

**ENERGY EFFICIENCY AS AN AFFORDABLE HOUSING**

**TOOL IN COLORADO**

**April 2003**

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ENERGY EFFICIENCY AS AN  
**AFFORDABLE HOUSING TOOL**  
in Colorado

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Energy efficiency investments directed toward lower income households could serve an important affordable housing function in Colorado. 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.

Each of these conclusions will be considered in more detail below. First, however, the discussion below presents an overview of affordable housing needs in Colorado.<sup>1</sup>

#### **OVERVIEW OF AFFORDABLE HOMEOWNERSHIP NEEDS IN COLORADO**

Few units of affordable housing exist for lower-income Colorado residents even if home utility bills are not taken into consideration. According to the Colorado Division of Housing:

During the 1990s, housing production did not keep pace with new households, and consequently demand exceeded supply. This inequity caused home prices to increase much faster than wages for low- and moderate-income households. Even in the current economy, affordable housing is out of reach for many working families.<sup>2</sup>

The affordability gap that exists in Colorado is not only large, but it is growing larger. This happens because of stagnating incomes combined with rapidly rising housing costs. Colorado median incomes increased 24 percent between 1996 and 2001, while the Housing Price Index increased 52 percent.<sup>3</sup>

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<sup>1</sup> The purpose here is not to redo the affordable housing analysis of the Colorado Division of Housing. It is merely to provide sufficient information about affordable housing needs to be able to create a context for a discussion of the energy efficiency proposal discussed below. Persons interested in obtaining detailed information about affordable housing needs in Colorado should visit the World Wide Web site for the state Division of Housing: <http://www.dola.state.co.us/Doh/Index.htm>

<sup>2</sup>Colorado Division of Housing, Department of Local Affairs (November 1, 2002). *Housing Colorado: The challenge for a growing state*, at 2, Division of Housing: Denver (CO). (hereinafter, Housing Colorado).

<sup>3</sup> Housing Colorado, at 3.

Even this, however, does not tell the entire story. Incomes for the lowest income Colorado residents increased much more slowly than those with higher incomes. Between the late 1970s and late 1990s, while the income of the richest fifth of Colorado residents increased by 39 percent, the income of the poorest fifth increased by only 17.7 percent.<sup>4</sup> During the decade from the late 1980s to the late 1990s, the income of the poorest fifth of Colorado residents increased \$6,600, from \$12,920 to \$19,520 while the income of the richest fifth increased \$45,580, from \$110,230 to \$155,810.

It is, however, not merely the poorest Colorado residents who cannot access affordable housing. In its 2002 *Housing Colorado* report, the Colorado Division of Housing (DOH) illustrated how households are faring in the housing market by preparing an analysis of incomes and housing costs for five common job categories and for a Supplemental Security Income (SSI) recipient. The five job categories included a retail sales person, a dental assistant, a truck driver, an elementary school teacher, and a patrol officer.

DOH found, “None can afford to purchase a home at the median price in the state.”<sup>5</sup>

As the DOH analysis shows, a patrol officer can afford 85% of the median price of a Colorado home, while the school teacher can afford only 73% of that median price. The retail sales person can afford 44% of the median sales price of a Colorado home.

Occupations and Affordable Prices				
Occupation	Income	Monthly Housing Allowance	Affordable Purchase Price	% of Median Purchase Price
SSI recipient	\$6,540	\$164	\$22,062	13%
Retail sales person	\$22,260	\$557	\$75,092	44%
Dental assistant	\$29,680	\$742	\$100,122	59%
Truck driver	\$32,400	\$810	\$109,128	64%
Elementary school teacher	\$36,780	\$920	\$124,073	73%
Patrol officer	\$43,000	\$1,075	\$145,056	85%

Housing Colorado, at Table 3, page 4.

Indeed, according to DOH, “Colorado cities are less affordable than surrounding cities.”<sup>6</sup> The most affordable Colorado city (Pueblo) ranks only as the 131st most affordable city in the country from a housing perspective. Only 64% of all Pueblo homes are affordable to households with the state median income; other Colorado cities have an even smaller proportion of homes that are affordable. Moreover, as the DOH analysis shows, common occupations such as retail sales people, dental assistants, truck drivers, elementary school teachers, and patrol officers do not receive pay at the median income level. Housing for these households is thus much less affordable.

<sup>4</sup> Center on Budget and Policy Priorities (April 2002). *Pulling Apart: A State-by-State Analysis of Income Trends, Colorado-specific Fact Sheet*, Denver (CO).

<sup>5</sup> Housing Colorado, at 5.

<sup>6</sup> Housing Colorado, at 4.

Housing Opportunity Index: First Quarter 2002		
	% of Homes Affordable to Median Income Household	National Ranking
Kansas City	86%	13
Phoenix	75%	89
Salt Lake City	68%	117
Pueblo	64%	131
Boulder—Longmont	62%	137
Colorado Springs	60%	144
Denver	60%	146
Fort Collins—Loveland	57%	153
Greeley	41%	166

SOURCE: Housing Colorado, at Table 2, page 4.

In sum, DOH found that the supply of affordable housing units in Colorado is insufficient to meet demand. DOH reports that “the number of affordable homes is still too small to accommodate all households desiring homeownership. In August 2002, there were only 7,516 homes available for the 42,334 households earning 60 to 80 percent of HUD median income that could purchase a home.”<sup>7</sup> Energy efficiency can be one tool to use in helping to redress this disparity.

#### UTILITY COSTS AND AFFORDABLE HOMEOWNERSHIP: A STATE PERSPECTIVE

Despite the bleak affordable housing picture painted by the State Division of Housing, adding a consideration of home utility bills makes the picture even worse. Consider, for example, the five job categories evaluated by DOH above. The “monthly housing allowance” reported by DOH is set equal to 30% of monthly income. Use of 30% is a commonly-accepted standard by which to measure the affordability of housing. That 30% of income, however, must support not only the mortgage payment, but the payment of property taxes, insurance, and utility bills as well. Setting property taxes and insurance equal to four percent of income,<sup>8</sup> and subtracting a typical home utility bill from the monthly housing allowance, the “affordable purchase price” adjusted for home utilities<sup>9</sup> is considerably lower than that reported by DOH.

The table below shows how taking utility bills into account affects the affordability of housing in Colorado. This table compares the monthly mortgage payments that persons in the five occupations studied by DOH could afford to make *before* considering utility bills to the monthly mortgage payments those persons could afford to make *after* considering home utility bills.

The reduction in purchasing power is substantial. While a retail sales person could afford a \$464 monthly mortgage payment without utilities, that sales person could afford only \$354 with utilities being taken into account (a reduction of 24% in purchasing power). The elementary school teacher could afford a monthly home mortgage payment of \$766 without considering utilities, but could afford only \$669 with utilities (a reduction of 13%). A patrol officer

<sup>7</sup> Housing Colorado, at 8.

<sup>8</sup> This is the percentage of income that DOH uses as an appropriate tax and insurance bill. Division of Housing (August 2002). *Affordable Housing in Your Community*.

<sup>9</sup> See, Appendix A for a discussion of the calculation of statewide home utility bills.

experiences a reduced purchasing power of 10% (from \$896 per month without utilities to \$804 with utilities taken into account).

Occupations and Affordable Monthly Payments After Adjusting for Home Utility Bills				
Occupation	Income	Affordable Monthly Mortgage Payments		
		Without Utilities	Adjusted for Utilities	Percent Reduction
Retail sales person	\$22,260	\$464	\$354	24%
Dental assistant	\$29,680	\$618	\$515	17%
Truck driver	\$32,400	\$675	\$574	15%
Elementary school teacher	\$36,780	\$766	\$669	13%
Patrol officer	\$43,000	\$896	<b>\$804</b>	10%

This reduced monthly purchasing power significantly reduces the value of a home that people can buy. The table below translates the reduced monthly mortgage payment into an affordable purchase price.<sup>10</sup> Without considering utilities, the retail sales person could afford a home valued at \$70,592, while that same sales person could afford only \$57,349 after considering utilities. An elementary school teacher could afford a home sold for \$124,073 without considering utilities, but could afford only \$108,290 once the cost of utilities is taken into account. The patrol officer experiences a lost value in home buying of \$14,944 (\$146,053 vs. \$130,112).

Occupations and Affordable Purchase Prices After Adjusting for Home Utility Bills				
Occupation	Median Sales Price: Colorado	Affordable Sales Price		
		Without Utilities	Adjusted for Utilities	Dollar Reduction
Retail sales person	\$170,000	\$75,092	\$57,349	\$17,742
Dental assistant	\$170,000	\$100,122	\$83,381	\$16,741
Truck driver	\$170,000	\$109,298	\$92,924	\$16,374
Elementary school teacher	\$170,000	\$124,073	\$108,290	\$15,783
Patrol officer	\$170,000	\$146,053	\$130,112	\$14,944

It is evident, that on a statewide basis, the cost of utilities has a substantial detrimental impact on the provision of affordable housing. Further exploration of this conclusion is merited. That exploration is presented within the context of DOH’s annual assessment of housing affordability. A possible partnership to help address the problem is then suggested below.

### **UTILITY COSTS AND AFFORDABLE HOMEOWNERSHIP: A COUNTY PERSPECTIVE**

Home utility bills can be a substantial barrier to affordable homeownership throughout Colorado. The Colorado Division of Housing (DOH) annually reports the number of housing units available at affordable prices for each county in Colorado.<sup>11</sup> As in its assessment of housing affordability to selected occupations, the “affordable payment” that DOH reports for each county is set equal to 30% of a household’s monthly income. Again, it is important to remember that

<sup>10</sup> The affordable purchase price uses the same inputs as the DOH calculation of affordable housing prices. It assumes a three percent (3%) downpayment and a 30-year fixed rate mortgage with an interest rate of 6.57%.

<sup>11</sup> This annual document is titled “Affordable Housing in Your Area.” The 2002 report was dated August 2002. The 2001 report was released in September 2001. The 2000 report was released in September 2000. The 1999 report was released in October 1999.

this 30% is to include principal, interest, taxes, insurance and utilities. Utilities include home energy, along with water and sewer.<sup>12</sup> “Utilities” do *not* include telephone, cable television, or trash collection.

As with its evaluation of housing affordability for common occupations, the DOH annual assessment of housing affordability by county does not consider the impacts of home utility bills on the housing payments that would be affordable to Colorado residents. Appendix B includes an estimated home utility bill for low-income homeowners in each Colorado county assuming that each county experienced normal weather. Appendix B further presents the affordable housing payments for each county as reported by DOH. Affordable payments are presented for three-person households with income equal to 80% of area median income, as well as for three-person households with income equal to 60% of median income.<sup>13</sup>

Appendix B finally shows the proportion of the affordable housing payment that would be devoted to home utility bills<sup>14</sup> in 2002 had Colorado experienced normal weather.<sup>15</sup> Appendix B shows that home utility bills consume a substantial part of the “affordable payment” which DOH reports as available to purchase housing for low-income Colorado residents. For households with incomes equal to 80% of the area median income, at the maximum, utility bills would consume 21% of the “affordable payment” (for example, Conejos, Costilla, Custer counties). At the minimum, utility bills would consume 8% to 9% of the “affordable payment” (for example, Arapahoe, Boulder, Denver counties). The distribution of the relationship between utility bills and affordable payments is shown in the table below.

Monthly Utility Bill as Percent of Affordable Housing Payment	Number of Colorado Counties	
	80% of Median Income	60% of Median Income
0 – 10%	6	2
11 – 15%	19	10
16 – 20%	35	14
21% or more	3	37

SOURCE: Appendix B.

As can be seen, utility bills have a much greater impact on reducing housing affordability as incomes decline. While utility bills consume 21% or more of the affordable housing costs for households at 80% of median income in only three (3) counties, they consume 21% or more of the affordable housing costs for households at 60% of area median income in 37 counties.

<sup>12</sup> According to data provided by the University of Colorado at Boulder, in 1990, 91.0% of all Colorado residents used a public system or private company for their water supplies (as opposed to individual wells). In addition, this data indicates that 86.9% of all Colorado households used public sewer systems (while only 12.4% used septic systems). <http://www.colorado.edu/libraries/govpubs/coloumb/watersrc.htm> (March 2003).

<sup>13</sup> The use of area median income is the generally-accepted standard by which to measure income for purposes of determining housing affordability. Area median income is published annually by the U.S. Department of Housing and Urban Development (HUD).

<sup>14</sup> Local water/sewer bills are not reported for individual communities. The typical water/sewer bill was developed using rates reported for Colorado Springs.

<sup>15</sup> Weather is measured in terms of Heating Degree Days (HDDs) and Cooling Degree Days (CDDs). “Normal” is the 30-year normal ending in 2000 as reported by the National Oceanographic and Atmospheric Administration (NOAA), the federal agency of which the National Weather Service is a part.

This relationship between bills and affordable housing payments will have four impacts on the housing market:

- It will reduce the “affordable sales price” of single family homes. As a result, fewer units of housing will be available to Colorado households with lower incomes (80% or 60% of median).
- It will freeze some lower income households out of the housing market altogether, because they have insufficient income to pay all homeowner cost components (principal, interest, taxes, insurance, utilities).
- It will force lower income homebuyers into less expensive homes. These houses will be less desirable, even though more affordable, because they are smaller, or lower quality, or in less desirable locations.
- It will increase the risk of default by consumers.<sup>16</sup> Payments based on tightly stretched incomes are more subject to disruption due to unexpected expenses (housing or otherwise) or temporary disruptions in income.<sup>17</sup>

### ***Reducing the Affordable Sales Price***

Taking home utility bills into account reduces affordable sales prices by 10% to 20% or more throughout Colorado. In some counties, the reductions are a bit less, while in others the reductions are a bit more. An estimated reduction in sales price of 10% to 20%, however, is typical. Appendix C presents the difference in 2002 affordable sales prices at both 80% and 60% of median income for a household of three persons assuming normal weather in 2002. Appendix C presents the reduced sales price in both dollar terms and percentage terms on a county-by-county basis.

At the lower end of affordable price reductions, households with incomes at 80% of area median incomes would lose the ability to purchase roughly \$12,000 to \$13,000 of additional housing size or quality. Typical of these losses are Arapahoe County (\$11,293 or 7%), Clear Creek County (\$13,401 or 8%), Jefferson County (\$11,931 or 7%), Larimer County (\$13,068 or 9%), Pitkin County (\$12,492 or 8%), and San Miguel County (\$13,068 or 9%).

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<sup>16</sup> One study for the U.S. Department Federal Energy Administration found that in 1974 and 1975, 2.5 percent of HUD mortgages failed because of high energy prices. Metrostudy Corporation (1976). *An Analysis of the Contribution of Energy Price Changes to HUD-Insured Mortgage Failures*. Federal Energy Administration: Washington D.C.

<sup>17</sup> See, National Fuel Funds Network (NFFN). (March 2002). *A Fragile Income: Deferred Payment Plans and the Ability to Pay of Working Poor Utility Customers*, National Fuel Funds Network: Washington D.C. See also, National Fuel Funds Network (October 2002). *Local Layoffs as National Emergencies: Using the National Emergency Grant Program to Respond to the Unmet Energy Needs of Displaced Low Wage Workers*, National Fuel Funds Network: Washington D.C.

At the other end of the spectrum, the lost purchasing power is much higher. Households at 80% of area median income lose \$25,507 in housing purchasing power in Conejos County (21%), \$23,718 (21%) in Costilla County, \$23,071 (21%) in Custer County, \$22,138 (20%) in Lake County, and \$24,939 (19%) in Park County. Other counties tend to fall somewhere in between.

Dollar Difference	Number of Counties	
	60% Median Income	80% Median Income
Percentage Amount		
0 – 10%	3	11
11 – 15%	10	23
16 – 20%	13	26
21% or more	37	3
Dollar Amount		
\$0 - \$10,000	0	0
\$10,001 - \$15,000	13	8
\$15,001 - \$20,000	40	38
\$20,001 or more	10	17
SOURCE: Appendix C.		

Not surprisingly, the reduced purchasing power for households with income at 60% of area median income is even higher. Utility costs consume a higher proportion of income as income goes down, and the resulting reduced ability to buy housing becomes disproportionately greater.

### ***Reducing the Number of Available Units***

A necessary corollary to reductions in the affordable purchase price for lower-income households is that fewer units of housing will be available to these households in the marketplace. This reduction in the number of available units makes a bad situation even worse. As discussed above, even *without* taking the reduced affordability attributable to utility bills into account, DOH reported only 7,516 homes available for the 42,334 households between 60% and 80% of area median income that wanted to purchase a home.

Taking home utility bills into account substantially reduces the number of affordable units that would be available for purchase by lower-income Colorado residents. Appendix D presents the number of housing units by their unit value as reported in the 2000 Census.<sup>18</sup> An owner-occupied unit is considered to be “available” at a price equal to its value.<sup>19</sup> The reduction in the number of affordable units available (both in gross numbers and in percentage terms) is presented in the table below.

<sup>18</sup> This methodology differs from the DOH methodology for assessing the number of available units. DOH considers the number of units (disaggregated by single family and condos) actually for-sales in a given month. DOH uses several databases that were not available for this analysis.

<sup>19</sup> Availability is, however, not synonymous with occupied. Units that are available at an affordable price can be occupied by households with higher incomes. See, Roger Colton (1997). "Fair Housing and Affordable Housing: Availability, Distribution and Quality." 1997 *Colloqui: Cornell University Journal of Planning and Urban Issues* 9.

Taking home utility bills into account reduces the availability of affordable units in Colorado by nearly 20%. Statewide, there were 516,320 owned-occupied units of all types (single family, condominiums, mobile homes, etc.) that had dollar valuations which, if equal to the sales price, would be affordable to households in the respective counties before taking utility costs into account. As Appendix D-1 shows, however, if the affordable purchase price is adjusted to account for utility costs, the number of owner-occupied units that would be affordable statewide drops to 416,110. This shows that accounting for utility costs in calculating the affordability of housing drops the number of available units nearly 20% ( $516,347 - 416,110 = 100,237 / 516,347 = .0.194$ ). The reduction in affordable units ranges from a maximum reduction of more 60% (San Miguel County, from 65 affordable units to 29) to a minimum of four percent (Alamosa County, from 2,335 affordable units to 2,239).

The reduction in affordable units is much bigger for households with incomes at 60% of median income. While only 30 of the 63 Colorado counties experienced reductions of 16% or more for households at 80% of median income, 46 of the counties experienced a reduction of 16% or more for households at 60% of median income. Nearly half (28 of 63) experience a reduction of affordable units for households with incomes of 60% of median income of 21% or more when utility costs are taken into account. Statewide, taking utility costs into account reduces the number of affordable housing units available to households with incomes at 60% of median income by nearly 30% ( $259,220 - 186,768 = 72,453 / 259,220 = 0.2795$ ).

Reduction in units	Number of Counties	
	80% of Median Income	60% of Median Income
0 – 10%	12	8
11 – 15%	21	9
16 – 20%	8	18
21% or more	22	28
SOURCE: Appendices D-1 and D-2		

In sum, while it may seem self-evident that considering utility costs reduces the affordability of housing in Colorado, and thus reduces the number of affordable housing units that would be available to low-income families, the *magnitude* of the impact is disturbing. Not only will some low-income households be frozen out of the market altogether because they cannot afford both the rent and mortgage payments, but those households who remain in the market for home buying opportunities will be chasing fewer affordable units.

Given this data, the next section of this analysis will suggest a partnership that could help alleviate some portion of the affordability problems documented above.

### **THE IMPACTS OF AN ENERGY EFFICIENCY PARTNERSHIP**

A partnership between Colorado’s energy efficiency providers and affordable housing providers designed to target energy efficiency investments to households participating in public first time

homebuyer programs<sup>20</sup> would offer significant benefits to the homebuyer as well as substantially expand the market for affordable housing.

Colorado’s state and local governments offer a wide range of first time homebuyer programs. According to the State Division of Housing’s annual *Housing Colorado* report, the state increased its supply of affordable housing units in each of the past three years.<sup>21</sup>

Reported Increases in Number of Affordable Homeowners in Colorado by Year	
2000	4,059
2001	4,303
2002	5,130
SOURCE: Housing Colorado: The Challenge for A Growing State, at 11 (2000) Housing Colorado: The Challenge for a Growing State, at 16 (November 1, 2001). Housing Colorado: The Challenge for a Growing State, at 1 (November 1, 2002).	

Directing investments in energy efficiency to each of these homebuyers would provide substantial benefits to both the state and the homebuyer.

### ***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. To finance the energy efficiency investment, the mortgage institution takes one percent of a 3% downpayment<sup>22</sup> 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 match<sup>23</sup> equal to one-half 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.<sup>24</sup>

To illustrate this process, assume the purchase of a home at the affordable sales price for a household at 80% of median income in Adams County (\$165,128). The \$3,500 cost of the efficiency improvement is offset by a one percent downpayment ( $\$165,000 \times 0.01 = \$1,650$ ) plus a matching third party grant ( $\$1,650 \times 0.50 = \$825$ ). The remainder ( $\$3,500 - \$1,650 - \$825 = \$1,025$ ) is then financed as part of the total mortgage. The final mortgage in this instance would thus be \$165,000 minus the two percent downpayment not devoted to energy efficiency plus the \$1,025 remaining cost of the energy efficiency improvement ( $\$165,000 - \$3,300 + \$1,025 = \$162,725$ ). Mortgage interest rates are assumed to be 6.57% in the discussion below.<sup>25</sup>

<sup>20</sup> In this sense, a “public” first time homebuyer program is deemed to include programs offered by financial institutions in fulfillment of their Community Reinvestment Act (CRA) responsibilities.

<sup>21</sup> This is not to say that an increased number of units did not occur in prior years. The research for this paper only reviewed the annual reports for the past three years (2000 – 2002).

<sup>22</sup> DOH assumes a 3% downpayment in its August 2002 affordable housing analysis.

<sup>23</sup> The Colorado Energy Assistance Foundation (EAF) may be interested in piloting this program with matching funds.

<sup>24</sup> Accordingly, if the homebuyer qualified for the underlying mortgage, the homebuyer will qualify for this energy efficiency program without further underwriting.

<sup>25</sup> DOH used an interest rate of 6.57% in its August 2002 housing affordability study.

### *The Impacts of the Efficiency Investments*

Energy reductions are assumed to be realized at a rate of 25% based on the discussion in Appendix A. The life of the energy efficiency measure is assumed to be 15 years. Annual gas price increases are set equal to 5.0%,<sup>26</sup> while annual electric price increases are set equal to 2.4%.<sup>27</sup> A discount rate of four percent (4%) is used. All starting energy bills are set using 2002 prices. The input data for this analysis is presented in Appendix E.

The analysis is performed using statewide energy data. Separate analyses are done for the lowest affordable home for households at 80% of median income as well as the higher affordable home price at 80% of median income.<sup>28</sup> In order to allow comparisons to be made, the affordable sales price identified by DOH is used rather than the adjusted prices described above. In addition, two different scenarios are considered for each affordable housing price. The first begins with the average annual utility bill. The second begins with a high user. A high user is one who has a utility bill set equal to 130% of the average bill. The discussion below thus considers a total of four scenarios:

Lowest home price/Average utility bill	Highest home price/Average utility bill
Lowest home price/Adjusted energy bill	Highest home price/Adjusted energy bill

Within each of these four 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;<sup>29</sup>
3. The effective pre-tax interest rate increase or decrease arising represented by the nominal savings over the life of the energy efficiency package;<sup>30</sup> 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.<sup>31</sup>

<sup>26</sup> Energy Information Administration (January 2003). *Annual Energy Outlook (2003) with Projections to 2025*, U.S. Department of Energy: Washington D.C.

<sup>27</sup> *Annual Energy Outlook (2003)*.

<sup>28</sup> This excludes the housing prices in San Miguel County, which are atypical.

<sup>29</sup> From the perspective of the household, the net present value benefits over the life of the energy efficiency investment are greater than \$0.

<sup>30</sup> From the perspective of the household, what interest rate reduction would generate the same amount of dollar savings generated by the energy efficiency investments?

### ***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, by pursuing the efficiency investment compared to not pursuing the investment.

In Scenario 1 (Low Housing Price/Average Bill), customers experience a positive cash flow in Year 1 of \$160. Because the mortgage stays constant and fuel prices escalate, the nominal cash flow savings increases in every year. By Year 15, the positive cash flow is \$399 annually in nominal terms, with a present value of \$216.

Not surprisingly, to the extent that households have energy bills that exceed the average, the positive cash flow is even greater. In Scenario 4 (High Housing Costs/High Utility User), the first year cash flow savings reach \$271. The Year 1 cash flow savings for each scenario are presented in the table below:

Year 1 Cash Flow Savings from Energy Efficiency Partnership				
	LowHsg/AvgBill	HighHsg/AvgBill	LowHsg/HighBill	HighHsg/HighBill
Year 1 cash flow	\$160	\$180	\$251	\$271
SOURCE: Appendix E				

### ***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 E 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 purchasing a low-cost home with average utility bills will save more than \$2,800. 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 \$2,823.

The other three scenarios have even higher benefits. The highest net present value cash savings is the \$4,336 achieved by the consumer in the High Cost/High User scenario. The table below presents the 15-year net present value savings to the consumer:

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<sup>31</sup> From the perspective of the household, what reduction in the purchase price of the home would generate the same amount of dollar savings as are generated by the energy efficiency investment?

15-year Present Value Savings from Energy Efficiency Partnership				
	LowHsg/AvgBill	HighHsg/AvgBill	LowHsg/HighBill	HighHsg/HighBill
15-year NPV savings	\$2,823	\$4,048	\$4,111	\$4,336
SOURCE: Appendix E				

### ***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 22 and 45 basis points. For the household buying a low cost home with an average utility bill, the efficiency investments would have the same effect as reducing interest rates by 0.31% (from 6.57% to 6.26%). The highest effective interest rate reduction occurs for the consumer buying a low cost home with utility bills at 130% of the average. In order for the customer to receive the same dollar savings, that customer would need to have an interest rate reduction of 0.45% (from 6.57% to 6.12%). The effective interest rate reductions are as follows:

Effective Interest Rate Reductions (from 6.57%) from Energy Efficiency Partnership				
	LowHsg/AvgBill	HighHsg/AvgBill	LowHsg/HighBill	HighHsg/HighBill
Effective reduction	0.31% (6.26%)	0.22% (6.35%)	0.45% (6.12%)	0.32% (6.25%)
SOURCE: Calculated from Appendix E.				

### ***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 \$3,700 and \$5,500. For the household buying a low cost home with an average utility bill, the efficiency investments would have the same effect as reducing the original purchase price of the home by \$3,700 (from \$11,700 to \$108,000). The highest effective purchase price reduction occurs for the consumer buying a high cost home with utility bills at 130% of the average. In order for this customer to receive the same dollar savings, that customer would need to have a purchase price reduction of \$5,500 (from \$165,100 to \$159,600). The effective purchase prices reductions are as follows:

Effective Purchase Price Reductions from Energy Efficiency Partnership				
	LowHsg/AvgBill	HighHsg/AvgBill	LowHsg/HighBill	HighHsg/HighBill
Effective reduction	\$3,700	\$3,900	\$5,300	\$5,500
SOURCE: Calculated from Appendix E.				

## SUMMARY AND CONCLUSIONS

Utility costs pose a significant barrier to affordable homeownership in Colorado. 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.

Public partnerships exist, however, that can help redress the additional affordability problems posed by utility costs in Colorado. 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 his or her investment in the efficiency measures back plus a “profit” on the investment—but will yield 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.

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 Colorado.

## Appendix A

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 25% 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 the most recent 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 metaevaluation of 17 state-level evaluations suggested that improved practices have indeed produced 80% higher average energy saving 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.<sup>32</sup>

These savings can be applied to low-income housing in Colorado. 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 2000 Census, 80% of all Colorado homeowners use natural gas as their primary space heating fuel.

	Home-Owners		Tenants	
	Number	Percent	Number	Percent
Gas space heating/DHW	893,136	80.0%	343,247	63.4%
Totals	1,116,305	xxx	541,933	xxx

SOURCE: U.S. Census, Summary Tape File 3A, Table HCT10.

Home energy bills are calculated using a combination of data from the 2000 Census and the most recent Residential Energy Consumption Survey (RECS) published by the U.S. Department of Energy. The RECS provides “energy intensity” statistics by U.S. Census Divisions. Data for the Mountain Division, of which Colorado is a part, is used in the calculations for this analysis. The following intensity data is provided through the RECS:

<sup>32</sup> 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).

Heating	MCF of gas per HDD per thousand square feet of heated living space.
Cooling	MCF of gas per CDD per thousand square feet of cooled living space.
Hot water	MCF per household member per day.
Refrigeration	Kilowatthour (kWh) per household member per day.
Appliances (including lighting)	kWh per household member per day.
Water	Supplied by author.

Heated and cooled living space data was calculated using 2000 Census data. Utility prices from the following sources were used in this calculation:

Space heating natural gas	January 2002 prices	Table 21, Natural Gas Monthly (October 2002)
Hot water natural gas	YTD 2002 prices	Natural Gas Monthly (February 2003)
Electricity	YTD 2002 prices	Table 55, Electric Power Monthly (February 2003)
Space cooling electricity	August 2002 prices	Table 53, Electric Power Monthly (November 2002)
Water/Wastewater	2002 prices	Raftellis Water/Wastewater rate survey (2002)
NOTES: Energy bills adjusted for taxes and franchise fees. Water/wastewater bills adjusted for inflation.		

The calculation of annual home utility bills for low-income Colorado homeowners yielded the following statewide bills:

	Gas heating plus electric
Space heating	\$506
Space cooling	\$36
Hot water	\$133
Electric refrigerator	\$99
Electric appliance	\$442
Water	\$160
Sewer	\$162
Total average annual bill	\$1,538
Total average annual bill + 30% average energy usage	\$1,903

Natural gas heating was assumed to be accompanied by natural gas water heating. Sewer bills are based on water consumption.

Appendix B-1  
(80% of Area Median Income)

80% AMI	AMI	Monthly AMI	Affordable Total Pyt	Utility as Pct of Aff Pyt	Affordable Sales Pyt w/ Utility	Affordable Sales Pyt
Adams County, Colorado	\$48,950	\$4,079	\$1,224	11%	\$924	\$1,020
Alamosa County, Colorado	\$33,100	\$2,758	\$828	17%	\$575	\$690
Arapahoe County, Colorado	\$48,950	\$4,079	\$1,224	9%	\$944	\$1,020
Archuleta County, Colorado	\$33,100	\$2,758	\$828	19%	\$564	\$690
Baca County, Colorado	\$33,100	\$2,758	\$828	15%	\$590	\$690
Bent County, Colorado	\$33,100	\$2,758	\$828	16%	\$586	\$690
Boulder County, Colorado	\$48,950	\$4,079	\$1,224	9%	\$950	\$1,020
Chaffee County, Colorado	\$33,100	\$2,758	\$828	15%	\$592	\$690
Cheyenne County, Colorado	\$36,150	\$3,013	\$904	15%	\$646	\$753
Clear Creek County, Colorado	\$44,150	\$3,679	\$1,104	11%	\$837	\$920
Conejos County, Colorado	\$33,100	\$2,758	\$828	21%	\$544	\$690
Costilla County, Colorado	\$33,100	\$2,758	\$828	21%	\$543	\$690
Crowley County, Colorado	\$33,100	\$2,758	\$828	17%	\$576	\$690
Custer County, Colorado	\$33,100	\$2,758	\$828	21%	\$547	\$690
Delta County, Colorado	\$33,100	\$2,758	\$828	16%	\$585	\$690
Denver County, Colorado	\$48,950	\$4,079	\$1,224	8%	\$957	\$1,020
Dolores County, Colorado	\$33,100	\$2,758	\$828	18%	\$569	\$690
Douglas County, Colorado	\$48,950	\$4,079	\$1,224	12%	\$912	\$1,020
Eagle County, Colorado	\$48,950	\$4,079	\$1,224	12%	\$918	\$1,020
El Paso County, Colorado	\$40,900	\$3,408	\$1,023	12%	\$761	\$852
Elbert County, Colorado	\$48,950	\$4,079	\$1,224	15%	\$876	\$1,020
Fremont County, Colorado	\$33,100	\$2,758	\$828	14%	\$597	\$690
Garfield County, Colorado	\$38,100	\$3,175	\$953	14%	\$695	\$794
Gilpin County, Colorado	\$48,950	\$4,079	\$1,224	12%	\$911	\$1,020
Grand County, Colorado	\$39,100	\$3,258	\$978	12%	\$730	\$815
Gunnison County, Colorado	\$34,850	\$2,904	\$871	14%	\$637	\$726
Hinsdale County, Colorado	\$33,100	\$2,758	\$828	16%	\$581	\$690
Huerfano County, Colorado	\$33,100	\$2,758	\$828	15%	\$595	\$690
Jackson County, Colorado	\$33,100	\$2,758	\$828	18%	\$566	\$690
Jefferson County, Colorado	\$48,950	\$4,079	\$1,224	9%	\$946	\$1,020

Kiowa County, Colorado	\$33,100	\$2,758	\$828	16%	\$585	\$690
Kit Carson County, Colorado	\$33,100	\$2,758	\$828	16%	\$585	\$690
La Plata County, Colorado	\$37,450	\$3,121	\$936	13%	\$686	\$780
Lake County, Colorado	\$33,100	\$2,758	\$828	20%	\$553	\$690
Larimer County, Colorado	\$43,800	\$3,650	\$1,095	11%	\$832	\$913
Las Animas County, Colorado	\$33,100	\$2,758	\$828	15%	\$593	\$690
Lincoln County, Colorado	\$33,100	\$2,758	\$828	16%	\$581	\$690
Logan County, Colorado	\$33,100	\$2,758	\$828	15%	\$589	\$690
Mesa County, Colorado	\$33,100	\$2,758	\$828	14%	\$597	\$690
Mineral County, Colorado	\$33,100	\$2,758	\$828	19%	\$558	\$690
Moffat County, Colorado	\$34,050	\$2,838	\$851	17%	\$597	\$709
Montezuma County, Colorado	\$33,100	\$2,758	\$828	17%	\$576	\$690
Montrose County, Colorado	\$33,100	\$2,758	\$828	17%	\$581	\$690
Morgan County, Colorado	\$33,750	\$2,813	\$844	17%	\$584	\$703
Otero County, Colorado	\$33,100	\$2,758	\$828	15%	\$595	\$690
Ouray County, Colorado	\$35,550	\$2,963	\$889	17%	\$619	\$741
Park County, Colorado	\$38,400	\$3,200	\$960	19%	\$646	\$800
Phillips County, Colorado	\$33,100	\$2,758	\$828	16%	\$581	\$690
Pitkin County, Colorado	\$48,950	\$4,079	\$1,224	10%	\$943	\$1,020
Prowers County, Colorado	\$33,100	\$2,758	\$828	16%	\$585	\$690
Pueblo County, Colorado	\$33,100	\$2,758	\$828	15%	\$597	\$690
Rio Blanco County, Colorado	\$33,100	\$2,758	\$828	16%	\$587	\$690
Rio Grande County, Colorado	\$33,100	\$2,758	\$828	18%	\$570	\$690
Routt County, Colorado	\$44,300	\$3,692	\$1,108	13%	\$813	\$923
Saguache County, Colorado	\$33,100	\$2,758	\$828	19%	\$563	\$690
San Juan County, Colorado	\$33,100	\$2,758	\$828	18%	\$571	\$690
San Miguel County, Colorado	\$49,250	\$4,104	\$1,231	10%	\$947	\$1,026
Sedgwick County, Colorado	\$33,100	\$2,758	\$828	15%	\$591	\$690
Summit County, Colorado	\$48,950	\$4,079	\$1,224	11%	\$921	\$1,020
Teller County, Colorado	\$48,150	\$4,013	\$1,204	14%	\$871	\$1,003
Washington County, Colorado	\$33,100	\$2,758	\$828	17%	\$573	\$690
Weld County, Colorado	\$34,500	\$2,875	\$863	15%	\$614	\$719
Yuma County, Colorado	\$33,100	\$2,758	\$828	17%	\$579	\$690

Appendix B-2  
(60% of Area Median Income)

60% AMI	AMI	Monthly AMI	Affordable Total Pyt	Utility as Pct of Affordable Pyt	Affordable Sales Pyt w/ Energy	Affordable Sales Pyt
Adams County, Colorado	\$37,740	3145	\$943	14%	\$681	\$786
Alamosa County, Colorado	\$24,840	2070	\$621	23%	\$396	\$517
Arapahoe County, Colorado	\$37,740	3145	\$943	12%	\$701	\$786
Archuleta County, Colorado	\$24,840	2070	\$621	25%	\$384	\$517
Baca County, Colorado	\$24,840	2070	\$621	20%	\$411	\$517
Bent County, Colorado	\$24,840	2070	\$621	21%	\$406	\$517
Boulder County, Colorado	\$46,980	3915	\$1,174	9%	\$907	\$978
Chaffee County, Colorado	\$24,840	2070	\$621	20%	\$413	\$517
Cheyenne County, Colorado	\$27,120	2260	\$678	20%	\$450	\$565
Clear Creek County, Colorado	\$33,120	2760	\$828	14%	\$598	\$690
Conejos County, Colorado	\$24,840	2070	\$621	28%	\$365	\$517
Costilla County, Colorado	\$24,840	2070	\$621	28%	\$364	\$517
Crowley County, Colorado	\$24,840	2070	\$621	23%	\$397	\$517
Custer County, Colorado	\$24,840	2070	\$621	27%	\$368	\$517
Delta County, Colorado	\$24,840	2070	\$621	21%	\$405	\$517
Denver County, Colorado	\$37,740	3145	\$943	11%	\$714	\$786
Dolores County, Colorado	\$24,840	2070	\$621	24%	\$390	\$517
Douglas County, Colorado	\$37,740	3145	\$943	16%	\$669	\$786
Eagle County, Colorado	\$40,440	3370	\$1,011	14%	\$733	\$842
El Paso County, Colorado	\$30,660	2555	\$766	16%	\$539	\$638
Elbert County, Colorado	\$38,100	3175	\$952	19%	\$640	\$793
Fremont County, Colorado	\$24,840	2070	\$621	19%	\$418	\$517
Garfield County, Colorado	\$28,560	2380	\$714	18%	\$488	\$595
Gilpin County, Colorado	\$44,100	3675	\$1,102	14%	\$806	\$918
Grand County, Colorado	\$29,340	2445	\$733	16%	\$518	\$611
Gunnison County, Colorado	\$26,160	2180	\$654	18%	\$448	\$545
Hinsdale County, Colorado	\$24,840	2070	\$621	22%	\$402	\$517
Huerfano County, Colorado	\$24,840	2070	\$621	20%	4415	\$517
Jackson County, Colorado	\$24,840	2070	\$621	24%	\$387	\$517

Jefferson County, Colorado	\$37,740	3145	\$943	12%	\$703	\$786
Kiowa County, Colorado	\$24,840	2070	\$621	21%	\$406	\$517
Kit Carson County, Colorado	\$24,840	2070	\$621	21%	\$406	\$517
La Plata County, Colorado	\$28,080	2340	\$702	18%	\$483	\$585
Lake County, Colorado	\$24,840	2070	\$621	26%	\$373	\$517
Larimer County, Colorado	\$32,820	2735	\$820	14%	\$593	\$683
Las Animas County, Colorado	\$24,840	2070	\$621	20%	\$413	\$517
Lincoln County, Colorado	\$24,840	2070	\$621	22%	\$402	\$517
Logan County, Colorado	\$24,840	2070	\$621	21%	\$410	\$517
Mesa County, Colorado	\$24,840	2070	\$621	19%	4418	\$517
Mineral County, Colorado	\$24,840	2070	\$621	26%	\$379	\$517
Moffat County, Colorado	\$25,560	2130	\$639	22%	\$412	\$532
Montezuma County, Colorado	\$24,840	2070	\$621	23%	\$397	\$517
Montrose County, Colorado	\$24,840	2070	\$621	22%	\$401	\$517
Morgan County, Colorado	\$25,320	2110	\$633	23%	\$401	\$527
Otero County, Colorado	\$24,840	2070	\$621	20%	\$415	\$517
Ouray County, Colorado	\$26,700	2225	\$667	23%	\$427	\$556
Park County, Colorado	\$28,800	2400	\$720	26%	\$437	\$600
Phillips County, Colorado	\$24,840	2070	\$621	22%	\$402	\$517
Pitkin County, Colorado	\$47,400	3950	\$1,185	10%	\$909	\$987
Prowers County, Colorado	\$24,840	2070	\$621	21%	\$405	\$517
Pueblo County, Colorado	\$24,840	2070	\$621	19%	\$417	\$517
Rio Blanco County, Colorado	\$24,840	2070	\$621	21%	\$408	\$517
Rio Grande County, Colorado	\$24,840	2070	\$621	24%	\$391	\$517
Routt County, Colorado	\$33,240	2770	\$831	18%	\$73	\$692
Saguache County, Colorado	\$24,840	2070	\$621	25%	\$383	\$517
San Juan County, Colorado	\$24,840	2070	\$621	24%	\$391	\$517
San Miguel County, Colorado	\$36,950	3079	\$923	13%	\$680	\$769
Sedgwick County, Colorado	\$24,840	2070	\$621	20%	\$412	\$517
Summit County, Colorado	\$39,240	3270	\$981	14%	\$711	\$817
Teller County, Colorado	\$36,120	3010	\$903	19%	\$610	\$752
Washington County, Colorado	\$24,840	2070	\$621	23%	\$393	\$517
Weld County, Colorado	\$25,860	2155	\$646	21%	\$426	\$538
Yuma County, Colorado	\$24,840	2070	\$621	22%	\$400	\$517

Appendix C-1  
(80% Area Median Income)

80% AMI	Principal w/o energy	Principal w/ energy	Dollar Difference	Pct Reduction
Adams County, Colorado	\$165,128	\$149,637	\$15,490	9%
Alamosa County, Colorado	\$111,659	\$93,125	\$18,534	17%
Arapahoe County, Colorado	\$165,128	\$152,913	\$12,214	7%
Archuleta County, Colorado	\$111,659	\$91,251	\$20,408	18%
Baca County, Colorado	\$111,659	\$95,586	\$16,073	14%
Bent County, Colorado	\$111,659	\$94,841	\$16,818	15%
Boulder County, Colorado	\$165,128	\$153,834	\$11,293	7%
Chaffee County, Colorado	\$111,659	\$95,875	\$15,784	14%
Cheyenne County, Colorado	\$121,948	\$104,557	\$17,391	14%
Clear Creek County, Colorado	\$148,935	\$135,535	\$13,401	9%
Conejos County, Colorado	\$111,659	\$88,152	\$23,507	21%
Costilla County, Colorado	\$111,659	\$87,941	\$23,718	21%
Crowley County, Colorado	\$111,659	\$93,343	\$18,316	16%
Custer County, Colorado	\$111,659	\$88,588	\$23,071	21%
Delta County, Colorado	\$111,659	\$94,650	\$17,010	15%
Denver County, Colorado	\$165,128	\$155,022	\$10,106	6%
Dolores County, Colorado	\$111,659	\$92,208	\$19,451	17%
Douglas County, Colorado	\$165,128	\$147,710	\$17,418	11%
Eagle County, Colorado	\$165,128	\$148,689	\$16,438	10%
El Paso County, Colorado	\$137,972	\$123,284	\$14,688	11%
Elbert County, Colorado	\$165,128	\$141,816	\$23,312	14%
Fremont County, Colorado	\$111,659	\$96,718	\$14,941	13%
Garfield County, Colorado	\$128,526	\$112,545	\$15,981	12%
Gilpin County, Colorado	\$165,128	\$147,588	\$17,539	11%
Grand County, Colorado	\$131,900	\$118,130	\$13,770	10%
Gunnison County, Colorado	\$117,563	\$103,162	\$14,401	12%
Hinsdale County, Colorado	\$111,659	\$94,153	\$17,506	16%
Huerfano County, Colorado	\$111,659	\$96,337	\$15,323	14%
Jackson County, Colorado	\$111,659	\$91,710	\$19,950	18%
Jefferson County, Colorado	\$165,128	\$153,196	\$11,931	7%

Kiowa County, Colorado	\$111,659	\$94,805	\$16,855	15%
Kit Carson County, Colorado	\$111,659	\$94,786	\$16,873	15%
La Plata County, Colorado	\$126,334	\$111,158	\$15,175	12%
Lake County, Colorado	\$111,659	\$89,522	\$22,138	20%
Larimer County, Colorado	\$147,755	\$134,687	\$13,068	9%
Las Animas County, Colorado	\$111,659	\$95,990	\$15,669	14%
Lincoln County, Colorado	\$111,659	\$94,100	\$17,559	16%
Logan County, Colorado	\$111,659	\$95,385	\$16,274	15%
Mesa County, Colorado	\$111,659	\$96,705	\$14,954	13%
Mineral County, Colorado	\$111,659	\$90,394	\$21,266	19%
Moffat County, Colorado	\$114,864	\$96,591	\$18,273	16%
Montezuma County, Colorado	\$111,659	\$93,281	\$18,378	16%
Montrose County, Colorado	\$111,659	\$94,005	\$17,654	16%
Morgan County, Colorado	\$113,852	\$94,557	\$19,295	17%
Otero County, Colorado	\$111,659	\$96,285	\$15,374	14%
Ouray County, Colorado	\$119,924	\$100,194	\$19,730	16%
Park County, Colorado	\$129,538	\$104,599	\$24,939	19%
Phillips County, Colorado	\$111,659	\$94,136	\$17,523	16%
Pitkin County, Colorado	\$165,128	\$152,636	\$12,492	8%
Prowers County, Colorado	\$111,659	\$94,708	\$16,951	15%
Pueblo County, Colorado	\$111,659	\$96,590	\$15,069	13%
Rio Blanco County, Colorado	\$111,659	\$95,080	\$16,579	15%
Rio Grande County, Colorado	\$111,659	\$92,343	\$19,317	17%
Routt County, Colorado	\$149,441	\$131,612	\$17,829	12%
Saguache County, Colorado	\$111,659	\$91,152	\$20,508	18%
San Juan County, Colorado	\$111,659	\$92,437	\$19,223	17%
San Miguel County, Colorado	\$166,140	\$153,315	\$12,825	8%
Sedgwick County, Colorado	\$111,659	\$95,694	\$15,965	14%
Summit County, Colorado	\$165,128	\$149,205	\$15,922	10%
Teller County, Colorado	\$162,429	\$141,083	\$21,346	13%
Washington County, Colorado	\$111,659	\$92,724	\$18,936	17%
Weld County, Colorado	\$116,382	\$99,393	\$16,989	15%
Yuma County, Colorado	\$111,659	\$93,808	\$17,851	16%

Appendix C-2  
(60% Area Median Income)

60% AMI	Affordable Sales Pyt w/ Energy	Principal w/o energy	Principal w/ energy	Dollar Difference	Pct Reduction
Adams County, Colorado	\$681	\$127,312	\$110,309	\$17,003	13%
Alamosa County, Colorado	\$396	\$83,795	\$64,146	\$19,649	23%
Arapahoe County, Colorado	\$701	\$127,312	\$113,585	\$13,727	11%
Archuleta County, Colorado	\$385	\$83,795	\$62,272	\$21,523	26%
Baca County, Colorado	\$411	\$83,795	\$66,608	\$17,187	21%
Bent County, Colorado	\$407	\$83,795	\$65,862	\$17,933	21%
Boulder County, Colorado	\$907	\$158,482	\$146,923	\$11,559	7%
Chaffee County, Colorado	\$413	\$83,795	\$66,896	\$16,899	20%
Cheyenne County, Colorado	\$450	\$91,486	\$72,877	\$18,610	20%
Clear Creek County, Colorado	\$598	\$111,727	\$96,838	\$14,889	13%
Conejos County, Colorado	\$365	\$83,795	\$59,173	\$24,622	29%
Costilla County, Colorado	\$364	\$83,795	\$58,962	\$24,833	30%
Crowley County, Colorado	\$398	\$83,795	\$64,365	\$19,430	23%
Custer County, Colorado	\$368	\$83,795	\$59,609	\$24,186	29%
Delta County, Colorado	\$406	\$83,795	\$65,671	\$18,124	22%
Denver County, Colorado	\$714	\$127,312	\$115,694	\$11,618	9%
Dolores County, Colorado	\$390	\$83,795	\$63,229	\$20,566	25%
Douglas County, Colorado	\$669	\$127,312	\$108,382	\$18,930	15%
Eagle County, Colorado	\$734	\$136,420	\$118,833	\$17,587	13%
El Paso County, Colorado	\$540	\$103,428	\$87,358	\$16,070	16%
Elbert County, Colorado	\$641	\$128,526	\$103,751	\$24,776	19%
Fremont County, Colorado	\$418	\$83,795	\$67,739	\$16,056	19%
Garfield County, Colorado	\$488	\$96,344	\$79,075	\$17,269	18%
Gilpin County, Colorado	\$806	\$148,767	\$130,573	\$18,194	12%
Grand County, Colorado	\$518	\$98,975	\$83,889	\$15,086	15%
Gunnison County, Colorado	\$449	\$88,248	\$72,675	\$15,573	18%
Hinsdale County, Colorado	\$403	\$83,795	\$65,174	\$18,621	22%
Huerfano County, Colorado	\$416	\$83,795	\$67,358	\$16,437	20%
Jackson County, Colorado	\$387	\$83,795	\$62,731	\$21,064	25%
Jefferson County, Colorado	\$703	\$127,312	\$113,868	\$13,444	11%

Kiowa County, Colorado	\$407	\$83,795	\$65,826	\$17,969	21%
Kit Carson County, Colorado	\$406	\$83,795	\$65,807	\$17,988	21%
La Plata County, Colorado	\$483	\$94,725	\$78,285	\$16,440	17%
Lake County, Colorado	\$374	\$83,795	\$60,543	\$23,252	28%
Larimer County, Colorado	\$594	\$110,715	\$96,165	\$14,550	13%
Las Animas County, Colorado	\$414	\$83,795	\$67,012	\$16,783	20%
Lincoln County, Colorado	\$402	\$83,795	\$65,121	\$18,674	22%
Logan County, Colorado	\$410	\$83,795	\$66,406	\$17,389	21%
Mesa County, Colorado	\$418	\$83,795	\$67,727	\$16,068	19%
Mineral County, Colorado	\$379	\$83,795	\$61,415	\$22,380	27%
Moffat County, Colorado	\$413	\$86,224	\$66,805	\$19,419	23%
Montezuma County, Colorado	\$397	\$83,795	\$64,302	\$19,493	23%
Montrose County, Colorado	\$402	\$83,795	\$65,026	\$18,769	22%
Morgan County, Colorado	\$401	\$85,414	\$64,982	\$20,432	24%
Otero County, Colorado	\$416	\$83,795	\$67,306	\$16,489	20%
Ouray County, Colorado	\$427	\$90,070	\$69,145	\$20,925	23%
Park County, Colorado	\$438	\$97,154	\$70,919	\$26,234	27%
Phillips County, Colorado	\$402	\$83,795	\$65,158	\$18,638	22%
Pitkin County, Colorado	\$909	\$159,899	\$147,198	\$12,701	8%
Prowers County, Colorado	\$406	\$83,795	\$65,729	\$18,066	22%
Pueblo County, Colorado	\$418	\$83,795	\$67,612	\$16,183	19%
Rio Blanco County, Colorado	\$408	\$83,795	\$66,102	\$17,693	21%
Rio Grande County, Colorado	\$391	\$83,795	\$63,364	\$20,431	24%
Routt County, Colorado	\$573	\$112,132	\$92,810	\$19,321	17%
Saguache County, Colorado	\$384	\$83,795	\$62,173	\$21,622	26%
San Juan County, Colorado	\$392	\$83,795	\$63,458	\$20,337	24%
San Miguel County, Colorado	\$680	\$124,647	\$110,162	\$14,484	12%
Sedgwick County, Colorado	\$412	\$83,795	\$66,715	\$17,080	20%
Summit County, Colorado	\$711	\$132,372	\$115,139	\$17,233	13%
Teller County, Colorado	\$611	\$121,847	\$98,878	\$22,969	19%
Washington County, Colorado	\$394	\$83,795	\$63,745	\$20,050	24%
Weld County, Colorado	\$427	\$87,236	\$69,081	\$18,154	21%
Yuma County, Colorado	\$400	\$83,795	\$64,829	\$18,966	23%

Appendix D-1  
(80% of median income)

	Without Considering Utility Costs		Considering Utility Costs		Difference	
	Affordable Sales Price	Available Affordable Units	Affordable Sales Price	Available Affordable Units	Number of Units	Percentage Reduction
Adams County, Colorado	\$165,128	60,299	\$149,637	51,502	8,797	15%
Alamosa County, Colorado	\$111,659	2,335	\$93,125	2,239	97	4%
Arapahoe County, Colorado	\$165,128	64,033	\$152,913	55,130	8,903	14%
Archuleta County, Colorado	\$111,659	945	\$91,251	783	162	17%
Baca County, Colorado	\$111,659	1,293	\$95,586	1,225	68	5%
Bent County, Colorado	\$111,659	1,199	\$94,841	1,131	68	6%
Boulder County, Colorado	\$165,128	19,011	\$153,834	15,963	3,048	16%
Chaffee County, Colorado	\$111,659	1,622	\$95,875	1,287	335	21%
Cheyenne County, Colorado	\$121,948	581	\$104,557	539	42	7%
Clear Creek County, Colorado	\$148,935	951	\$135,535	830	121	13%
Conejos County, Colorado	\$111,659	2,040	\$88,152	1,862	178	9%
Costilla County, Colorado	\$111,659	972	\$87,941	891	81	8%
Crowley County, Colorado	\$111,659	790	\$93,343	729	62	8%
Custer County, Colorado	\$111,659	426	\$88,588	317	109	26%
Delta County, Colorado	\$111,659	4,232	\$94,650	3,048	1,184	28%
Denver County, Colorado	\$165,128	69,857	\$155,022	59,241	10,615	15%
Dolores County, Colorado	\$111,659	436	\$92,208	384	53	12%
Douglas County, Colorado	\$165,128	8,624	\$147,710	4,120	4,504	52%
Eagle County, Colorado	\$165,128	2,014	\$148,689	1,802	212	11%
Elbert County, Colorado	\$137,972	1,396	\$123,284	969	427	31%
El Paso County, Colorado	\$165,128	58,749	\$141,816	44,404	14,345	24%
Fremont County, Colorado	\$111,659	7,074	\$96,718	5,852	1,222	17%
Garfield County, Colorado	\$128,526	3,067	\$112,545	2,605	462	15%
Gilpin County, Colorado	\$165,128	652	\$147,588	461	191	29%
Grand County, Colorado	\$131,900	867	\$118,130	693	174	20%
Gunnison County, Colorado	\$117,563	748	\$103,162	573	175	23%
Hinsdale County, Colorado	\$111,659	51	\$94,153	28	23	45%
Huerfano County, Colorado	\$111,659	1,467	\$96,337	1,372	95	7%
Jackson County, Colorado	\$111,659	302	\$91,710	268	34	11%

Jefferson County, Colorado	\$165,128	61,275	\$153,196	45,319	15,955	26%
Kiowa County, Colorado	\$111,659	436	\$94,805	407	29	7%
Kit Carson County, Colorado	\$111,659	1,624	\$94,786	1,414	210	13%
Lake County, Colorado	\$126,334	1,181	\$111,158	836	345	29%
La Plata County, Colorado	\$111,659	3,535	\$89,522	2,974	562	16%
Larimer County, Colorado	\$147,755	24,912	\$134,687	18,360	6,552	26%
Las Animas County, Colorado	\$111,659	3,011	\$95,990	2,709	302	10%
Lincoln County, Colorado	\$111,659	1,056	\$94,100	902	154	15%
Logan County, Colorado	\$111,659	3,447	\$95,385	3,098	349	10%
Mesa County, Colorado	\$111,659	16,939	\$96,705	13,439	3,500	21%
Mineral County, Colorado	\$111,659	125	\$90,394	106	19	15%
Moffat County, Colorado	\$114,864	2,219	\$96,591	1,923	296	13%
Montezuma County, Colorado	\$111,659	3,782	\$93,281	2,964	818	22%
Montrose County, Colorado	\$111,659	5,027	\$94,005	3,701	1,326	26%
Morgan County, Colorado	\$113,852	4,144	\$94,557	3,303	841	20%
Otero County, Colorado	\$111,659	4,586	\$96,285	4,293	293	6%
Ouray County, Colorado	\$119,924	203	\$100,194	167	36	18%
Park County, Colorado	\$129,538	1,256	\$104,599	738	518	41%
Phillips County, Colorado	\$111,659	996	\$94,136	852	145	15%
Pitkin County, Colorado	\$165,128	808	\$152,636	716	91	11%
Prowers County, Colorado	\$111,659	2,920	\$94,708	2,620	301	10%
Pueblo County, Colorado	\$111,659	25,329	\$96,590	21,802	3,527	14%
Rio Blanco County, Colorado	\$111,659	1,029	\$95,080	809	220	21%
Rio Grande County, Colorado	\$111,659	2,300	\$92,343	2,026	275	12%
Routt County, Colorado	\$149,441	1,684	\$131,612	1,487	197	12%
Saguache County, Colorado	\$111,659	1,208	\$91,152	1,094	114	9%
San Juan County, Colorado	\$111,659	65	\$92,437	26	39	61%
San Miguel County, Colorado	\$166,140	416	\$153,315	363	52	13%
Sedgwick County, Colorado	\$111,659	745	\$95,694	698	47	6%
Summit County, Colorado	\$165,128	1,102	\$149,205	962	140	13%
Teller County, Colorado	\$162,429	3,416	\$141,083	2,598	818	24%
Washington County, Colorado	\$111,659	1,112	\$92,724	950	162	15%
Weld County, Colorado	\$116,382	16,462	\$99,393	10,531	5,931	36%
Yuma County, Colorado	\$111,659	1,965	\$93,808	1,679	286	15%
State total		516,347		416,110	100,237	19%

Appendix D-2  
(60% of median income)

	Without Considering Utility Costs		Considering Utility Costs		Difference	
	Affordable Sales Price	Available Affordable Units	Affordable Sales Price	Available Affordable Units	Number of Units	Percentage Reduction
Adams County, Colorado	\$127,312	34,887	\$110,309	23,259	11,628	33%
Alamosa County, Colorado	\$83,795	1,383	\$64,146	1,145	238	17%
Arapahoe County, Colorado	\$127,312	30,236	\$113,585	20,153	10,083	33%
Archuleta County, Colorado	\$83,795	553	\$62,272	446	107	19%
Baca County, Colorado	\$83,795	1,032	\$66,608	980	52	5%
Bent County, Colorado	\$83,795	913	\$65,862	849	64	7%
Boulder County, Colorado	\$158,482	17,177	\$146,923	14,129	3,048	18%
Chaffee County, Colorado	\$83,795	852	\$66,896	749	103	12%
Cheyenne County, Colorado	\$91,486	459	\$72,877	388	72	16%
Clear Creek County, Colorado	\$111,727	528	\$96,838	419	109	21%
Conejos County, Colorado	\$83,795	1,571	\$59,173	1,319	252	16%
Costilla County, Colorado	\$83,795	784	\$58,962	633	151	19%
Crowley County, Colorado	\$83,795	586	\$64,365	496	91	15%
Custer County, Colorado	\$83,795	274	\$59,609	198	76	28%
Delta County, Colorado	\$83,795	1,785	\$65,671	1,434	351	20%
Denver County, Colorado	\$127,312	36,548	\$115,694	29,230	7,318	20%
Dolores County, Colorado	\$83,795	297	\$63,229	247	51	17%
Douglas County, Colorado	\$127,312	1,987	\$108,382	899	1,088	55%
Eagle County, Colorado	\$136,420	1,570	\$118,833	1,367	203	13%
Elbert County, Colorado	\$103,428	717	\$87,358	465	252	35%
El Paso County, Colorado	\$128,526	24,618	\$103,751	12,887	11,731	48%
Fremont County, Colorado	\$83,795	3,276	\$67,739	2,697	579	18%
Garfield County, Colorado	\$96,344	1,986	\$79,075	1,675	311	16%
Gilpin County, Colorado	\$148,767	422	\$130,573	316	106	25%
Grand County, Colorado	\$98,975	442	\$83,889	335	107	24%
Gunnison County, Colorado	\$88,248	390	\$72,675	359	31	8%
Hinsdale County, Colorado	\$83,795	21	\$65,174	18	3	15%
Huerfano County, Colorado	\$83,795	953	\$67,358	876	77	8%
Jackson County, Colorado	\$83,795	199	\$62,731	159	40	20%
Jefferson County, Colorado	\$127,312	23,219	\$113,868	14,895	8,324	36%

Kiowa County, Colorado	\$83,795	345	\$65,826	278	67	19%
Kit Carson County, Colorado	\$83,795	1,040	\$65,807	933	107	10%
Lake County, Colorado	\$94,725	682	\$78,285	492	190	28%
La Plata County, Colorado	\$83,795	2,110	\$60,543	1,770	340	16%
Larimer County, Colorado	\$110,715	10,747	\$96,165	7,067	3,680	34%
Las Animas County, Colorado	\$83,795	1,805	\$67,012	1,547	258	14%
Lincoln County, Colorado	\$83,795	651	\$65,121	536	115	18%
Logan County, Colorado	\$83,795	2,148	\$66,406	1,919	229	11%
Mesa County, Colorado	\$83,795	6,441	\$67,727	4,893	1,548	24%
Mineral County, Colorado	\$83,795	78	\$61,415	59	19	24%
Moffat County, Colorado	\$86,224	1,310	\$66,805	971	339	26%
Montezuma County, Colorado	\$83,795	2,008	\$64,302	1,572	436	22%
Montrose County, Colorado	\$83,795	2,488	\$65,026	1,819	669	27%
Morgan County, Colorado	\$85,414	2,080	\$64,982	1,442	638	31%
Otero County, Colorado	\$83,795	3,174	\$67,306	2,888	286	9%
Ouray County, Colorado	\$90,070	148	\$69,145	118	30	20%
Park County, Colorado	\$97,154	584	\$70,919	375	209	36%
Phillips County, Colorado	\$83,795	610	\$65,158	524	86	14%
Pitkin County, Colorado	\$159,899	691	\$147,198	630	61	9%
Prowers County, Colorado	\$83,795	2,075	\$65,729	1,938	137	7%
Pueblo County, Colorado	\$83,795	12,120	\$67,612	9,837	2,283	19%
Rio Blanco County, Colorado	\$83,795	539	\$66,102	469	70	13%
Rio Grande County, Colorado	\$83,795	1,420	\$63,364	1,153	267	19%
Routt County, Colorado	\$112,132	1,132	\$92,810	831	301	27%
Saguache County, Colorado	\$83,795	892	\$62,173	769	124	14%
San Juan County, Colorado	\$83,795	13	\$63,458	11	2	15%
San Miguel County, Colorado	\$124,647	242	\$110,162	178	64	26%
Sedgwick County, Colorado	\$83,795	541	\$66,715	514	27	5%
Summit County, Colorado	\$132,372	818	\$115,139	637	181	22%
Teller County, Colorado	\$121,847	1,648	\$98,878	879	769	47%
Washington County, Colorado	\$83,795	720	\$63,745	596	124	17%
Weld County, Colorado	\$87,236	7,043	\$69,081	5,138	1,905	27%
Yuma County, Colorado	\$83,795	1,223	\$64,829	966	258	21%
State total		259,220		186,768	72,453	28%

**APPENDIX E**

	Low Affordable Sales Price	High Affordable Sales Price
Sales price	\$111,659	\$165,128
Downpayment against sales price (2%)	\$2,233	\$3,303
Cost of energy efficiency improvement	\$3,500	\$3,500
Customer payment against energy efficiency improvement (1%)	\$1,117	\$1,651
Matching grant (0.5 of customer payment)	\$558	\$826
Energy efficiency cost financed through mortgage	\$1,825	\$1,023
Total mortgage	\$111,251	\$162,849
Interest	6.57%	6.57%
Natural gas price escalator	5.0%	5.0%
Electric price escalator	2.4%	3.0%
Efficiency reduction in bills	20% of energy	20% of energy
Life of energy efficiency measure	15 years	15 years
Discount rate	4%	4%
Year 1 bill (average)	\$1,538	\$1,538
Year 1 bill (energy is 130% of average)	\$1,903	\$1,903
NOTES:		
<p>The 2003 Annual Energy Outlook (January 2003) published by the Energy Information Administration, U.S. Department of Energy, projects that natural gas prices will move from \$2.75 per thousand cubic feet in 2002 to \$7.00 per thousand cubic feet (nominal dollars) by 2020. That implies an average annual fuel price escalation of roughly 5.0% (not distinguished between inflation and real prices increases). The 2003 Annual Energy Outlook further projects a 0.4% real price increase in electricity through 2020 as natural gas prices move higher. An assumed inflation rate of 2.0% is added to this 0.4% real price increase to yield a 3.0% price escalator. Water/sewer bills are assumed to increase at the rate of inflation (2.0%).</p>		

**APPENDIX F-1**

Lowest Housing Price/Average Utility Bill

Period	Year	Without Energy Efficiency			With Energy Efficiency			Annual Nominal Savings/(Cost)	Discounted Savings	
		Mortgage Payment	Utility Payment	Mortgage plus Utility	Mortgage Payment	Utility Payment	Mortgage plus Utility		Annual	Cumulative
1	2003	\$690	\$128	\$818	\$708	\$96	\$804	\$160	\$160	\$160
2	2004	\$690	\$133	\$822	\$708	\$99	\$808	\$173	\$159	\$319
3	2005	\$690	\$137	\$827	\$708	\$103	\$811	\$186	\$165	\$484
4	2006	\$690	\$142	\$831	\$708	\$106	\$815	\$200	\$170	\$654
5	2007	\$690	\$147	\$836	\$708	\$110	\$818	\$215	\$175	\$830
6	2008	\$690	\$152	\$841	\$708	\$114	\$822	\$230	\$180	\$1,010
7	2009	\$690	\$157	\$847	\$708	\$118	\$826	\$246	\$185	\$1,195
8	2010	\$690	\$163	\$852	\$708	\$122	\$830	\$263	\$190	\$1,385
9	2011	\$690	\$168	\$858	\$708	\$126	\$834	\$280	\$194	\$1,579
10	2012	\$690	\$174	\$864	\$708	\$131	\$839	\$298	\$198	\$1,777
11	2013	\$690	\$180	\$870	\$708	\$135	\$844	\$316	\$202	\$1,979
12	2014	\$690	\$187	\$876	\$708	\$140	\$848	\$336	\$206	\$2,184
13	2015	\$690	\$194	\$883	\$708	\$145	\$853	\$356	\$209	\$2,394
14	2016	\$690	\$201	\$890	\$708	\$150	\$859	\$377	\$213	\$2,607
15	2017	\$690	\$208	\$897	\$708	\$156	\$864	\$399	\$216	\$2,823

**APPENDIX F-2**

Highest Housing Price/Average Utility Bill

		A	B	C	D	E	F	G	H	I
		Without Energy Efficiency		With Energy Efficiency			Annual Nominal Savings/(Cost)		Discounted Savings	
Period	Year	Mortgage Payment	Utility Payment	Mortgage plus Utility	Mortgage Payment	Utility Payment	Mortgage plus Utility		Annual	Aggregate
1	2003	\$1,020	\$128	\$1,148	\$1,037	\$96	\$1,133	\$180	\$180	\$180
2	2004	\$1,020	\$133	\$1,152	\$1,037	\$99	\$1,136	\$193	\$178	\$358
3	2005	\$1,020	\$137	\$1,157	\$1,037	\$103	\$1,140	\$207	\$183	\$541
4	2006	\$1,020	\$142	\$1,162	\$1,037	\$106	\$1,143	\$221	\$188	\$729
5	2007	\$1,020	\$147	\$1,166	\$1,037	\$110	\$1,147	\$236	\$192	\$921
6	2008	\$1,020	\$152	\$1,172	\$1,037	\$114	\$1,151	\$251	\$196	\$1,117
7	2009	\$1,020	\$157	\$1,177	\$1,037	\$118	\$1,155	\$267	\$200	\$1,318
8	2010	\$1,020	\$163	\$1,182	\$1,037	\$122	\$1,159	\$283	\$204	\$1,522
9	2011	\$1,020	\$168	\$1,188	\$1,037	\$126	\$1,163	\$300	\$208	\$1,730
10	2012	\$1,020	\$174	\$1,194	\$1,037	\$131	\$1,167	\$318	\$212	\$1,942
11	2013	\$1,020	\$180	\$1,200	\$1,037	\$135	\$1,172	\$337	\$215	\$2,157
12	2014	\$1,020	\$187	\$1,207	\$1,037	\$140	\$1,177	\$356	\$218	\$2,375
13	2015	\$1,020	\$194	\$1,213	\$1,037	\$145	\$1,182	\$376	\$221	\$2,596
14	2016	\$1,020	\$201	\$1,220	\$1,037	\$150	\$1,187	\$397	\$224	\$2,821
15	2017	\$1,020	\$208	\$1,228	\$1,037	\$156	\$1,193	\$419	\$227	\$3,048

**APPENDIX F-3**

Lowest Housing Price/Adjusted Utility Bill

		A	B	C	D	E	F	G	H	I
		Without Energy Efficiency			With Energy Efficiency			Annual Nominal Savings/(Cost)	Discounted Savings	
Period	Year	Mortgage Payment	Utility Payment	Mortgage plus Utility	Mortgage Payment	Utility Payment	Mortgage plus Utility		Annual	Aggregate
1	2003	\$690	\$159	\$848	\$708	\$119	\$827	\$251	\$251	\$251
2	2004	\$690	\$164	\$854	\$708	\$123	\$831	\$267	\$246	\$497
3	2005	\$690	\$170	\$859	\$708	\$127	\$836	\$285	\$252	\$749
4	2006	\$690	\$176	\$865	\$708	\$132	\$840	\$302	\$257	\$1,006
5	2007	\$690	\$182	\$871	\$708	\$136	\$845	\$321	\$262	\$1,268
6	2008	\$690	\$188	\$878	\$708	\$141	\$850	\$340	\$266	\$1,534
7	2009	\$690	\$195	\$885	\$708	\$146	\$855	\$360	\$271	\$1,805
8	2010	\$690	\$202	\$892	\$708	\$152	\$860	\$381	\$275	\$2,080
9	2011	\$690	\$209	\$899	\$708	\$157	\$865	\$403	\$279	\$2,359
10	2012	\$690	\$217	\$906	\$708	\$163	\$871	\$426	\$283	\$2,642
11	2013	\$690	\$225	\$914	\$708	\$169	\$877	\$449	\$287	\$2,929
12	2014	\$690	\$233	\$922	\$708	\$175	\$883	\$474	\$290	\$3,220
13	2015	\$690	\$241	\$931	\$708	\$181	\$889	\$500	\$294	\$3,513
14	2016	\$690	\$250	\$940	\$708	\$188	\$896	\$526	\$297	\$3,811
15	2017	\$690	\$260	\$949	\$708	\$195	\$903	\$554	\$300	\$4,111

**APPENDIX F-4**

Highest Housing Price/Adjusted Utility Bill

		A	B	C	D	E	F	G	H	I
		Without Energy Efficiency			With Energy Efficiency			Annual Nominal Savings/(Cost)	Discounted Savings	
Period	Year	Mortgage Payment	Utility Payment	Mortgage plus Utility	Mortgage Payment	Utility Payment	Mortgage plus Utility		Annual	Aggregate
1	2003	\$1,020	\$159	\$1,178	\$1,037	\$119	\$1,156	\$271	\$271	\$271
2	2004	\$1,020	\$164	\$1,184	\$1,037	\$123	\$1,160	\$288	\$265	\$537
3	2005	\$1,020	\$170	\$1,190	\$1,037	\$127	\$1,164	\$305	\$270	\$807
4	2006	\$1,020	\$176	\$1,196	\$1,037	\$132	\$1,169	\$323	\$274	\$1,081
5	2007	\$1,020	\$182	\$1,202	\$1,037	\$136	\$1,173	\$341	\$278	\$1,359
6	2008	\$1,020	\$188	\$1,208	\$1,037	\$141	\$1,178	\$361	\$282	\$1,642
7	2009	\$1,020	\$195	\$1,215	\$1,037	\$146	\$1,183	\$381	\$286	\$1,928
8	2010	\$1,020	\$202	\$1,222	\$1,037	\$152	\$1,188	\$402	\$290	\$2,218
9	2011	\$1,020	\$209	\$1,229	\$1,037	\$157	\$1,194	\$424	\$293	\$2,511
10	2012	\$1,020	\$217	\$1,237	\$1,037	\$163	\$1,199	\$446	\$297	\$2,807
11	2013	\$1,020	\$225	\$1,245	\$1,037	\$169	\$1,205	\$470	\$300	\$3,107
12	2014	\$1,020	\$233	\$1,253	\$1,037	\$175	\$1,211	\$494	\$303	\$3,410
13	2015	\$1,020	\$241	\$1,261	\$1,037	\$181	\$1,218	\$520	\$306	\$3,716
14	2016	\$1,020	\$250	\$1,270	\$1,037	\$188	\$1,225	\$547	\$309	\$4,025
15	2017	\$1,020	\$260	\$1,279	\$1,037	\$195	\$1,232	\$574	\$311	\$4,336