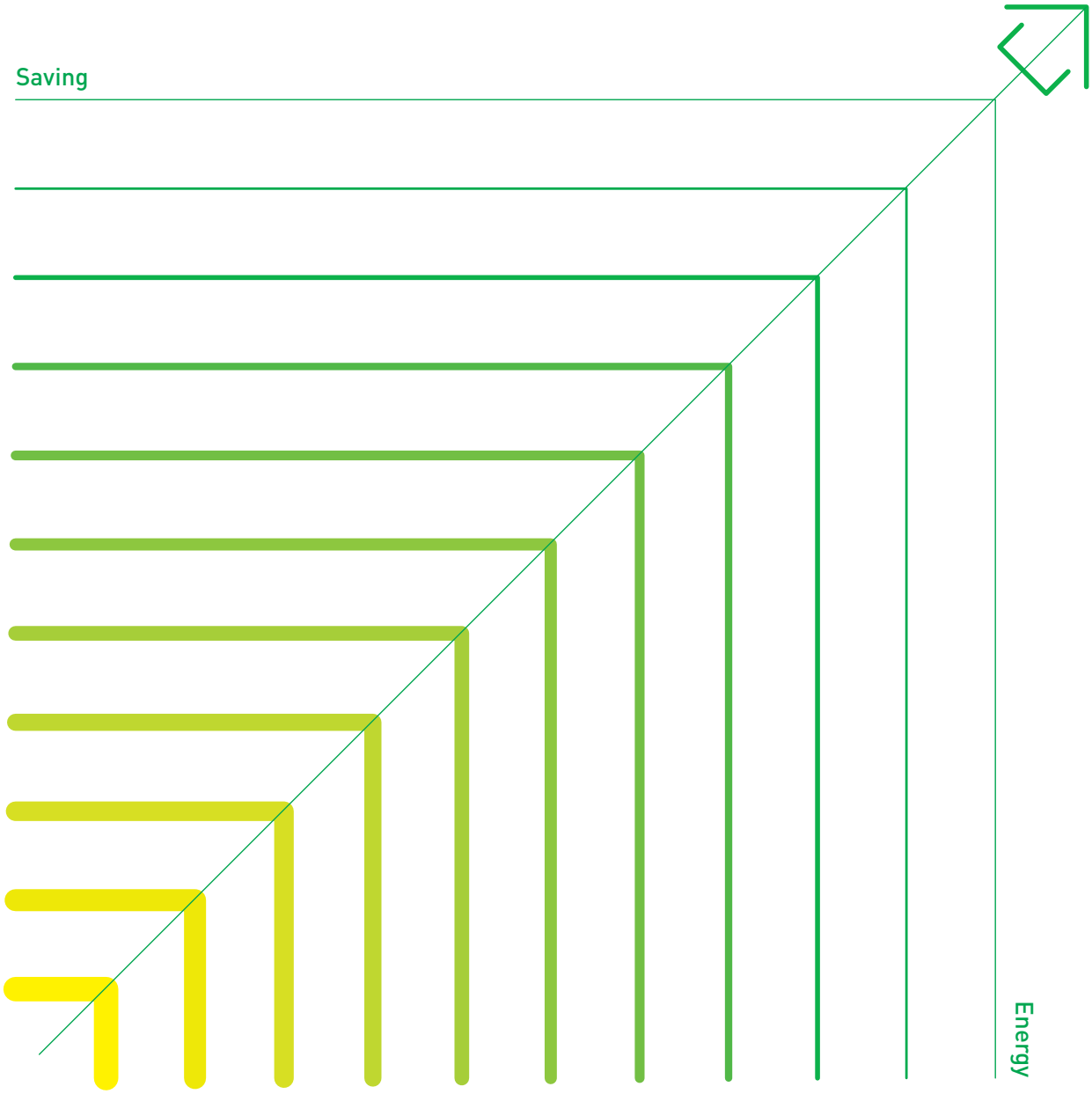
BRINGING RESIDENTIAL ENERGY EFFICIENCY TO SCALE

National Residential Energy Efficiency Program

August 21, 2009



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The Energy Programs Consortium (EPC) is a nonprofit energy research organization sponsored by the National Association of State Energy Officials, National Energy Assistance Directors' Association, National Association of State Regulatory Commissioners, and the National Association for State Community Services Programs.

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ACKNOWLEGEMENTS

Energy Programs Consortium would like to thank Mark Wolfe for directing the project and Jackie Berger, Director of Program Evaluation, Apprise, Inc. for developing the tables and underlying analysis of the report.

In addition, EPC would like to thank Robin LeBaron and Howard Banker, EPC senior staff for their contributions in developing the project methodology and text, Spencer Cowan, Senior Research Associate, Center for Urban and Regional Studies, University of North Carolina at Chapel Hill for his analysis of low income finances, Frank Zeman, Director, Center for Metropolitan Sustainability, New York Institute of Technology, for developing the estimates and value of carbon savings, Graham Schell, Sr. Business Analyst, Home Depot for providing product and installation representative pricing guidance and Jen Damiano for designing the report cover and layout, JoAnn Simony for editing the final document and Jenna Stokes for assisting in the coordination of the overall project.

EPC would also like to thank Sharon Alpert, Jeff Genzer, Dian Grueneich, Bill Prindle, George "Mac" McCarthy, Eddie Moses, Gil Sperling, Karen Villenueve and Tim Warfield for their thoughtful comments and advice in developing the report.

Lastly, EPC would like to thank the Ford Foundation and the US Department of Energy for their generous support in funding this report.

ABOUT THE ENERGY PROGRAMS CONSORTIUM

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

Other reports prepared by EPC in this series include:

- State Residential Energy Efficiency Loan Programs
- The New Energy Efficient Mortgage: An Innovative Financial Tool for Energy Efficiency
- State-Sponsored Energy Efficiency Grant, Loan and Tax Credit Programs
- Energy Efficiency in Multi-Family Housing: A Profile and Analysis.

Copies of these reports can be downloaded from the EPC website at: www.energyprograms.org

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INTRODUCTION

For more than thirty years, state energy officials have played a leading role in developing and implementing energy efficiency retrofit programs in residential buildings. The experience from these programs, such as the Weatherization Assistance Program for low-income families, is an important resource for the Obama administration and Congress as they seek cost-effective strategies to reduce carbon emissions.

Additional funding for state energy programs provided through the American Recovery and Reinvestment Act (ARRA) of 2009 should be the first step toward a comprehensive national residential building retrofit program that will not only curb greenhouse gases, but will also reduce dependence on foreign energy sources, reduce homeowners' energy costs, and create hundreds of thousands of new jobs.

This paper draws from the experience of the state programs to outline key considerations for a national residential energy efficiency retrofit program. Specifically, the paper:

1. Provides a comprehensive overview of energy consumption and expenditures within the residential housing sector, identifying important differences in consumption according to building age, homeowner tenure, and region.

2. Summarizes carbon emissions data and their potential value by housing sector and income group and energy savings.

3. Identifies financing tools to fund retrofit strategies and leverage government subsidies.

SUMMARY OF KEY FINDINGS

The implementation of comprehensive residential energy efficiency finance programs will require a working partnership between the states and the federal government. Many states are currently supporting residential energy efficiency finance programs. All of these programs could be expanded to reach national goals if adequate federal loan guarantees or other supports were made available.

The following is a summary of the key findings from this report:

Energy Efficiency Retrofits Pay for Themselves with Modest Federal Subsidies: The key conclusion of this report is that comprehensive energy efficiency retrofits can largely pay for themselves through energy savings and can provide a modest net benefit when combined with the projected value from the sale of the resulting carbon credits and a modest federal subsidy averaging $1,500 a unit.

Energy Efficiency Loans and Mortgages Leverage Private Capital: The leveraging potential of $1,500 per unit would enable the retrofitting of approximately 650,000 units for every $1 billion in appropriations made available. The subsidies would leverage 3.75 to 15 times their value in private capital to fund the national retrofit program, or approximately $5 billion for every $1 billion in federal funds. The program would need to be supported by a secondary market, which could be financed by government-issued bonds that would enable energy efficiency loans to be made at an interest rate of about 5 percent. For low-income families, we would recommend an additional guarantee—that in the event of extreme market conditions, they would be held harmless during periods when total savings were less than their actual energy bills.

Benefits to the Borrower Are Income Sensitive: The value of energy savings when applied to an energy loan would result in a net savings to the borrower as well as pay the full cost of the measures installed. For a low-income family, the annual energy savings in the first year would be $642 (including the value of carbon sales), resulting in a net savings of $124 a year under a fifteen-year loan and $180 a year under a thirty-year mortgage. For a middle-income family, the annual savings would be $56 for an energy efficiency loan and $262 for a mortgage loan. (*Note*: Under the mortgage scenario, a family that stays in their home for the full thirty-year term of the mortgage would likely need to replace some of the units purchased, because they would not last the full thirty years. This fact would not be a problem for most families, because the average home turns over about every seven years.)

Protections for Low-Income Households: The design of a national energy efficiency retrofit program must address several key issues. First among these is the situation of low-income households. As the body of this report demonstrates, low-income households (about 200 percent of the federal poverty level, or 60 percent of national median income) are an important part of the residential housing sector: they occupy 35 percent of the nation's housing units, and account for 31 percent of total national residential energy consumption. A large majority of these low-income households have overwhelmingly high housing costs – 29 percent spend more than 60 percent of their income on housing costs alone. These households cannot assume responsibility for any additional housing-related payments.

A Multi-Year Federal Commitment Would Be Required to Support the Program Effort: The federal government would need to make a long-term commitment to support a national residential energy efficiency retrofit program in order to convince the private sector to invest in providing retrofit services. One option to consider is a national public benefit fund charge similar to the charges now imposed in twenty-two states that support energy efficiency and renewable energy programs. A charge of 1 mill per kilowatt-hour (1/10 of one cent) across all uses of electricity, for example, would raise approximately $3 billion annually, enough financing to support the retrofitting of approximately 2 million homes annually.

Financing Mechanisms: States are reviewing other options, including supporting programs that finance the cost of the improvements as part of a homeowner's real estate tax assessment or as part of the homeowners' utility bill. The attraction of these programs is that they offer a simple, cost-effective way to collect the payments necessary to amortize the cost of the retrofit. They would not require loan-by-loan underwriting, and they would not require the borrower to qualify for the loan. Such programs would reduce transactional costs and provide an infrastructure that would allow a national program to come to scale. These options have been tried on a limited basis, and present a number of challenges. In the case of utility bill financing, some utilities have expressed concerns about taking on additional financial risk; in the case of residential tax financing, some jurisdictions have limited additional taxing authority and would be reluctant to take on additional responsibilities.

Ability to Pay for Residential Energy Efficiency Improvements: The ability of a building owner to undertake energy efficiency upgrades is related to factors such as whether the property is owner- or renter-occupied, residents' housing cost obligations, and the total debt that is secured by the building itself.

- *Home ownership*: Sixty-seven percent of households own their homes, and the remainder rent. Among all homeowners, 46 percent have a mortgage on their home, 21 percent own the home free and clear, 3 percent have a second mortgage, 9 percent have a home equity loan, and 1 percent have both.

- *Total housing cost burden:* Seventy-one percent of households have a total housing burden of 30 percent of their annual income or less.[1]

Low-Income Households (Income Below 200 Percent of Poverty, or 60 Percent of National Median Income): Low-income households require special consideration, as they differ from the broader population on several dimensions. However, they should be considered an integral part of the national strategy for the following reasons:

- *Size of the population:* Low-income households comprise 35 percent of the population and use 31 percent of the residential energy.

- *Energy intensity:* These households have the least energy-efficient homes. Their homes use an average of 68 thousand BTUs per square foot compared to 56 thousand BTUs per square foot for the average home.

- *Region*: More than 16 million households with income below 200 percent of poverty live in the Northeast or Midwest, where energy usage and energy expenditures are the highest. These households use an average of 103 million BTUs. Costs average more than $2,000 annually for these households in the Northeast, and more than $1,700 for these households in the Midwest.

[1] Housing cost burden includes mortgage payments, fire/hazard/flood insurance, property taxes, energy costs, water costs, and mobile home and condominium fees.

- *Manufactured homes*: Nearly 60 percent of the households who live in manufactured homes have income below 200 percent of poverty. These homes are very inefficient and present additional challenges for increasing energy efficiency.

- *Home ownership*: Lower income households are less likely to own their homes and less likely to have mortgages. Only 46 percent of households with income below 200 percent of poverty own their homes, compared to 67 percent of all households. Only 22 percent have mortgages, compared to 46 percent of all households. Fifty percent rent their homes, compared to 31 percent overall.

- *Ability to pay:* Lower income households have higher housing burdens than higher income households. While 29 percent of low-income households pay more than 60 percent of their income on housing costs, only 1 percent of high-income households have this great a housing cost burden. Households in this lowest income group have the greatest need for energy efficiency investments in their homes, but they are unlikely to be able to take on additional debt to finance this work without a guarantee that the savings will cover the additional debt burden.

- *Net worth:* Lower income households have lower net worth, and loans to pay for energy efficiency measures would place a greater burden on these households. For example, the median value of mortgages held by households in the bottom income quintile is $100,000. A $10,000 loan to finance energy efficiency would increase this debt by 10 percent. In contrast, households in the highest decile have a median mortgage value of $500,000, so a $10,000 increase in debt would be much less burdensome.

PART I ENERGY CONSUMPTION AND EXPENDITURES

Overview

As the Obama administration plans for a comprehensive national residential building retrofit program, it is critical to understand how residential energy usage and costs varies by region, level of urbanization, housing type, home ownership, and household income, because the level of energy usage will drive savings opportunities and the design of the program. This section of the report provides this critical background information.

This paper examines the number and percentage of households, energy usage in total, average usage per household, average usage per square foot of living space, and average household energy costs by the following variables.

- *Region*: The greatest energy usage and opportunities for usage reduction are found in the Northeast, followed by the Midwest. Energy usage and costs are lowest in the West.

- *Urbanization*: Homes in suburbs and towns use the most energy per home, but homes in cities and towns use the greatest energy per square foot.

- *Housing unit type*: Single-family homes use the most energy; however, apartments in buildings with 2–4 units use the most energy per square foot.

- *Housing unit type and home ownership*: Owner-occupied single-family homes and homes in small apartment buildings use less energy per household than rented units.

- *Year of construction*: Except for homes built in 2000 or later, which are likely to be larger, homes that were built in more recent years use less energy per household. However, the more recently a home was built, including these newest homes, the less energy the home uses per square foot of living space.

- *Main heating fuel*: The majority of homes use natural gas for heating. These homes use more than the average amount of energy, both on a per household and per square foot basis. Only 7 percent of homes use fuel oil for heating, but these homes use the most energy on a per household and on a per square foot basis.

- *End use*: The uses analyzed are space heating, air-conditioning, water heating, refrigerators, and other appliances. The most energy is used by space heating, followed by other appliances, and then water heating. In the country as a whole, air-conditioning only accounts for about 8 percent of energy usage.

- *Poverty level*: Households with income below 200 percent of poverty, or approximately 60 percent of national median income, comprise 35 percent of the population, and are eligible for services through the Weatherization Assistance Program. These households have the least efficient homes.

Region and Urbanization

Table I-1 displays how energy usage and energy costs vary by region. The table shows that per household energy usage and per square foot energy usage is greatest in the Northeast, followed by the Midwest. While the average energy usage per household is 95 million BTUs in the United States as a whole, the average energy usage per household is 122 million BTUs in the Northeast. Higher energy usage in the Northeast is related to the fact that homes in this region are older and less energy efficient, and that they are more likely to use fuel oil, a less efficient energy source. Likewise, average household energy costs are significantly higher in the Northeast than in the other regions of the country. Energy usage and costs are lowest in the West.

Table I-1
Households and Residential Energy Usage by Region

Region	Households		Residential Energy Usage			Average Energy Costs (2010)
	Number (Millions)	Percent	Total (Quadrillion BTU)	Per Household (Million BTU)	Per Square Foot (Thousand BTU)	
Northeast	20.6	19%	2.52	122.2	75.9	$2,533
Midwest	25.6	23%	2.91	113.5	59.6	$1,951
South	40.7	37%	3.25	79.9	46.7	$1,920
West	24.2	22%	1.87	77.4	49.9	$1,628
Total	111.1	100%	10.55	94.9	55.8	$1,977

Source: 2005 Residential Energy Consumption Survey (RECS). Energy costs data updated to 2010 based on Energy Information Administration (EIA) data and projections.

Table I-2 displays how energy usage varies by urban/rural location. The table shows that homes in suburbs and towns use the most energy per home, but homes in cities and towns use the greatest amount of energy per square foot.

Table I-2
Households and Residential Energy Usage by Urban/Rural Location

Urban/Rural	Households		Residential Energy Usage			Average Energy Costs (2010)
	Number (Millions)	Percent	Total (Quadrillion BTU)	Per Household (Million BTU)	Per Square Foot (Thousand BTU)	
City	47.1	42%	4.02	85.3	61.3	$1,746
Town	19.0	17%	1.94	102.3	58.3	$2,015
Suburbs	22.7	20%	2.46	108.6	48.0	$2,214
Rural	22.3	20%	2.13	95.2	49.9	$2,190
Total	111.1	100%	10.55	94.9	55.8	$1,977

Source: 2005 RECS. Energy costs data updated to 2010 based on EIA data and projections.

Housing Unit Type

Table I-3 displays how energy use varies by housing unit type. The table shows that single-family homes use the most energy. These homes average 108 million BTUs, compared to only 54 million BTUs for apartments in buildings with 5 or more units. However, apartments in buildings with 2–4 units use the most energy per square foot—99 thousand BTUs per square foot compared to 56 thousand BTUs in homes overall.[3]

Table I-3
Households and Residential Energy Use
by Housing Unit Type

Housing Unit Type	Households		Residential Energy Usage			Average Energy Costs (2010)
	Number (Millions)	Percent	Total (Quadrillion BTU)	Per Household (Million BTU)	Per Square Foot (Thousand BTU)	
Single-Family Detached	72.1	65%	7.81	108.4	45.6	$2,250
Single-Family Attached	7.6	7%	0.68	89.3	55.6	$1,745
Apartment in Building with 2–4 Units	7.8	7%	0.66	85.0	98.5	$1,699
Apartment in Building with 5 or More Units	16.7	15%	0.91	54.4	71.7	$1,176
Mobile Home	6.9	6%	0.49	70.4	75.8	$1,639
Total	111.1	100%	10.55	94.9	55.8	$1,977

Source: 2005 RECS. Energy costs data updated to 2010 based on EIA data and projections.

Table I-4 displays how residential energy usage varies both by housing unit type and by home ownership. Owned single-family homes and owned homes in small apartment buildings use less energy per household than rented ones. However, in all types of homes except 2–4 unit buildings, rented homes use more energy per square foot than owned homes. These homes are the most difficult to weatherize, as there are split incentives between the owners and the tenants.

[3] Smaller homes tend to use more energy per square foot due to their greater relative surface area. However, this variable is an indicator of the home's efficiency.

Table I-4
Households and Residential Energy Usage by Housing Unit Type and Home Ownership

Housing Unit Type	Owned/ Rented	Households		Residential Energy Usage			Average Energy Costs (2010)
		Number (Millions)	Percent	Total (Quadrillion BTU)	Per Household (Million BTU)	Per Square Foot (Thousand BTU)	
Single-Family Detached	Owned	64.1	58%	7.04	109.9	44.0	$2,283
	Rented	8.0	7%	0.77	96.5	57.9	$1,992
Single-Family Attached	Owned	4.2	4%	0.40	94.9	44.6	$1,837
	Rented	3.4	3%	0.28	82.6	68.9	$1,633
Apartment in Building with 2–4 Units	Owned	1.8	2%	0.20	110.5	110.5	$2,234
	Rented	5.9	5%	0.46	77.1	94.8	$1,533
Apartment in Building with 5 or More Units	Owned	2.3	2%	0.12	50.9	64.3	$1,153
	Rented	14.4	13%	0.79	55.0	72.9	$1,180
Mobile Home	Owned	5.7	5%	0.41	70.5	73.6	$1,654
	Rented	1.2	1%	0.08	70.0	86.5	$1,572
Total	Owned	78.1	70%	8.16	104.5	48.4	$2,178
	Rented	33.0	30%	2.39	72.4	73.3	$1,502
	Total	111.1	100%	10.55	94.9	55.8	$1,977

Source: 2005 RECS. Energy costs data updated to 2010 based on EIA data and projections.

Year of Construction

Table I-5 demonstrates the relationship between the year the home was built and the home's energy usage. Except for homes built in 2000 or later, which are likely to be larger, homes built in more recent years tend to use less energy per household. However, the table also shows that the more recently a home was built, including these newest homes, the less energy the home uses per square foot of living space.

Table I-5 Households and Residential Energy Usage by Year of Construction

Year of Construction	Households		Residential Energy Usage			Average Energy Costs (2010)
	Number (Millions)	Percent	Total (Quadrillion BTU)	Per Household (Million BTU)	Per Square Foot (Thousand BTU)	
Before 1940	14.7	13%	1.77	120.4	74.1	$2,236
1940–1959	19.9	18%	2.00	100.4	60.6	$1,950
1960–1979	31.4	28%	2.76	88.0	58.0	$1,855
1980–1999	35.9	32%	3.15	87.7	48.0	$1,957
2000 or Later	9.2	8%	0.87	94.7	39.0	$2,119
Total	111.1	100%	10.55	94.9	55.8	$1,977

Source: 2005 RECS. Energy costs data updated to 2010 based on EIA data and projections.

Main Heating Fuel And End Use

Table I-6 displays residential energy usage by type of main heating fuel. The majority of homes use natural gas for heating. These homes use more than the average amount of energy, both on a per household and per square foot basis. Only 7 percent of homes use fuel oil for heating, but these homes use the most energy on a per household and on a per square foot basis. While the average home uses 95 million BTUs, homes heated by fuel oil use an average of 144 million BTUs. These homes also have much higher than average energy costs, due to the high price of fuel oil and the higher energy usage.

Table I-6
Households and Residential Energy Usage
by Main Heating Fuel

Main Heating Fuel	Households		Residential Energy Usage			Average Energy Costs (2010)
	Number (Millions)	Percent	Total (Quadrillion BTU)	Per Household (Million BTU)	Per Square Foot (Thousand BTU)	
Natural Gas	58.4	53%	6.47	110.7	63.2	$2,002
Electricity	33.4	30%	2.01	60.1	39.7	$1,647
Fuel Oil	7.7	7%	1.11	143.9	77.9	$3,077
LPG	6.1	5%	0.65	107.2	59.7	$2,514
Kerosene	0.7	1%	0.04	55.3	47.2	$1,391
Other	3.5	3%	0.23	65.5	38.3	$1,763
No Fuel	1.3	1%	0.05	35.3	37.1	$1,190
Total	111.1	100%	10.55	94.9	55.8	$1,977

LPG = liquid petroleum gas.
Source: 2005 RECS. Energy costs data updated to 2010 based on EIA data and projections.

Table I-7 displays energy usage by end use—space heating, air-conditioning, water heating, refrigerators, and other appliances. The table shows that the most energy is used by space heating, followed by other appliances, and then water heating. In the country as a whole, air-conditioning only accounts for about 8 percent of energy usage.

Table I-7
Households and Residential Energy Usage
by End Use

End Use	Households		Residential Energy Usage			Average Energy Costs (2010)
	Number (Millions)	Percent	Total (Quadrillion BTU)*	Per Household (Million BTU)	Per Square Foot (Thousand BTU)	
Space Heating	107.4	97%	4.28	39.9	23.2	$555
Air-Conditioning	91.4	82%	0.88	9.6	4.6	$248
Water Heating	109.8	99%	2.11	19.2	11.3	$315
Refrigerators	111.0	100%	0.70	6.3	3.6	$200
Other Appliances and Lighting	111.1	100%	2.55	23.0	12.9	$656
Total	111.1	100%	10.55	94.9	55.8	$1,977

Source: 2005 RECS. Energy costs data updated to 2010 based on EIA data and projections.
*Usage does not sum to total because kerosene values are omitted from space heating, water heating, and appliances on the RECS public use file. If all kerosene usage is allocated to space heating, then total energy usage and average energy costs for space heating increase to 4.30 quadrillion BTUs and $558.

Poverty Level

Table I-8 displays energy usage by household poverty level. Households with income below 200 percent of poverty, or approximately 60 percent of national median income, comprise 35 percent of the population, and are eligible for services through the Weatherization Assistance Program. The data suggest that these households have the greatest opportunities for energy efficiency opportunities, with average energy usage per square foot equal to 68 thousand BTUs, compared to 56 thousand BTUs in the average home.

Table I-8
Households and Residential Energy Usage
by Poverty Level

Poverty Level	Households		Residential Energy Usage			Average Energy Costs (2010)
	Number (Millions)	Percent	Total (Quadrillion BTU)	Per Household (Million BTU)	Per Square Foot (Thousand BTU)	
≤200%	39.2	35%	3.22	82.2	67.8	$1,696
201–300%	21.2	19%	1.95	91.8	56.3	$1,874
301–400%	13.3	12%	1.30	97.5	51.1	$2,028
>400%	37.4	34%	4.08	109.2	44.6	$2,313
Total	111.1	100%	10.55	94.9	55.8	$1,977

Source: 2005 RECS. Energy costs data updated to 2010 based on EIA data and projections.

PART II HOUSING AND MORTGAGE DATA

Overview

Different possibilities for financing energy improvements have been discussed, including energy efficiency mortgages, subsidized loans, and on-bill financing. To understand the potential for these different options, it is important to understand the ownership and mortgage characteristics of U.S. households.

This section examines the number and percentage of households who own homes, who have mortgages, and who have second mortgages and/or home equity loans, overall and by poverty level.

- Almost half of all households own their homes with a mortgage or loan, about one-third rent their homes, and about 20 percent own their homes without a mortgage or loan.
- The lowest income households are less likely to have a mortgage and are more likely to rent their homes.
- Less than 15 percent have a home equity loan and/or a second mortgage. These households may be less willing to take on additional debt to finance energy efficiency improvements.
- Higher income households are much more likely to have a second mortgage or home equity loan.

We then examine total annual housing cost obligations, and what percentage of annual income those obligations represent, overall and by poverty level. Obligations include the mortgage payments, fire/hazard/flood insurance, property taxes, energy costs, water costs, and mobile home and condominium fees.

- The majority of households have housing obligations that are below 30 percent of their household income.
- Many lower income households have quite high annual housing costs.
- Lower income households have housing burdens that make up a greater percentage of their annual income.

We then examine family net worth and the value of the homes by income level.

- The data demonstrate vast differences in net worth between the bottom income quintile and the top income decile.
- The median value of homes for those in the top decile is 5 times the median value of those in the bottom quintile.

Housing Tenure

Table II-1 displays housing tenure. The table shows that the majority of households, 46 percent, own their homes with a mortgage or loan. About one-third rent their homes, and about 20 percent own their homes without a mortgage or loan.

Table II-1
Housing Tenure

Housing Tenure	Households	
	Number (Millions)	Percent
Owned with Mortgage or Loan	51.1	46%
Owned Free and Clear	23.9	21%
Rented for Cash Rent	34.3	31%
No Cash Rent	2.2	2%
Total	111.6	100%

Source: 2005–2007 ACS.

Table II-2 displays housing tenure by household poverty level. The table shows that the lowest income households are less likely to have a mortgage and are more likely to rent their homes. While 22 percent of households with income below 200 percent of poverty, or approximately 60 percent of national median income, have a mortgage or loan, 64 percent with income above 400 percent of poverty have a mortgage or loan.

Table II-2
Housing Tenure
by Poverty Level

Housing Tenure	≤200%		201–300%		301–400%		>400%	
	Number (Millions)	Percent	Number (Millions)	Percent	Number (Millions)	Percent	Number (Millions)	Percent
Owned with Mortgage or Loan	7.1	22%	7.2	39%	8.0	50%	28.9	64%
Owned Free and Clear	7.7	24%	4.6	25%	3.4	21%	8.2	18%
Rented for Cash Rent	16.3	50%	6.2	34%	4.3	27%	7.6	17%
No Cash Rent	1.2	4%	0.4	2%	0.2	2%	0.4	1%
Total	32.3	100%	18.4	100%	15.9	100%	45.1	100%

Source: 2005–2007 ACS.

Second Mortgages and Home Equity Loans

Table II-3 shows that 9 percent of households have a home equity loan, and 3 percent have a second mortgage. These households may be less willing to take on additional debt to finance energy efficiency improvements.

Table II-3
Second Mortgage or Home Equity Loan

Second Mortgage or Home Equity Loan	Households	
	Number (Millions)	Percent
Not Owned	36.5	33%
Second Mortgage	3.1	3%
Home Equity Loan	9.7	9%
Neither	37.7	34%
Both Second Mortgage and Home Equity Loan	0.6	1%
Owned without a Mortgage	23.9	21%
Total	111.6	100%

Source: 2005–2007 ACS.

Table II-4 shows that higher income households are much more likely to have a second mortgage or home equity loan. The table shows that 15 percent of households with income above 400 percent of poverty have a home equity loan and 4 percent have a second mortgage, compared to only 2 percent of households with income below 200 percent of poverty who have a home equity loan and 1 percent who have a second mortgage.

Table II-4
Second Mortgage or Home Equity Loan
by Poverty Level

Second Mortgage or Home Equity Loan	≤200%		201–300%		301–400%		>400%	
	Number (Millions)	Percent	Number (Millions)	Percent	Number (Millions)	Percent	Number (Millions)	Percent
Not Owned	17.5	54%	6.6	36%	4.5	28%	8.0	18%
Second Mortgage	0.4	1%	0.4	2%	0.5	3%	1.8	4%
Home Equity Loan	0.7	2%	1.0	5%	1.3	8%	6.7	15%
Neither	6.0	18%	5.8	31%	6.0	38%	19.9	44%
Both Second Mortgage and Home Equity Loan	0.1	<1%	0.1	<1%	0.1	1%	0.3	1%
Owned without a Mortgage	7.7	24%	4.6	25%	3.4	21%	8.2	18%
Total	32.3	100%	18.4	100%	15.9	100%	45.1	100%

Source: 2005–2007 ACS.

Housing Cost Obligations

Table II-5 displays total annual housing cost obligations for homeowners. These obligations include the mortgage payments, fire/hazard/flood insurance, property taxes, energy costs, water costs, and mobile home and condominium fees. The table shows that 17 percent have total obligations below $5,000 and 5 percent have total obligations exceeding $40,000 annually.

Table II-5 Total Annual Housing Cost Obligations of Homeowners

Total Annual Housing Cost Obligations*	Households	
	Number (Millions)	Percent
≤$5,000	13.0	17%
$5,001–$10,000	15.9	21%
$10,001–$20,000	25.4	34%
$20,001–$30,000	12.3	16%
$30,001–$40,000	4.8	6%
$40,001–$50,000	1.9	3%
>$50,000	1.7	2%
Total	75.1	100%

*Includes mortgage payment, fire/hazard/flood insurance, property taxes, second mortgage payment, energy costs, water costs, and mobile home and condominium fees.
Source: 2005–2007 ACS.

Table II-6 displays total annual housing cost obligations for homeowners by poverty level. The table shows that many lower income households have high annual housing costs. Twenty-nine percent of households with income below 200 percent of poverty have annual housing costs that are between $5,000 and $10,000, 25 percent have costs that are between $10,000 and $20,000, and 10 percent have costs that are above $20,000.

Table II-6 Total Annual Housing Cost Obligations of Homeowners by Poverty Level

Total Annual Housing Cost Obligations*	≤200%		201–300%		301–400%		>400%	
	Number (Millions)	Percent	Number (Millions)	Percent	Number (Millions)	Percent	Number (Millions)	Percent
≤$5,000	5.4	36%	2.8	24%	1.8	16%	3.1	8%
$5,001–$10,000	4.3	29%	3.2	27%	2.6	23%	5.7	16%
$10,001–$20,000	3.7	25%	4.1	35%	4.6	40%	13.0	35%
$20,001–$30,000	0.9	6%	1.2	10%	1.6	14%	8.5	23%
$30,001–$40,000	0.3	2%	0.3	3%	0.5	4%	3.8	10%
$40,001–$50,000	0.1	1%	0.1	1%	0.1	1%	1.6	4%
>$50,000	0.1	1%	0.1	1%	0.1	1%	1.5	4%
Total	14.8	100%	11.8	100%	11.4	100%	37.1	100%

*Includes mortgage payment, fire/hazard/flood insurance, property taxes, second mortgage payment, energy costs, water costs, and mobile home and condominium fees. Source: 2005–2007 ACS.

Table II-7 displays total annual housing cost obligations as a percentage of household income. The table shows that the majority of households have housing obligations that are below 30 percent of their household income. Only 17 percent have obligations that are above 40 percent of income. This suggests that many households may have the ability to take on additional debt to make energy efficiency improvements to their homes.

Table II-7
Total Annual Housing Cost Obligations of Homeowners as a Percentage of Household Income

Total Annual Housing Cost Obligations*	Households	
	Number (Millions)	Percent
≤10%	13.4	18%
11–20%	22.5	30%
21–30%	17.3	23%
31–40%	9.0	12%
41–50%	4.5	6%
51–60%	2.5	3%
>60%	6.0	8%
Total	75.1	100%

*Includes mortgage payment, fire/hazard/flood insurance, property taxes, second mortgage payment, energy costs, and water costs, and mobile home and condominium fees.
Source: 2005–2007 ACS.

Table II-8 displays total annual housing cost obligations as a percentage of income by household poverty level. The table shows that higher income households have lower housing burdens. While 25 percent of households with income above 400 percent of poverty have housing burdens below 10 percent of income, only 7 percent of households with income below 200 percent of poverty have such low housing burdens. While 29 percent of households with income below 200 percent of poverty have housing burdens that are greater than 60 percent of income, only 1 percent of households with income above 400 percent of poverty have such great housing burdens. Therefore, the lowest income group may have difficulty taking on additional debt to finance energy efficiency.

Table II-8
Total Annual Housing Cost Obligations of Homeowners as a Percentage of Household Income by Poverty Level

Total Annual Housing Cost Obligations*	≤200%		201–300%		301–400%		>400%	
	Number (Millions)	Percent	Number (Millions)	Percent	Number (Millions)	Percent	Number (Millions)	Percent
≤10%	1.0	7%	1.3	11%	1.8	16%	9.3	25%
11–20%	2.4	15%	3.2	27%	3.3	29%	13.7	37%
21–30%	2.5	17%	2.8	24%	3.0	27%	9.0	24%
31–40%	2.1	14%	1.9	16%	1.7	15%	3.2	9%
41–50%	1.6	10%	1.1	9%	0.8	7%	1.1	3%
51–60%	1.1	8%	0.6	5.0%	0.3	3%	0.4	1%
>60%	4.4	29%	0.9	8%	0.4	3%	0.3	1%
Total	14.8	100%	11.8	100%	11.4	100%	37.1	100%

*Includes mortgage payment, fire/hazard/flood insurance, property taxes, second mortgage payment, energy costs, and water costs, and mobile home and condominium fees.
Source: 2005–2007 ACS.

Table II-9 displays housing burden according to whether the homeowner has a mortgage. The majority of homeowners with mortgages have housing burdens above 20 percent, and almost three-quarters of homeowners who do not have mortgages have housing burdens below 20 percent.

Table II-9
Total Annual Housing Cost Obligations of Homeowners as a Percentage of Household Income

Total Annual Housing Cost Obligations*	Owned with Mortgage or Loan		Owned Free and Clear	
	Number (Millions)	Percent	Number (Millions)	Percent
≤10%	3.2	6%	10.2	43%
11–20%	15.2	30%	7.3	30%
21–30%	14.4	28%	2.9	12%
31–40%	7.6	15%	1.4	6%
41–50%	3.8	7%	0.7	3%
51–60%	2.0	4%	0.4	2%
>60%	4.9	10%	1.1	4%
Total	51.1	100%	23.9	100%

*Includes mortgage payment, fire/hazard/flood insurance, property taxes, second mortgage payment, energy costs, and water costs, and mobile home and condominium fees.
Source: 2005–2007 ACS.

Net Worth And Mortgage Holdings

Data on family net worth can also provide important information on the ability of households to take on additional debt. Table II-10 displays family net worth by household income percentile. The table shows that households in the bottom income quintile have a mean net worth of about $8,000 and households in the top decile have a mean net worth of approximately $1 million.

Table II-10
Family Net Worth
by Household Income Percentile

Household Income Percentile	Family Net Worth (Thousands of 2007 Dollars)	
	Mean	Median
<20	8.1	105.2
20–39.9	37.9	134.9
40–59.9	88.1	209.9
60–79.9	204.9	375.1
80–89.9	356.2	606.3
90–100	1,119.0	3306.0
Total	120.3	556.3

Source: Federal Reserve Board, Survey of Consumer Finances, 2007.

Table II-11 displays mortgage holdings. The table shows that 41 percent in the bottom quintile have mortgages on their primary residence and the median value of the home is $100,000. Almost 95 percent of families in the top decile hold mortgages on their primary residence, and the median value of the home is $500,000.

Table II-11
Family Holdings of Nonfinancial Assets–Primary Residence
by Household Income Percentile

Household Income Percentile	Family Holdings of Nonfinancial Assets–Primary Residence	
	Percentage Holding Asset	Median Value (Thousands of 2007 Dollars)
<20	41.4%	100.0
20–39.9	55.2%	120.0
40–59.9	69.3%	150.0
60–79.9	83.9%	215.0
80–89.9	92.6%	300.0
90–100	94.3%	500.0
Total	68.6%	200.0

Source: Federal Reserve Board, Survey of Consumer Finances, 2007.

Low-Income Households

Households with income at or below 200 percent of poverty, or approximately 60 percent of national median income, require special consideration, as they vary from the broader population on several dimensions. These poorest households have a higher need for energy efficiency because they live in older, less efficient homes and do not have the resources to pay for these higher energy costs. They also have the least ability to pay for efficiency improvements because of their lower income and net worth.

Households with income at or below 200 percent of poverty comprise 35 percent of the population and use 31 percent of the residential energy. They use a lower percentage of energy because they tend to live in smaller homes. The average household in this group uses 82 million BTUs, compared to 95 million BTUs for the average household in the United States. However, these households have the least energy-efficient homes. Their homes use an average of 68 thousand BTUs per square foot compared to 56 thousand BTUs per square foot for the average home. While their energy costs are lower than average, these costs comprise a greater percentage of their household income.

More than 16 million households with income below 200 percent of poverty live in the Northeast or Midwest, where energy usage and energy expenditures are the highest. These households use an average of 103 million BTUs. Costs average over $2,000 for these households in the Northeast and over $1,700 in the Midwest. Nearly 60 percent of the households who live in manufactured homes have income below 200 percent of poverty. These homes are very inefficient and present additional challenges for increasing energy efficiency.

Lower income households are less likely to own their homes and less likely to have mortgages. Only 46 percent of households with income below 200 percent of poverty own their homes, compared to 67 percent of all households. Only 22 percent have mortgages, compared to 46 percent of all households. Fifty percent rent their homes, compared to 31 percent overall.

Households with income below 200 percent of poverty have greater housing burdens. While only 7 percent of these households have burdens that are less than or equal to 10 percent of their annual incomes, 29 percent have burdens that are greater than 60 percent of their annual income. This does not leave room for these households to take on additional debt to finance energy efficiency.

Lower income households have lower net worth, and loans to pay for energy efficiency measures would place a greater burden them. For example, the median value of mortgages held by households in the bottom income quintile is $100,000. A $10,000 loan to finance energy efficiency would increase this debt by 10 percent. The highest decile has a median mortgage value of $500,000, so a $10,000 increase in debt is much less significant.

While households in this lowest income group have the greatest need for energy efficiency investments in their homes, they are unlikely to be able to take on additional debt to finance this work without subsidized loans or guaranteed savings from a sponsoring agency.

PART III INVESTMENT LEVELS

Overview

This section provides an analysis of cost-effective investment levels that can be achieved through energy savings and reduced carbon emissions given different assumptions about energy costs and potential energy savings.

- The maximum amounts that could be cost-effectively invested given different assumptions about potential savings are calculated. Household energy costs, energy cost inflation, the measure life, and the discount rate are factored in to calculate the present discounted value of energy savings. As energy costs increase and as potential savings increase, the maximum cost-effective investment increases.

- The relationship between maximum cost-effective investment levels and poverty status and region are explored.

- The value of reduced carbon emissions, given the current Regional Greenhouse Gas Initiative (RGGI) price of carbon and the Congressional Budget Office (CBO)–forecasted price of carbon given assumptions of developing carbon markets in the United States, are calculated.

- Carbon values vary based not only on the potential energy savings but on the mix of fuels used in the region to produce electricity and the various carbon intensities of those fuels. While energy usage is higher in the Northeast than in the Midwest, carbon values are greater in the Midwest because the older coal-fired plants in this region have a higher emissions factor.

- Taking account of the value of carbon significantly increases the maximum investment that could be cost-effectively spent on energy efficiency.

- Payback time is calculated for an investment in energy efficiency given different energy costs and assumptions about potential energy and carbon savings. Subsidies can be used to reduce the time needed to recoup the investment and to provide a cushion for the uncertainty inherent in the many assumptions that must be made to implement these calculations.

Maximum Cost-Effective Investment Levels

Under retrofit programs such as the Home Performance with ENERGY STAR Program, measures and expenditures in a home are determined after a home energy audit is conducted. The auditor conducts diagnostic testing to determine the home's air leakage, measure insulation levels, and assess the energy consumption of various appliances in the home. Based on these data, and knowledge about the prices of replacement materials and labor, the auditor recommends a set of measures that would be cost-effective over the lifetime of the measures, often assumed to be about fifteen years for many common measures.

However, when designing a program and investigating possible investment levels, other analytic tools can be used to estimate average energy expenditures and develop an understanding of the magnitude of program investment levels that can be cost effective. These investment levels depend on the following variables.

- *Household energy costs*: Potential energy savings are driven by energy expenditures. To understand what the potential savings are, we need to have an understanding of energy expenditures. These expenditures depend on the home's energy efficiency and on energy prices.

- *Energy cost inflation*: Energy efficiency investments result in a stream of savings over the lifetime of the measures. Therefore, it is necessary to estimate the change in energy prices over this period to accurately estimate the stream of future benefits that result from home energy efficiency improvements.

- *Potential energy savings*: The cost-effectiveness of a set of efficiency measures depends on the energy savings that can be achieved from that set of measures.

- *Measure life*: The total savings from the efficiency investment depends on the number of years that the measures will last and that the household will continue to accrue savings.

- *Discount rate*: Future energy savings must be discounted when calculating the present value of the stream of savings. Future benefits must be discounted to account for the fact that benefits received in the future are not worth the same as benefits received today, due to the interest that is not received.

Realistic values of all of these variables can be estimated based on various available data sources. Current energy costs are best estimated using the 2005 Residential Energy Consumption Survey data,[4] as shown in the previous sections of this report. These data provide a good source of energy costs, as they are collected from the energy bills of households nationwide. These energy costs must be updated to the present time and to the next fifteen years. The energy cost inflation is estimated based on Energy Information Administration forecasts.[5] Three scenarios for potential energy savings—25, 30, and 40 percent—are explored. Actual savings will depend on

[4] Data available at http://www.eia.doe.gov/emeu/recs/.
[5] Forecasts available at http://www.eia.doe.gov/oiaf/aeo/index.html.

region, age of home, and type of home. A measure life of fifteen years and a discount rate of 5 percent, based on current interest rates, are included in the calculations.

Chart III-1 provides an illustration of estimated energy costs, savings, and discounted savings over a fifteen-year measure lifetime. The chart shows how energy costs and savings, calculated at 30 percent, increase over the fifteen years. The savings are discounted by 5 percent each year to account for the cost of capital. The sum of the discounted savings over the fifteen years is the net present value of the energy savings.

Chart III-1
Energy Costs and Savings
over Fifteen-Year Measure Lifetime
for Single Family Homes and
Households with Income at or below 200 Percent of Poverty

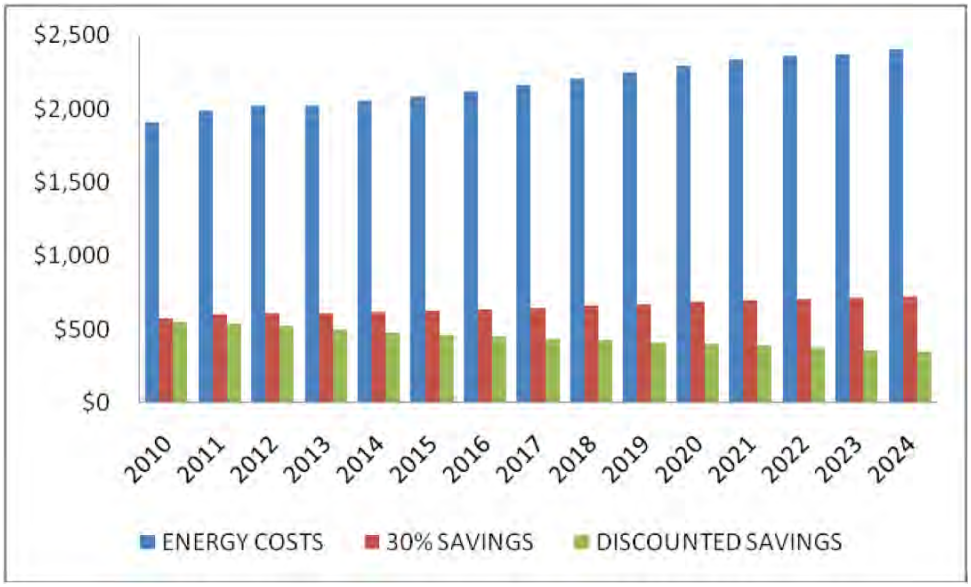

Table III-1 displays energy costs and the present discounted value of energy savings for single-family homes under three different savings scenarios—25, 30, and 40 percent. This table shows the maximum investment in energy efficiency that could be cost-effective given different energy savings. For example, the table shows that if 40 percent energy savings could be achieved, then $8,882 could be cost-effectively invested for households with income at or below 200 percent of the poverty level, or approximately 60 percent of national median income. As energy costs increase and as potential savings increase, the maximum cost-effective investment increases.

Table III-1
Maximum Cost-Effective Investment Calculations for Single-Family Attached and Detached Homes by Poverty Level

	Poverty Level			
	≤200%	201–300%	301–400%	>400%
2005 Energy Costs	$1,750	$1,894	$1,987	$2,271
2010 Energy Costs	$1,911	$2,069	$2,170	$2,480
25% Savings PDV	$5,551	$6,008	$6,303	$7,204
30% Savings PDV	$6,661	$7,209	$7,563	$8,644
40% Savings PDV	$8,882	$9,613	$10,085	$11,526

PDV = present discounted value.
Note: A fifteen-year measure life and 5 percent discount rate is assumed.

Table III-2 displays the same statistics by poverty level and region. This table illustrates how potential investment levels will vary based on costs and potential savings. For example, households with income at or below 200 percent of poverty in the West have average 2010 energy costs of $1,579, and assuming a 25 percent savings potential, the maximum cost-effective investment would be $4,587. However, households with income above 400 percent of poverty in the Northeast have average 2010 energy costs of $3,283. Assuming a potential savings of 40 percent, the maximum cost-effective investment level for these homes would be $15,256.

Table III-2
Maximum Cost-Effective Investment Calculations for Single-Family Attached and Detached Homes by Poverty Level and Region

	Poverty Level			
	≤200%	201–300%	301–400%	>400%
Northeast				
2005 Energy Costs	$2,173	$2,513	$2,460	$3,006
2010 Energy Costs	$2,373	$2,745	$2,687	$3,283
25% Savings PDV	$6,893	$7,971	$7,803	$9,535
30% Savings PDV	$8,271	$9,566	$9,364	$11,442
40% Savings PDV	$11,028	$12,754	$12,485	$15,256
Midwest				
2005 Energy Costs	$1,772	$1,845	$1,907	$2,144
2010 Energy Costs	$1,935	$2,015	$2,083	$2,342
25% Savings PDV	$5,621	$5,852	$6,049	$6,801
30% Savings PDV	$6,745	$7,023	$7,259	$8,161
40% Savings PDV	$8,993	$9,364	$9,678	$10,881

	Poverty Level			
	≤200%	201–300%	301–400%	>400%
South				
2005 Energy Costs	$1,698	$1,855	$1,956	$2,228
2010 Energy Costs	$1,855	$2,026	$2,136	$2,433
25% Savings PDV	$5,386	$5,884	$6,204	$7,067
30% Savings PDV	$6,463	$7,061	$7,445	$8,481
40% Savings PDV	$8,618	$9,415	$9,927	$11,308
West				
2005 Energy Costs	$1,446	$1,550	$1,706	$1,923
2010 Energy Costs	$1,579	$1,693	$1,863	$2,100
25% Savings PDV	$4,587	$4,917	$5,411	$6,100
30% Savings PDV	$5,504	$5,900	$6,494	$7,320
40% Savings PDV	$7,339	$7,867	$8,658	$9,760

PDV = present discounted value. Note: A fifteen-year measure life and 5 percent discount rate is assumed.

Carbon Values

Reduced carbon emissions is another benefit of increased energy efficiency. The value of these benefits can be calculated based on the carbon price. Currently, the RGGI auction price is $3.23 per ton of CO_2. However, assuming the introduction of some type of cap and trade system or carbon trading in the United States, CBO is forecasting a carbon price of $15 in 2011 and $26 in 2019. We conduct the analysis with both the current RGGI price and an average price of $20, based on CBO projections. While we could inflate the prices over time, we use these two constant prices for the tables below as an initial estimate of the value of carbon savings.

Table III-3 shows estimates of the present discounted value of carbon over the fifteen-year measure life under the two carbon prices and three assumptions about potential energy savings. The table shows that with carbon prices at $3.23 and a 25 percent energy savings, the present discounted value of carbon over the fifteen years is $114 for households with income at or below 200 percent of poverty. However, with carbon prices at $20, for the same group of households and the same level of energy savings, the present discounted value of the carbon is $704, significantly increasing the potential value of an energy efficiency investment.

Table III-3 Present Discounted Value of Carbon for Single-Family Attached and Detached Homes by Poverty Level

Energy Savings	Carbon Price (per ton CO_2)	Poverty Level			
		≤200%	201–300%	301–400%	>400%
25%	**$3.23**	$114	$123	$126	$141
	$20.00	$704	$761	$779	$875
30%	**$3.23**	$136	$147	$151	$170
	$20.00	$845	$913	$934	$1,050
40%	**$3.23**	$182	$197	$201	$226
	$20.00	$1,126	$1,217	$1,246	$1,399

Note: A fifteen-year measure life and 5 percent discount rate is assumed.

Chart III-2 shows how adding the carbon savings increases the value of the energy efficiency work. The chart shows the value of carbon savings over the fifteen-year life of the measure, assuming 30 percent savings and $20 per ton of CO_2 for households with income at or below 200 percent of the poverty level.

Chart III-2
Energy and Carbon Savings
over Fifteen-Year Measure Lifetime
for Single-Family Homes and
Households with Income at or below 200 Percent of Poverty

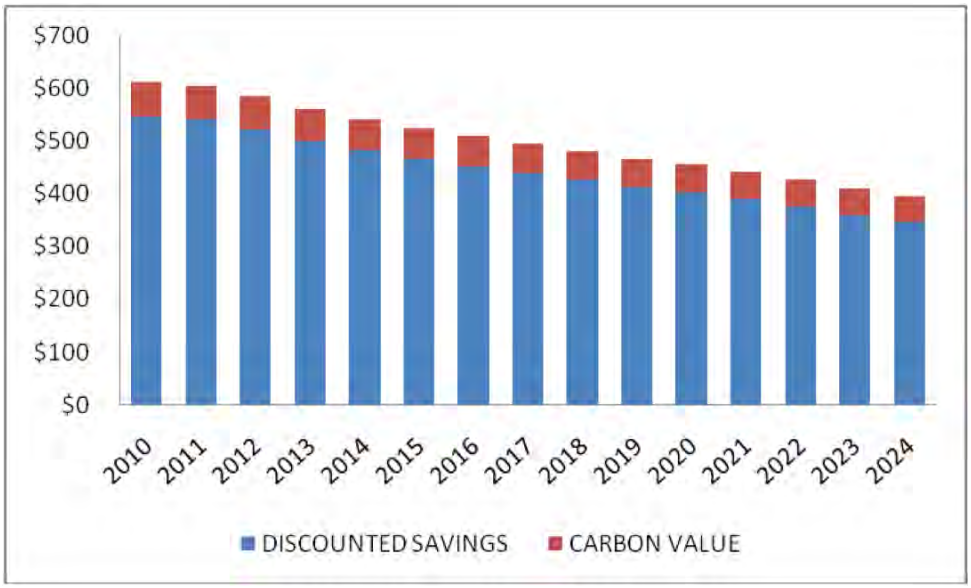

Table III-5 sums the energy savings benefits and the carbon benefit based on assumptions of 30 percent energy savings and a carbon value of $20 per ton. The table shows how taking account of the value of carbon significantly increases the maximum investment that could be cost-effectively spent on energy efficiency. For example, for households with income below 200 percent of poverty in the Midwest, taking account of the carbon value increases the potential investment from $6,745 to $7,802.

Table III-5
Potential Energy Savings and Carbon Value
for Single-Family Attached and Detached Homes
by Poverty Level and Region

	Poverty Level			
	≤200%	201–300%	301–400%	>400%
Northeast				
30% Savings PDV	$8,271	$9,566	$9,364	$11,442
Carbon Value at $20/ton	$734	$868	$810	$970
Total Investment Maximum	$9,005	$10,434	$10,174	$12,412
Midwest				
30% Savings PDV	$6,745	$7,023	$7,259	$8,161
Carbon Value at $20/ton	$1,057	$1,087	$1,101	$1,219
Total Investment Maximum	$7,802	$8,110	$8,360	$9,380
South				
30% Savings PDV	$6,463	$7,061	$7,445	$8,481
Carbon Value at $20/ton	$918	$1,017	$1,035	$1,205
Total Investment Maximum	$7,381	$8,078	$8,480	$9,686
West				
30% Savings PDV	$5,504	$5,900	$6,494	$7,320
Carbon Value at $20/ton	$584	$588	$642	$697
Total Investment Maximum	$6,088	$6,488	$7,136	$8,017

PDV = present discounted value.
Note: A fifteen-year measure life and 5 percent discount rate is assumed.

Payback Analysis

The tables and charts above demonstrated how energy and carbon savings accrue over the fifteen-year measure life and how the level of cost-effective investment relates to energy usage, energy prices, potential savings, and carbon prices. It is also useful to examine how quickly energy investments could be paid back, given different assumptions about energy costs and potential savings.

Chart III-3 displays an example of how long it would take to achieve complete payback on a $7,500 investment for different poverty levels. We assume that the investment is financed by a $7,500 loan with a 5 percent interest rate. The total loan payments over the fifteen years are $10,676, the breakeven point. The data are shown in Table III-6.

The chart and table show that, with 30 percent savings, the $7,500 investment is just cost-effective after fourteen years for households with income below 200 percent of poverty. However, there is little net benefit for these households, as their total savings from the

improvements are $11,020 compared to the $10,676 investment. A government subsidy would provide greater incentive for these households to take on the risk of this investment.

The higher-poverty-level households have greater energy costs and greater energy savings. The cost is paid back after thirteen years for households with income between 201 and 300 percent of poverty and 301 and 400 percent of poverty, and after twelve years for households with income above 400 percent of poverty.

Chart III-3
Energy and Carbon Savings Payback from $7,500 Investment over Fifteen-Year Measure Lifetime for Single-Family Homes by Poverty Level

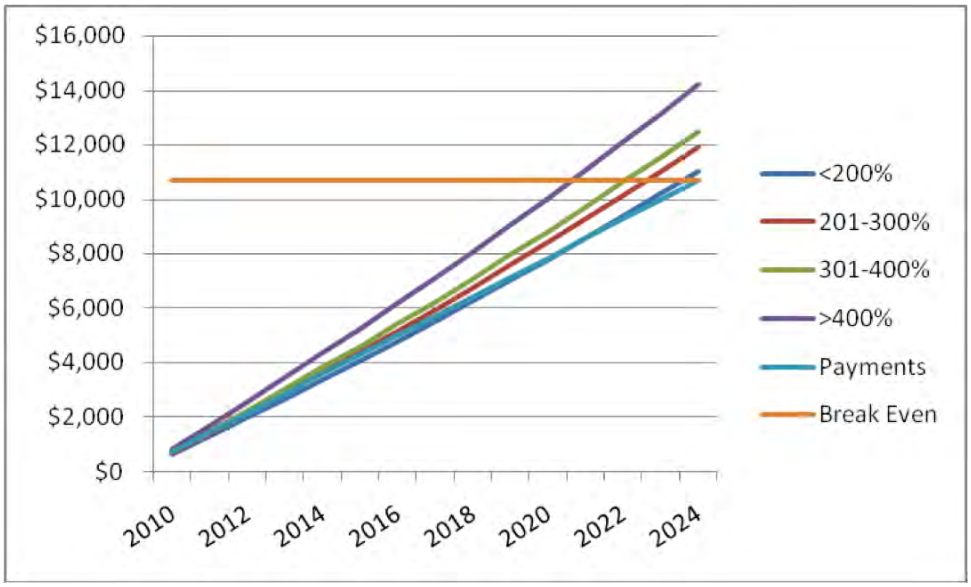

Table III-6
Cumulative Savings by Poverty Level (Breakeven Point Highlighted)

	Cumulative Savings by Poverty Level				Cumulative Payments
	<200%	201–300%	301–400%	>400%	
2010	$642	$695	$727	$829	$712
2011	$1,309	$1,417	$1,482	$1,691	$1,423
2012	$1,987	$2,150	$2,250	$2,567	$2,135
2013	$2,668	$2,887	$3,021	$3,447	$2,847
2014	$3,361	$3,637	$3,805	$4,341	$3,559
2015	$4,063	$4,396	$4,600	$5,248	$4,270

	Cumulative Savings by Poverty Level				Cumulative Payments
	<200%	201–300%	301–400%	>400%	
2016	$4,779	$5,172	$5,411	$6,173	$4,982
2017	$5,510	$5,962	$6,238	$7,117	$5,694
2018	$6,256	$6,770	$7,083	$8,080	$6,405
2019	$7,017	$7,593	$7,944	$9,063	$7,117
2020	$7,795	$8,435	$8,825	$10,068	$7,829
2021	$8,586	$9,292	$9,721	$11,090	$8,541
2022	$9,390	$10,161	$10,630	$12,127	$9,252
2023	$10,199	$11,037	$11,546	$13,172	$9,964
2024	$11,020	$11,925	$12,475	$14,231	$10,676

Chart III-4 shows how the payback varies with different assumptions about savings. Table III-6 shows that households with income above 400 percent of poverty recoup their investment after thirteen years if they achieve 25 percent savings, after twelve years if they achieve 30 percent savings, and after nine years if they achieve 40 percent savings. Table III-7 displays the data contained in the chart.

Chart III-4
Energy and Carbon Savings Payback from $7,500 Investment Over Fifteen-Year Measure Lifetime for Single-Family Homes and Households with Income above 400 Percent of Poverty by Savings Percentage

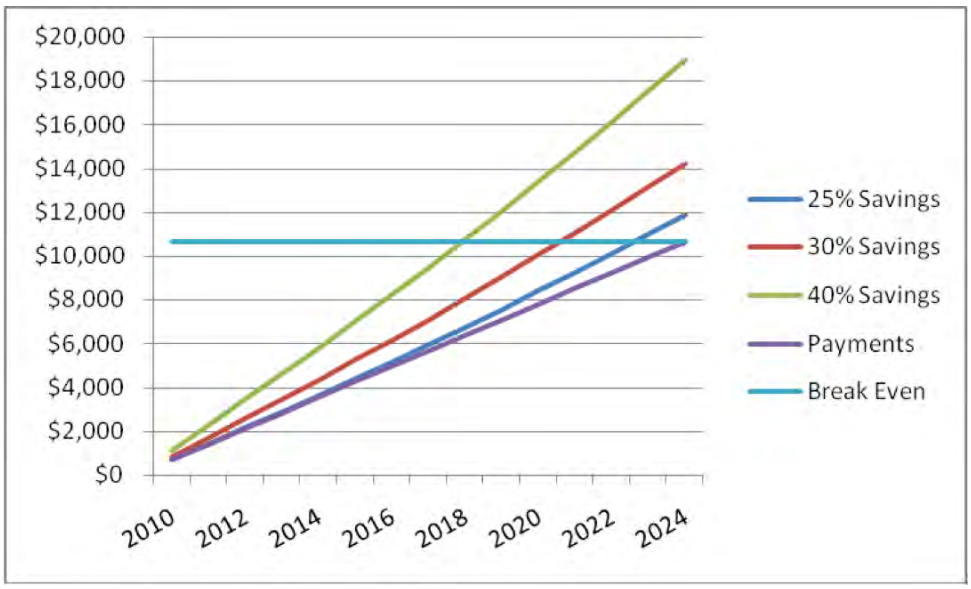

Table III-7
Cumulative Savings
by Savings Percentage
(Breakeven Point Highlighted)

	Cumulative Savings by Savings Percentage			Cumulative Payments
	25%	30%	40%	
2010	$691	$829	$1,106	$712
2011	$1,409	$1,691	$2,255	$1,423
2012	$2,139	$2,567	$3,423	$2,135
2013	$2,872	$3,447	$4,596	$2,847
2014	$3,618	$4,341	$5,788	$3,559
2015	$4,373	$5,248	$6,997	$4,270
2016	$5,144	$6,173	$8,231	$4,982
2017	$5,931	$7,117	$9,489	$5,694
2018	$6,734	$8,080	$10,774	$6,405
2019	$7,552	$9,063	$12,083	$7,117
2020	$8,390	$10,068	$13,423	$7,829
2021	$9,241	$11,090	$14,786	$8,541
2022	$10,106	$12,127	$16,169	$9,252
2023	$10,976	$13,172	$17,562	$9,964
2024	$11,860	$14,231	$18,975	$10,676

Comparison of Energy Efficiency Loans with Energy Efficiency Mortgages

Another option would to include energy efficiency improvements when a family purchases or finances their home as part of their underlying mortgage. The same basic pattern would follow as in the loan analysis, except that the payments would be amortized over thirty years, resulting in a lower monthly payment and a slightly higher net savings as compared with a regular loan. The project savings would pay for themselves without any additional federal subsidy.

Again, assuming an average investment of $7,500, for a low-income family, the monthly payments on an annualized basis would be reduced from $772 to $537—about the same rate as the monthly payback before including the value of potential carbon savings—as shown in Table III-8. This assumes a fixed-rate thirty-year mortgage, an interest rate of 5.5 percent, and 5 percent in closing costs.

Applying the $1,500 average subsidy in combination with carbon savings, as shown in Tables III-9 through III-12, would result in a positive net benefit of $249 for families with incomes below 200 percent of the poverty level, increasing to $328 for those with incomes above 400 percent of the poverty level.

Note: Under the mortgage scenario, a family that stays in their home for the full thirty-year term of the mortgage would likely need to replace some of the units purchased, because they would not last the full thirty years. This fact would not be a problem for most families, because the average home turns over about every seven years.

Table III-8 Annual Costs and Benefits from $7,500 Energy Efficiency Investment and Comparison of Payback of 15-Year Loan and 30-Year Mortgage, for Households with Income Below 200 Percent of Poverty

	30% Energy Savings	Energy and Carbon Savings	15-Year Loan Annual Payment	30-Year Mortgage Annual Payment
2010	$573	$642	$772	$537
2011	$597	$667	$772	$537
2012	$606	$678	$772	$537
2013	$607	$681	$772	$537
2014	$616	$692	$772	$537
2015	$624	$702	$772	$537
2016	$636	$717	$772	$537
2017	$648	$731	$772	$537
2018	$661	$746	$772	$537
2019	$673	$761	$772	$537
2020	$688	$778	$772	$537
2021	$699	$792	$772	$537
2022	$708	$803	$772	$537
2023	$712	$809	$772	$537
2024	$721	$821	$772	$537

Assumes a 5 percent interest rate for the loan, and a 5.5 percent interest rate and 5 percent loan origination fee for the mortgage.

Table III-9 Annual Costs and Benefits from $7,500 Energy Efficiency Investment with $2,000 Subsidy, and Comparison of Payback of 15-Year Loan and 30-Year Mortgage, for Households with Income Below 200 Percent of Poverty

	30% Energy Savings	Energy and Carbon Savings	15-Year Loan Annual Payment	30-Year Mortgage Annual Payment
2010	$573	$642	$566	$393
2011	$597	$667	$566	$393
2012	$606	$678	$566	$393
2013	$607	$681	$566	$393
2014	$616	$692	$566	$393
2015	$624	$702	$566	$393
2016	$636	$717	$566	$393
2017	$648	$731	$566	$393
2018	$661	$746	$566	$393
2019	$673	$761	$566	$393
2020	$688	$778	$566	$393
2021	$699	$792	$566	$393
2022	$708	$803	$566	$393
2023	$712	$809	$566	$393
2024	$721	$821	$566	$393

Assumes a 5 percent interest rate for the loan, and a 5.5 percent interest rate and 5 percent loan origination fee for the mortgage.

Table III-1 Annual Costs and Benefits from $7,500 Energy Efficiency Investment with $1,000 Subsidy, and Comparison of Payback of 15-Year Loan and 30-Year Mortgage, for Households with Income Between 200 and 300 Percent of Poverty

	30% Energy Savings	Energy and Carbon Savings	15-Year Loan Annual Payment	30-Year Mortgage Annual Payment
2010	$621	$695	$669	$465
2011	$646	$695	$669	$465
2012	$655	$695	$669	$465
2013	$657	$695	$669	$465
2014	$667	$695	$669	$465
2015	$675	$695	$669	$465
2016	$688	$695	$669	$465
2017	$701	$695	$669	$465
2018	$715	$695	$669	$465
2019	$729	$695	$669	$465
2020	$745	$695	$669	$465
2021	$757	$695	$669	$465
2022	$767	$695	$669	$465
2023	$771	$695	$669	$465
2024	$780	$695	$669	$465

Assumes a 5 percent interest rate for the loan, and a 5.5 percent interest rate and 5 percent loan origination fee for the mortgage.

Table III-11 Annual Costs and Benefits from $7,500 Energy Efficiency Investment with $1,000 Subsidy, and Comparison of Payback of 15-Year Loan and 30-Year Mortgage, for Households with Income Between 300 and 400 Percent of Poverty

	30% Energy Savings	Energy and Carbon Savings	15-Year Loan Annual Payment	30-Year Mortgage Annual Payment
2010	$651	$727	$669	$465
2011	$678	$756	$669	$465
2012	$688	$768	$669	$465
2013	$689	$771	$669	$465
2014	$699	$784	$669	$465
2015	$708	$795	$669	$465
2016	$722	$811	$669	$465
2017	$735	$827	$669	$465
2018	$751	$845	$669	$465
2019	$764	$861	$669	$465
2020	$782	$881	$669	$465
2021	$794	$896	$669	$465
2022	$804	$909	$669	$465
2023	$808	$916	$669	$465
2024	$818	$929	$669	$465

Assumes a 5 percent interest rate for the loan, and a 5.5 percent interest rate and 5 percent loan origination fee for the mortgage.

Table III-12 Annual Costs and Benefits from $7,500 Energy Efficiency Investment with $500 Subsidy, and Comparison of Payback of 15-Year Loan and 30-Year Mortgage, for Households with Income Above 400 Percent of Poverty

	30% Energy Savings	Energy and Carbon Savings	15-Year Loan Annual Payment	30-Year Mortgage Annual Payment
2010	$744	$829	$721	$501
2011	$775	$862	$721	$501
2012	$786	$876	$721	$501
2013	$788	$880	$721	$501
2014	$799	$894	$721	$501
2015	$809	$907	$721	$501
2016	$825	$925	$721	$501
2017	$841	$943	$721	$501
2018	$858	$964	$721	$501
2019	$874	$982	$721	$501
2020	$893	$1,005	$721	$501
2021	$907	$1,022	$721	$501
2022	$919	$1,037	$721	$501
2023	$924	$1,045	$721	$501
2024	$935	$1,060	$721	$501

Assumes a 5 percent interest rate for the loan, and a 5.5 percent interest rate and 5 percent loan origination fee for the mortgage.

PART IV SUBSIDIES AND FINANCING

The estimates shown in the previous charts and tables are based on a number of assumptions including the value of potential carbon offsets, long term energy pricing, and energy savings. All of these variables are subject to change based on market and other conditions. As such, we would recommend that the adoption of this type of program includes a subsidy based on poverty level to provide a guarantee or backstop in the event that the underlying conditions change in a way that reduces the net benefit. A subsidy of $2,000 for households with income below 200 percent of poverty, or approximately 60 percent of national median income, would provide a considerable level of protection as shown in the following table. For higher income families, a lower subsidy would be needed. We show a $1,000 subsidy for households with income between 200 and 400 percent of poverty and a $500 subsidy for households with income above 400 percent of poverty. The subsidies would provide a cushion and allow the family a considerable net benefit and margin for changing market conditions.

The leveraging potential of $1,500 would be equal to approximately the retrofit of 650,000 units for every $1 billion in appropriations made available. Assuming a budget of $3 billion a year, this would allow the program to reach about two million households annually or 20 million during a ten-year period. For low income families, we would also recommend an additional guarantee, that in the event of extreme market conditions, they would be held harmless during periods when total savings were less their actual energy bills.

Table IV-1 Energy and Carbon Savings Payback from $7,500 Investment with Subsidy Level Varying by Poverty Level (Breakeven Point Highlighted)

	Poverty Level							
	<200%		**201–300%**		**301–400%**		**>400%**	
	Savings	**Payments ($2,000 Subsidy)**	**Savings**	**Payments ($1,000 Subsidy)**	**Savings**	**Payments ($1,000 Subsidy)**	**Savings**	**Payments ($500 Subsidy)**
2010	$642	$522	$695	$617	$727	$617	$829	$664
2011	$1,309	$1,044	$1,417	$1,234	$1,482	$1,234	$1,691	$1,329
2012	$1,987	$1,566	$2,150	$1,850	$2,250	$1,850	$2,567	$1,993
2013	$2,668	$2,088	$2,887	$2,467	$3,021	$2,467	$3,447	$2,657
2014	$3,361	$2,609	$3,637	$3,084	$3,805	$3,084	$4,341	$3,322
2015	$4,063	$3,131	$4,396	$3,701	$4,600	$3,701	$5,248	$3,986
2016	$4,779	$3,653	$5,172	$4,318	$5,411	$4,318	$6,173	$4,650
2017	$5,510	$4,175	$5,962	$4,934	$6,238	$4,934	$7,117	$5,315
2018	$6,256	$4,697	$6,770	$5,551	$7,083	$5,551	$8,080	$5,979
2019	$7,017	$5,219	$7,593	$6,168	$7,944	$6,168	$9,063	$6,643
2020	$7,795	$5,741	$8,435	$6,785	$8,825	$6,785	$10,068	$7,308
2021	$8,586	$6,263	$9,292	$7,402	$9,721	$7,402	$11,090	$7,972
2022	$9,390	$6,784	$10,161	$8,018	$10,630	$8,018	$12,127	$8,636
2023	$10,199	$7,306	$11,037	$8,635	$11,546	$8,635	$13,172	$9,300
2024	$11,020	$7,828	$11,925	$9,252	$12,475	$9,252	$14,231	$9,965

The federal government would need to make a long-term commitment to support a national residential energy efficiency retrofit program in order to convince the private sector to invest in providing retrofit services. One option to consider is a national public benefit fund charge similar to the charges now imposed in twenty-two states that support energy efficiency and renewable energy programs. A charge of 1 mill per kilowatt-hour (1/10 of one cent) across all uses of electricity, for example, would raise approximately $3 billion annually, enough financing to support the retrofitting of approximately 2 million homes annually.

Financing the National Program

Energy efficiency savings provide a potential means to fund energy efficiency retrofits. However, this potential must be realized through a financing program. A number of financing programs have been developed, many of which have demonstrated potential, but none of which have succeeded in tapping the potential savings in a way that allows an energy efficiency program to come to national scale. Three general financing approaches in particular — loans (secured and unsecured), municipal/utility programs for financing and/or payment collection, and specially designed secondary markets — provide tools to meet the energy efficiency financing needs within all market segments, including those varying by housing type, energy cost/energy use, and household income.

1. Loan Financing: Conventional loans, whether unsecured personal loans or secured mortgage financing, are the most obvious means of funding energy efficiency work. Loans are a familiar tool to property owners, and the United States has a highly developed lending infrastructure. To date, however, loans designed to fund energy efficiency retrofits have not attracted much interest from either property owners or the lending industry for three reasons:

- Energy efficiency is a specialized, highly technical field that few lenders or homeowners understand;
- The transactional costs of these loans, which are small and require a considerable amount of work to close, are high compared to the actual cost of the retrofit; and
- The program's loan terms were not always well designed (e.g. short terms and/or high interest rates) and did not have any functioning secondary market to purchase these loans, thereby providing liquidity to the market

New, innovative energy efficiency loan products designed to overcome these barriers (such as the DOE/EPA Energy Star mortgage and financing products) will reach certain segments of the market, notably middle- and upper-income households capable of qualifying for loan financing and integrating low income energy federal/state energy grants with loan financing. However, loans can be a difficult option for many of the nation's 35 million low-income households or for those who pay more than 30 percent of their income on housing costs, and the millions of over-leveraged property owners.

2. Utility and Municipal On-Bill / Tax District Programs: Several states and municipalities have developed programs through which the cost of the retrofit is financed by a public loan pool or by a systems benefit fund, and repaid either through an increase in property taxes or through a surcharge on the utility bill. These mechanisms have several advantages over direct unsecured or secured loans:

- Greatly reduce transactional costs by eliminating the need for individualized underwriting;
- Align the term of the financing with the life of the energy efficiency improvement;
- Address the "split incentive" problem (in which one party pays for the improvement and another benefits from the savings, as may occur in a multifamily building where tenants pay for utilities, or in cases in which an owner-occupant leaves a home in which improvements have been made;
- Provide an opportunity to standardize audit and contracting services and allow scaled use of systems to drive audit costs lower;
- Have good collection histories with low delinquency rates;
- Offer significant opportunities to "go to scale";
- More fully support green job creation by allowing greater opportunities to go to scale.

Problems associated with these programs include the large investment necessary to establish them, the need to reimburse the utility companies for the work of financing and/or billing for the energy efficiency work, and potential legal and regulatory challenges.

A variant on this programmatic approach is to have a utility collect monthly payments, but not to provide the financing. These on-bill collection (or tariff) programs address the split incentive problem and allow an increase to scale. Utilities may be reluctant to serve as "collection systems" for these efforts, and thus regulatory efforts to impose requirements may need to be a part of any such effort. Providing "on-bill or municipal" administrative revenue to support these measures are necessary.

These options have been tried on a limited basis, and present a number of challenges. In the case of utility bill financing, some utilities have expressed concerns about taking on additional financial risk; in the case of residential tax financing, some jurisdictions have limited additional taxing authority and would be reluctant to take on additional responsibilities.

3. Secondary Market: The most important component to any financing program is the creation of a secondary market for each and all forms of financing:

- The secondary market could purchase secured and unsecured loans from the originating financial institution. The securities (which could be Energy Star securities to attract additional investor interest, and might be supported by tax benefits) made from these loan purchases could then be provided a loan guarantee (i.e. through DOE Section 17). These bonds or securities could then deliver capital at small increments over similar term US Treasuries and include the costs of the loan guarantee.

- The secondary could function as a capital pool from which capital from which a borrower (whether an ESCO, a utility, a municipality, a state, or a private company) borrow to implement the efficiency improvements. Repayment could be made through on-bill, municipal or loan-by-loan amortizing payments. These payments would be offset by the benefits of reduced energy expenses, carbon credits and/or tax benefits to the borrower(s).

The absence of a functioning secondary market is currently the single greatest impediment to developing an energy efficiency financing system. Addressing this issue would represent a major step towards bringing a national program to scale.

Guarantees

In addition to these three financing approaches, the federal government could facilitate the rapid expansion and acceptance of a national retrofit program by selectively providing guarantees to property owners who face a real risk of paying more as a result of an energy efficiency retrofit. A guaranteed savings would remove the risk, ensuring that the owner derives at least some net benefit from an energy efficiency retrofit.

Low-income homeowners are the most obvious target for a savings guarantee, but other market segments, particularly multifamily building owners, should also be considered. If properly structured, a savings guarantee would not impose a serious burden on the treasury, but would play a very important role in stimulating participation in the national energy efficiency retrofit program.

Table IV-2 displays the annual net energy and carbon savings after loan payment. Net savings increase over time as energy costs and energy savings increase, but loan repayment amount remains fixed.

Table IV-2 Energy and Carbon Savings Payback from $7,500 Investment with Monthly Net Savings Analysis by Poverty Level

	<200%		201–300%		301–400%		>400%	
	$2,000 Subsidy		$1,000 Subsidy		$1,000 Subsidy		$500 Subsidy	
	Annual Energy Costs	Energy and Carbon Annual Net Savings	Annual Energy Costs	Energy and Carbon Annual Net Savings	Annual Energy Costs	Energy and Carbon Annual Net Savings	Annual Energy Costs	Energy and Carbon Annual Net Savings
2010	$1,911	$120	$2,069	$78	$2,170	$110	$2,480	$165
2011	$1,990	$145	$2,153	$105	$2,259	$139	$2,582	$198
2012	$2,018	$156	$2,184	$117	$2,292	$151	$2,619	$211
2013	$2,023	$159	$2,189	$120	$2,297	$154	$2,625	$216
2014	$2,053	$170	$2,222	$132	$2,331	$167	$2,664	$230
2015	$2,079	$180	$2,250	$143	$2,361	$178	$2,698	$243
2016	$2,120	$195	$2,294	$159	$2,407	$194	$2,751	$261
2017	$2,159	$209	$2,337	$174	$2,451	$210	$2,802	$279
2018	$2,203	$224	$2,385	$191	$2,502	$228	$2,859	$299
2019	$2,244	$239	$2,428	$206	$2,548	$244	$2,912	$318
2020	$2,295	$256	$2,483	$225	$2,605	$264	$2,978	$341
2021	$2,331	$270	$2,522	$240	$2,646	$279	$3,024	$358
2022	$2,361	$281	$2,555	$252	$2,681	$292	$3,064	$373
2023	$2,373	$288	$2,568	$259	$2,695	$299	$3,080	$381
2024	$2,402	$299	$2,600	$271	$2,728	$312	$3,118	$395

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Table A-1
Households and Residential Energy Usage
by Year of Construction and Housing Type

	Households		Residential Energy Usage			Average Energy Costs (2010)
	Number (Millions)	Percent	Total (Quadrillion BTU)	Per Household (Million BTU)	Per Square Foot (Thousand BTU)	
Single Family Detached						
Before 1940	9.8	9%	1.26	129.0	54.5	$2,388
1940-1959	15.5	14%	1.62	104.7	52.2	$2,037
1960-1979	18.8	17%	1.95	103.7	46.1	$2,191
1980-1999	21.5	19%	2.28	105.8	39.6	$2,347
2000 or Later	6.5	6%	0.70	108.5	34.5	$2,403
Single Family Attached						
Before 1940	1.0	1%	0.11	106.3	58.9	$2,017
1940-1959	1.2	1%	0.12	100.6	62.0	$1,808
1960-1979	2.0	2%	0.18	90.3	66.7	$1,778
1980-1999	2.7	2%	0.21	77.0	46.7	$1,566
2000 or Later	0.6	1%	0.06	90.3	42.0	$1,849
Apartment in 2-4 Unit Bldg.						
Before 1940	2.4	2%	0.29	118.7	131.2	$2,163
1940-1959	1.1	1%	0.10	94.8	95.6	$1,868
1960-1979	2.0	2%	0.14	71.7	103.2	$1,483
1980-1999	2.0	2%	0.11	55.4	62.3	$1,270
2000 or Later	0.3	<1%	0.02	56.3	49.4	$1,539
Apartment in 5 or More Unit Bldg.						
Before 1940	1.4	1%	0.10	76.6	122.8	$1,506
1940-1959	2.0	2%	0.14	72.4	101.5	$1,434
1960-1979	6.2	6%	0.32	52.3	66.2	$1,110
1980-1999	5.9	5%	0.28	47.8	60.6	$1,103
2000 or Later	1.3	1%	0.06	44.2	50.4	$1,092
Mobile Home						
Before 1940	0.1	<1%	0.00	41.8	100.0	$1,154
1940-1959	0.2	<1%	0.01	70.2	113.2	$1,508
1960-1979	2.4	2%	0.16	68.1	85.5	$1,504
1980-1999	3.8	3%	0.27	71.5	70.0	$1,715
2000 or Later	0.5	<1%	0.04	77.4	56.6	$1,841
Total	111.1	100%	10.55	94.9	55.8	$1,977

Source: 2005 RECS. Energy costs data updated to 2010 based on EIA data and projections.

Table A-2
Households and Residential Energy Usage
by Housing Type and Region

	Households		Residential Energy Usage			Average Energy Costs (2010)
	Number (Millions)	Percent	Total (Quadrillion BTU)	Per Household (Million BTU)	Per Square Foot (Thousand BTU)	
Single Family Detached						
Northeast	11.2	10%	1.61	144.1	51.4	$3,014
Midwest	18.7	17%	2.33	124.6	51.5	$2,147
South	27.2	25%	2.48	91.1	39.5	$2,171
West	15.0	14%	1.40	93.0	44.8	$1,952
Single Family Attached						
Northeast	2.3	2%	0.25	109.9	64.7	$2,151
Midwest	1.5	1%	0.16	106.3	55.1	$1,774
South	2.0	2%	0.14	72.4	54.8	$1,674
West	1.8	2%	0.12	67.6	45.3	$1,284
Apartment in 2-4 Unit Bldg.						
Northeast	2.5	2%	0.30	119.1	143.8	$2,444
Midwest	1.5	1%	0.16	102.0	94.1	$1,613
South	1.9	2%	0.11	56.9	73.7	$1,387
West	1.8	2%	0.09	52.1	64.4	$1,045
Apartment in 5 or More Unit Bldg.						
Northeast	4.2	4%	0.32	76.6	105.3	$1,576
Midwest	3.1	3%	0.19	61.0	81.9	$1,053
South	5.8	5%	0.27	47.0	54.6	$1,159
West	3.6	3%	0.13	35.5	52.2	$853
Mobile Home						
Northeast	0.4	<1%	0.03	78.2	91.3	$1,805
Midwest	0.8	1%	0.07	95.2	107.4	$1,814
South	3.8	3%	0.25	65.8	68.2	$1,692
West	2.0	2%	0.13	67.9	75.0	$1,434
Total	111.1	100.00	10.55	94.9	55.8	$1,977

Source: 2005 RECS. Energy costs data updated to 2010 based on EIA data and projections.

Table A-3
Households and Residential Energy Usage
by Poverty Level and Region

	Households		Residential Energy Usage			Average Energy Costs (2010)
	Number (Millions)	Percent	Total (Quadrillion BTU)	Per Household (Million BTU)	Per Square Foot (Thousand BTU)	
Northeast						
≤200%	7.2	6%	0.74	103.2	95.8	$2,118
201–300%	3.8	3%	0.46	120.5	77.8	$2,394
301–400%	2.7	2%	0.32	119.9	62.4	$2,493
>400%	6.9	6%	0.99	144.1	59.4	$3,060
Midwest						
≤200%	9.1	8%	0.94	103.3	72.6	$1,725
201–300%	4.9	4%	0.54	109.9	60.6	$1,881
301–400%	3.3	3%	0.38	112.1	51.2	$1,962
>400%	8.2	7%	1.05	127.6	48.0	$2,238
South						
≤200%	15.6	14%	1.07	68.6	55.6	$1,671
201–300%	7.9	7%	0.61	77.5	47.8	$1,821
301–400%	4.4	4%	0.37	83.7	44.0	$2,026
>400%	12.8	12%	1.21	93.9	36.0	$2,250
West						
≤200%	7.3	7%	0.47	64.2	60.1	$1,294
201–300%	4.6	4%	0.33	73.0	48.1	$1,517
301–400%	2.9	3%	0.23	80.6	51.1	$1,678
>400%	9.5	9%	0.84	88.6	42.5	$1,921
Total	111.1	100%	10.55	94.9	55.8	$1,977

Source: 2005 RECS. Energy costs data updated to 2010 based on EIA data and projections.

Table A-4
Households and Residential Energy Usage
by Poverty Level and Urban/Rural Location

	Households		Residential Energy Usage			Average Energy Costs (2010)
	Number (Millions)	Percent	Total (Quadrillion BTU)	Per Household (Million BTU)	Per Square Foot (Thousand BTU)	
City						
≤200%	19.5	18%	1.53	78.5	73.2	$1,592
201–300%	9.1	8%	0.77	84.0	58.8	$1,683
301–400%	5.4	5%	0.45	83.3	53.3	$1,752
>400%	13.0	12%	1.27	97.1	48.7	$2,021
Town						
≤200%	6.8	6%	0.59	86.5	63.8	$1,667
201–300%	4.0	4%	0.43	106.1	64.7	$2,046
301–400%	2.4	2%	0.26	106.9	54.8	$2,194
>400%	5.7	5%	0.66	116.6	48.4	$2,338
Suburbs						
≤200%	4.4	4%	0.41	91.4	64.5	$1,781
201–300%	4.1	4%	0.39	97.0	50.1	$1,938
301–400%	3.1	3%	0.34	110.7	48.0	$2,185
>400%	11.1	10%	1.32	119.2	40.5	$2,497
Rural						
≤200%	8.4	8%	0.69	82.3	60.4	$1,914
201–300%	4.0	4%	0.36	90.0	48.2	$2,071
301–400%	2.4	2%	0.24	103.4	46.3	$2,293
>400%	7.6	7%	0.83	109.8	40.4	$2,527
Total	111.1	100%	10.55	94.9	55.8	$1,977

Source: 2005 RECS. Energy costs data updated to 2010 based on EIA data and projections.

Table A-5
Households and Residential Energy Usage
by Poverty Level and Housing Unit Type

	Households		Residential Energy Usage			Average Energy Costs (2010)
	Number (Millions)	Percent	Total (Quadrillion BTU)	Per Household (Million BTU)	Per Square Foot (Thousand BTU)	
Single Family Detached						
≤200%	19.2	17%	1.83	95.6	52.4	$1,950
201–300%	14.2	13%	1.46	102.5	46.6	$2,078
301–400%	9.7	9%	1.03	107.0	44.6	$2,222
>400%	29.0	26%	3.49	120.1	40.8	$2,542
Single Family Attached						
≤200%	3.1	3%	0.27	88.9	68.6	$1,672
201–300%	1.0	1%	0.10	100.8	56.5	$1,934
301–400%	0.9	1%	0.07	78.9	45.9	$1,618
>400%	2.6	2%	0.23	88.9	43.4	$1,799
Apartment in 2-4 Unit Building						
≤200%	4.2	4%	0.36	85.7	106.5	$1,714
201–300%	1.4	1%	0.12	82.8	101.4	$1,635
301–400%	0.7	1%	0.05	80.5	83.2	$1,638
>400%	1.5	1%	0.13	87.3	80.0	$1,748
Apartment in 5 or More Unit Building						
≤200%	8.7	8%	0.48	55.0	76.6	$1,169
201–300%	3.0	3%	0.16	54.9	75.3	$1,174
301–400%	1.5	1%	0.09	60.2	68.9	$1,298
>400%	3.5	3%	0.18	50.0	58.0	$1,142
Mobile Home						
≤200%	4.1	4%	0.28	68.4	81.0	$1,626
201–300%	1.6	1%	0.11	67.6	65.8	$1,532
301–400%	0.5	<1%	0.05	85.1	84.9	$1,809
>400%	0.7	1%	0.06	76.9	61.5	$1,819
Total	111.1	100%	10.55	94.9	55.8	$1,977

Source: 2005 RECS. Energy costs data updated to 2010 based on EIA data and projections.

Table A-6
Households and Residential Energy Usage
by Poverty Level and Home Ownership

	Households		Residential Energy Usage			Average Energy Costs (2010)
	Number (Millions)	Percent	Total (Quadrillion BTU)	Per Household (Million BTU)	Per Square Foot (Thousand BTU)	
Owned						
≤200%	20.8	27%	1.88	90.4	57.4	$1,888
201–300%	15.4	20%	1.51	98.4	48.6	$2,011
301–400%	10.4	13%	1.07	102.8	46.5	$2,124
>400%	31.5	40%	3.70	117.2	43.0	$2,468
Rented						
≤200%	18.4	56%	1.34	72.8	79.6	$1,477
201–300%	5.8	18%	0.44	74.7	76.5	$1,513
301–400%	2.9	9%	0.23	78.5	67.5	$1,685
>400%	5.9	18%	0.39	66.1	53.3	$1,477
Total	111.1	100%	10.55	94.9	55.8	$1,977

Source: 2005 RECS. Energy costs data updated to 2010 based on EIA data and projections.

Table A-7
Households and Residential Energy Usage by Housing Unit Type and Home Ownership

Housing Unit Type	Owned/ Rented	Poverty Level	Households		Residential Energy Usage			Average Energy Costs (2010)
			Number (Millions)	Percent	Total (Quadrillion BTU)	Per Household (Million BTU)	Per Square Foot (Thousand BTU)	
Single Family (Detached and Attached)	Owned	<=200%	16.2	15%	1.55	95.5	48.3	$1,952
		201% - 300%	13.4	12%	1.37	102.8	45.5	$2,076
		301% - 400%	9.4	8%	0.99	105.3	43.9	$2,173
		>400%	29.2	26%	3.52	120.4	41.0	$2,531
	Rented	<=200%	6.0	5%	0.56	92.5	71.5	$1,802
		201% - 300%	1.9	2%	0.18	99.3	59.9	$2,012
		301% - 400%	1.2	1%	0.11	98.7	51.5	$2,137
		>400%	2.4	2%	0.20	83.6	41.2	$1,870
Apartment in 2-4 Unit Bldg.	Owned	<=200%	0.7	1%	0.08	116.1	148.6	$2,453
		201% - 300%	0.3	< 1%	0.03	110.2	102.6	$2,281
		301% - 400%	0.3	< 1%	0.02	84.1	69.2	$1,742
		>400%	0.6	1%	0.07	116.9	90.7	$2,195
	Rented	<=200%	3.5	3%	0.28	79.8	98.4	$1,572
		201% - 300%	1.2	1%	0.09	76.0	101.0	$1,476
		301% - 400%	0.4	0%	0.03	77.8	93.6	$1,562
		>400%	0.9	1%	0.06	67.3	72.7	$1,446
Apartment in 5 or More Unit Bldg.	Owned	<=200%	0.7	1%	0.03	46.7	68.5	$996
		201% - 300%	0.3	0%	0.01	43.7	81.7	$1,148
		301% - 400%	0.2	0%	0.02	61.3	48.5	$1,248
		>400%	1.1	1%	0.06	53.4	60.2	$1,239
	Rented	<=200%	8.0	7%	0.45	55.7	77.3	$1,185
		201% - 300%	2.7	2%	0.15	56.2	74.6	$1,176
		301% - 400%	1.3	1%	0.08	60.0	72.7	$1,306
		>400%	2.5	2%	0.12	48.5	57.0	$1,102
Mobile Home	Owned	<=200%	3.2	3%	0.22	69.2	81.3	$1,649
		201% - 300%	1.4	1%	0.09	65.4	59.4	$1,523
		301% - 400%	0.5	0%	0.04	84.2	84.4	$1,793
		>400%	0.6	1%	0.05	78.7	58.5	$1,874
	Rented	<=200%	0.9	1%	0.06	65.3	80.0	$1,541
		201% - 300%	0.1	0%	0.01	92.3	135.4	$1,648
		301% - 400%	0.1	0%	0.01	90.3	87.3	$1,898
		>400%	0.1	0%	0.01	66.3	80.0	$1,482
Total			111.1	100%	10.55	94.9	55.8	$1,977

Source: 2005 RECS. Energy costs data updated to 2010 based on EIA data and projections.

Table A-8
Households and Residential Energy Usage
by Poverty Level and Year Built

	Households		Residential Energy Usage			Average Energy Costs (2010)
	Number (Millions)	Percent	Total (Quadrillion BTU)	Per Household (Million BTU)	Per Square Foot (Thousand BTU)	
Before 1940						
≤200%	6.2	6%	0.62	100.0	81.8	$1,914
201–300%	2.9	3%	0.39	133.9	79.0	$2,332
301–400%	1.8	2%	0.23	127.1	66.5	$2,480
>400%	3.8	3%	0.53	140.0	61.4	$2,567
1940-1959						
≤200%	7.9	7%	0.75	94.6	72.9	$1,819
201–300%	4.1	4%	0.39	96.1	57.1	$1,880
301–400%	2.4	2%	0.23	93.1	47.7	$1,869
>400%	5.5	5%	0.63	115.2	51.2	$2,228
1960-1979						
≤200%	12.2	11%	0.96	78.3	69.1	$1,608
201–300%	6.0	5%	0.51	84.0	53.1	$1,770
301–400%	3.8	3%	0.36	95.5	58.1	$1,966
>400%	9.4	8%	0.94	100.0	46.4	$2,185
1980-1999						
≤200%	10.8	10%	0.76	70.0	58.6	$1,589
201–300%	6.4	6%	0.50	77.4	52.2	$1,752
301–400%	3.9	4%	0.35	87.8	43.7	$1,952
>400%	14.8	13%	1.55	105.1	39.7	$2,317
2000 or Later						
≤200%	2.2	2%	0.15	68.1	47.3	$1,651
201–300%	1.8	2%	0.16	92.0	42.8	$1,898
301–400%	1.3	1%	0.13	99.2	37.4	$2,109
>400%	4.0	4%	0.44	108.7	33.4	$2,472
Total	111.1	100%	10.55	94.9	55.8	$1,977

Source: 2005 RECS. Energy costs data updated to 2010 based on EIA data and projections.

Table A-9 Households and Residential Energy Usage by Poverty Level & Main Heating Fuel

	Households		Residential Energy Usage			Average Energy Costs (2010)
	Number (Millions)	Percent	Total (Quadrillion BTU)	Per Household (Million BTU)	Per Square Foot (Thousand BTU)	
Natural Gas						
≤200%	18.2	16%	1.80	99.2	81.1	$1,681
201–300%	11.4	10%	1.22	106.8	65.1	$1,873
301–400%	7.7	7%	0.84	108.3	56.6	$2,039
>400%	21.1	19%	2.61	123.5	49.3	$2,334
Electricity						
≤200%	13.2	12%	0.71	53.6	47.5	$1,464
201–300%	6.2	6%	0.36	58.8	39.0	$1,603
301–400%	3.7	3%	0.23	61.7	35.2	$1,710
>400%	10.3	9%	0.71	68.6	31.7	$1,886
Fuel Oil						
≤200%	2.8	2%	0.36	129.0	99.6	$2,686
201–300%	1.4	1%	0.18	129.2	69.8	$2,838
301–400%	1.0	1%	0.14	143.1	65.8	$2,923
>400%	2.5	2%	0.43	168.5	63.7	$3,693
LPG						
≤200%	2.3	2%	0.22	95.4	66.4	$2,348
201–300%	1.2	1%	0.12	98.8	63.0	$2,313
301–400%	0.6	1%	0.08	133.5	69.0	$2,851
>400%	2.0	2%	0.24	118.2	47.3	$2,729
Kerosene						
≤200%	0.6	1%	0.03	55.2	50.8	$1,421
201–300%	0.1	<1%	0.01	54.1	29.8	$1,102
301–400%	0.0	0%	0.00	--	--	--
>400%	0.0	<1%	0.00	67.6	19.1	$2,130
Other						
≤200%	1.5	1%	0.08	53.7	48.2	$1,681
201–300%	0.7	1%	0.05	71.0	33.9	$1,873
301–400%	0.2	<1%	0.01	48.0	24.2	$2,039
>400%	1.1	1%	0.09	81.6	30.0	$2,334
No Fuel						
≤200%	0.7	1%	0.03	35.9	41.8	$1,464
201–300%	0.1	<1%	0.01	34.6	41.4	$1,603
301–400%	0.0	<1%	0.00	21.9	20.0	$978
>400%	0.3	<1%	0.01	37.8	29.1	$1,485
Total	111.1	100%	10.55	94.9	55.8	$1,977

LPG = liquid petroleum gas.
Source: 2005 RECS. Energy costs data updated to 2010 based on EIA data and projections.

Table A-10
Households and Residential Energy Usage
by Poverty Level and End Use

	Households		Residential Energy Usage			Average Energy Costs (2010)
	Number (Millions)	Percent	Total (Quadrillion BTU)	Per Household (Million BTU)	Per Square Foot (Thousand BTU)	
Space Heating						
≤200%	37.0	33%	1.37	37.0	29.2	$505
201–300%	20.5	18%	0.80	39.1	23.5	$534
301–400%	13.1	12%	0.53	40.2	21.0	$573
>400%	36.8	33%	1.59	43.1	17.5	$614
Air Conditioning						
≤200%	31.1	28%	0.27	8.5	5.4	$211
201–300%	17.7	16%	0.16	9.1	4.7	$233
301–400%	11.1	10%	0.11	9.8	4.4	$257
>400%	31.6	28%	0.35	11.0	3.7	$294
Water Heating						
≤200%	38.4	35%	0.64	16.5	13.6	$283
201–300%	21.0	19%	0.38	18.2	11.3	$292
301–400%	13.1	12%	0.26	20.0	10.5	$313
>400%	37.2	33%	0.83	22.3	9.2	$362
Refrigerators						
≤200%	39.1	35%	0.22	5.5	4.4	$171
201–300%	21.2	19%	0.14	6.4	3.7	$199
301–400%	13.3	12%	0.08	6.3	3.2	$199
>400%	37.4	34%	0.27	7.1	2.9	$230
Other Appliances and Lighting						
≤200%	39.2	35%	0.73	18.5	14.8	$522
201–300%	21.2	19%	0.46	21.8	13.1	$614
301–400%	13.3	12%	0.31	23.6	12.0	$685
>400%	37.4	34%	1.05	28.2	11.3	$812
Total	111.1	100%	10.55	94.9	55.8	$1,977

Source: 2005 RECS. Energy costs data updated to 2010 based on EIA data and projections.

Table A-11
Total Annual Housing Cost Obligations of Homeowners as a Percentage of Household Income by Poverty Level

Total Annual Housing Cost Obligations*	Owned with Mortgage or Loan		Owned Free and Clear	
	Number (Millions)	Percent	Number (Millions)	Percent
≤200% Poverty Level				
≤20%	0.4	1%	2.8	12%
21–40%	1.7	3%	2.8	12%
41–60%	1.7	3%	1.0	4%
>60%	3.3	6%	1.0	4%
201-300% Poverty Level				
≤20%	1.0	2%	3.5	15%
21–40%	3.8	7%	0.9	4%
41–60%	1.6	3%	0.1	< 1%
>60%	0.9	2%	0.0	< 1%
301-400% Poverty Level				
≤20%	2.0	4%	3.1	13%
21–40%	4.5	9%	0.3	1%
41–60%	1.1	2%	0.0	< 1%
>60%	0.4	1%	0.0	< 1%
>400% Poverty Level				
≤20%	15.0	29%	8.0	33%
21–40%	12.0	23%	0.2	1%
41–60%	1.5	3%	0.0	< 1%
>60%	0.3	1%	0.0	< 1%
Total	51.1	100%	23.9	100%

*Includes mortgage payment, fire/hazard/flood insurance, property taxes, second mortgage payment, energy costs, and water costs, and mobile home and condominium fees.
Source: 2005–2007 ACS.

State-Level Tables

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Table A-12 Housing Type by State

State	Single-Family Detached		Single-Family Attached		Apartment in Building with 2–4 Units		Apartment in Building with 5 or More Units		Mobile Home	
	Households		Households		Households		Households		Households	
	#	%	#	%	#	%	#	%	#	%
Alabama	1,258,508	70%	34,508	2%	89,580	5%	169,804	9%	244,223	14%
Alaska	137,013	59%	19,991	9%	29,718	13%	34,855	15%	11,997	5%
Arizona	1,417,485	64%	114,601	5%	106,677	5%	336,647	15%	227,439	10%
Arkansas	784,678	72%	19,646	2%	64,555	6%	89,882	8%	136,599	12%
California	7,124,544	59%	863,667	7%	976,107	8%	2,689,692	22%	468,539	4%
Colorado	1,193,416	65%	132,191	7%	91,586	5%	336,417	18%	83,432	5%
Connecticut	807,328	61%	70,357	5%	213,736	16%	220,175	17%	11,602	1%
Delaware	195,275	61%	43,866	14%	11,865	4%	41,338	13%	29,257	9%
District of Columbia	33,416	13%	67,441	27%	25,845	10%	123,101	49%	0	0%
Florida	4,095,729	58%	440,451	6%	435,294	6%	1,430,824	20%	663,659	9%
Georgia	2,291,516	68%	118,831	4%	174,097	5%	452,932	13%	326,382	10%
Hawaii	244,806	56%	31,885	7%	32,672	8%	123,363	28%	733	0%
Idaho	396,521	73%	17,015	3%	37,420	7%	39,907	7%	53,620	10%
Illinois	2,877,720	61%	274,042	6%	567,925	12%	874,475	19%	128,900	3%
Indiana	1,823,885	75%	81,419	3%	141,047	6%	271,768	11%	129,168	5%
Iowa	909,246	75%	37,776	3%	71,363	6%	139,763	12%	48,004	4%
Kansas	808,349	75%	46,112	4%	61,898	6%	111,718	10%	55,440	5%
Kentucky	1,153,880	70%	37,222	2%	108,207	7%	165,114	10%	189,209	11%
Louisiana	1,088,580	68%	43,685	3%	113,512	7%	145,993	9%	210,896	13%
Maine	359,289	66%	12,940	2%	64,258	12%	53,063	10%	52,701	10%
Maryland	1,120,587	54%	429,472	21%	80,121	4%	419,063	20%	33,154	2%
Massachusetts	1,303,824	53%	117,421	5%	523,366	21%	484,244	20%	19,355	1%
Michigan	2,807,793	73%	177,448	5%	197,569	5%	467,039	12%	213,819	6%
Minnesota	1,406,657	69%	150,262	7%	86,844	4%	330,298	16%	67,048	3%
Mississippi	757,017	70%	15,323	1%	56,643	5%	80,021	7%	166,789	16%
Missouri	1,659,897	72%	76,750	3%	179,932	8%	232,543	10%	150,277	7%
Montana	256,106	69%	10,009	3%	27,380	7%	30,767	8%	44,901	12%
Nebraska	521,140	75%	25,273	4%	32,763	5%	95,424	14%	23,399	3%
Nevada	558,424	60%	47,500	5%	68,732	7%	191,996	21%	63,156	7%
New Hampshire	316,226	63%	27,103	5%	56,193	11%	70,424	14%	30,621	6%
New Jersey	1,749,029	56%	278,998	9%	480,957	15%	602,962	19%	30,618	1%
New Mexico	469,324	65%	29,614	4%	40,935	6%	69,213	10%	117,832	16%
New York	2,996,984	42%	364,841	5%	1,249,895	18%	2,314,754	33%	167,674	2%
North Carolina	2,315,081	67%	118,651	3%	171,558	5%	376,894	11%	488,193	14%
North Dakota	171,970	63%	12,429	5%	18,477	7%	51,494	19%	16,682	6%
Ohio	3,183,648	71%	196,459	4%	369,689	8%	574,232	13%	175,876	4%
Oklahoma	1,036,881	75%	29,296	2%	63,566	5%	139,230	10%	116,745	8%
Oregon	932,032	65%	58,268	4%	103,026	7%	221,517	15%	128,095	9%
Pennsylvania	2,833,692	58%	885,420	18%	415,190	9%	521,263	11%	202,053	4%
Rhode Island	231,382	57%	12,793	3%	94,002	23%	61,321	15%	4,871	1%
South Carolina	1,083,920	65%	38,540	2%	79,978	5%	160,321	10%	300,480	18%
South Dakota	218,827	70%	9,187	3%	15,150	5%	40,173	13%	28,264	9%
Tennessee	1,671,452	70%	73,645	3%	141,282	6%	260,595	11%	234,729	10%
Texas	5,446,771	67%	218,556	3%	419,697	5%	1,411,700	17%	583,929	7%
Utah	575,006	71%	42,294	5%	63,322	8%	101,415	12%	29,868	4%
Vermont	163,719	65%	9,378	4%	35,256	14%	24,021	10%	18,439	7%
Virginia	1,866,698	64%	299,515	10%	123,254	4%	465,730	16%	153,357	5%
Washington	1,578,722	64%	84,658	3%	157,355	6%	462,985	19%	183,083	7%
West Virginia	539,133	73%	13,415	2%	34,500	5%	46,738	6%	104,936	14%
Wisconsin	1,509,151	68%	93,550	4%	242,715	11%	315,402	14%	74,000	3%
Wyoming	137,438	67%	8,235	4%	15,868	8%	14,536	7%	28,979	14%
Total	70,419,715	63%	6,461,949	6%	9,062,577	8%	18,489,146	17%	7,073,022	6%

Source: 2005–2007 ACS.

Table A-13
Home Ownership by State

State	Own		Rent	
	# of Households	% of Households	# of Households	% of Households
Alabama	1,279,468	71%	518,832	29%
Alaska	148,665	64%	85,194	36%
Arizona	1,520,101	69%	695,654	31%
Arkansas	746,368	68%	350,246	32%
California	7,083,797	58%	5,057,092	42%
Colorado	1,262,065	69%	576,242	31%
Connecticut	922,318	70%	401,112	30%
Delaware	236,709	74%	85,038	26%
District of Columbia	110,328	44%	139,475	56%
Florida	4,974,963	70%	2,102,170	30%
Georgia	2,283,222	68%	1,081,529	32%
Hawaii	254,509	59%	179,155	41%
Idaho	389,932	72%	155,237	28%
Illinois	3,315,748	70%	1,408,714	30%
Indiana	1,765,486	72%	682,399	28%
Iowa	883,777	73%	323,054	27%
Kansas	759,085	70%	324,772	30%
Kentucky	1,172,485	71%	481,624	29%
Louisiana	1,093,999	68%	511,210	32%
Maine	394,815	73%	147,612	27%
Maryland	1,442,113	69%	640,464	31%
Massachusetts	1,590,948	65%	857,657	35%
Michigan	2,902,523	75%	961,780	25%
Minnesota	1,546,984	76%	494,494	24%
Mississippi	765,120	71%	314,462	29%
Missouri	1,624,660	71%	675,556	29%
Montana	257,389	70%	111,935	30%
Nebraska	476,625	68%	221,534	32%
Nevada	568,705	61%	364,012	39%
New Hampshire	366,116	73%	134,552	27%
New Jersey	2,122,018	68%	1,021,387	32%
New Mexico	506,519	70%	221,989	30%
New York	3,949,946	56%	3,146,081	44%
North Carolina	2,374,718	68%	1,097,035	32%
North Dakota	179,026	66%	92,113	34%
Ohio	3,151,109	70%	1,349,521	30%
Oklahoma	946,259	68%	440,592	32%
Oregon	936,711	65%	510,701	35%
Pennsylvania	3,487,164	72%	1,371,346	28%
Rhode Island	255,999	63%	148,551	37%
South Carolina	1,170,516	70%	494,043	30%
South Dakota	215,619	69%	96,022	31%
Tennessee	1,668,003	70%	714,969	30%
Texas	5,278,320	65%	2,816,716	35%
Utah	585,005	72%	227,599	28%
Vermont	180,962	72%	69,909	28%
Virginia	2,028,217	70%	881,004	30%
Washington	1,621,020	66%	851,465	34%
West Virginia	552,099	75%	186,840	25%
Wisconsin	1,573,287	70%	661,965	30%
Wyoming	143,352	70%	62,064	30%
Total	75,064,892	67%	36,544,719	33%

Source: 2005–2007 ACS.

Table A-14
Poverty Level by State

State	≤200%		201–300%		301–400%		>400%	
	Households		Households		Households		Households	
	#	%	#	%	#	%	#	%
Alabama	671,244	37%	326,081	18%	244,594	14%	556,381	31%
Alaska	49,989	21%	36,766	16%	31,381	13%	115,723	49%
Arizona	643,140	29%	378,128	17%	324,927	15%	869,560	39%
Arkansas	431,900	39%	209,151	19%	150,198	14%	305,365	28%
California	3,260,464	27%	1,775,933	15%	1,505,270	12%	5,599,222	46%
Colorado	455,616	25%	279,727	15%	264,536	14%	838,428	46%
Connecticut	262,906	20%	175,582	13%	171,736	13%	713,206	54%
Delaware	76,007	24%	49,443	15%	48,642	15%	147,655	46%
District of Columbia	70,907	28%	28,075	11%	24,845	10%	125,976	50%
Florida	2,082,485	29%	1,265,545	18%	1,053,734	15%	2,675,369	38%
Georgia	1,020,809	30%	556,378	17%	484,030	14%	1,303,534	39%
Hawaii	93,727	22%	64,864	15%	67,739	16%	207,334	48%
Idaho	174,426	32%	110,475	20%	88,080	16%	172,188	32%
Illinois	1,246,409	26%	743,038	16%	666,613	14%	2,068,402	44%
Indiana	703,565	29%	466,500	19%	397,612	16%	880,208	36%
Iowa	344,589	29%	231,773	19%	203,621	17%	426,848	35%
Kansas	315,832	29%	200,720	19%	167,458	15%	399,847	37%
Kentucky	610,516	37%	296,749	18%	235,686	14%	511,158	31%
Louisiana	615,851	38%	271,882	17%	217,507	14%	499,969	31%
Maine	164,096	30%	101,991	19%	86,156	16%	190,184	35%
Maryland	389,165	19%	276,724	13%	266,979	13%	1,149,709	55%
Massachusetts	560,019	23%	318,226	13%	315,204	13%	1,255,156	51%
Michigan	1,100,967	28%	671,646	17%	584,079	15%	1,507,611	39%
Minnesota	460,146	23%	326,838	16%	317,820	16%	936,674	46%
Mississippi	464,506	43%	195,990	18%	137,744	13%	281,342	26%
Missouri	724,750	32%	423,490	18%	350,510	15%	801,466	35%
Montana	121,959	33%	72,933	20%	56,450	15%	117,982	32%
Nebraska	201,611	29%	133,294	19%	115,841	17%	247,413	35%
Nevada	225,184	24%	159,234	17%	146,579	16%	401,720	43%
New Hampshire	95,872	19%	75,422	15%	79,727	16%	249,647	50%
New Jersey	650,444	21%	409,724	13%	399,955	13%	1,683,282	54%
New Mexico	269,632	37%	126,262	17%	96,504	13%	236,110	32%
New York	2,013,256	28%	1,042,736	15%	920,569	13%	3,119,466	44%
North Carolina	1,139,505	33%	618,842	18%	505,858	15%	1,207,548	35%
North Dakota	83,562	31%	53,022	20%	45,107	17%	89,448	33%
Ohio	1,337,431	30%	807,305	18%	697,293	15%	1,658,601	37%
Oklahoma	502,548	36%	258,137	19%	202,054	15%	424,112	31%
Oregon	424,902	29%	256,639	18%	216,439	15%	549,432	38%
Pennsylvania	1,402,304	29%	855,846	18%	736,944	15%	1,863,416	38%
Rhode Island	106,424	26%	60,309	15%	55,838	14%	181,979	45%
South Carolina	568,966	34%	299,819	18%	245,624	15%	550,150	33%
South Dakota	98,700	32%	62,115	20%	53,019	17%	97,807	31%
Tennessee	826,290	35%	429,277	18%	356,912	15%	770,493	32%
Texas	2,732,423	34%	1,317,183	16%	1,067,163	13%	2,978,267	37%
Utah	215,351	27%	158,453	20%	136,595	17%	302,205	37%
Vermont	64,893	26%	45,571	18%	41,125	16%	99,282	40%
Virginia	667,202	23%	426,966	15%	405,101	14%	1,409,952	48%
Washington	613,807	25%	382,052	15%	369,379	15%	1,107,247	45%
West Virginia	300,284	41%	139,266	19%	102,463	14%	196,926	27%
Wisconsin	584,482	26%	395,407	18%	367,186	16%	888,177	40%
Wyoming	52,479	26%	37,594	18%	33,023	16%	82,320	40%
Total	32,293,542	29%	18,405,123	16%	15,859,449	14%	45,051,497	40%

Source: 2005–2007 ACS.