

IMPACT ANALYSIS

Federal Housing Administration Proposed Pilot Program:

“Power Saver” Home Energy Retrofit Loan Insurance

FR-5450-N-04

1 Summary of Impact Analysis

The Consolidated Appropriations Act of 2010 (the Act) directs HUD to conduct an “Energy Efficient Mortgage Innovation” pilot program targeted to the owner-occupied housing market, and provides \$25 million in appropriated funds to support such an initiative. FHA’s authorizing statute for insurance authorities, the National Housing Act, authorizes FHA to provide insurance for home improvement loans. In this Notice, FHA proposes to combine its existing authority under the National Housing Act with the new authority and funding appropriated under the Act to provide an incentive to lenders and potential loan investors to participate in a pilot program wherein FHA insurance for home improvement loans would be made available to homeowners for the specific purpose of making improvements to their homes that result in lower energy costs and consumption levels. In addition, FHA proposes to tighten portions of its relevant underwriting guidelines and strengthen its administrative oversight in connection with the pilot program. The primary benefit of the set of actions outlined in the Notice will be to increase the availability of affordable financing for consumers to make energy improvements to their homes.

As a pilot program, FHA proposes to, to define the eligible markets lenders may serve, and to limit the pilot’s duration to a period of two years. FHA envisions that the pilot program will provide insurance for up to 24,000 loans over that two year period, with an expected average loan size of \$12,500. The program is expected to result in the extension of as much as \$300 million in FHA-insured energy efficiency property improvement loans over two years and a resulting energy-saving valued at as much as \$263 million (in present discounted value) with a discounted cost of \$232 million. Social benefits include the reduction of greenhouse gas emissions and generating knowledge concerning the loan program.

2 Need for Policy Change

The primary purpose of regulation is to implement the “Energy Efficient Mortgage Innovation” pilot program mandated by Congress and to evaluate the performance of those loans. There are other deeper motivations: if FHA is able to learn from the pilot and launch a broader program, then there will be the potential for creation of a market for a new type of loan and the reduction of negative environmental externalities.

2.1 Negative Environmental Externalities of Energy Consumption

The opportunities to reduce residential energy consumption, with resulting reductions in both greenhouse gas emissions and consumer expenditures on energy, have been widely observed (EPA, February 2011). The negative environmental externalities of energy consumption are not internalized by the household, leading to a “common resources” market failure in which energy is over consumed (Congressional Budget Office, 2003).¹ The most serious market failure in the building sector is that the private cost of energy is lower than the social cost. Optimal policies for reducing emissions are generally agreed to be a carbon tax or marketable emission permits because they equate the social marginal costs and the marginal benefits of consumption (Baumol and Oates, 1988). These market-based policies are beyond the Department’s regulatory authority. Nonetheless, a policy aimed at reducing energy consumption within the residential sector could have a substantial impact on negative externalities.

According to the U.S. Energy Information Agency (EIA), the residential sector accounts for 20.9 percent of the energy consumed in the U.S. and 20 percent of U.S. carbon dioxide emissions behind electricity generation, transportation, and industrial use. Energy expenditures per household have increased by 20 percent on average since 1990 and currently exceed \$200 billion annually, according to EIA. The U.S. Department of Housing and Urban Development has contributed to a small reduction in energy consumption through encouraging energy efficiency in assisted housing (Energy Star compliance in public housing and HUD-DOE weatherization grants, for example). One of the aims of the last Congress in funding the pilot program was to bring about a Pareto increase in welfare by reducing energy consumption in the single-family residential sector and thus a reduction in carbon emissions. If successful, the program may

¹ See OMB (1996) for a definition of “market failure” in the presence of externalities.

provide the experience and foundation to offer a much higher volume of loans, resulting in a correspondingly higher level of energy savings.

Estimates of the economic and technical potential for reducing energy consumption and expenditure in existing homes through efficiency improvements (as opposed to conservation) are somewhat varied. There is considerable consensus that reductions of 20 – 30 percent in both energy consumption and related expenditures are achievable. A meta analysis of multiple studies conducted by the American Council for an Energy Efficient economy in 2004 found the median achievable potential for reduction of energy consumption in the residential sector is 26 percent. The Harvard University Joint Center for Housing Studies found that energy consumption per square foot in homes fell 21.6 percent from 1993 to 2005, likely due to energy-efficient home improvements. The Center noted that if pre-2000 homes were brought up to the same efficiency level as post-2000 homes in their regions, overall residential energy consumption would fall by an additional 22.5 percent. In terms of expenditure, an Environmental Protection Agency analysis shows that the typical home can save about 30 percent on annual home energy bills (\$200 - \$400) through use of ENERGY STAR-qualified products. The Department of Energy (DOE) reports that homes assisted under the Weatherization Assistance Program reduce annual gas heating consumption by 32% percent on average and realize average annual cost savings of \$350.

Despite the benefits of residential energy efficiency, relatively few homes are as efficient as they could be. It has been estimated that fewer than 5 percent of existing single family homes have been fully retrofitted for energy efficiency. There is a substantial body of literature on the interlocking barriers to broader and deeper levels of energy efficiency in the residential sector. A lack of access to capital to pay the upfront costs of energy improvements is frequently observed as one of the primary barriers. Recent analysis by McKinsey and Company (Choi Granade et al., 2009), among others, suggests that affordable, accessible financing for home energy improvements, in combination with strategies to increase consumer awareness, provide quality assurance and enhance the delivery of related services, can “unlock” substantial energy, economic and environmental benefits for individual consumers, and society as a whole.

2.2 Lack of Alternatives to FHA loans

The Act directs HUD to develop an innovative pilot program to support home energy improvements. FHA determined that there was a need for less expensive and more widely available financing for energy-related home improvements. FHA established a set of core principles it believed any such financing should include:

1. The financing should not disrupt the first mortgage on the property or its priority for repayment;
2. Borrowers should qualify for the loan based on sound underwriting practices;
3. The expected energy savings should be equal to or greater than the cost of the financed amount; and
4. The term of the financing should be equal to or less than the expected life of the improvements.

With the exception of a few very small programs serving specific markets, FHA determined that a form of financing for home energy improvements that reflected the principles above and was generally available and affordable did not exist. In addition, FHA determined that the programs that generally did reflect these principles, such as the Fannie Mae Energy Loan, are typically provided as unsecured consumer loans. FHA determined that this fact results in a higher cost for consumers and a less liquid market for financing than a more conventional mortgage product, since consumer loans of this nature typically cannot be securitized or generate liquidity through capital markets investment. A table in the appendix summarizes the available alternatives to the FHA loan.

FHA determined that for mainstream mortgage financing for home energy improvements to be generally available and affordable, a viable secondary market for such products would be necessary. FHA determined that unless lenders were able to either sell whole loans, or securities backed by loans, it would be unlikely that such loans would ever be as widely available or as affordable as would be desirable. FHA determined that piloting the viability of a secondary market for a federally insured home energy retrofit loan program would be the optimal utilization of the funding and congressional authority under the Act.

Under the pilot program, as under the Title I PI program, the loan interest rate will be determined by the market and likely will vary to some extent by lender and location. Under the

Title I PI program, FHA has little ability to influence the interest rate beyond the (presumably significant) positive effect that federal insurance has on the rate. Recent reported interest rates for Title I PI loans have been 6 – 8 percent.

Under the pilot program, FHA is proposing several measures to further lower the interest rate and/or provide other financial benefit to borrowers – in addition to making financing more widely available than some other forms of financing. The first is through the use of appropriated funds under the Act as described above in Section 3.5. FHA believes that providing greater assurance to lenders (and potential investors in securities derived through the program) that they are less likely to owe more than 10 percent on the amount of any defaulted loan will contribute to better pricing for borrowers. It is not possible to quantify the extent of this benefit without until such pricing data becomes available through the conduct of the program.

The second is through the removal of the limitation on borrower discount points. By allowing city and state agencies states and nongovernmental entities to help lower the cost of financing for borrowers (either directly, such as through an interest rate write down, or indirectly, such as through a partial payment of servicing or other transaction costs), FHA projects that nominal interest rates could be reduced by up to 200 basis points for some consumers for loans that are sold or securitized, perhaps more for loans that are held in portfolio by the originating lender.

It is also the case that some of the requirements FHA proposes to add, such as required property valuation, may contribute to slightly higher lender costs, and therefore, potentially higher interest rates than would otherwise be the case. In all, FHA anticipates that most borrowers under the pilot program will be able to access financing at rates at or below the current interest rate for Title I PI loans. The pilot program is expected to promote voluntary investment in energy-saving technology by filling the current gap in the market for financing such investments.

2.3 Market Barriers to Investment in Energy-Saving Technology

There is some debate as to whether investment in energy-saving technology occurs at efficient levels. Indeed, there is no consensus as to whether the barriers that inhibit energy-

investment² are market-failures or even whether the existence of the “energy paradox” has been measured correctly. The market barrier approach to understanding energy-efficient investment takes the approach of evaluating a household’s investment decisions using sophisticated theoretical and empirical models. The fundamental premise of this approach is that the simple net present value approach used by engineers and manufacturers overestimate the return on the investment. Researchers have found that taking account of a wider set of variables have led them to conclude that there is no “energy paradox.” A market barrier is distinct from a market failure in that the market barrier is a private cost to adoption that does not require government intervention, whereas a market failure leads to a suboptimal level of market activity that may require government intervention.

First, a major incentive problem and market barrier leading to an under supply of energy-efficient investment in the residential sector would be the inability of the current homeowner to recapture the full value of the investment upon resale. This is, in effect, a principal-agent problem in which the benefit of the investment does not accrue to the investor. A homeowner may find that an investment would make financial sense because of the energy savings but does not make the optimal investment because its value would not be perfectly reflected in the resale price of the property. This misplaced incentive will occur whenever energy efficiency is not fully transparent; and the expected payback period is greater than the expected length of tenancy. The distortions in this respect do not need to be large for a consumer to under invest in energy-efficiency. For a prospective homebuyer to accurately assess the value of the current energy-saving technology, they would need to determine the efficiency of the appliances and shell of the current home (often without any standard labeling); predict future energy prices and interest rates; and finally have a good knowledge of what their own level of energy consumption would be in that home. Most households make home purchase decisions infrequently so that it is more likely that they will not have developed a sufficient background to accurately value the energy retrofit. Shoppers for homes will have an incentive to become informed if they can be compensated for the cost of information by lower energy costs. Thus, homeowners have a profit incentive to choose a level of investment that reflects the average consumers’ preferences. An investment decision that is rational for the current homeowner under

² See Sutherland (1991) for a description of the barriers to energy-efficiency in the residential sector and Garbely and McFarlane (2001) for an analysis of a tax on residential energy use.

asymmetric information would be suboptimal if made under perfect information, but that does not imply that there is a market failure.

Second, an energy-efficient investment is an irreversible investment for which the returns are uncertain. Energy prices are in general volatile, although the price charged to consumers is not as volatile as the spot market because of average cost pricing. Nonetheless, given the swings in energy prices, a consumer may be hesitant to make a bet on the future direction of energy prices until it seems that an obvious long-term trend has emerged. The greater the volatility, the longer an investor will postpone their investment in energy. Uncertainty in energy prices does not need to exist for a consumer to delay in investment. An investor may observe a downward trend in the cost of an energy-saving technology and decide to wait until it was even cheaper. Hassett and Metcalf (1995) find that, accounting for uncertainty, investment in energy-saving technology appears to optimal.

Third, high rates of return are likely to be required by households. Discount rates have been estimated for energy-efficient investments and have been found to range from 20 percent to 800 percent (Jaffe and Stavins, 1994). Even the lower bound of 20 percent is high when compared to prevailing interest rates at the time when these various studies were done (ranging from 6 to 10 percent). Note that the measurement of the high discount rates may, in fact, measure other barriers. A contrasting result comes from an empirical study (Metcalf and Hassett, 1999) of energy savings, which finds that the median return to an energy-efficient investment (attic insulation) is 9.7 percent. Their own result, however, is consistent with a CAPM estimate of a discount rate, and thus provides little in the way of evidence of an “energy paradox.” The authors hypothesize that many of the previous energy-efficiency analyses used engineering estimates rather than the actual results. There are, however, reasonable grounds to doubt the theoretical approach of Metcalf and Hassett (1999). According to Sutherland (1991), the assumptions of the CAPM model are that the underlying security markets are characterized by: zero transaction costs and perfect liquidity; assets are marketable; and there is an ability to reduce risk. Because a household faces market barriers such as illiquidity and high risk that they can not diversify³, they are likely to demand a higher compensation than the prevailing average return on business investments.

³ Do households have a sufficient portfolio to diversify attic insulation?

Contrary to the market barrier approach, the market-failure rationale is often used to explain the undersupply of energy efficient investment (Jaffee and Stavins, 1994). First, information concerning the energy-saving technology may be in short supply because the marginal cost to the consumer of using it is zero. Having information on the range of opportunities provided by energy conservation retrofits is critical to making the optimal decision concerning its adoption.⁴ Government policies aimed at setting well-defined standards attempt to resolve this failure. Second, consumers may face artificially low energy prices, a situation which has the effect of discouraging energy efficient investment. Examples of below optimal prices are: subsidized electricity prices, environmental externalities resulting from residential use, and average cost pricing of energy that does not reflect the marginal cost of supply. If it is determined that the outcome is suboptimal, then identifying cause of the market failure is important in guiding effective policy (Jaffe and Stavins, 1994).

There exists evidence of significant market barriers to energy conservation investment in the residential sector. If uncertainty, illiquidity without marketability, and the cost of information lead to a shortfall in retrofits, then any energy savings as a result of the FHA loan program are best viewed as a transfer to the consumer because they constitute a reduction of private costs that would not have occurred otherwise. If there are no market failures, then it is arguable whether the end goal of public policy should be to encourage energy conservation. However, it is apparent that the primary market failure in the residential energy sector is the overproduction of emissions. The FHA loan addresses this market failure by lowering private costs to energy-saving investment.

3 Summary of Notice

After analyzing the viability of several existing FHA programs to serve as the basis for such a pilot program, FHA determined that the FHA Title I Property Improvement (PI) program provided the most appropriate basis for a pilot. Therefore, FHA provides a set of modifications to the current Title I PI program that will yield a new product for use in the pilot. While most of the proposed changes are relatively minor, as a group, and in combination with the appropriated funds, they have the effect of creating an innovative pilot program that accords with Congress' direction in the Act. These changes fall into the following categories: 1)

⁴ The empirical analysis of DeCanio and Watkins (1998) suggests the importance of informational diffusion.

changes designed to enhance FHA underwriting of program loans; 2) changes related to FHA administration of the program, specifically in the areas of loan servicing, claim procedures and reporting; 3) changes to target the pilot program specifically on its purpose of improving home energy performance; and 4) changes to provide additional benefits to borrowers. Finally, as noted, FHA proposes to augment these changes with incentives for lenders to participate, using funding appropriated for the under the Act. In summary, these changes adjust the current flexible framework for the Title I PI program to enable it to encourage and directly support home improvements that improve energy performance, while reducing barriers to making financing under the program more widely available and more affordable. The Retrofit Pilot Program will be conducted for loans originated during a period of 2 years. In selecting communities in which to conduct the Pilot Program, HUD will target communities that have already developed a robust home energy efficiency retrofit infrastructure.

3.1 Changes to Enhance Underwriting

FHA's underwriting standards for Title I PI loans give lenders flexibility in extending credit. There is no minimum required credit score for borrowers and no combined loan-to-value ratio (CLTV) cap. (Total debt-to-income is capped at 45 percent). In the Notice, FHA proposes that for the pilot program product borrowers be required to have a decision credit score⁵ of 660 or higher. In addition, FHA proposes to limit the maximum CLTV ratio for the mortgage and energy retrofit loan to 100 percent. FHA also proposes to require a method to determine valuation of the property, such as an Exterior-Only Inspection Residential Appraisal Report (HUD Form 2055) or an Automated Valuation Model (AVM) to establish property value. The borrower's total debt-to-income ratios would remain capped at 45 percent under the pilot program.

There are several reasons for these changes. The purpose of tighter mortgage underwriting is to determine a borrower's ability and willingness to repay the debt, and to limit the probability of default. FHA believes it is important to limit the financing under the program to borrowers who are in a financial position to take on and repay additional debt. While these proposed changes would prevent some consumers from being able to access the program, FHA determined that it is appropriate, if not necessary, to test the program with borrowers who meet the above criteria. In addition, FHA determined that creating liquidity through secondary

⁵ A decision credit score is one using the methodology established by the Fair Isaac Corporation, or other similar credit scoring systems.

market investment in loans under the program would require the adoption of requirements such as these.

3.2 Changes in Loan Servicing, Claim Procedures and Reporting

Under the Title I PI program, lenders remain responsible for proper collection efforts, even though actual loan servicing and collection may be performed by an agent of the lender. For the purposes of the pilot, FHA proposes that in addition to meeting these requirements the servicer be made fully accountable for the required servicing responsibilities, whether the servicer is the original lender or a subsequent servicer. This is the norm under FHA's major single family program (commonly referred to as the Title II Program). As with the Title II program, FHA proposes that in the pilot program, "the mortgagee shall remain fully responsible for proper servicing, and the actions of its servicer shall be considered to be the actions of the mortgagee." FHA proposes to specify that the servicer shall also be fully responsible for its actions as a servicer and intends to seek recovery from servicers if FHA losses are attributable to servicing errors.

Also, under the Title I PI program, FHA requires that insurance claims be fully documented. Under the pilot program, FHA proposes that the holder of the note will be accountable to FHA for origination/underwriting errors, and the servicer will be accountable to FHA for servicing errors. If a claim would be denied due to servicing errors, FHA would pay the claim to the holder of the note and seek recovery of its losses from the servicer. To effectuate this, the insured lender would be required to obtain at loan origination an indemnification or subrogation agreement from the sub-servicer that would be assigned to FHA when an insurance claim is filed.

The primary reason for these changes is to clarify the responsibilities and obligations of servicers under the pilot program. In addition, FHA determined that clarity with respect to FHA claim payments due to servicer errors would mitigate risk from the perspective of potential secondary market capital sources.

3.3 Changes to Improve Home Energy Performance

Under the Title I PI program, loan proceeds may be used only for the purposes disclosed in the loan application. Under the Title I PI program, proceeds may be used only to finance

property improvements that substantially protect or improve the basic livability or utility of the property. FHA has the authority to establish a list of items and activities that may not be financed with the proceeds of any property improvement loan. Under the pilot program, FHA proposes that loan proceeds may be used only for measures that improve home energy performance or directly make such measures possible for single family, attached, and semi-detached owner-occupied homes. Condominiums and fee simple ownership properties are also eligible. FHA proposes that if a lender has any doubt as to the eligibility of any item or activity, the lender must request a determination from FHA before making a loan.

The reason for this limitation is that the purpose of the pilot is to provide financing specifically for home energy retrofits. In addition, FHA determined that limiting the eligible uses of loan proceeds as described will allow better evaluation of the pilot for its intended purpose and facilitate broader analysis of pilot program data to inform other financing efforts to support home energy retrofits.

A related change is a specification on loan maturities. Under the Title I PI program, an insured loan may have a term as long as 20 years. Under the pilot, FHA proposes to limit loan maturities to 15 years, except in the case of renewable energy improvements, which may be financed with 20-year loans. The reason for this change is to better align the term of financing with the useful life and benefits of typical home energy improvements which the pilot program will allow and encourage. In general, most the typical retrofit improvements financed through the program will have a useful life of 15 years or less. More closely aligning financing with useful life helps ensure that consumers do not pay an inordinate amount over time for the cost of the improvements.

3.4 Changes to Provide Additional Borrower Benefits

Under the Title I PI program, the lender may not require or allow any party, other than the borrower, to pay discount points or other financing charges in connection with the loan transaction. FHA proposes to allow other parties, such as state and local governments, private organizations and nonprofit organizations to pay discount points or other financing charges in connection with loans under the pilot program. FHA proposes to specify that the benefits must be bona fide and accrue to the borrower. FHA would review and approve the use of this authority on a case-by-case basis. The rationale for this change is that a growing number of cities and states, as well as utilities, nonprofits and other institutions, have made commitments

to provide grant funds and other resources to leverage, extend, or otherwise enhance the value of financing for home energy retrofits. Participating lenders would also have this ability (see 3.5 below). FHA determined that enabling and encouraging lenders participating in the pilot program to work with and align resources with such entities would foster innovative partnerships, help generate additional investment and offer additional value to consumers.

In addition the Title I PI requirements generally provide that loan proceeds may be disbursed to the borrower in full at loan closing. Under the pilot program, FHA proposes that funds would be disbursed to the borrower(s) in two increments: (1) 50 percent of the proceeds shall be disbursed at loan funding/closing; and (2) the remaining 50 percent of the proceeds shall be disbursed after the energy retrofit improvements have been completed as evidenced by an executed Completion Certificate for Property Improvements (Form HUD-56002) by the borrower(s), and a lender required inspection. This change strikes a balance between enabling contractors to start work, while providing borrowers the ability to ensure that they receive the services and improvements they expect and were approved for under the pilot program.

Finally, the Title I PI program allows “dealer loans” defined as, “a loan where a dealer, having a direct or indirect financial interest in the transaction between the borrower and the lender, assists the borrower in preparing the credit application or otherwise assists the borrower in obtaining the loan from the lender.” Generally, dealer loans made under the Title I PI program are marketed by home improvement contractors and executed in the form of retail sales installment contracts. FHA proposes to disallow dealer loans under the pilot program. While FHA recognizes that there are many responsible dealers who can and would provide financing through dealer loans in a responsible manner, FHA is proposing to limit the pilot program to “direct loans” as defined under the Title I program (at § 201.2) as, “a loan for which a borrower makes application directly to a lender without any assistance from a dealer.” FHA determined that dealer loans have been disproportionately correlated with poor loan performance under Title I and other home improvement loan programs in the past. Home performance contractors and others whose activity may be described under the definition of “dealer” under the Title I program would still have an opportunity to participate in their primary business by performing the actual retrofits.

3.5 Use of Appropriated Funds

FHA determined that even with federal mortgage insurance such as would be available under the pilot program, small loans for home energy retrofits may have relatively high transaction costs for lenders, discouraging some from offering such loans and forcing others that do offer them to increase costs to borrowers. FHA proposes to use the \$25 million appropriated by the Act to provide lender incentive payments to support activities that lower costs to borrowers. Eligible uses of such payments will include lowering loan interest rates (per 3.4 above) and, for lenders that will also service their loans, reducing servicing costs. HUD will also consider other proposed uses of such funds. Any use of funds must deliver, to HUD's satisfaction, bona fide benefit to borrowers. The amount of payment to each lender and the eligible uses of funds by each lender will be determined by HUD based on the lender's Expression of Interest. HUD anticipates that the amount of grant funds will not exceed \$5 million per lender. Funds would be available to lenders who request them, but would not be required for participation. Lenders who do not seek funds could still participate in the program.

HUD recognizes that even with federal mortgage insurance such as would be available under the Pilot Program, small loans for home energy retrofits may have relatively high transaction costs for lenders, discouraging some from offering such loans and forcing others that do offer them to increase costs to borrowers. HUD will utilize the appropriated funds provided under the 2010 Appropriations Act to provide lender incentive payments to support activities that lower costs to borrowers. Eligible uses of such payments include: (1) Lowering loan interest rates; (2) Supporting costs associated with creating or enhancing systems necessary to deliver PowerSaver insured loans; (3) Offsetting costs associated with appraisals and other approved methods of property valuation; and, (4) for lenders that will also service their own loans, reducing servicing costs.

4 Benefits and Costs

Given the Congressional directive to pilot an innovative program, the proposed program is essentially a new initiative for FHA. As a result, existing data with which to forecast costs and benefits are limited. At this stage, a provisional assessment is possible, but it should be noted that numerous unforeseen factors may affect the actual performance and results of this program.

4.1 Aggregate Loans Affected

As noted, FHA envisions a 2-year program in which it would provide insurance on an estimated 24,000 home energy retrofit loans. Assuming loans are distributed roughly evenly over that period (1,000 per month/12,000 per year), activity under the pilot program would be larger than the current activity in the Title I PI program. (See accompanying chart on the Title I PI program.)

4.2 Benefit of Policy Change

The direct purpose of the policy change outlined in this Notice is to achieve the statutorily mandated requirement to conduct an “Energy Efficient Mortgage Innovation” pilot program targeted to the single family housing market. The broader purpose of the policy change, however, is to test and demonstrate the feasibility of expanding the availability of low-cost financing for secured home energy retrofit loans through a mainstream mortgage lending approach and access to a secondary market.

While homeowners stand to save money through implementing cost-effective measures to improve their home’s energy performance, relatively few homeowners have taken such steps. Research suggests that multiple barriers impede wider activity, including inadequate information on the costs and benefits of home energy improvements, limited availability of qualified contractors to perform retrofits and various behavioral barriers. In addition to these factors, a lack of capital to fund retrofit improvements is consistently cited as a primary barrier as well.

Based upon FHA’s analysis, it would appear that the availability of federally-insured financing products for home energy retrofits could significantly broaden the appeal and feasibility of pursuing such home improvements. While there are other financing options available for consumers in certain places, these programs typically experience minimal usage, further evidencing the opportunities for a broader, nationwide initiative. The financing options currently available in the marketplace may also have downsides or require tradeoffs. Unsecured consumer loans or credit card products for home improvements typically charge high interest rates, for example. Home equity lines of credit require owners to be willing and able to borrow against the value of their homes during a period when home values are flat or declining in many markets. Subsidized revolving loans funds are generally limited in availability and do not always

offer loans for home improvements. Utility “on bill” financing (in which a home energy retrofit loan is amortized through an incremental change on a utility bill) have been resisted by most utilities and only serve a handful of markets on a small scale. “Property assessed clean energy” (PACE) assessments (in which financing for retrofits is amortized through an incremental increase in property tax or similar bills) have generated resistance from federal financial system regulators due to their general requirement to have priority over all existing liens on a property, including the first mortgage. These alternative programs are summarized in a table in the appendix.

FHA has further determined that the most beneficial means of testing the pilot program is to target it to communities that appear to be best positioned to deliver resources to support the other aforementioned components of a comprehensive retrofit program. FHA therefore intends to target the pilot program to the communities that recently received competitive grant funding under the Department of Energy’s “Retrofit Ramp Up” program, now known as the ‘Better Buildings’ program. The program was specifically focused on supporting the most promising holistic, “place-based” retrofit initiatives, i.e., those that integrate consumer education and marketing; audits and other information tools; workforce capacity and quality assurance, as well as financing. The program strongly emphasizes the importance of linking financing to broader retrofit programs. Given the generally limited availability of financing for home energy retrofits noted above – in particular, the apparent restrictions on PACE financing, which many communities had anticipated would be their primary source for home retrofit financing – FHA determined that there is significant demand for a program such as the one proposed in the Notice in communities best suited to effectively deploy it.

Targeting the pilot program in this way may bias the results of the pilot in a more successful direction because the chosen communities are not typical. Achieving a high volume of loans is critical because the more learning-by-doing that can be accomplished during the pilot, the faster will be the adoption of energy-efficient mortgages across the nation in potential future stages of the policy experiment. It was decided that the opportunity to evaluate a large number of loans was more important than experience in a wide range of communities.

4.3 Private Benefits of More Energy Efficient Homes

Beyond the direct purpose of the pilot, a second approach to measuring the advantages of loans made under the pilot program is to characterize the benefits to the consumer of living in a more energy efficient home. As noted in 2, one expected benefit to consumers is lower household energy costs. Data from the federal Weatherization Assistance Program and the Energy Star program suggest that a relatively modest set of home retrofit energy improvements, achievable for less than \$10,000 on average, can lead to average annual savings of \$200 - \$400. DOE's data indicate that every \$1 invested in weatherization reduces household energy bills by \$1.65 per month. This range of savings is probably an appropriate one to project as a starting point for the proposed pilot program.

On the one hand, the proposed pilot program would allow for more extensive improvements, including the use of renewable energy technologies, (up to \$25,000) than a typical home energy retrofit would entail, potentially leading to deeper savings. On the other hand, consumers would not be required to borrow a specified amount or adopt a defined set of measures; they would be free to choose from the list of eligible improvements approved by FHA and the Department of Energy. FHA's general sense is that consumers will find it cost effective to invest in either a package of several modest improvements (e.g. weather stripping, duct sealing and additional insulation) or a single or smaller set of higher cost improvements (new windows or a new HVAC system), in either case costing approximately \$10,000. Consumers who are interested and able to make a smaller investment for a specified improvement may find it more cost effective to seek access to other subsidies such as: a local utility rebate, or a local, state, or federal tax credit.

The net benefit of an energy-saving retrofit depends on the cost of the retrofit, the resulting reduction in energy consumption, the path of energy prices, and the discount rate. The potential reduction in energy consumption from the retrofit (technical efficiency) provides us with the value of annual saving at current energy prices. The annual benefit, as measured by the potential reduction in energy expenditure depends on energy prices: as energy prices rise, the energy efficiency is worth more. The longer the lifetime of the investment the greater is the sum of benefits. Finally, as benefits are discounted at a higher rate, the sum of the present value of benefits will be lesser. The tables below show the benefit-cost ratios for a retrofit cost of \$10,000 that provides energy savings over a period of twenty years. Ratios vary by the

discount rate, annual energy saving, and energy price growth. The estimates in these tables are similar to other benefit-cost analyses. Clinch and Healy (2001) estimate a benefit-cost ratio of 1.7 and find that their estimate is about the midpoint of other studies on energy efficiency.

The benefit estimates rely on the estimates of annual saving. From the 2008 Consumer Expenditure Survey, we know that the average household spends \$2,400 on energy. The \$600 saving would represent a 25% reduction; \$800 represents a 33% reduction; and \$1000 represents a 41.7 percent reduction. These estimates are in line with what is provided by Pike Research (2010) based on data from HUD, DOE, and EPA: they find a potential 36 percent reduction in annual energy bills. Energy saving estimates of this range is confirmed by Nadel et al. Upon reviewing other studies, they conclude that the technical potential for energy saving is 33 percent for electricity and 40 percent for natural gas. The assumed cost of the investment at \$10,000 is 10 percent of the highest annual saving. This is roughly similar to the 15 percent reported by Pike Research.

Table A. shows the cost-benefit ratios when the cost is an up-front investment, \$10,000 in the first year. Table B. shows the cost-benefit ratios when the retrofit is financed with a 15 year loan subject to a 5 percent interest payment, a 1 percent annual premium, and a 3 percent down payment.

Cost Benefit Ratio of \$10,000 Energy saving Retrofit (over 20 years)									
A. Upfront Investment of \$10,000									
Energy Price Growth	Discount Rate of 3%			Discount rate of 7%			Discount rate of 10%		
	Annual Energy Saving			Annual Energy Saving			Annual Energy Saving		
	\$600	\$800	\$1,000	\$600	\$800	\$1,000	\$600	\$800	\$1,000
-1%	0.85	1.13	1.41	0.63	0.84	1.05	0.53	0.70	0.88
0%	0.92	1.23	1.53	0.68	0.91	1.13	0.56	0.75	0.94
1%	1.00	1.34	1.67	0.73	0.98	1.22	0.60	0.80	1.00
B. Financed by 15 year loan with 5% interest rate and 1% premium									
Energy price Growth	Discount Rate of 3%			Discount rate of 7%			Discount rate of 10%		
	Annual Energy Saving			Annual Energy Saving			Annual Energy Saving		
	\$600	\$800	\$1,000	\$600	\$800	\$1,000	\$600	\$800	\$1,000
-1%	0.68	0.90	1.13	0.63	0.85	1.06	0.61	0.81	1.02
0%	0.74	0.98	1.23	0.68	0.91	1.14	0.65	0.87	1.08
+1%	0.80	1.07	1.34	0.73	0.98	1.22	0.69	0.93	1.16

The net benefits of an energy efficient retrofit are not always positive under the scenarios considered above. The highest benefit-cost ratio is 1.67, which, with a \$1000 annual saving, 1 percent appreciation, and 3% discount rate, breaks even after eleven years. The retrofits with a lower cost-benefit ratio take longer to repay. With a ratio of 1.05, annual saving of \$1000, price appreciation of -1 percent, and a discount rate of 7 percent, the investment breaks even after seventeen years.

Offering a loan to pursue the retrofit has two effects on costs: it adds to the cost through the interest cost, but at the same time it postpones the costs of the investment into the future. The net effect on cost to the consumer depends on the difference between the cost of the loan and their own discount rate. The current value of the payments on a 5 percent loan with a 1 percent premium over fifteen years add up to \$14,780. When the discount rate of the consumer is high, for example 10 percent, then the loan makes the investment beneficial under certain circumstances. Consumers with higher discount rates value money in the present more highly relative to money in the future. Energy savings would need to be significant to motivate an upfront investment of \$10,000. If, however, a consumer can leverage the investment through a loan, then he or she can delay the costs as well as the benefits. The present value of the loan payments is \$8,600 when the discount rate is 10 percent. The loan allows the consumer with a 10 percent discount rate to make an energy saving investment when the annual saving is \$1,000. As long as there is a buffer between the interest rate on the loan and the consumer's discount rate, the loan will be advantageous. This positive effect of the loan can also be seen with the consumer who has a discount rate of 7%, although the difference is very small and does not affect outcomes.

The loan has the opposite effect on the benefit-cost ratio for consumers with discount rates below the interest rate. We see from the above Table that the loan is less advantageous than the upfront investment for the consumer with a 3 percent discount rate. The present value of the loan payments is \$12,460. In this case, two of the scenarios are no longer profitable with the loan. Despite this particular example, we expect the loan to have positive effects on investment. First, the discount rates of consumers have consistently been shown to be at least as high as 10 percent in the context of energy-saving investment. Second, even if the interest cost adds to the costs of the investment, many consumers would not have the necessary funds to undertake the investment without a loan.

Whatever the predicted technical efficiencies of an energy retrofit, the actual savings by a household is likely to be smaller due to a behavioral response known as the “rebound effect.” By increasing energy efficiency, the retrofit reduces the expense of physical comfort and will thus increase the demand for comfort. In fact, the retrofit may have been driven by a demand for more heating in the winter or cooling in the summer. The size of the rebound effect will depend on the income of the household and the path of energy prices. Boardman (1994) found that 70 percent of the benefits of energy-efficient improvements reduce energy consumption, the rest go towards increased health and comfort. Reliable estimates of the long-run rebound effect for consumers range from 1.4 percent to 60 percent. An upper end estimate of the rebound effect for space-heating and cooling would be 30 percent (Sorrel, 2007).

The concept of a rebound effect is not controversial in energy-efficiency studies. Although it is difficult to pinpoint an agreed upon proportion, the rebound effect is usually less than 50 percent (Clinch and Healy 2001). More controversial is the idea that the rebound effect can be equal to or greater than 100 percent. Such an effect is referred to as the “Jevons effect” or paradox. While theoretically compelling, there is little empirical validation of the Jevons paradox.

The rebound effect does not in any way reduce the energy efficiency benefit to a consumer. Rather, the rebound effect informs us to what extent the benefits of the consumer are divided between reduced energy costs and increased comfort. The technical efficiency generated by a retrofit expands the budget set of the consumer and may be consumed either as income or comfort. The net benefit to the consumer of the loan is thus equal to the above benefit-cost ratio multiplied by the cost of the investment less the cost of the investment. For example, for an annual saving of \$1000, 0% price growth, and 7% discount rate, the net benefit to the consumer is \$1,400. The \$1,400 will be divided between comfort and energy savings, but that proportion does not affect the total amount of benefits to the consumer.

The size of the rebound effect does have implications for measuring the public benefit of reducing energy consumption. If the primary goal of an energy efficiency investment program is to reduce emissions, then the amount of benefits going towards reduced energy consumption is critical.

4.4 Consumer Benefits versus Transfers

When the barriers to energy-efficient investment are market failures then an increase in energy saving investment can be counted as a benefit created by the program. If, however, there are primarily non-market failures, then the energy savings should be counted as a transfer to consumers. At this time there is no research indicating what the appropriate split should be between the two. However, the tendency in the last twenty years has been to rely on market barriers (non-market failures) as an explanation for the state of affairs.

4.5 Non-Energy Benefits

There may be significant non-financial benefits associated with more energy efficient homes as well. The American Council for an Energy Efficient Economy found that residential retrofits deliver an “array of benefits beyond energy savings,” including greater comfort, convenience, health, safety and noise reduction.⁶ These “non-energy benefits” have been broadly estimated to be worth 50 percent to 300 percent of annual household energy bill savings. The rebound effect of 30 percent of potential energy savings can be counted as greater comfort.

4.5.1 Emissions

One metric is reduced energy consumption and resulting lower carbon dioxide emissions. As noted in Section 2, there is general consensus that energy savings of 20 – 30 percent are broadly achievable through the type and range of home energy improvements contemplated under the pilot program. A third approach is to evaluate the social benefits of more energy efficient homes. The effect of a decline on energy consumption reduces emissions of pollutants (such as particulate matter) that cause health and property damage and greenhouse gases (such as carbon dioxide) that cause global warming. While the data on the potential carbon emission reduction is limited, data from the DOE suggests that low-income residential retrofits through the Weatherization Assistance Program reduce carbon dioxide emissions by an average of 1.6 tons per home, per year. Another study found that weatherizing 12,000 homes in Ohio avoided more than 24,000 tons of carbon dioxide (while also reducing 100,000 pounds of sulfur dioxide). Tradable emissions permits or a tax on the marginal social cost are often recognized as the

⁶ According to the U.S. Department of Energy, a home needs ventilation to reduce indoor contaminants, moisture, and odors: “Unless properly ventilated, an airtight home can seal in indoor air pollutants. (U.S. Department of Energy, 02/09/2011).”

preferable policies for addressing pollution. Encouragement of investment in energy efficient housing, while it may be considered a second-best policy, is one of the only policy instruments available to the Department to influence energy consumption in the built environment. Thus, any social surplus lost by encouraging an economic activity (energy retrofits) beyond the market equilibrium should be evaluated against the potential social gain of reduced energy consumption.

4.5.2 Health Benefits

Besides reductions of emissions are health benefits resulting from reduced mortality and morbidity. Greater energy-efficiency for all allows households to afford energy for heating during severe cold or cooling during intense heat. Doing so reduces the risk of both death and illness for vulnerable populations.

4.6 Costs of Energy Efficient Investment

The cost of receiving the energy-savings is the upfront investment plus the costs of financing the investment. The average loan is characterized by a term of 15 years, a down payment of 3 percent, an interest rate of 5 percent, and a 1 percent annual insurance premium. The sum of the undiscounted mortgage and insurance premium payments is \$14,780. For a consumer with a discount rate of 3 percent, the present value of the cost of the \$10,000 investment loan would be \$12,460. For a consumer with a discount rate of 7 percent, the present value of the cost of the investment would be \$9,980. For a consumer with a discount rate of 3 percent, the present value of the cost of the loan would be \$8,640.

4.7 Aggregate Benefits and Costs

FHA envisions a 2-year program in which it would provide insurance on an estimated 24,000 home energy retrofit loans. Assuming loans are distributed roughly evenly over that period (1,000 per month/12,000 per year); activity under the pilot program would be larger than the current activity in the Title I PI program. There exist three primary “leakages” to the energy-conserving purpose of the pilot program: 1) a rebound in energy use; 2) the extent to which the loan product is a windfall versus an incentive 3) the use of a portion of the loan for purposes other than retrofits.

If we take the annual saving of \$1000, 0 percent price growth, and 7 percent discount rate as a base case, then the present value of the technical retrofit is \$11,400. Assuming a rebound

effect of 30 percent yields a comfort benefit of \$3,400 and energy savings of \$8,000 per participant. Approximately 24,000 loans are expected over two years. For the base case scenario described above, this would equal \$41 million in comfort benefits and \$96 million in private energy savings for each year of the program.

The benefits and transfers generated by the FHA program may not equal the sum of the benefits and transfers of all retrofits financed through the program, but only reflect the benefits and transfers of the retrofits that would not have occurred without the program. For example, if consumers would have invested without the loan guarantee, then the only effect of the program would be a transfer to consumers equal to the lower cost of capital. We have discussed, however, the existence of significant market imperfections and the lack of affordable financing so that it is reasonable to assume that a large proportion, if not all of the loans, will generate benefits. While there are no previous experiments of energy efficient loans, the federal government provides an incentive in the form of the energy conservation tax credit. Studies of the impacts of the tax credit have been mixed, but the most complete work by Hasset and Metcalf shows that an increase in the tax price of energy increases the propensity to make an energy conservation investment. The lessons to be taken from this study are that 1) incentives that reduce the cost of capital will lead encouraging energy efficient investment; and 2) there is a demand for those incentives.

The possibility exists, however, that a portion of the investment undertaken by participants of the program would have occurred without the program. In these cases, the program serves as a windfall to the consumer receiving the subsidy and does not serve to create any of the benefits discussed above. HUD believes that the likelihood that households that would receive a loan would have renovated without the loan is very small.

A very small share of homeowners historically has invested in home energy improvements. The primary financing options that have been available – home equity loans and consumer loans – are out of the reach of most homeowners, perhaps more so today than ever before; the former due to relatively high thresholds for home equity and credit score; the latter due to relatively high interest rates. Even in communities that have been identified as leading in raising consumer demand (e.g., Department of Energy Better Building program participants), financing options may be limited. Many of these communities built their residential programs in anticipation of utilization property assessment clean energy (OACE) financing. That option has

been largely foreclosed in recent months as a result of actions taken by the Federal Housing Finance Administration, Fannie Mae, Freddie Mac and the Office of the Comptroller of the Currency. The aggregate net benefits are obtained by multiplying the individual net benefits by the expected number of loans and adding the expected social benefits of reduced energy consumption.

Present Value of Potential Energy Savings of Pilot Program in First Year (12,000 Participants) in \$Millions									
Retrofits Induced by Pilot	Discount Rate of 3%			Discount Rate of 7%			Discount Rate of 10%		
	Benefits	Costs	Net benefits	Benefits	Costs	Net benefits	Benefits	Costs	Net benefits
25%	46	37	9	34	30	4	28	26	2
50%	92	75	17	68	60	8	56	52	4
100%	184	150	34	136	120	16	112	104	8

Above three scenarios are presented: one where all of the energy benefits are realized by the program; one where only half of them are realized; and one where only one quarter of the benefits are induced by the pilot. We have discussed, however, the existence of significant market imperfections and the lack of affordable financing so that it is reasonable to assume that a large proportion, if not all of the loans will generate benefits.

Present Value of Potential Energy Savings over Two Years of Pilot Program (24,000 Participants) in \$Millions (all proceeds of loan used for retrofit)									
	Discount Rate of 3%			Discount Rate of 7%			Discount Rate of 10%		
	Benefits	Costs	Net benefits	Benefits	Costs	Net benefits	Benefits	Costs	Net benefits
Year 1	184	150	34	136	120	16	112	104	9
Year 2	179	145	33	127	112	15	102	94	8
Total	362	295	68	263	232	31	215	198	17
Annualized	24	19	4	24	21	3	25	23	2

The estimated energy saving over the lifetime of the program, given a 100 percent incentive effect, is provided in the table above. The benefits and costs of the total program are annualized over 21 years to yield an annual rate of return of 1.5 percent (4 divided by 150) for the case of the 3 percent discount rate; 1.2 percent for the case of the 7% discount rate; and 0.9 percent discount for a 10 percent discount rate.

An in-depth analysis by Clinch and Healy (2001) of domestic energy efficiency found the benefit-cost ratio to be 3.0 (with a 5% discount rate). Energy reduction benefits represent the majority of the benefits (57%), followed by health benefits (25%), comfort benefits (10%), and

emissions reduction (8%). Even if private consumers do not undertake an investment for which there appears to be a 1.7 benefit-cost ratio, there are other public benefits to motivate energy efficient investment.

Below we present the benefit-cost ratio based on the Clinch and Healy analysis.

Benefit-Cost Ratio by Discount Rate					
Participation	Energy Savings	Comfort	Emissions	Morbidity and Mortality	Sum of Benefits
3%	2.14	0.31	0.31	0.74	3.50
5%	1.69	0.29	0.25	0.72	2.95
8%	1.24	0.26	0.18	0.70	2.38

The benefit-cost ratio at a 3 percent discount rate is 2.14 for energy savings and 3.50 for the sum of all benefits. Note that the comfort benefit is a smaller proportion of the overall benefit than for our analysis. Although Clinch and Healy assume a higher rebound effect (40 percent); they also assume that over time more energy efficient housing will be built, which will make energy saving easier. The above table can be used to estimate the value of non-energy benefits. In all of the above scenarios, reduced emissions are approximately twelve percent of energy benefits (savings plus comfort). Health benefits range from 30 to 46 percent of energy benefits. Thus, in the most comparable case of a discount rate of 3 percent, the benefits of the rule could be 63 percent greater than the potential energy savings ($3.50/2.14$) and an additional \$230 million in benefits. According to the Clinch-Healy analysis, the differential grows between potential energy savings (energy and comfort) and non-energy benefits grows: at a 5 percent discount rate, non-energy benefits could account for an additional 75 percent of benefits; and at a 8 percent discount rate, non-energy benefits accounts account for an additional 92. A linear interpolation of these results suggests that with a 7 percent discount rate the additional benefits (reduction of emissions, mortality and morbidity) would represent an additional 86 percent, or \$226 million.

The last potential leakage is that the FHA loan is not required to finance only energy-efficient investments. Up to 25 percent may be diverted to other home improvements. If, however, all households elect to use only 75 percent of the proceeds of the loan to finance energy retrofits, then the benefits are expected to proportionally lower. It is expected that the

most common proportion of the loan devoted to energy retrofits will be 75 percent. In this case, the private energy benefits of the program would be \$197 million. However, there are benefits of the non-retrofit allowance. First, this feature of the loan is useful in marketing the loan and may result in a greater diffusion of the loan product. Second, there may be efficiencies for consumers in the non-retrofit portion of the loan: consumers who need to finance renovations made necessary by the retrofit will not be required to pay the transactions costs for an additional loan. The aggregate energy savings in the presence of the maximum allocation towards non-conservation uses are described in the below table.

Present Value of Potential Energy Savings over Two Years of Pilot Program (24,000 Participants) in \$Millions when 75 percent of proceeds are allocated to retrofit									
	Discount Rate of 3%			Discount Rate of 7%			Discount Rate of 10%		
	Benefits	Costs	Net benefits	Benefits	Costs	Net benefits	Benefits	Costs	Net benefits
Year 1	138	113	26	102	90	12	84	78	7
Year 2	134	109	25	95	84	11	77	71	6
Total	272	221	51	197	174	23	161	149	13
Annualized	18	14	3	18	16	2	19	17	2

5 Transfers

5.1 FHA

For broadly illustrative purposes, FHA has estimated the credit subsidy rate for the Title I PI program to be -0.76, the expected average loan size to be \$14,780 and the expected claim rate to be 4.51 percent. Without the ability to formally model the pilot program absent data or experience FHA estimates that the underwriting and operation features of the pilot program, described in 3.1 and 3.2, will not contribute to a higher risk profile for the program as it is implemented. We expect that this program will generate positive transfers for FHA. If the credit subsidy rate were -0.76 percent and the loan volume \$150 million annually, then the FHA could expect \$1.14 million from the pilot.

5.2 Consumers

The transfer to consumers is equal to the difference between the FHA interest rate and the interest rates on other loans available for the same purpose. As discussed, alternative means of financing are limited and come with higher interest costs. However, if the next best

interest rate for the consumer were fairly low at 10 percent, then this loan would represent a transfer of approximately \$5,000 per household. Such a transfer, or windfall, would apply for households that would have financed an energy retrofit without the incentive of an FHA loan. Aggregated over 12,000 participants, the aggregate annual consumer transfer through lower interest costs would be \$62 million. Note, however, that in an earlier discussion we concluded that most households would not invest without the FHA loan.

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7 Appendix

Characteristics of Financing Instruments				
Financing Type	Availability	Cost	Pros	Cons
Home Equity Loans	Varies widely by borrower, home value.	Relatively low, 6-7% on average.	Can be relatively quick and simple for homeowners to execute.	Not marketed or targeted for energy efficiency. Home values flat or declining for many consumers
Unsecured Personal Home Improvement Loans	Widely available	High.	Can be relatively quick and simple for homeowners to execute.	Not marketed or targeted for energy efficiency, except for Fannie Mae Energy Loan, which is available only through three lenders and operates at very low-volume. Cost may exceed savings.
Credit Card Loans	Widely available	High	Can be relatively quick and simple for homeowners to execute.	Not marketed or targeted for energy efficiency. Cost may exceed savings.
Retail sales Installment Contracts	Widely available	Relatively high	Can be relatively quick and simple for homeowners to execute.	Cost may exceed savings.
"PACE" Assessments	Not widely available.	Relatively low in most cases; 6-7 percent on average; APRs higher in some cases.	Can be relatively quick and simple for homeowners to execute.	Only available in a few communities due to federal financial regulator and GSE concerns.
Utility "On Bill" Financing	Not widely available.	Relatively low in most cases; 6-7 percent on average cases.	Can be relatively quick and simple for homeowners to execute.	Only available in a few communities.

ECONOMIC DATA SUMMARIZING COSTS AND BENEFITS

Category	Primary Estimate	Low Estimate	High Estimate	Units			Notes
				Year Dollars	Disc	Period Covered	
Benefits							
Annualized Monetized \$millions/year	\$25 Million	\$9 Million	\$33 Million	2011	7%	2011-2012	Private energy savings are annualized over a period of 20 years, for two cohorts of 15-year loans. Benefits include energy savings and public benefits such as reduced emissions and health benefits. Public benefits are estimated at 40% of potential energy savings (energy + comfort benefits) from Clinch-Healy analysis. The high estimate assumes full participation and environmental benefits. The primary estimate includes only 75% spending on efficiency and environmental benefits. The low estimate assumes a low incentive effect of loan program (50 %) and no environmental benefits.
	\$25 Million	\$9 Million	\$33 Million	2011	3%	2011-2012	
Annualized Quantified					7%		.
					3%		
Qualitative	An additional benefit is the generation of knowledge concerning the loan market.					2011-2012	
Costs							
	\$21 Million	\$21 Million	\$21 Million	2011	7%	2011-2012	The average loan has a term of 15 years, a down payment of 3 %, an interest rate of 5 %, and a 1 percent annual insurance premium for ten years. In all of the above scenarios, the number of loans are assumed to be 24,000 over two years
Annualized Monetized \$millions/year	\$19 Million	\$19 Million	\$19 Million	2011	3%	2011-2012	
Annualized Quantified					7%		
					3%		
Qualitative							
Transfers							
Federal Annualized Monetized \$millions/year	\$5 Million	\$ 0 Million	\$13 Million	2011	7%	2011-2012	Transfers to consumers consist of comfort benefits, i.e., the portion of energy savings that does not result in reduced energy consumption. The transfer estimates for low and high correspond with the benefit estimates for high and low.
	\$5 Million	\$0 Million	\$12 Million	2011	3%	2011-2012	