

ENERGY EFFICIENCY AS A HOMEBUYER AFFORDABILITY

TOOL IN PENNSYLVANIA

June 2009

Prepared For:

*Pennsylvania Utility Law Project (PULP)
Harry Geller, Executive Director
Harrisburg, Pennsylvania*

June 2009

Energy Efficiency as a Homebuyer Affordability Tool in Pennsylvania

June 2009

Prepared By:

Roger D. Colton
Fisher, Sheehan & Colton
Public Finance and General Economics
34 Warwick Road, Belmont, MA 02478
617-484-0597 (voice) 617-484-0597 *** (fax) 617-484-0594
(e-mail) roger@fsconline.com *** <http://www.fsconline.com>

“Committed to the power of concentrated expertise widely shared.”

TABLE OF CONTENTS

Pennsylvania's HOME Dollars and Homebuyer Units	1
The Affordability Implications of an Energy Efficiency Partnership	2
The Proposed Partnership	2
The Impacts of Efficiency Investments	3
The Impact on Cash Flows	4
Net Present Value Savings	5
Effective Interest Rate Discount	5
Effective Purchase Price Discount	6
Summary and Conclusions	6
Appendix A: HOME funding and production in Pennsylvania	
Appendix B: Usage reductions from energy efficiency investments	
Appendix C: Affordable housing impact model (six scenarios)	

Energy efficiency investments directed toward lower income households could serve an important affordable housing function in Pennsylvania. Efficiency investments can supplement other affordable housing programs in significant ways. Efficiency investments can:

- Increase the number of low-income households that qualify for first time home ownership opportunities, holding income and purchase prices constant;
- Increase the value of the home (and thus presumably the size or quality of the home) that a low-income first time home owner can afford to buy, holding income constant;
- Increase the safety of the financial institution’s investments in first time homebuyers through increased home value, decreased default rates, and protections against price volatility; and
- Provide substantial economic subsidies to first time homebuyers not only by providing positive cash flow on a month-to-month basis, but also by effectively reducing interest rates or effectively reducing the overall purchase price of the home.

The basis for these conclusions will be considered in more detail below. First, however, a brief examination of Pennsylvania’s HOME Investment Partnership Program (HOME) investments in home ownership units is presented.

PENNSYLVANIA’S HOME DOLLARS AND HOMEBUYER UNITS

Dollars directed toward low-income energy efficiency improvements may have a ready market in homebuyer units produced statewide with federal Home Investment Partnership Fund (HOME) dollars. Since the HOME program’s inception in 1992, the state (along with local Pennsylvania jurisdictions directly receiving HOME dollars from the federal government)¹ has produced nearly 13,000 housing units for purchase by low-income households. In recent years, HOME dollars in Pennsylvania have produced nearly 1,000 homeownership units each year in Pennsylvania.

Home Ownership Units Produced Statewide in Pennsylvania Using Federal Home Investment Partnership Program (HOME) Funds		
	Total	Increased Unit Numbers
Through 1 st quarter 2005	8,428	---
Through 1 st quarter 2007	11,128	2,700
Through 1 st quarter 2009	12,620	1,492

HOME Snapshot Report, 2nd quarter (2005, 2007, 2009). Pennsylvania participating jurisdictions.

¹ Some local jurisdictions receive HOME funding directly from the federal government. Other jurisdictions must competitively seek an allocation of the funds provided through the state government.

HOME has the advantage of reaching into every corner of Pennsylvania. Appendix A shows each participating jurisdiction in Pennsylvania, the date the jurisdiction began receiving funds through the HOME program, and the cumulative number of homeownership units produced as of the end of the First Quarters of 2005, 2007 and 2009. As of the first quarter of 2009, 31 participating jurisdictions in Pennsylvania received more than \$850 million to produce affordable housing. Of course, not all of those dollars go to support the production of homeownership units. Since 1992, HOME dollars have also subsidized the production of 15,970 rental units.

THE AFFORDABILITY IMPLICATIONS OF AN ENERGY EFFICIENCY PARTNERSHIP

The analysis below examines a partnership between the energy efficiency programs of Pennsylvania's public utilities and Pennsylvania's affordable housing programs. The discussion that follows focuses on the production of homeownership units. Creating a partnership between utility energy efficiency dollars and the affordable housing subsidies of the HOME program, by targeting energy efficiency investments to households participating in public first time homebuyer programs, would yield benefits for the utility, the homebuyers and the affordable housing developers (along with the institutions that finance those developments).

The Proposed Partnership

The energy efficiency partnership used as the basis for this analysis assumes that an energy efficiency investment of \$3,500 is made in each single family home ownership units subsidized with HOME funds. To finance the energy efficiency investment, the mortgage institution takes one percent of a 5% downpayment and uses that as a household payment toward energy efficiency investments. The cost of the energy efficiency investment is further offset by a third party match² equal to one-half of the customer's payment. The amount of the energy efficiency investment not paid through these two funding sources is then financed as part of the mortgage without further underwriting.³

The impacts to the home buyers are examined for three baseline scenarios of this proposed partnership:

- A home priced at 60% of state median income (SMI),⁴ coupled with an average energy bill;⁵
- A home priced at 80% of state median income (SMI), coupled with an average energy bill; and

² Utility energy efficiency dollars are proposed to be used for this match.

³ Accordingly, if the homebuyer qualified for the underlying mortgage, the homebuyer will qualify for this energy efficiency program without further underwriting.

⁴ A home priced at 60% of median income means that the total mortgage costs, when coupled with utility costs, do not exceed 30% of the income utilized.

⁵ For purposes of this analysis, "energy" bills include water and sewer bills as well.

- A home priced at 100% of state median income (SMI), coupled with an average energy bill.

The three scenarios are then repeated (for a total of six scenarios) with an energy bill set equal to 80% of the average. A “low-bill” set of scenarios seems appropriate given the fact that the homes involve new construction.

To illustrate this process, assume the purchase of a home at the affordable sales price for a household at 60% of median income (\$122,200). The \$3,500 cost of the efficiency improvement is offset by a one percent downpayment ($\$122,200 \times 0.01 = \$1,222$) plus a matching third party grant ($\$1,222 \times 0.50 = \611). The remainder ($\$3,500 - \$1,222 - \$611 = \$1,667$) is then financed as part of the total mortgage. The final mortgage in this instance would thus be \$122,200 minus the four percent downpayment not devoted to energy efficiency plus the \$1,667 remaining cost of the energy efficiency improvement ($\$122,200 - \$4,888 + \$1,667 = \$118,972$). Mortgage interest rates are assumed to be 5.5% on a 15-year mortgage in the discussion below.

The Impacts of the Efficiency Investments

Energy reductions are assumed to be realized at a rate of 20% of the pre-efficiency bill. Based on the discussion in Appendix B, it can be concluded that efficiency investments would result in a 25% usage reduction. Given that these investments are directed toward new construction, however, the percentage reduction is set somewhat lower. The life of the energy efficiency measure is assumed to be 15 years. Energy prices escalations are set equal to 2.5%. A discount rate of three percent (3%) is used. All starting energy bills are set using 2008 prices. The input data for this analysis is presented at the bottom of each table in Appendix C setting forth the results of the analysis.

The impact of the efficiency investment on the home buyer is considered using the six scenarios identified above:

Home price @ 60% SMI/Average utility bill	Home price @80% SMI/Average utility bill	Home price @ 100% SMI/Average utility bill
Home price @60% SMI/Low utility bill	Home price @80% SMI/Low utility bill	Home price @100% SMI/Low utility bill

Within each of these scenarios, the analysis below compares the proposed partnership between energy efficiency and affordable housing providers on four different points:

1. The extent to which reductions in energy bills offset the increased mortgage payment, thus providing a positive monthly cash flow;
2. The net present value (NPV) savings/cost to the household arising from such a strategy over the life of the energy efficiency package;

3. The effective pre-tax interest rate increase or decrease represented by the nominal savings over the life of the energy efficiency package;⁶ and
4. The effective discount on the purchase price of the house represented by the nominal savings over the life of the energy efficiency measures.⁷

The Impact on Cash Flows

The energy efficiency partnership proposed above will result in positive cash flows to the household beginning in Year 1 of each scenario. A positive cash flow indicates that the extent to which energy bills decrease as a result of the delivery of energy efficiency measures will more than offset the debt service on the amount of the energy efficiency investment wrapped into the mortgage. A positive cash flow in Year One means that the customer is better off financially, from the very beginning, under a scenario in which the home buyer pursues the efficiency investment compared to a scenario in which the customer does not make the investment.

In Scenario 1 (60% SMI/Average Bill), customers experience a positive cash flow in Year 1 of \$260. Because the mortgage stays constant and fuel prices escalate, the nominal cash flow savings increase in every year. By Year 15, the positive cash flow in Scenario 1 is \$484 annually in nominal terms, with a present value of \$307.

Not surprisingly, to the extent that households have energy bills that are lower than the average, the positive cash flow is somewhat less. In Scenario 4 (60% SMI/Low Bill), the first year cash flow savings reach \$171. The Year 1 cash flow savings for each Scenario are presented in the table below:

Year 1 Cash Flow Savings from Energy Efficiency Partnership						
	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
	60% SMI/Avg Bill	80% SMI/Avg Bill	100% SMI/Avg Bill	60% SMI/Low Bill	80% SMI/Low Bill	100% SMI/Low Bill
Year 1 cash flow	\$260	\$280	\$300	\$171	\$191	\$311

SOURCE: Appendix C

In each Scenario, the homebuyer has more money in his or her pocket having made the energy efficiency investment than he or she would have should he or she instead have paid the lower mortgage along with the higher home energy bills. This is true from the first year of the home purchase mortgage. Overall household expenditures decrease as a result of the energy efficiency partnership.

⁶ From the perspective of the household, what interest rate reduction would generate at least the same amount of dollar savings generated by the energy efficiency investments?

⁷ From the perspective of the household, what reduction in the purchase price of the home would generate at least the same amount of dollar savings as are generated by the energy efficiency investment?

Net Present Value Savings

The accumulation of these monthly savings over a 15-year time frame provides a considerable economic advantage to the low-income first time homebuyer. Appendix C reports the aggregate discounted present value dollar savings to homebuyers over an assumed 15-year life of the efficiency investment. In present value terms the family with an income equal to 60% of the State Median Income purchasing a home with average utility bills will save more than \$4,200 in present value terms. This means that the family recoups the energy efficiency investment downpayment made at the beginning of the program, recoups the full cost of the energy efficiency investment financed through the mortgage, recoups the interest paid on the energy efficiency costs included as part of the mortgage, and receives an additional present value dollar benefit of \$4,242.

The other scenarios have similar benefits. The highest net present value cash savings is the \$4,717 achieved by the consumer in Scenario 3 (100% of SMI with average bills). The table below presents the 15-year net present value savings to the consumer. The Net Present Value (NPV) savings range from \$3,000 (Scenario 4: 60% SMI with Low-Bill) to more than \$4,700 (Scenario 3).

15-year Present Value Savings from Energy Efficiency Partnership						
	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
	60% SMI/Avg Bill	80% SMI/Avg Bill	100% SMI/Avg Bill	60% SMI/Low Bill	80% SMI/Low Bill	100% SMI/Low Bill
15-year NPV benefit	\$4,242	\$4,479	\$4,717	\$3,000	\$3,238	\$3,475

SOURCE: Appendix C

Effective Interest Rate Discount

One way to view the dollar savings generated by energy efficiency measures is to translate those dollars into an effective interest rate reduction. This inquiry seeks to determine, in other words, what interest rate reduction on the underlying mortgage would be necessary to provide the same dollar savings to the consumer as the energy efficiency measures provide.

In order to achieve the same savings as generated by the proposed energy efficiency partnership, consumers would need to have interest rate reductions of between 24 and 50 basis points. For the household at 60% of SMI buying a home with an average utility bill, the efficiency investments would have the same effect as reducing interest rates by 0.50% (from 5.50% to 5.00%). In contrast, the person with an income at 100% of SMI buying a home with an average utility bill would experience an effective interest rate reduction of 0.33% (from 5.5% to 5.17%).

The highest effective interest rate reduction for the consumer buying a home with lower than average utility bills (80% of the average) is 0.36%. In order for the customer to receive the same dollar savings as he or she would receive from the investment in energy efficiency, that customer would need to have an interest rate reduction of from 5.50% to 5.14%. The effective interest rate reductions are presented in the table below.

Effective Interest Rate Reductions (from 5.50%) from Energy Efficiency Partnership						
	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
	60% SMI/Avg Bill	80% SMI/Avg Bill	100% SMI/Avg Bill	60% SMI/Low Bill	80% SMI/Low Bill	100% SMI/Low Bill
Effective reduction	0.50%	0.39%	0.33%	0.36%	0.28%	0.24%

SOURCE: Appendix C

Effective Purchase Price Discount

A final alternative way to view the energy efficiency savings is to determine what purchase price discount would be necessary in order to provide the same dollar savings to the consumer as the energy efficiency investments generate.

In order to achieve the same savings as generated by the proposed energy efficiency partnership, consumers would need to have a purchase price reduction of between \$2,800 and \$4,360. For the household at 60% SMI buying a home with an average utility bill, the efficiency investments would have the same effect as reducing the original purchase price of the home by \$3,930 (from \$122,200 to \$118,270). The highest effective purchase price reduction occurs for the consumer with income equal to 100% of SMI buying a home with average utility bills (Scenario 3). In order for this customer to receive the same dollar savings as are generated by the energy efficiency investment, that customer would need to have a purchase price reduction of \$4,360 (from \$203,667 to \$199,307). The effective purchase price reductions are set forth in the table below. As can be seen, the energy efficiency investment generates the same savings to the homebuyer as would have been generated by an initial reduction of from roughly 1.5% to 3.5% in the purchase price of the home

Effective Purchase Price Reduction from Energy Efficiency Partnership						
	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
	60% SMI/Avg Bill	80% SMI/Avg Bill	100% SMI/Avg Bill	60% SMI/Low Bill	80% SMI/Low Bill	100% SMI/Low Bill
Effective reduction (\$)	\$3,930	\$4,150	\$4,360	\$2,800	\$3,010	\$3,225
Effective reduction (%)	3.3%	2.6%	2.2%	2.3%	1.9%	1.6%

SOURCE: Appendix C

SUMMARY AND CONCLUSIONS

Utility costs pose a significant barrier to affordable homeownership in Pennsylvania. When utility costs are taken into account, low-income first time homebuyers experience both a reduction in their home purchasing power and a reduction in the number of affordable units that might otherwise be available to them.

Public partnerships exist, however, that can help redress the additional affordability problems posed by utility costs in Pennsylvania. One partnership considered in this analysis involves the combined investment of the financial institution, the homebuyer, and a third party in energy efficiency investments. The implementation of energy efficiency measures through such a combined

investment will not only yield substantial long-term net present values savings –meaning the customer receives all of his or her investment in the efficiency measures back plus a “profit” on the investment—but will also yield a positive cash flow from Year 1 forward.

From a financial institution’s perspective, the pursuit of such a partnership generates several advantages. It reduces the risk of default on the part of the first time homebuyer since that homebuyer has greater disposable income. It increases the value of the home, since increased values have been found to flow directly from the extent of energy efficiency investments. It increases business to the institution, since the homebuyer can afford to buy a higher-priced home.

Should the third party partner involve electric and/or natural gas utilities using utility energy efficiency investments as the matching grant, the utility benefits as well. By definition, since investments would be made only in “cost-effective” efficiency measures, the utility would receive a payback in traditional regulatory terms. Moreover, the utility would receive the additional efficiency benefits from the leveraged dollars of investment made by the customer’s front-end payment and the dollars financed through the mortgage transaction. For every dollar of utility investment, in other words, an *additional* two dollars of private investment are made in efficiency measures.

An energy efficiency partnership directed toward first time homebuyers, where every stakeholder makes a contribution and every stakeholder receives a benefit, is worth pursuing in Pennsylvania.

Appendix A
(page 1 of 3)

HOME Funding and Production (15 Months ending April 2009)

	PJ Since FY	HOME Received	Cumulative Production Since HOME Participation		
			Rental Units	Homebuyer Unit	Homeowner Rehab
State of Pennsylvania	1992	\$426,689,276	3,101	3,480	10,364
Allegheny County Consortium	1992	\$69,220,017	1,087	214	337
Allentown	1992	\$14,348,146	42	90	337
Altoona	1994	\$7,067,793	509	13	0
Beaver County	1992	\$16,760,116	331	63	141
Berks County	1992	\$10,290,884	164	99	55
Bethlehem	1994	\$8,056,705	170	74	38
Bucks County Consortium	1992	\$19,854,936	256	41	35
Chester	1997	\$5,607,260	4	180	0
Cumberland County	2005	\$2,305,322	9	25	28
Dauphin County	2002	\$4,456,383	16	282	53
Delaware County	1992	\$24,258,825	558	687	184
Erie	1992	\$18,348,097	259	166	191
Harrisburg	1992	\$11,092,466	80	81	216
Johnstown	1994	\$4,798,692	23	29	206
Lancaster	1992	\$10,717,124	165	306	122
Lancaster County	1992	\$19,260,995	559	222	25
Luzerne County	1992	\$19,570,371	336	195	371
Montgomery County	1992	\$22,119,090	934	58	25
Philadelphia	1992	\$253,495,128	3,524	4,209	432
Pittsburgh	1992	\$64,278,630	1,619	366	468
Reading	1992	\$14,780,885	246	186	232
Scranton	1992	\$11,414,172	59	796	114
State College	1996	\$5,675,694	25	39	8
Washington County	1992	\$17,248,449	262	80	97
Westmoreland Cnty Consortium	1992	\$25,483,076	244	57	503
Wilkes-Barre	1997	\$4,932,058	0	17	71
Williamsport	1994	\$6,013,196	25	90	115
York	1994	\$7,746,619	392	392	28
York County	1992	\$13,489,062	971	83	0
Total statewide		\$1,139,379,467	15,970	12,620	14,796

Appendix A
(page 2 of 3)

HOME Funding and Production (15 Months ending April 2007)

	PJ Since FY	HOME Received	Cumulative Production Since HOME Participation		
			Rental Units	Homebuyer Unit	Homeowner Rehab
State of Pennsylvania	1992	\$372,589,671	2,485	2,795	9,202
Allegheny County Consortium	1992	\$61,350,931	1,021	124	312
Allentown	1992				
Altoona	1994	\$6,240,251	462	8	0
Beaver County	1992	\$15,159,388	304	51	132
Berks County	1992	\$8,931,631	150	61	51
Bethlehem	1994	\$6,947,891	116	34	3
Bucks County Consortium	1992	\$17,368,470	220	36	13
Chester	1997	\$4,749,327	4	155	0
Chester County	1997	\$14,913,076	292	286	15
Dauphin County	2002	\$3,272,358	16	192	33
Delaware County	1992	\$21,707,402	550	631	184
Erie	1992	\$16,373,280	224	138	154
Harrisburg	1992	\$9,944,834	75	78	202
Johnstown	1994	\$4,202,880	23	25	165
Lancaster	1992	\$9,491,112	115	244	98
Lancaster County	1992	\$16,854,190	415	194	25
Luzerne County	1992	\$17,711,327	322	132	370
Montgomery County	1992	\$19,275,186	546	31	25
Philadelphia	1992	\$223,133,877	2,784	4,032	432
Pittsburgh	1992	\$57,179,321	1,109	318	469
Reading	1992	\$12,825,714	246	159	232
Scranton	1992	\$10,137,965	59	751	89
State College	1996	\$4,683,589	25	33	8
Washington County	1992	\$15,461,759	316	56	94
Westmoreland Cnty Consortium	1992	\$23,067,013	120	40	499
Wilkes-Barre	1997	\$4,183,728	0	15	46
Williamsport	1994	\$5,315,316	19	72	97
York	1994	\$6,736,091	392	365	0
York County	1992	\$11,883,804	887	72	0
Total statewide		\$567,750,780	13,297	11,128	12,950

Appendix A
(page 3 of 3)

HOME Funding and Production (15 Months ending April 2005)

	PJ Since FY	HOME Received	Cumulative Production Since HOME Participation		
			Rental Units	Homebuyer Unit	Homeowner Rehab
State of Pennsylvania	1992	\$316,532,850	1,322	2,230	7,659
Allegheny County Consortium	1992	\$52,943,806	175	42	118
Allentown	1992	\$10,353,847	23	2	162
Altoona	1994	\$5,366,297	270	7	0
Beaver County	1992	\$13,450,060	250	0	97
Berks County	1992	\$7,479,804	132	16	42
Bethlehem	1994	\$5,784,651	106	26	3
Bucks County Consortium	1992	\$14,708,802	159	6	13
Chester	1997	\$3,846,361	4	115	0
Chester County	1997	\$12,557,863	286	256	14
Cumberland County	2005		No data reported		
Dauphin County	2002		No data reported		
Delaware County	1992	\$18,985,566	499	558	182
Erie	1992	\$14,286,440	171	104	134
Harrisburg	1992	\$8,735,865	75	60	136
Johnstown	1994	\$3,570,106	1	10	109
Lancaster	1992	\$8,199,274	111	159	48
Lancaster County	1992	\$14,279,361	331	185	25
Luzerne County	1992	\$15,728,623	272	66	307
Montgomery County	1992	\$16,249,763	488	17	25
Philadelphia	1992	\$190,860,783	1,651	3,401	373
Pittsburgh	1992	\$49,616,623	136	73	391
Reading	1992	\$10,767,496	246	86	230
Scranton	1992	\$8,792,491	53	654	74
State College	1996	\$3,635,083	25	23	8
Washington County	1992	\$13,554,119	316	32	67
Westmoreland Cnty Consortium	1992	\$20,126,033	52	14	459
Wilkes-Barre	1997	\$3,395,819	0	5	16
Williamsport	1994	\$4,578,576	19	65	75
York	1994	\$5,672,161	22	216	0
York County	1992	\$10,165,388	677	0	0
Total statewide		\$864,223,911	7,872	8,428	10,767

Appendix B

Assessing the impact that energy efficiency investments can have on first time home purchasers begins with estimating the usage reduction that can be generated through such investments. Energy efficiency investments are assumed to generate a 20% savings for total utility bills in this analysis. This savings estimate is based on the national evaluation of the savings generated by the federal Weatherization Assistance Program (WAP). According to an Oak Ridge National Laboratory (ORNL) evaluation, the WAP program has increased its ability to generate energy savings in recent years. Compared to the 18% savings found by the national evaluation (based on the 1989 program year), the WAP program now saves nearly 25% of energy in natural gas heated homes.

According to the Oak Ridge evaluation:

The 1996 meta-evaluation of 17 state-level evaluations suggested that improved practices have indeed produced 80% higher average energy savings per dwelling today as compared to the measured savings in 1989. . . Weatherization. . . has advanced technically in the past seven years. The Program is saving 80% more energy per dwelling weatherized and is more cost effective than it was in 1989. The implementation of procedures and measures associated with higher energy savings and the adoption of new technologies are the major sources of progress.⁸

These savings can be applied to low-income housing in Pennsylvania. For purposes of this analysis, low-income housing will be limited to housing units using natural gas for both space heating and domestic hot water (DHW), along with electricity for appliances, lighting and the like. According to the 2007 American Community Survey (ACS), more than half of all Pennsylvania homeowners use natural gas as their primary space heating fuel.

	Home-Owners		Tenants	
	Number	Percent	Number	Percent
Piped natural gas as fuel	1,779,084	51%	1,382,326	53%
Totals	3,491,156	---	728,128	---

SOURCE: U.S. Census, American Community Survey (2007), Table B25117.

⁸ Linda Berry, Marilyn Brown and Laurence Kinney. (1997). *Progress Report of the National Weatherization Assistance Program*, at 1, U.S. Department of Energy, Oak Ridge National Laboratory: Oak Ridge (TN).

Appendix C

Period	Year	Without Energy Efficiency			With Energy Efficiency			Annual Nominal Savings/(Cost)	Discounted Savings			Mortgage Payment	
		Mortgage Payment	Utility Payment	Mortgage plus Utility	Mortgage Payment	Utility Payment	Mortgage plus Utility		Annual	Aggregate	Reduced Interest	Reduce Home Price	
1	2009	\$949	\$226	\$1,175	\$972	\$181	\$1,153	\$260	\$260	\$260	\$918	\$918	
2	2010	\$949	\$232	\$1,181	\$972	\$186	\$1,158	\$274	\$257	\$517	\$918	\$918	
3	2011	\$949	\$238	\$1,186	\$972	\$190	\$1,162	\$287	\$262	\$780	\$918	\$918	
4	2012	\$949	\$244	\$1,192	\$972	\$195	\$1,167	\$302	\$267	\$1,047	\$918	\$918	
5	2013	\$949	\$250	\$1,198	\$972	\$200	\$1,172	\$316	\$272	\$1,318	\$918	\$918	
6	2014	\$949	\$256	\$1,205	\$972	\$205	\$1,177	\$331	\$276	\$1,594	\$918	\$918	
7	2015	\$949	\$262	\$1,211	\$972	\$210	\$1,182	\$347	\$280	\$1,874	\$918	\$918	
8	2016	\$949	\$269	\$1,218	\$972	\$215	\$1,187	\$362	\$284	\$2,158	\$918	\$918	
9	2017	\$949	\$276	\$1,224	\$972	\$221	\$1,193	\$379	\$288	\$2,446	\$918	\$918	
10	2018	\$949	\$283	\$1,231	\$972	\$226	\$1,198	\$395	\$291	\$2,738	\$918	\$918	
11	2019	\$949	\$290	\$1,238	\$972	\$232	\$1,204	\$412	\$295	\$3,032	\$918	\$918	
12	2020	\$949	\$297	\$1,246	\$972	\$238	\$1,210	\$429	\$298	\$3,330	\$918	\$918	
13	2021	\$949	\$304	\$1,253	\$972	\$244	\$1,216	\$447	\$301	\$3,631	\$918	\$918	
14	2022	\$949	\$312	\$1,261	\$972	\$250	\$1,222	\$466	\$304	\$3,935	\$918	\$918	
15	2023	\$949	\$320	\$1,268	\$972	\$256	\$1,228	\$484	\$307	\$4,242	\$918	\$918	
		\$170,739		\$219,443			\$213,951	\$5,492	\$4,242		\$165,246	\$165,248	

Inputs	
Housing price: 60% median income (PA 4-person)	\$122,200
Downpayment	5%
Efficiency investment	\$3,500
Downpayment against housing price	4%
Downpayment against efficiency price	1%
Downpayment against housing price	\$4,888
Downpayment against efficiency price	\$1,222
Matching grant toward efficiency (0.5 x customer pymnt)	\$611
Efficiency investment included in mortgage	\$1,667
Mortgage without efficiency investment	\$116,090
Mortgage with efficiency investment	\$118,979
Interest rate	5.50%
Beginning annual utility bill (gas heating plus electric)	\$2,216
Efficiency savings	20%
Length of mortgage in years	15
Total number of monthly payments	180
Reduced interest	0.5%
Reduce home price	\$3,930
Mortgage atr reduced home price	\$112,357
Discount rate	3%

Mtg payment without efficiency	5.5%	Interest	Mtg Payment w/o EE	Check
Mtg with reduced interest	5.0%		\$170,739	
Savings at reduced interest			\$165,246	
Interest reduction equivalent	0.5%		\$5,494	-\$2
		Sales Price	Mtg Payment w/o EE	Check
Mtg payment without efficiency		\$122,200	\$170,739	
Mtg payment with reduced home price		\$118,270	\$165,248	
Savings at reduce home price			\$5,491	\$1
Home price reduction		\$3,930		
Percent home price reduction		3.2%		
		Median income (PA 4-person--2009)	\$61,100	
		50% median	\$30,550 HUD User income limits: statewide PA: 4-person (2009)	
		Pct of median income (PA 4-person 2009)	\$36,660	60%

Period	Year	Without Energy Efficiency			With Energy Efficiency			Annual Nominal Savings/(Cost)	Discounted Savings		Mortgage Payment	
		Mortgage Payment	Utility Payment	Mortgage plus Utility	Mortgage Payment	Utility Payment	Mortgage plus Utility		Annual	Aggregate	Reduced Interest	Reduce Home Price
1	2009	\$1,265	\$226	\$1,491	\$1,287	\$181	\$1,468	\$280	\$280	\$280	\$1,233	\$1,233
2	2010	\$1,265	\$232	\$1,497	\$1,287	\$186	\$1,472	\$293	\$276	\$556	\$1,233	\$1,233
3	2011	\$1,265	\$238	\$1,503	\$1,287	\$190	\$1,477	\$307	\$281	\$837	\$1,233	\$1,233
4	2012	\$1,265	\$244	\$1,508	\$1,287	\$195	\$1,482	\$322	\$285	\$1,121	\$1,233	\$1,233
5	2013	\$1,265	\$250	\$1,515	\$1,287	\$200	\$1,487	\$336	\$289	\$1,410	\$1,233	\$1,233
6	2014	\$1,265	\$256	\$1,521	\$1,287	\$205	\$1,492	\$351	\$293	\$1,703	\$1,233	\$1,233
7	2015	\$1,265	\$262	\$1,527	\$1,287	\$210	\$1,497	\$367	\$296	\$1,999	\$1,233	\$1,233
8	2016	\$1,265	\$269	\$1,534	\$1,287	\$215	\$1,502	\$382	\$300	\$2,299	\$1,233	\$1,233
9	2017	\$1,265	\$276	\$1,541	\$1,287	\$221	\$1,507	\$399	\$303	\$2,602	\$1,233	\$1,233
10	2018	\$1,265	\$283	\$1,547	\$1,287	\$226	\$1,513	\$415	\$306	\$2,908	\$1,233	\$1,233
11	2019	\$1,265	\$290	\$1,554	\$1,287	\$232	\$1,518	\$432	\$309	\$3,217	\$1,233	\$1,233
12	2020	\$1,265	\$297	\$1,562	\$1,287	\$238	\$1,524	\$449	\$312	\$3,529	\$1,233	\$1,233
13	2021	\$1,265	\$304	\$1,569	\$1,287	\$244	\$1,530	\$467	\$314	\$3,843	\$1,233	\$1,233
14	2022	\$1,265	\$312	\$1,577	\$1,287	\$250	\$1,536	\$486	\$317	\$4,160	\$1,233	\$1,233
15	2023	\$1,265	\$320	\$1,585	\$1,287	\$256	\$1,543	\$504	\$319	\$4,479	\$1,233	\$1,233
		\$227,653		\$276,356			\$270,564	\$5,791	\$4,479		\$221,928	\$221,854
							\$5,791					

Inputs	
Housing price: 60% median income (PA 4-person)	\$162,933
Downpayment	5%
Efficiency investment	\$3,500
Downpayment against housing price	4%
Downpayment against efficiency price	1%
Downpayment against housing price	\$6,517
Downpayment against efficiency price	\$1,629
Matching grant toward efficiency (0.5 x customer pymnt)	\$815
Efficiency investment included in mortgage	\$1,056
Mortgage without efficiency investment	\$154,787
Mortgage with efficiency investment	\$157,472
Interest rate	5.50%
Beginning annual utility bill (gas heating plus electric)	\$2,216
Efficiency savings	20%
Length of mortgage in years	15
Total number of monthly payments	180
Reduced interest	0.39%
Reduce home price	\$4,150
Mortgage atr reduced home price	\$150,844
Discount rate	3%

Interest	Mtg Payment w/o EE	Check
Mtg payment without efficiency	\$227,653	
Mtg with reduced interest	\$221,928	
Savings at reduced interest	\$5,725	-\$66
Interest reduction equivalent	0.4%	
Sales Price	Mtg Payment w/o EE	
\$162,933	\$227,653	
\$158,783	\$221,854	
Savings at reduce home price	\$5,798	-\$7
Home price reduction	\$4,150	
Percent home price reduction	2.5%	
Median income (PA 4-person--2009)	\$61,100	
50% median	\$30,550	HUD User income limits: statewide PA: 4-person (2009)
Pct of median income (PA 4-person 2009)	\$48,880	80%

Period	Year	Without Energy Efficiency			With Energy Efficiency			G Annual Nominal Savings/(Cost)	H Discounted Savings		I Mortgage Payment	
		A Mortgage Payment	B Utility Payment	C Mortgage plus Utility	D Mortgage Payment	E Utility Payment	F Mortgage plus Utility		Annual	Aggregate	Reduced interest	Reduce Home Price
1	2009	\$1,581	\$226	\$1,807	\$1,601	\$181	\$1,782	\$300	\$300	\$300	\$1,547	\$1,547
2	2010	\$1,581	\$232	\$1,813	\$1,601	\$186	\$1,787	\$313	\$295	\$595	\$1,547	\$1,547
3	2011	\$1,581	\$238	\$1,819	\$1,601	\$190	\$1,791	\$327	\$299	\$894	\$1,547	\$1,547
4	2012	\$1,581	\$244	\$1,825	\$1,601	\$195	\$1,796	\$342	\$302	\$1,196	\$1,547	\$1,547
5	2013	\$1,581	\$250	\$1,831	\$1,601	\$200	\$1,801	\$356	\$306	\$1,502	\$1,547	\$1,547
6	2014	\$1,581	\$256	\$1,837	\$1,601	\$205	\$1,806	\$371	\$309	\$1,811	\$1,547	\$1,547
7	2015	\$1,581	\$262	\$1,843	\$1,601	\$210	\$1,811	\$387	\$312	\$2,124	\$1,547	\$1,547
8	2016	\$1,581	\$269	\$1,850	\$1,601	\$215	\$1,816	\$402	\$315	\$2,439	\$1,547	\$1,547
9	2017	\$1,581	\$276	\$1,857	\$1,601	\$221	\$1,822	\$419	\$318	\$2,757	\$1,547	\$1,547
10	2018	\$1,581	\$283	\$1,864	\$1,601	\$226	\$1,827	\$435	\$321	\$3,078	\$1,547	\$1,547
11	2019	\$1,581	\$290	\$1,871	\$1,601	\$232	\$1,833	\$452	\$323	\$3,401	\$1,547	\$1,547
12	2020	\$1,581	\$297	\$1,878	\$1,601	\$238	\$1,839	\$469	\$326	\$3,727	\$1,547	\$1,547
13	2021	\$1,581	\$304	\$1,885	\$1,601	\$244	\$1,845	\$487	\$328	\$4,055	\$1,547	\$1,547
14	2022	\$1,581	\$312	\$1,893	\$1,601	\$250	\$1,851	\$505	\$330	\$4,385	\$1,547	\$1,547
15	2023	\$1,581	\$320	\$1,901	\$1,601	\$256	\$1,857	\$524	\$332	\$4,717	\$1,547	\$1,547
		\$284,566		\$333,269			\$327,178	\$6,091	\$4,717		\$278,504	\$278,474
							\$6,091					

Inputs	
Housing price: 60% median income (PA 4-person)	\$203,667
Downpayment	5%
Efficiency investment	\$3,500
Downpayment against housing price	4%
Downpayment against efficiency price	1%
Downpayment against housing price	\$8,147
Downpayment against efficiency price	\$2,037
Matching grant toward efficiency (0.5 x customer pymnt)	\$1,018
Efficiency investment included in mortgage	\$445
Mortgage without efficiency investment	\$193,483
Mortgage with efficiency investment	\$195,965
Interest rate	5.50%
Beginning annual utility bill (gas heating plus electric)	\$2,216
Efficiency savings	20%
Length of mortgage in years	15
Total number of monthly payments	180
Reduced interest	0.33%
Reduce home price	\$4,360
Mortgage atr reduced home price	\$189,341
Discount rate	3%

Interest	Mtg Payment w/o EE	Check
5.5%	\$284,566	
5.2%	\$278,504	
	\$6,062	-\$29
0.3%		
Sales Price	Mtg Payment w/o EE	
\$203,667	\$284,566	
\$199,307	\$278,474	
	\$6,092	-\$1
\$4,360		
2.1%		
Median income (PA 4-person--2009)	\$61,100	
50% median	\$30,550	HUD User income limits: statewide PA: 4-person (2009)
Pct of median income (PA 4-person 2009)	\$61,100	100%

Period	Year	Without Energy Efficiency			With Energy Efficiency			G Annual Nominal Savings/(Cost)	H Discounted Savings		I Mortgage Payment	
		Mortgage Payment	Utility Payment	Mortgage plus Utility	Mortgage Payment	Utility Payment	Mortgage plus Utility		Annual	Aggregate	Reduced Interest	Reduce Home Price
1	2009	\$949	\$189	\$1,138	\$972	\$152	\$1,124	\$171	\$171	\$171	\$927	\$927
2	2010	\$949	\$194	\$1,143	\$972	\$155	\$1,127	\$183	\$172	\$343	\$927	\$927
3	2011	\$949	\$199	\$1,148	\$972	\$159	\$1,131	\$194	\$177	\$520	\$927	\$927
4	2012	\$949	\$204	\$1,153	\$972	\$163	\$1,135	\$206	\$183	\$703	\$927	\$927
5	2013	\$949	\$209	\$1,158	\$972	\$167	\$1,139	\$218	\$188	\$891	\$927	\$927
6	2014	\$949	\$214	\$1,163	\$972	\$171	\$1,144	\$231	\$192	\$1,083	\$927	\$927
7	2015	\$949	\$220	\$1,168	\$972	\$176	\$1,148	\$244	\$197	\$1,280	\$927	\$927
8	2016	\$949	\$225	\$1,174	\$972	\$180	\$1,152	\$257	\$201	\$1,482	\$927	\$927
9	2017	\$949	\$231	\$1,179	\$972	\$185	\$1,157	\$271	\$206	\$1,687	\$927	\$927
10	2018	\$949	\$237	\$1,185	\$972	\$189	\$1,161	\$284	\$210	\$1,897	\$927	\$927
11	2019	\$949	\$242	\$1,191	\$972	\$194	\$1,166	\$299	\$214	\$2,111	\$927	\$927
12	2020	\$949	\$249	\$1,197	\$972	\$199	\$1,171	\$313	\$217	\$2,328	\$927	\$927
13	2021	\$949	\$255	\$1,203	\$972	\$204	\$1,176	\$328	\$221	\$2,549	\$927	\$927
14	2022	\$949	\$261	\$1,210	\$972	\$209	\$1,181	\$343	\$224	\$2,773	\$927	\$927
15	2023	\$949	\$268	\$1,216	\$972	\$214	\$1,186	\$359	\$227	\$3,000	\$927	\$927
		\$170,739		\$211,495			\$207,593	\$3,902	\$3,000		\$166,774	\$166,827
							\$3,902					

Inputs	
Housing price: 60% median income (PA 4-person)	\$122,200
Downpayment	5%
Efficiency investment	\$3,500
Downpayment against housing price	4%
Downpayment against efficiency price	1%
Downpayment against housing price	\$4,888
Downpayment against efficiency price	\$1,222
Matching grant toward efficiency (0.5 x customer pymnt)	\$611
Efficiency investment included in mortgage	\$1,667
Mortgage without efficiency investment	\$116,090
Mortgage with efficiency investment	\$118,979
Interest rate	5.50%
Beginning annual utility bill (gas heating plus electric)	\$2,216
Efficiency savings	20%
Length of mortgage in years	15
Total number of monthly payments	180
Reduced interest	0.36%
Reduce home price	\$2,800
Mortgage atr reduced home price	\$113,430
Discount rate	3%

Interest	Mtg Payment w/o EE	Check
5.5%	\$170,739	
5.1%	\$166,774	
	\$3,966	-\$63
Interest reduction equivalent		
0.4%		
Sales Price	Mtg Payment w/o EE	Check
\$122,200	\$170,739	
\$119,400	\$166,827	
Savings at reduce home price	\$3,912	-\$10
Home price reduction		
\$2,800		
Percent home price reduction		
2.3%		
Median income (PA 4-person--2009)	\$61,100	
50% median	\$30,550 HUD User income limits: statewide PA: 4-person (2009)	
Pct of median income (PA 4-person 2009)	\$36,660	60%

Period	Year	Without Energy Efficiency			With Energy Efficiency			G Annual Nominal Savings/(Cost)	H Discounted Savings		I Mortgage Payment	
		A Mortgage Payment	B Utility Payment	C Mortgage plus Utility	D Mortgage Payment	E Utility Payment	F Mortgage plus Utility		Annual	Aggregate	Reduced interest	Reduce Home Price
1	2009	\$1,265	\$189	\$1,454	\$1,287	\$152	\$1,438	\$191	\$191	\$191	\$1,242	\$1,241
2	2010	\$1,265	\$194	\$1,459	\$1,287	\$155	\$1,442	\$203	\$191	\$382	\$1,242	\$1,241
3	2011	\$1,265	\$199	\$1,464	\$1,287	\$159	\$1,446	\$214	\$196	\$577	\$1,242	\$1,241
4	2012	\$1,265	\$204	\$1,469	\$1,287	\$163	\$1,450	\$226	\$200	\$778	\$1,242	\$1,241
5	2013	\$1,265	\$209	\$1,474	\$1,287	\$167	\$1,454	\$238	\$205	\$983	\$1,242	\$1,241
6	2014	\$1,265	\$214	\$1,479	\$1,287	\$171	\$1,458	\$251	\$209	\$1,192	\$1,242	\$1,241
7	2015	\$1,265	\$220	\$1,484	\$1,287	\$176	\$1,462	\$264	\$213	\$1,405	\$1,242	\$1,241
8	2016	\$1,265	\$225	\$1,490	\$1,287	\$180	\$1,467	\$277	\$217	\$1,622	\$1,242	\$1,241
9	2017	\$1,265	\$231	\$1,496	\$1,287	\$185	\$1,471	\$291	\$221	\$1,843	\$1,242	\$1,241
10	2018	\$1,265	\$237	\$1,501	\$1,287	\$189	\$1,476	\$304	\$224	\$2,067	\$1,242	\$1,241
11	2019	\$1,265	\$242	\$1,507	\$1,287	\$194	\$1,481	\$319	\$228	\$2,295	\$1,242	\$1,241
12	2020	\$1,265	\$249	\$1,513	\$1,287	\$199	\$1,485	\$333	\$231	\$2,526	\$1,242	\$1,241
13	2021	\$1,265	\$255	\$1,519	\$1,287	\$204	\$1,490	\$348	\$234	\$2,760	\$1,242	\$1,241
14	2022	\$1,265	\$261	\$1,526	\$1,287	\$209	\$1,496	\$363	\$237	\$2,998	\$1,242	\$1,241
15	2023	\$1,265	\$268	\$1,532	\$1,287	\$214	\$1,501	\$379	\$240	\$3,238	\$1,242	\$1,241
		\$227,653		\$268,408			\$264,207	\$4,202	\$3,238		\$223,534	\$223,447

Inputs	
Housing price: 60% median income (PA 4-person)	\$162,933
Downpayment	5%
Efficiency investment	\$3,500
Downpayment against housing price	4%
Downpayment against efficiency price	1%
Downpayment against housing price	\$6,517
Downpayment against efficiency price	\$1,629
Matching grant toward efficiency (0.5 x customer pymnt)	\$815
Efficiency investment included in mortgage	\$1,056
Mortgage without efficiency investment	\$154,787
Mortgage with efficiency investment	\$157,472
Interest rate	5.50%
Beginning annual utility bill (gas heating plus electric)	\$2,216
Efficiency savings	20%
Length of mortgage in years	15
Total number of monthly payments	180
Reduced interest	0.28%
Reduce home price	\$3,010
Mortgage atr reduced home price	\$151,927
Discount rate	3%

Interest	Mtg Payment w/o EE	Check
5.5%	\$227,653	
5.2%	\$223,534	
	\$4,119	-\$83
0.3%		
Sales Price	Mtg Payment w/o EE	
\$162,933	\$227,653	
\$159,923	\$223,447	
	\$4,206	-\$4
\$3,010		
1.8%		
\$61,100		
\$30,550		HUD User income limits: statewide PA: 4-person (2009)
\$48,880		80%

Period	Year	Without Energy Efficiency			With Energy Efficiency			Annual Nominal Savings/(Cost)	Discounted Savings		Mortgage Payment	
		Mortgage Payment	Utility Payment	Mortgage plus Utility	Mortgage Payment	Utility Payment	Mortgage plus Utility		Annual	Aggregate	Reduced Interest	Reduce Home Price
1	2009	\$1,581	\$189	\$1,770	\$1,601	\$152	\$1,753	\$211	\$211	\$211	\$1,556	\$1,556
2	2010	\$1,581	\$194	\$1,775	\$1,601	\$155	\$1,757	\$223	\$209	\$421	\$1,556	\$1,556
3	2011	\$1,581	\$199	\$1,780	\$1,601	\$159	\$1,760	\$234	\$214	\$634	\$1,556	\$1,556
4	2012	\$1,581	\$204	\$1,785	\$1,601	\$163	\$1,764	\$246	\$218	\$852	\$1,556	\$1,556
5	2013	\$1,581	\$209	\$1,790	\$1,601	\$167	\$1,768	\$258	\$222	\$1,074	\$1,556	\$1,556
6	2014	\$1,581	\$214	\$1,795	\$1,601	\$171	\$1,773	\$271	\$226	\$1,300	\$1,556	\$1,556
7	2015	\$1,581	\$220	\$1,801	\$1,601	\$176	\$1,777	\$284	\$229	\$1,529	\$1,556	\$1,556
8	2016	\$1,581	\$225	\$1,806	\$1,601	\$180	\$1,781	\$297	\$233	\$1,762	\$1,556	\$1,556
9	2017	\$1,581	\$231	\$1,812	\$1,601	\$185	\$1,786	\$311	\$236	\$1,998	\$1,556	\$1,556
10	2018	\$1,581	\$237	\$1,817	\$1,601	\$189	\$1,790	\$324	\$239	\$2,237	\$1,556	\$1,556
11	2019	\$1,581	\$242	\$1,823	\$1,601	\$194	\$1,795	\$339	\$242	\$2,480	\$1,556	\$1,556
12	2020	\$1,581	\$249	\$1,829	\$1,601	\$199	\$1,800	\$353	\$245	\$2,725	\$1,556	\$1,556
13	2021	\$1,581	\$255	\$1,836	\$1,601	\$204	\$1,805	\$368	\$248	\$2,972	\$1,556	\$1,556
14	2022	\$1,581	\$261	\$1,842	\$1,601	\$209	\$1,810	\$383	\$250	\$3,222	\$1,556	\$1,556
15	2023	\$1,581	\$268	\$1,849	\$1,601	\$214	\$1,815	\$399	\$253	\$3,475	\$1,556	\$1,556
		\$284,566		\$325,321			\$320,820	\$4,501	\$3,475		\$280,150	\$280,060

Inputs	
Housing price: 60% median income (PA 4-person)	\$203,667
Downpayment	5%
Efficiency investment	\$3,500
Downpayment against housing price	4%
Downpayment against efficiency price	1%
Downpayment against housing price	\$8,147
Downpayment against efficiency price	\$2,037
Matching grant toward efficiency (0.5 x customer pymnt)	\$1,018
Efficiency investment included in mortgage	\$445
Mortgage without efficiency investment	\$193,483
Mortgage with efficiency investment	\$195,965
Interest rate	5.50%
Beginning annual utility bill (gas heating plus electric)	\$2,216
Efficiency savings	20%
Length of mortgage in years	15
Total number of monthly payments	180
Reduced interest	0.24%
Reduce home price	\$3,225
Mortgage atr reduced home price	\$190,420
Discount rate	3%

Interest	Mtg Payment w/o EE	Check
5.5%	\$284,566	
5.3%	\$280,150	
	\$4,416	-\$85
Sales Price	Mtg Payment w/o EE	
\$203,667	\$284,566	
\$200,442	\$280,060	
	\$4,506	-\$5
\$3,225		
1.6%		
Median income (PA 4-person--2009)	\$61,100	
50% median	\$30,550	HUD User income limits: statewide PA: 4-person (2009)
Pct of median income (PA 4-person 2009)	\$61,100	100%