

# Cost-Benefit Analyses for a HERS 70 Energy Efficient Residential Building Standard

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A group of HERS raters and builders met with County and City staff to analyze the difference between an example house meeting the NM Energy Conservation Code also known as the International Energy Conservation Code (IECC 2009) and that same house modified to meet a Home Energy Rating Standard (HERS) of 70 or equivalent requirement. HERS is a “performance” rather than a “prescriptive” standard - allowing the builder a whole host of options to achieve the standard. This analysis is necessary because the IECC 2009 will not be in effect in New Mexico until February 2012 and Santa Fe County wanted to verify the affordability of a home built to a HERS 70 or equivalent requirement. Affordability, in this context, is defined as lowering the combined monthly mortgage and energy utility payments when compared to the base case home.

A 2,300 square foot one-story home with 300 square feet of windows equally distributed on all four walls was modeled to comply with the requirements of the 2009 IECC that apply to climate zone 5b (all of Santa Fe County.) This example or base case home was equipped with a conventional water heater and forced air heating and air conditioning system with the HVAC ducts located in the unheated attic. When modeled to meet the requirements of the IECC 2009 code, this home had a projected HERS rating of 89 (this is equivalent to annual total energy use of 50 KBTU/square foot.)

County staff has recommended a “HERS 70, plus, plus” (HERS 70, ++) standard where the two “pluses” represent: 1) inclusion of a thermal by-pass inspection/check-list process to ensure that there are not air gaps between the inside and outside of the home, 2) inclusion of mechanical fresh air exchange to protect occupant health by maintaining indoor air quality.

Changes were made to the example home to reach a HERS 70++, (42 KBTU/SF.) Those changes are listed in the table on the document’s last page. As shown in that table, the changes were sequentially modeled to determine their impact on reducing the home’s energy use and lowering the home’s HERS rating. While there are many other design-related ways to reduce a home’s energy use that are more cost-effective (building shape and orientation, window size and location, inclusion of some passive solar features, selection of major appliances, for example) the changes modeled in this example were chosen to make a straightforward before-and-after comparison. However, it’s important to emphasize that if those other less costly measures were utilized, rather than those modeled for this analyses, the net financial benefit of a HERS 70 standard would be even greater than those presented below. The table also includes the estimated costs of each of those changes as well as some average service costs for third-party analysis, inspection and verification of the HERS requirement.

It is important to note that the IECC 2009 code has some new requirements that many builders may not be currently familiar with. For example, the new code requires that whole house air infiltration must be tested using either a blower door or through visual inspection by an approved independent party (IECC 402.4.2.) Also, duct systems outside of the conditioned space must also be tested. That will require a duct blaster test and may also require the blower door test (IECC 403.2.2.)

From the table on the following page, the estimated costs of the improvements are \$3,870 for homes using natural gas and \$4,370 for homes using propane. This is because the NM Gas Company offers rebates for efficient water heaters and furnaces in both new and existing homes and those rebates are not available for propane-fueled homes. Financing the costs of these improvements for the HERS 70 home will result in an increased monthly mortgage payment as shown in the table below when financed at 4% for 30 years.

If we assume that a 2300 sq. ft. home might sell for \$300,000 (\$230,000 in construction costs at \$100/sq. ft. plus \$70,000 in land costs), \$3870 represents a 1.3% cost impact.

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Fuel Type	Additional Cost of Measures to reach HERS 70	Monthly Mortgage Increase	Monthly Energy Bill Savings for HERS 70 (includes electricity)	Combined Decrease in Monthly Bills (Affordability)
Natural Gas	\$3,870	\$18.50	-\$26.50	- \$8.00
Propane	\$4,370	\$21.00	-\$129.00	-\$108.00

Annual electricity and natural gas costs for this example home are modeled at \$1,646 for the base case HERS 89 home and \$1,327 for the HERS 70 home. Fueling and powering the HERS 70 natural gas home will save the homeowner approximately \$26.50 a month. For propane, the energy savings are greater ( $\$3,284 - \$1,725 = \$1,559 / 12 = \$129.00$  per month.) This analysis indicates that building this example home to a HERS 70 or equivalent will lead to lower combined mortgage and energy payments than the base case home. Of course, as electric, natural gas and propane costs increase over the coming years and decades, the monthly savings will increase compared to the base case home.

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Original Equipment	Changed Equipment	HERS before	HERS after	Estimated Cost of Change
Base case 2009 IECC Code Compliant House	None	N/A	89	N/A
100% Incandescent Lighting	100% Compact Fluorescent Lighting	89	85	\$100 (40 lamps at \$2.50 each)
Windows w/ R value of 2.85 (U = 0.35)	Windows w/ R value of 3.33 (U = 0.30)	85	83	\$800
82% efficient (AFUE) furnace	92.4% efficient (AFUE) furnace	83	78	\$900(after \$200 NM Gas Co rebate for natural gas) – source Hercules in ABQ
56% efficient (EF) tank water heater	83% efficient (EF) tankless water heater	78	71	\$500 (after \$300 NM Gas Co rebate for natural gas) – source Takagi 144kBTU cost
Conventional bathroom exhaust fans (To protect occupant health by maintaining indoor air quality.)	Continuous-duty fans & timers (improved ventilation to meet ASHRAE 62.2)	71	71	\$200 – source Panasonic Whisper Green representative
Code default infiltration assumed	Perform Blower Door Test to verify code required infiltration	71	70	Cost included below in testing
<b>Subtotal of this example's additional cost items to reach HERS 70 and comply with ASHRAE 62.2 improved ventilation</b>				
<b>Estimated Average Service Costs for Third Party Verification</b>				
Plan Analysis (unit cost can be reduced if many homes built to the same model)				\$345
Inspections				\$200
Testing (may be lower depending upon IECC 2009 required testing as discussed above)				\$250
Quality Assurance Fee				\$55
Subtotal of Verification Costs				<b>\$800</b>
<b>Sub-total</b>				<b>\$3,300 (\$3,800 for Propane areas)</b>
Contractor markup / profit (15%)				<b>\$570</b>
<b>Total</b>				<b>\$3,870 (\$4,370 for Propane areas)</b>
<b>“Beyond 70” improvements for informational purposes on possible options</b>				
Code Default Infiltration of 7 air changes per hour at 50 Pascals (ACH at 50 Pa)	6 ACH at 50 Pa	70	69	No cost / Low Cost, requires improved construction management
Non-Energy STAR refrigerator 775 kWh/year	Energy STAR Refrigerator 500 kWh/yr	69	68	No cost / Low Cost
Window orientation - 75 SF of windows all four sides	40 SF windows E and W, 140 SF S, 65 SF N, no overhangs	68	67	No cost / Low Cost
R38 batt ceiling Insulation	R50 blown ceiling insulation	67	65	TBD