014	11,834	11,540	4,863	11,977	47,228	0.2%
Wisconsin	69,061	54,637	77,055	40,250	61,279	302,282	1.6%
Wyoming	2,043	3,828	4,925	1,423	2,703	14,922	0.1%
Total	2,689,644	3,611,381	4,327,300	2,802,419	5,712,833	19,143,577	100.0%
Percent of Total	14.0%	18.9%	22.6%	14.6%	29.8%	100.0%	

Source: 2000 U.S. Census Data.

Appendix C-2. Multi-Family Renter Stock by State—by Age of Construction

State	1990-2000	1980-1989	1970-1979	1960-1969	Pre-1960	Total	Percent of Total
Alabama	32,843	40,030	42,143	18,142	18,636	151,794	1.0%
Alaska	2,813	7,380	9,189	3,803	4,970	28,155	0.2%
Arizona	74,377	108,807	71,540	30,239	20,321	305,284	1.9%
Arkansas	21,430	18,391	19,843	8,851	7,912	76,427	0.5%
California	273,207	486,552	589,965	461,394	596,555	2,407,673	15.1%
Colorado	50,393	58,539	82,385	39,950	42,852	274,119	1.7%
Connecticut	16,904	32,045	42,543	30,275	59,152	180,919	1.1%
Delaware	5,236	7,582	10,641	7,061	6,656	37,176	0.2%
District of Columbia	2,772	7,526	13,783	22,163	57,282	103,526	0.6%
Florida	213,251	238,639	221,843	115,479	98,090	887,302	5.6%
Georgia	110,565	105,516	84,598	45,025	41,985	387,689	2.4%
Hawaii	10,546	12,599	26,578	17,298	10,922	77,943	0.5%
Idaho	9,936	5,467	8,593	2,933	5,569	32,498	0.2%
Illinois	65,251	100,446	170,191	125,958	279,372	741,218	4.7%
Indiana	48,897	52,801	72,375	40,889	42,317	257,279	1.6%
Iowa	22,614	20,411	35,442	15,777	25,177	119,421	0.7%
Kansas	20,195	25,455	30,957	15,624	13,954	106,185	0.7%
Kentucky	26,562	32,284	41,756	22,426	27,105	150,133	0.9%
Louisiana	19,145	40,256	47,977	23,240	24,533	155,151	1.0%
Maine	3,969	8,555	8,625	3,709	21,437	46,295	0.3%
Maryland	43,736	59,491	91,616	78,640	66,993	340,476	2.1%
Massachusetts	23,527	55,546	98,325	60,394	176,666	414,458	2.6%
Michigan	69,317	90,239	136,179	75,826	79,182	450,743	2.8%
Minnesota	36,300	58,112	87,558	53,531	64,281	299,782	1.9%
Mississippi	17,598	18,892	21,401	9,626	6,401	73,918	0.5%
Missouri	28,659	46,139	56,168	33,831	50,854	215,651	1.4%
Montana	4,424	3,868	7,203	2,786	8,076	26,357	0.2%
Nebraska	21,554	14,763	24,665	12,387	16,986	90,355	0.6%
Nevada	57,906	40,790	31,036	14,566	9,851	154,149	1.0%
New Hampshire	5,996	15,166	15,565	5,664	20,219	62,610	0.4%
New Jersey	43,817	64,800	104,263	100,809	193,065	506,754	3.2%
New Mexico	13,120	16,190	17,002	8,637	6,688	61,637	0.4%
New York	98,843	128,470	255,974	319,551	1,206,888	2,009,726	12.6%
North Carolina	93,525	77,930	61,482	29,597	30,371	292,905	1.8%
North Dakota	10,332	8,987	13,830	4,536	6,317	44,002	0.3%
Ohio	79,230	87,663	154,207	107,391	135,314	563,805	3.5%
Oklahoma	17,754	37,983	41,084	20,172	14,253	131,246	0.8%
Oregon	59,690	30,220	46,626	25,400	37,210	199,146	1.3%
Pennsylvania	41,701	68,281	126,550	87,862	169,833	494,227	3.1%
Rhode Island	4,813	10,806	15,815	9,001	20,325	60,760	0.4%
South Carolina	30,130	35,038	31,527	10,713	11,416	118,824	0.7%
South Dakota	8,386	7,071	10,584	3,496	5,684	35,221	0.2%
Tennessee	50,096	61,841	65,480	34,363	31,460	243,240	1.5%
Texas	268,520	407,158	359,359	167,423	102,357	1,304,817	8.2%
Utah	21,474	18,608	19,634	8,983	11,451	80,150	0.5%
Vermont	2,403	3,230	3,646	1,542	9,062	19,883	0.1%
Virginia	73,450	83,740	98,569	64,209	64,057	384,025	2.4%
Washington	93,335	86,670	83,201	51,099	69,400	383,705	2.4%
West Virginia	6,807	11,606	11,280	4,656	10,975	45,324	0.3%
Wisconsin	64,423	50,642	72,072	38,719	54,423	280,279	1.8%
Wyoming	1,967	3,701	4,740	1,330	2,578	14,316	0.1%
Total	2,423,739	3,112,922	3,797,608	2,496,976	4,097,433	15,928,678	100.0%
Percent of Total	15.2%	19.5%	23.8%	15.7%	25.7%	100.0%	

Source: 2000 U.S. Census data.

Appendix C-3. Multi-Family Owner Housing Stock by State—by Age of Construction

State	1990-2000	1980-1989	1970-1979	1960-1969	Pre-1960	Total	Percent of Total
Alabama	1,048	2,240	1,292	797	3,234	8,611	0.3%
Alaska	208	2,047	1,270	191	991	4,707	0.1%
Arizona	2,883	8,276	4,847	2,892	11,129	30,027	0.9%
Arkansas	161	757	531	323	1,277	3,049	0.1%
California	30,036	70,884	68,675	34,497	133,779	337,871	10.5%
Colorado	6,092	13,892	13,446	5,303	17,745	56,478	1.8%
Connecticut	3,557	13,739	9,280	4,975	18,294	49,845	1.6%
Delaware	558	1,110	913	580	2,124	5,285	0.2%
District of Columbia	528	1,278	1,533	4,595	26,879	34,813	1.1%
Florida	50,004	139,028	168,435	49,863	322,702	730,032	22.7%
Georgia	3,316	8,118	3,891	2,782	11,283	29,390	0.9%
Hawaii	8,431	6,048	15,399	6,008	37,934	73,820	2.3%
Idaho	155	303	457	131	440	1,486	0.0%
Illinois	22,184	22,852	54,142	32,190	156,264	287,632	8.9%
Indiana	1,694	1,762	1,874	1,054	3,426	9,810	0.3%
Iowa	2,110	1,765	1,979	706	2,715	9,275	0.3%
Kansas	302	930	647	573	1,683	4,135	0.1%
Kentucky	3,393	2,045	2,327	954	3,563	12,282	0.4%
Louisiana	531	2,346	1,506	1,189	5,095	10,667	0.3%
Maine	241	902	395	145	1,562	3,245	0.1%
Maryland	17,401	11,969	12,184	7,851	28,003	77,408	2.4%
Massachusetts	5,558	19,668	13,392	8,336	53,362	100,316	3.1%
Michigan	4,374	5,279	8,545	5,381	10,256	33,835	1.1%
Minnesota	3,500	11,408	8,971	3,391	27,900	55,170	1.7%
Mississippi	371	521	534	252	890	2,568	0.1%
Missouri	2,339	4,886	2,821	2,246	5,991	18,283	0.6%
Montana	278	551	380	46	547	1,802	0.1%
Nebraska	518	511	514	547	2,794	4,884	0.2%
Nevada	6,124	2,135	1,874	684	3,252	14,069	0.4%
New Hampshire	661	3,612	1,400	204	1,129	7,006	0.2%
New Jersey	15,739	25,873	15,362	9,985	53,115	120,074	3.7%
New Mexico	314	545	700	425	930	2,914	0.1%
New York	11,133	24,494	32,808	75,725	488,077	632,237	19.7%
North Carolina	6,101	7,620	3,218	1,241	5,009	23,189	0.7%
North Dakota	374	747	1,266	213	646	3,246	0.1%
Ohio	6,973	6,906	8,410	5,999	17,236	45,524	1.4%
Oklahoma	294	1,449	986	573	2,231	5,533	0.2%
Oregon	1,436	1,536	2,257	852	4,250	10,331	0.3%
Pennsylvania	5,467	8,480	9,898	7,391	36,044	67,280	2.1%
Rhode Island	616	1,886	737	286	2,296	5,821	0.2%
South Carolina	3,239	4,601	2,518	745	3,915	15,018	0.5%
South Dakota	507	225	256	75	462	1,525	0.0%
Tennessee	1,743	2,837	3,201	2,091	5,669	15,541	0.5%
Texas	2,953	17,289	11,911	7,595	31,798	71,546	2.2%
Utah	2,226	2,433	3,236	1,119	3,423	12,437	0.4%
Vermont	354	953	423	117	581	2,428	0.1%
Virginia	12,467	13,664	12,226	6,489	37,881	82,727	2.6%
Washington	10,492	11,709	11,397	4,005	17,611	55,214	1.7%
West Virginia	207	228	260	207	1,002	1,904	0.1%
Wisconsin	4,638	3,995	4,983	1,531	6,856	22,003	0.7%
Wyoming	76	127	185	93	125	606	0.0%
Total	265,905	498,459	529,692	305,443	1,615,400	3,214,899	100.0%
Percent of Total	8.3%	15.5%	16.5%	9.5%	50.2%	100.0%	

Source: 2000 U.S. Census data.

Appendix D-1. HUD-Assisted Multi-Family Housing Units by State as Percent of All Multi-Family Housing Units

State	Total HUD-Assisted Multi-Family	Total Multi-Family Households	Percent of All Multi-Family That Is HUD-Supported
Alabama	102,943	160,405	64%
Alaska	7,442	32,862	23%
Arizona	48,656	335,311	15%
Arkansas	59,646	79,476	75%
California	545,396	2,745,544	20%
Colorado	69,037	330,597	21%
Connecticut	95,372	230,764	41%
Delaware	15,215	42,461	36%
District of Columbia	36,598	138,339	26%
Florida	251,058	1,617,334	16%
Georgia	158,412	417,079	38%
Hawaii	25,117	151,763	17%
Idaho	15,073	33,984	44%
Illinois	252,580	1,028,850	25%
Indiana	117,995	267,089	44%
Iowa	53,896	128,696	42%
Kansas	48,186	110,320	44%
Kentucky	89,565	162,415	55%
Louisiana	108,353	165,818	65%
Maine	30,079	49,540	61%
Maryland	127,942	417,884	31%
Massachusetts	209,260	514,774	41%
Michigan	183,909	484,578	38%
Minnesota	104,000	354,952	29%
Mississippi	63,328	76,486	83%
Missouri	122,524	233,934	52%
Montana	16,485	28,159	59%
Nebraska	31,860	95,239	33%
Nevada	26,381	168,218	16%
New Hampshire	23,001	69,616	33%
New Jersey	170,514	626,828	27%
New Mexico	31,618	64,551	49%
New York	582,740	2,641,963	22%
North Carolina	144,119	316,094	46%
North Dakota	16,026	47,248	34%
Ohio	267,094	609,329	44%
Oklahoma	64,466	136,779	47%
Oregon	60,869	209,477	29%
Pennsylvania	252,046	561,507	45%
Rhode Island	41,289	66,581	62%
South Carolina	73,395	133,842	55%
South Dakota	17,632	36,746	48%
Tennessee	126,018	258,781	49%
Texas	329,361	1,376,363	24%
Utah	22,341	92,587	24%
Vermont	14,823	22,311	66%
Virginia	142,249	466,752	30%
Washington	92,534	438,919	21%
West Virginia	36,909	47,228	78%
Wisconsin	97,308	302,282	32%
Wyoming	7,535	14,922	50%
TOTAL	5,630,195	19,143,577	41%

Source: U.S. Department of Housing and Urban Development, 2005.

Appendix E-1. Multi-Family Housing Units Financed by LIHTC

State	Population 2005	Total LIHTC Allocations, 1987-2005 (in dollars)	Total LIHTC Units 1987-2005
California	36,132,147	$932,447,467	115,478
Texas	22,859,968	500,710,062	159,296
New York	19,254,630	554,276,534	73,397
Florida	17,789,864	424,916,761	85,024
Illinois	12,763,371	321,028,502	57,180
Pennsylvania	12,429,616	313,325,531	52,850
Ohio	11,464,042	306,524,684	72,039
Michigan	10,120,860	276,558,314	57,497
Georgia	9,072,576	196,056,434	53,065
New Jersey	8,717,925	229,532,248	27,275
North Carolina	8,683,242	176,455,103	40,034
Virginia	7,567,465	198,669,724	48,775
Massachusetts	6,398,743	181,955,993	29,936
Washington	6,287,759	154,555,074	27,127
Indiana	6,271,973	158,616,976	33,362
Tennessee	5,962,959	128,130,720	33,290
Arizona	5,939,292	125,848,916	21,514
Missouri	5,800,310	138,784,665	32,318
Maryland	5,600,388	143,407,560	31,631
Wisconsin	5,536,201	144,984,708	33,220
Minnesota	5,132,799	125,082,935	27,081
Colorado	4,665,177	105,459,497	17,777
Alabama	4,557,808	107,780,897	28,187
Louisiana	4,523,628	122,715,167	40,204
South Carolina	4,255,083	102,585,344	25,065
Kentucky	4,173,405	112,126,768	25,992
Oregon	3,641,056	87,381,812	17,594
Oklahoma	3,547,884	78,325,513	26,627
Connecticut	3,510,297	92,711,858	11,412
Iowa	2,966,334	74,638,565	17,792
Mississippi	2,921,088	69,587,209	23,643
Arkansas	2,779,154	60,333,578	17,545
Kansas	2,744,687	77,782,511	20,545
Utah	2,469,585	60,112,806	12,807
Nevada	2,414,807	45,707,575	9,149
New Mexico	1,928,384	48,098,533	10,454
West Virginia	1,816,856	38,897,395	9,876
Nebraska	1,758,787	46,743,188	10,151
Idaho	1,429,096	31,656,945	7,056
Maine	1,321,505	31,720,272	5,708
New Hampshire	1,309,940	25,504,591	3,833
Hawaii	1,275,194	30,266,470	3,709
Rhode Island	1,076,189	34,281,120	6,277
Montana	935,670	21,986,702	4,099
Delaware	843,524	25,711,168	6,080
South Dakota	775,933	22,690,034	6,366
Alaska	663,661	18,824,979	2,299
North Dakota	636,677	24,115,043	5,132
Vermont	623,050	22,151,103	4,498
District of Columbia	550,521	12,755,465	6,150
Wyoming	509,294	18,553,890	3,349
TOTAL	296,410,404	$7,383,074,909	1,500,765

Source: See www.danter.com/taxcredit, Danter Company, 2007

Appendix F-1. Energy Efficiency Program Results: Southface EarthCraft Homes

Building Type—Retrofit			
Location	**Status**	**Energy Consumption Per Square Foot**	**Percentage Efficiency Gain**
City Line, Va.	Baseline	0.0691	
	Improved Envelope, 10 SEER AC, 6.8 HSPF	0.0492	28.80%
City Line, Va.	Baseline	0.0765	
	Improved Envelope, 10 SEER AC, 6.8 HSPF	0.0500	34.62%
Hibbens Ferry; Mt. Pleasant, S.C.	Baseline	0.0787	
	Improved Envelope, 12 SEER AC	0.0484	38.47%
Hibbens Ferry; Mt. Pleasant, S.C.	Baseline	0.0887	
	Improved Envelope, 12 SEER AC	0.0550	38.06%
Hillmeade, Tenn.	Baseline	0.0570	
	Improved Envelope, 13 SEER AC, 7.7 HSPF	0.0329	42.24%
Hillmeade, Tenn.	Baseline	0.0470	
	Improved Envelope, 13 SEER AC, 7.7 HSPF	0.0320	31.91%
Maple Bay; Virginia Beach, Va.	Baseline	0.0442	
	Improved Envelope, 10 SEER AC, 6.8 HSPF	0.0366	17.19%
Mariner's Cove; Virginia Beach, Va.	Baseline	0.0980	
	Improved Envelope, 13 SEER AC, 92 AFUE	0.0712	27.28%
Mariner's Cove; Virginia Beach, Va.	Baseline	0.1006	
	Improved Envelope, 13 SEER AC, 92 AFUE	0.0735	26.95%
Post Ridge, Tenn.	Baseline	0.0526	
	Improved Envelope, 13 SEER, 7.7 HSPF	0.0330	37.25%
Rivercrest; Dunwoody, Ga.	Baseline	0.0538	
	Improved Envelope, 10 SEER, 6.8 HSPF	0.0432	19.74%
Rivercrest; Dunwoody, Ga.	Baseline	0.0529	
	Improved Envelope, 10 SEER, 6.8 HSPF	0.0393	25.67%
Saddlebrook; Norcross, Ga.	Baseline	0.1138	
	Improved Envelope, 80 AFUE, 13 SEER	0.0531	53.35%
Saddlebrook; Norcross, Ga.	Baseline	0.1235	
	Improved Envelope, 80 AFUE, 13 SEER	0.0604	51.11%
Falls of Bells Ferry; Norcross, Ga.	Baseline	0.0659	
	Improved Envelope, 10 SEER	0.0491	25.47%
Falls of Bells Ferry; Norcross, Ga.	Baseline	0.0486	
	Improved Envelope, 10 SEER	0.0426	12.32%
The Woods at Overlook; Ga.	Baseline-with heat pump	0.0500	
	Improved Envelope, 13 SEER, 92 AFUE	0.0496	0.82%
The Woods at Overlook; Ga.	Baseline-with heat pump	0.0396	
	Improved Envelope, 13 SEER, 92 AFUE	0.0390	1.46%
Webb Bridge; Alpharetta, Ga.	Baseline	0.0498	
	Improved Envelope, 13 SEER, 8 HSPF	0.0400	19.61%
Woodshire; Atlanta, Ga.	Baseline	0.0914	
	Improved Envelope, 92 AFUE, 13 SEER	0.0685	25.08%
Woodshire; Atlanta, Ga.	Baseline	0.0871	
	Improved Envelope, 92 AFUE, 13 SEER	0.0653	25.00%
Atlanta, Ga.	Baseline	0.1352	
	Imp. Envelope, 12 SEER, 7.5 HSPF, inst. elec. hot water	0.0492	63.63%
Atlanta, Ga.	baseline	0.1322	
	Imp. Envelope, 12 SEER, 7.5 HSPF, inst. elec. hot water	0.0500	62.18%
Yorktown, Va.	Baseline	0.0668	
	Improved Envelope, 7.5 HSPF, 12 SEER	0.0484	27.50%
Yorktown, Va.	Baseline	0.0563	
	Improved Envelope, 7.5 HSPF, 12 SEER	0.0423	24.82%
Gainseville, Ga.	Baseline	0.0790	
	Improved Envelope, 92 AFUE, 13 SEER	0.0561	29.02%
Gainseville, Ga.	Baseline	0.0752	
	Improved Envelope, 92 AFUE, 13 SEER	0.0510	32.17%
Atlanta, Ga.	Baseline	0.0645	
	Improved Envelope, 7.8 HSPF, 14.6 SEER	0.0436	32.51%
Atlanta, Ga.	Baseline	0.0604	
	Improved Envelope, 7.8 HSPF, 14.6 SEER	0.0418	30.79%

Appendix F-1. Energy Efficiency Program Results: Southface EarthCraft Homes (continued)

Building Type—Retrofit			
Location	***Status***	***Energy Consumption Per Square Foot***	***Percentage Efficiency Gain***
Decatur, Ga.	Baseline	0.1047	
	Improved Envelope, 80 AFUE, 13 SEER	0.0643	38.61%
Decatur, Ga.	Baseline	0.0906	
	Improved Envelope, 80 AFUE, 13 SEER	0.0617	31.86%

Building Type—New Construction		
Location	***Status***	***Energy Consumption Per Square Foot***
Wytheville, Va.	Energy Star Qualified	0.0438
Atlanta, Ga.	Energy Star Qualified	0.0389
Atlanta, Ga.	Energy Star Qualified	0.0330
Milledgeville, Ga.	Energy Star Qualified	0.0401
Milledgeville, Ga.	Energy Star Qualified	0.0396
Athens, Ga.	Energy Star Qualified	0.0314
Athens, Ga.	Energy Star Qualified	0.0324
Chattanooga, Tenn.		0.0336
Chattanooga, Tenn.	Energy Star Qualified	0.0309
Chattanooga, Tenn.	Energy Star Qualified	0.0288
Atlanta, Ga.	Energy Star Qualified	0.0321
Atlanta, Ga.	Energy Star Qualified	0.0306
Atlanta, Ga.	Energy Star Qualified	0.0317
Atlanta, Ga.	Energy Star Qualified	0.0315
Atlanta, Ga.	Energy Star Qualified	0.0384
Atlanta, Ga.	Energy Star Qualified	0.0371
Marietta, Ga.	Energy Star Qualified	0.0360
Marietta, Ga.	Energy Star Qualified	0.0313

Source: Southface, 2007.

Appendix G-1. Estimated Funding for State Residential Energy Efficiency Programs ($ in thousands)

State	Federal	State Funds		Other Residential	Commercial/ Industrial/ Other	Total Federal + State
	WAP*	PBF	Utility			
Alabama	$3,555	$0	$0	$0	$0	$3,555
Alaska	2,334	0	0	0	0	2,334
Arizona	2,538	0	870	14,200	11,700	29,308
Arkansas	3,518	0	0	0	0	3,518
California	45,367	0	99,057	168,800	398,200	711,424
Colorado	11,684	0	2,700	5,100	10,100	29,584
Connecticut	2,759	5,100	0	13,400	36,800	58,059
Delaware	1,244	0	0	0	0	1,244
District of Columbia	1,507	3,500	0	0	0	5,007
Florida	5,610	0	0	47,400	41,700	94,710
Georgia	8,199	0	1,430	4,400	800	14,829
Hawaii	235	0	0	6,600	8,000	14,835
Idaho	4,312	0	2,225	1,600	7,400	15,537
Illinois	36,958	4,845	0	1,700	15,600	59,102
Indiana	11,144	0	567	1,800	500	14,011
Iowa	10,690	0	4,815	13,600	23,900	53,005
Kansas	6,846	0	0	0	0	6,846
Kentucky	8,696	0	361	400	300	9,757
Louisiana	4,220	0	883	0	0	5,102
Maine	8,914	1,700	0	1,600	8,000	20,214
Maryland	5,781	1,600	717	0	0	8,097
Massachusetts	15,386	21,215	0	33,900	72,100	142,601
Michigan	18,447	5,000	0	0	0	23,447
Minnesota	21,332	0	3,956	6,900	25,830	58,018
Mississippi	1,656	0	0	0	0	1,656
Missouri	8,368	0	500	900	1,700	11,468
Montana	4,229	1,274	0	1,850	7,800	15,154
Nebraska	7,149	0	0	0	0	7,149
Nevada	1,064	2,621	1,454	19,300	5,300	29,739
New Hampshire	2,343	953	0	5,814	9,900	19,011
New Jersey	10,874	13,671	0	42,900	34,400	101,845
New Mexico	2,708	0	0	0	500	3,208
New York	59,418	3,660	0	39,700	187,600	290,378
North Carolina	13,608	0	0	0	0	13,608
North Dakota	4,589	0	0	0	0	4,589
Ohio	36,744	6,977	780	0	2,900	47,401
Oklahoma	4,092	0	0	0	0	4,092
Oregon	6,451	8,900	0	11,100	27,100	53,551
Pennsylvania	43,093	20,646	0	0	0	63,739
Rhode Island	3,756	1,100	0	4,443	14,800	24,099
South Carolina	3,980	0	0	0	0	3,980
South Dakota	3,580	0	0	0	0	3,580
Tennessee	7,237	0	0	7,100	4,500	18,837
Texas	18,640	0	2,099	29,500	37,600	87,838
Utah	4,411	0	0	8,000	10,500	22,911
Vermont	1,354	2,100	49	5,200	8,800	17,503
Virginia	14,925	0	0	0	0	14,925
Washington	11,245	0	5,452	21,600	32,000	70,298
West Virginia	6,894	0	0	0	0	6,894
Wisconsin	23,907	41,485	0	15,100	22,500	102,992
Wyoming	2,951	0	0	0	0	2,951
Totals	$550,543	$146,347	$127,915	$533,907	$1,068,830	$2,427,542

Source: National Association of State Community Services Programs and Consortium for Energy Efficiency Survey
* Includes direct federal appropriations for the Weatherization Assistance Program (WAP) and state transfers of funds from the Low Income Home Energy Assistance Program.