An Early Look at Energy Efficiency and Contributory Value

Case Studies of Residential Properties in the Greater Denver Metro Area

Commissioned by the Colorado Energy Office

Written, Reviewed and Vetted by Real Property Appraisers

2015

Intent of This Study

This study has been conducted on behalf of the Colorado Energy Office to provide an analysis of the impact of energy efficiency on the home buying process. Specifically, the purpose is to assess the impact of energy efficiency elements on the purchase decision, not to estimate property value based on the presence of energy efficient elements.

This study includes the analysis of residential properties in the greater Denver metro area, which ranged in sale price from $196,000 to $1,180,000. This work has been completed in conformity with the base Rules of the Uniform Standards of Professional Practice (USPAP). Standards 1-10 are not applicable.

To reiterate, the goal of the study is to better understand the impact energy efficiency has, if any, on the home sales transaction process. While the majority of the case studies presented here contain data for specific, individual residential properties, a few contain broad data, for example, a subdivision analysis. The case studies analyzing a specific home all reflect sales that occurred between January 2012 and April 2014, while the broader data sets contain a mix of older and current data, ranging from 2006 to 2014.

Prior to the publication and/or the communication of this report with real estate transaction stakeholders, this report was reviewed by members of a committee empowered by the Colorado Energy Office, the Colorado Chapter of the Appraisal Institute and the Colorado Coalition of Appraisers. These reviewers provided both review and comments according to the terms of a Memorandum of Understanding signed in August 2012 with the Colorado Energy Office.

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**The green colored boxes reflect market premiums that include both energy efficient and other green features. It was not possible to separate the value of energy efficiency from the value of "green" since green includes elements related to energy efficiency.*

Additional Information

Introduction and Executive Summary

Introduction

At the start of this study, the basic question was posed: "What impact does energy efficiency have on the home buying process?" At the outset, the intent was to answer this question. However, as the study evolved, it became clear that the question in and of itself was insufficient in depth. The question implied that energy efficiency was a clearly identifiable feature, like a two-car garage or a kitchen; but in fact, it wasn't.

Energy efficiency was found to be inherent in every habitable property we located in the study area. In other words, every home had some way to retain heated or cooled air, and a way to control the use of electricity. Energy efficiency, as it turned out, was not an option – it was a necessity. What mattered was not whether it existed, but to what extent it existed.

Thus, while this study started off trying to answer one question, it ended up, by default, answering a different question:

"What level of energy efficiency is expected in different market segments, and what impact does that have on the home buying process?"

How the Study Was Designed

This study was designed to reflect the diversity of the Denver market area. Like most areas, the Denver residential real estate market is extremely diverse. Diverse market areas are the result of differing desires among homebuyers for property features in different areas. While homebuyers in **"Market Area 1"** expect six-car garages, homebuyers in "**Market Area 2"** do not want garages. Therefore, a six-car garage in "**Market Area 2"** will likely have no value to buyers, and the lack of a garage would have a negative impact on value in "**Market Area 1."**

Energy efficiency is the same. Every market segment has its own expectation for what it considers to be an "energy efficient" home. In real estate markets, one level of energy efficiency is not inherently better (or worse) than another level of energy efficiency; rather, the value of energy efficiency is directly related to the expectations of the market. Some market areas expect a home to be extremely energy efficient, others are satisfied with moderate levels of energy efficiency and still others show a minimal interest in improved energy efficiency.

To adequately study energy efficiency, the various levels of energy efficiency must be studied not unto themselves, but across the most common market segments found in the Denver area. To accomplish this, we needed to assemble a group of case studies that would most accurately represent these different market segments (as much as was reasonably possible). The most common market segments in the Denver market area consist of:

- Homes ranging in age from new construction to over 100 years old

- Homes that sold at the low end of the market (under $200,000) and at the high end of the market (over $1 million)
- Large and small square-footage homes (under 900 and over 3,000 square feet)
- Updated and original homes
- Attached and detached dwellings
- Tract and custom homes
- Suburban and urban homes (rural properties proved elusive)

By making sure that case studies represented each category of home, the study could address energy efficiency based on age, size, type, quality, location and condition of the home relative to the expectations of different market areas.

To find qualifying properties, we conducted a very broad search in the local Multiple Listing Services (MLS) for the greater Denver metro area (including Boulder, Fort Collins, Aurora and Highlands Ranch), and made calls to associates who might know of qualified properties that sold in the recent past. We assembled thousands of properties that sold between January 2012 and April 2014, and then sorted the data into the following sub-categories:

- Homes with and without paired sales data available in the area
- Homes located in areas experiencing revitalization and areas experiencing stability (declining areas proved elusive)
- Homes with a variety of updates related to energy efficiency (minor, moderate and significant updates)
- Homes with and without certifications and ratings (HERS, LEED, ENERGY STAR, NAHB)
- Homes with HERS scores (not a HERS rating)
- Homes with all ranges of HERS ratings (including unknown HERS ratings)
- Homes without HERS ratings
- Homes with and without supporting documentation (such as certifications)
- Homes with known energy use and/or predicted energy usage
- Homes with levels of energy efficiency that meet, exceed or fail market expectations

We dropped other criteria from the list (such as properties with known total construction costs, under-improved properties, or properties with recorded energy use) after we found that properties could not fulfill those categories.

After organizing and sifting through thousands of different properties, we selected the first properties that met the criteria listed above. As an example, when looking for a net-zero energy home, or one that produces as much energy as it consumes, we considered that category filled as soon as we located a net-zero home, and did not look further.

This methodology was necessary, as it was a struggle finding properties that qualified as case studies; this is also a testament to the difficulty appraisers have in gathering data related to energy efficiency. Standardized documentation about energy efficiency appears to be in its infancy; thus, during this study and the valuation process, we ran into many challenges related to information gathering and sharing. For example, performance reports were not attached to MLS listings, incorrect verbiage was used in reference to energy-efficient features or ratings, we aroused suspicions when we requested certain information, and municipal building departments routinely discarded data, such as HERS reports. Because we encountered roadblocks to data collection, some types of properties are missing from the study. However, while the case studies were not meant to intentionally exclude (or include) any particular type of home or market segment, they do demonstrate the current limitations of available data.

What This Study Includes

While the cornerstones of the study are the case studies themselves, the case studies are not useful without additional background information and research to accompany them. Therefore, this study also does the following:

- Studies and reports general trends related to energy efficiency
- Defines the different levels of energy efficiency
- Explains how to identify different levels of energy efficiency
- Through use of example, reports and communicates the different levels of energy efficiency
- Notes the limitations found in gathering data
- Evaluates the quality and relevance of available data
- Discusses limitations in data found during research
- Shows how to develop an opinion of value
- Using the case study data, illustrates the process one can use to develop opinions of contributory value for the various levels of energy efficiency[1]
- Reports the findings in an executive summary

[1] These illustrations are not intended to be construed as definitive value opinions for energy efficiency features.

Executive Summary

The results of study can be summarized into two main points:

1) **There is a current lack of researchable and quantifiable data (such as energy ratings, audits, reports and labels). In some of the case studies, this lack of data resulted in an inordinate amount of time dedicated to research and analysis. In other case studies, it directly limited the ability to support a market-derived conclusion of contributory value for energy efficiency.**

   Currently, the documentation about the level of energy efficiency noted in any particular home is a rare occurrence – even when energy efficiency is a relevant feature to that market area. Without a reasonable quantity of researchable data, it is not possible for an appraiser to develop a reliable, credible and market-supported opinion of value for energy efficiency. Additionally, the amount of time required to assimilate and dissect the data may be problematic for the typical residential assignment. Until the data is consistently available and easy to find, it is likely that the residential appraiser's ability to develop a credible opinion of value will be limited.

2) **The value of the various levels of energy efficiency is market-specific.**
   In some of the case studies, there was enough data to develop a credible opinion of the contributory value of energy efficiency. In those cases, it was clear that energy efficiency, as a value-added amenity, is similar to the *condition* or *quality of construction* of a home: its contributory value is relative to its market area. However, just as it would be impossible to say that one level of quality of construction is better than another (and is not an over- or under-improvement), it would be impossible – without understanding a property's market area – to definitively say that one level of energy efficiency is intrinsically better across all markets and for different property types.

In summary, in addition to highlighting the appraisers' dependence on Realtor[2]-supplied data, this study clearly illustrates the need for appraisers to be competent on items related to energy efficiency; in as far as these items are relevant to the appraiser's specific assignment, scope of work and market area. Energy efficiency comes in many forms and is valued by different markets in different ways. If different levels of energy efficiency are a relevant property feature for a particular market, then appraisers must learn the nuances and preferences of that specific market.

[2] Certainly, other market participants do and can provide ample amounts of relevant data. However, Realtors are among the greatest sources of information for appraisers, and our dependence on the data they record in the MLS is crucial to the appraisal process.

Energy Efficiency

Introduction to Energy Efficiency

This section will address the following:

Definition of Energy Efficiency

This section includes a brief explanation of energy efficiency.

Energy Efficient Trends

The market's desire for (or rejection of) homes with different levels of energy efficiency is the result of a combination of various global, national and local trends. Some of these trends are discussed.

An Introduction to Building Code related to Energy Efficiency

Because energy-related building codes have a direct influence on the levels of energy efficiency noted in homes, the following will be discussed in detail: what energy-related codes are and how they evolved, what these codes mean, where they are trending, and how codes are applicable to the Denver metro area.

Energy Rating Certificates

Different entities rate, classify and score energy use for different homes. The most prevalent certification entities for the Denver metro area will be discussed in detail.

The Cost of Energy, and Energy Use

How much energy costs can impact the decisions of homebuyers. The relative cost of energy will be discussed, as will the average levels of energy use for the Denver market area.

How to Label and Identify Various Levels of Energy Efficiency

For ease of communication, we created a labeling system for energy efficiency. This provides an easy way to report and compare the different levels of energy efficiency. Additionally, we include photo examples from specific homes. The photos show some of the features that impacted the level of energy efficiency noted in those homes.

Definition of Energy Efficiency

The International Energy Agency (IEA) defines energy efficiency as "*a way of managing and restraining the growth in energy consumption. Something is more energy efficient if it delivers more services for the same energy input, or the same services for less energy input*."

A home that is more energy efficient than another similar home will typically have a more comfortable living environment, cost less to operate and maintain, and have a lesser impact on the environment. An energy efficient building should not be confused with a "green building."[3] While energy efficiency is one of the elements of a green building, it does not, in itself, indicate whether a building is "green" or not. In other words, if a building is a green building, energy efficiency will likely be included in its amenities. If a building has energy efficiency measures, it will not necessarily be a green building.

The case studies will distinguish between homes that only have energy efficiency elements, and those that have energy efficiency elements AND are considered green buildings.

[3] Wikipedia defines "green building" as "*a structure and process that is environmentally responsible and resource-efficient throughout a building's life-cycle: from siting to design, construction, operation, maintenance, renovation, and demolition."*

Energy Efficiency Trends

National Energy Efficiency Trends in the Residential Market

Increasing energy efficiency in homes is not a fad. Generally speaking, the greater national market has shown a proclivity toward both having and creating higher levels of energy efficiency in their homes. We drew this conclusion based on the findings from the seven studies and the reports noted below.

2011 American Housing Survey

The 2011 American Housing Survey conducted by the U.S. Census asks respondents to report on topics such as routine maintenance and energy efficiency as they related to their homes. This information shows that of the 15 million respondents located in the "West"[4] region of the United States, energy efficiency has the following relevance:

% of Homeowners Who, When Installing Appliances, Installed ENERGY STAR® Rated Appliances	
Refrigerator	48%
Dishwasher	34%
Central AC	16%
Heating equipment	21%
% of Homeowners Who Made Specific Home Improvements in the Last 2 Years	
Made at least 1 home improvement	58%
What *type of improvement* was made?	
Replaced appliances	23%
Made at least 1 home improvement for energy efficiency	13%
Replaced windows	11%
Replaced roof	9%
Remodeled bathroom	7%
Replaced HVAC	7%
Remodeled kitchen	5%
Increased insulation	5%
Replaced siding	2%

Based on the above information, of the 58 percent of households that made improvements:

- The three most frequent *types of improvements* were related to energy efficiency (new appliances, new windows and updates specifically made to improve energy efficiency) and,
- Five of the nine *types of improvements* were related to energy efficiency.

National Association of Realtors 2013 Profile of Homebuyers and Sellers

According to this survey, 85 percent of homebuyers thought that heating and cooling costs were "somewhat important" when purchasing a home. This survey was nationwide.

[4] This includes Montana, Idaho, Wyoming, Nevada, Utah, Colorado, Arizona and New Mexico

Home Energy Performance Scores: Efforts to Date with Modeling Tool Comparison and Summary of Key Issues[5]

This survey asked respondents about Home Energy Rating System (HERS) ratings. Of those:

- 46 percent who received a home energy score thought the energy score would be useful if they sold the home.
- 83 percent said they would want to see an energy score if they were buying a home.

Builders Energy Data Book

Energy efficiency can often be taken for granted in the marketplace. This is most likely due to the fact that energy efficiency IS a building factor in new homes: "*Homes built between 2000 and 2005 used 14 percent less energy per square foot than homes built in the 1980s and 40 percent less energy per square foot than homes built before 1950. However, larger home sizes have offset these efficiency improvements."*

In conclusion, our homes are larger today than they were 30 and 70 years ago, but they are much more efficient.

McGraw-Hill Companies "World Green Building Trends"

While this study focuses on buildings with green features, one "green" feature is energy efficiency. Thus, the following comment was felt to be relevant to this study: "*Green homes comprised 17 percent of the overall residential construction market in 2011 and are expected to grow to between 29 percent and 38 percent of the market by 2016. [Additionally], 34 percent of remodelers expect to be doing mostly green work by 2016, a 150 percent increase over 2011."*

American Council for an Energy Efficient Economy (ACEEE)'s International Energy Efficiency Scoreboard

The most energy efficient nations (in descending order) as of 2012 are as follows:

1. United Kingdom
2. Germany
3. Italy
4. Japan
5. France
6. European Union, Australia, China (three-way tie)
7. United States
8. Brazil
9. Canada
10. Russia

[5] MetaResource Group. 2012. Energy Trust of Oregon

Johnson Controls, July 2013

"Energy Efficiency Interest up 116 Percent Globally"

Local Energy Efficiency Trends in the Residential Market

While the data and trends previously noted apply to the national market, there are noticeable trends in the local market that also reflect a proclivity toward both having and creating higher levels of energy efficiency in homes.

Use of the Word "Energy" in MLS[6]

In the Denver metro area, there are two main MLS systems: IRES and Metrolist. We made a search in both MLS systems regarding trends in the use of the word "energy" in MLS listings.

How often the word "energy" is used to describe homes listed for sale in MLS:

	IRES MLS				Metrolist MLS		
	Total # of MLS listings	Total # of listings containing the word "energy"			Total # of MLS listings	Total # of listings containing the word "energy"	
2006	18138	352	1.9%		45947	176	.4%
2007	17364	304	1.7%		46673	176	.4%
2008	15309	299	1.9%		45745	160	.4%
2009	13920	333	2.4%		39932	245	.6%
2010	13866	346	2.5%		37041	257	.7%
2011	14425	399	2.8%		37896	487	1.3%
2012	17056	557	3.3%		44894	725	1.6%
2013	19718	670	3.4%		53279	874	1.6%

Based on the above data, features in homes that relate to "energy" are increasingly viewed by listing agents as being worth specifically highlighting to potential buyers. While the overall percentage of listings using the word "energy" is still below 5 percent, we must keep in mind that even the most used descriptors comprise only about 20 percent of all listings.

While the word "energy" is used less than 5 percent of the time in all listings, it is especially prevalent for new home listings.

[6] Includes all residential attached, detached and single-unit income properties.

How often the word "energy" is used to describe NEW (detached) homes listed for sale in MLS

	IRES MLS				METROLIST MLS
	Total # of MLS listings	Total # of listings containing the word "energy"			Due to recent changes in Metrolist, this data could not be assembled.
2006	2239	177	7.9%		
2007	1812	119	6.5%		
2008	1304	73	5.5%		
2009	1059	106	10%		
2010	911	65	7.1%		
2011	1135	100	8.8%		
2012	1540	146	9.4%		
2013	1712	253	14.7%		

Additionally, it should be noted that because of the way the MLS systems are set up, Realtors are able to convey energy efficient features without actually using the word "energy." In addition to purposefully using the word "energy" in their written MLS comments, listing agents can also fill out any number of "Green Fields" available to them.

The Green Fields allow the listing agent to indicate whether any of the following features/certifications exist for the subject property:

- HERS-Rated
- ENERGY STAR®-Rated
- LEED for Homes-Certified
- NAHB/NGBS – ICC 700 Certification
- Solar Photovoltaic System
- Solar Thermal System
- Green Disclosure

These Green Fields have only been in place since 2012. Since their inception, the fields have been utilized on 1,061 separate residential listings – lower than 1 percent of the time. Further research showed that among Realtors who indicate that a property has "energy" or "green" features, Realtors most often do this without using the Green Fields to convey that information. Thus, it can still be a challenge for appraisers to search MLS listings based on energy-related features.

Interviewing Listing Agents who Chose to Identify a Home as "ENERGY STAR"-Qualified

We conducted a search of homes that sold through the local MLS systems and that were identified as having an ENERGY STAR certificate or as being ENERGY STAR-qualified. There were 306[7] MLS listings that disclosed the existence of an ENERGY STAR certificate by using the Green Fields[8]. Of the 306 properties, most were new-construction. After eliminating new-construction properties, 52 MLS listings remained. Every listing agent for those 52 properties was contacted. Below is a summary of those who responded to the survey.

	= Positive Comment		= Neutral Comment		= Negative Comment

Location	Date of sale	Year built	Did anyone comment on the energy efficiency of the home?	Did the energy efficiency of the home impact value?	Did the energy efficiency of the home impact marketability?	Was having an ENERGY STAR certificate a positive?	Do people know what a HERS rating is?
Longmont	May 2013	2003	Yes, people said it was a nice feature.	It was considered, but value is hard to estimate.	Not sure.	No, no one asked for it.	
Greeley	June 2013	2010	Energy efficiency is in the top 10 features people want, but not the top 5.	Sometimes.			
Louisville	June 2013	2010	The market is oblivious to the energy features. The reputation of the builder was a selling feature[9].	No	No	No	No
Louisville	April 2012	2011	Working to educate the buyers resulted in the buyers paying more.	Yes, as long as the energy efficiency is explained to them.	Yes	Yes	Many do
Denver	April 2013	2008	Yes. Displaying all the energy efficient data is important to buyers.	Yes, energy savings was very important.	Yes	Yes	Not really, it needs to be explained.
Louisville	January 2013	2011	Energy efficiency is a nice bonus, but not the reason people will buy the home.	Maybe	Maybe	Yes	No, it needs to be explained.
Thornton	June 2013	2010	People like the concept of energy efficiency, but the	Yes	Yes	Yes	It needed to be

[7] This is f over 100,000 listings.
[8] Since the "Green Fields" are relatively new to the MLS, not all Realtors use the designated field to identify whether or not a property has an ENERGY STAR certificate. Some disclose the information in other parts of the listing. However, for simplicity's sake, we researched only those listings that specifically used the field indicating whether or not a home is ENERGY STAR-rated.
[9] This was an interesting comment. This particular builder does a good job educating buyers about energy efficiency; so, while buyers may not be directly talking about energy efficiency, it is still possible they have some understanding of the energy efficiency features in the home.

			actual monthly savings is not really important.				explained.
Severance	February 2014	2010	People appreciate energy efficiency, but they do not ask about utility bills.	No	Yes	Yes	Not usually

Location	Date of sale	Year built	Did anyone comment on the energy efficiency of the home?	Did the energy efficiency of the home impact value?	Did the energy efficiency of the home impact marketability?	Was having an ENERGY STAR certificate a positive?	Do people know what a HERS rating is?
Denver	March 2013	1914	This was a LEED home, and most buyers are very confused by "green" building. However, buyers did ask about energy consumption.	Yes	Yes	Yes	It needs to be explained.
Denver	February 2013	2005	This is a very energy efficient neighborhood, so buyers expect energy efficiency.	Yes	Yes	Not sure, since the sellers did not have their certificate.	
Lafayette	December 2013	2006	Buyers asked no questions about energy efficiency; however, I did emphasize it.	Yes, for this sale it did.	Yes, for this sale it did.	Sometimes. For the average buyer, little attention is paid to the certificate.	No
Longmont	May 2013	2007	Because this house was valued under $250K, it was not important.	No	No	No	No
Lafayette	September 2013	2008	No questions were asked regarding utility costs.	No	Yes	Not sure. The certificate was, however, provided to the buyer.	No
Castle Rock	January 2014	2009	Energy efficiency had zero impact.	No	No	No	No
Lochbuie	October 2013	2010	The more information we provided, the more comfortable buyers were with the purchase; however, buyers never asked about utilities.	Not sure	Not sure	Not sure	
Erie	May 2013	2010	Yes, buyers asked about utilities.	Yes	Yes	Yes	No
Castle Rock	June 2013	2010	No one asked anything about energy efficiency.	No	No	No	No

In conclusion, of the 85 boxes categorized by color, the market is slightly tilted toward energy efficiency being a positive feature and/or something buyers understand, ask about or appreciate:

- **41%** of boxes have positive indicators.
- **35%** of boxes indicate energy efficiency was not a valued feature.
- **16%** of boxes indicate that it was not clear how energy efficiency is valued by buyers.
- **7%** of boxes demonstrate no response.

Homeowner Survey

To better understand how homeowners view energy efficiency, we mailed surveys to homeowners of various ENERGY STAR-qualified homes. The 26 responses can be summarized as follows:

96% knew their home had energy-efficient features when they purchased.	76% were made aware of energy-efficient features through marketing materials, while only 4 percent knew how to identify energy efficiency by observation.	50% do not recall receiving any type of energy efficiency certificate when they bought their home.
50% did NOT believe they paid more for their home because of its energy efficiency.	26% of respondents made additional energy efficiency improvements after purchasing their home, spending an average of $3,800.	Of those who recall receiving an energy efficiency certificate, 84% felt it made an impact on their decision to buy the home.
Of those who believe they did pay more to have energy-efficient features in their homes, the most common premium they believed they paid was 3-5%.	If they were to buy another home in the future, 96% would look to purchase a home with energy-efficient features.	50% knew what a HERS rating was, and 57% knew what an energy audit was.
If they were to buy another home in the future, 96% would like that home to have an energy efficiency rating so that they could compare it to other homes.		

Additionally, as part of the survey, we asked homeowners an open-ended question regarding what they look for when trying to understand whether or not a home is energy efficient. The answers were varied and contained multiple responses:

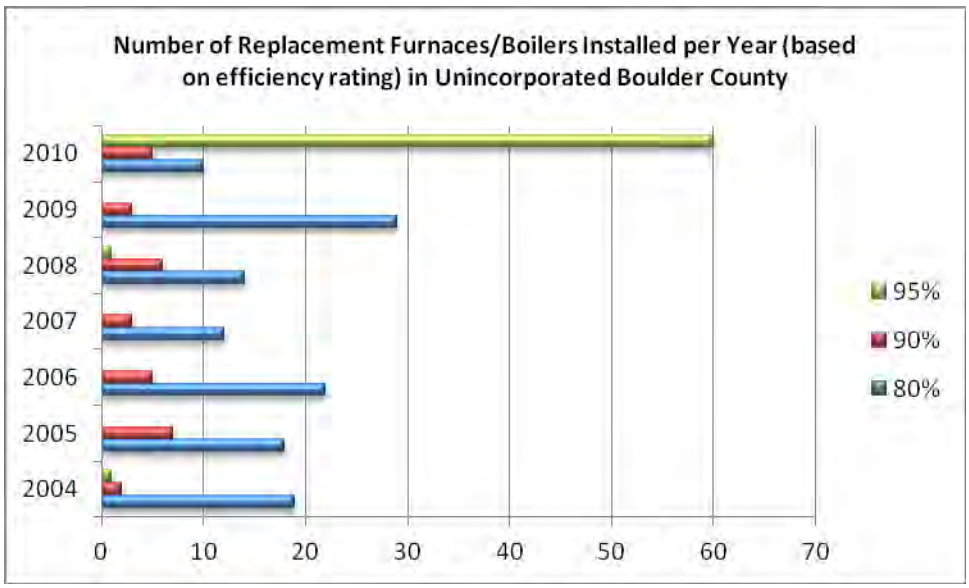
Furnace/AC efficiency	●●●●●●●●●
Insulation	●●●●●●●●
Window efficiency	●●●●●●●●
Utility bills	●●●●●
ENERGY STAR or HERS certificate	●●●●●
Marketing materials explaining energy efficiency	●●●●●
Appliance efficiency	●●●●●
Air sealant/Envelope efficiency	●●●●
Year of construction	●●●
Lighting	●●
Water heater	●●
Solar panels	●●
Doors	●

Finally, survey respondents offered the following quotes regarding energy efficiency:

"Energy-efficient features were a strong consideration."	The seller provided a "huge sales pitch" [on energy efficiency].	"We looked for 2 years before finding this energy-efficient home. Energy efficiency was a BIG part of the decision."
"I purchased the home because of the energy-efficient features in the prospectus."	Energy efficiency "certainly helped when deciding" but it was not a major decisive feature.	"Energy efficiency had an impact" on our buying decision.
"I am interested in specific [energy efficient] features, not ratings."	"Would be interesting to know the [energy efficiency] rating."	"I had an energy audit conducted by an Xcel rep on a previous home and plan to do one on this home as well."

Furnace Installations in Boulder County

If energy efficiency did not matter, buyers would install the minimally efficient furnaces in their homes. This, however, is not the trend in Boulder County (*2004 thru 2010*[10]), as demonstrated below.



While there was a very notable increase in the number of 95 percent-efficient furnaces as of 2010, we were unable to confirm why this increase occurred. (Was it due to changes in building code requirements? Rebates offered for higher efficiency furnaces? The buyer's preference? The furnace installer's preference?). Nonetheless, the trend is notable.

Energy Smart

In January 2011, Boulder County launched what is known as the "Energy Smart Program"[11]. The goal of the program is to provide energy advising and some financial assistance to help homeowners and commercial building owners increase their buildings' overall energy efficiency. According to a study prepared by Navigant, the program has had the following impacts:

- 5,072 households enrolled in the Energy Smart program (4 percent of all households in Boulder County).
- Of the 5,072 households, 51 percent proceeded to complete one or more energy update.
- A total of 4,747 energy updates were completed.
- The total investment in energy efficient updates was $6,159,577.

[10] Data includes only those permits that listed an efficiency rating on them. Of the 1,173 permits located for unincorporated Boulder County, 249 had efficiency ratings listed on the permit.
[11] The City and County of Denver has a similar program called the "Denver Energy Challenge."

- The average participant saved $188 per year in energy costs.

As noted by Navigant, a key finding in the study was that it wasn't sufficient to provide information to homeowners in regard to energy efficiency. The Energy Smart program also had to make it easy for homeowners to complete energy efficient updates. Thus, Energy Smart worked to target the correct population, qualify trustworthy contractors, offer all necessary information in regard to rebates, and provide quick pathways to have any updates completed.

Energy Information Administration

"Clean energy is considered a key industry in Colorado. In 2004, Colorado became the first state with a voter-approved renewable portfolio standard (RPS). The RPS and other state support for efficiency and renewable energy industries have attracted private investment and made Colorado a clean energy industry leader in the Mountain West."

Conclusion

The above data sets and information give a quick look at how the local market views energy efficiency overall. These views are not something to be ignored. The greater Denver market, in general, places value on having energy-efficient homes. Thus, to adequately reflect the real estate transactions of market participants (homebuyers and sellers), appraisers need to be aware of, understand, document and track energy efficient trends such as those noted above.

An Introduction to "Code"

What Code Is

In the United States, it is common for municipalities to require that buildings be constructed (or remodeled) according to a set of very specific rules. These rules are generically referred to in the building industry as "code."

Code, however, is not one thing. There are different *types* of code, different *versions* of code and different *ways* to apply and adopt each code. In Colorado, every city, county and state decides what its building code will be (or can elect to have no building code at all). Each municipality can choose to adopt codes that have already been written by an international (or national) organization, or can write its own codes.

Some of the more recognized and commonly adopted codes in Colorado are:

Code Type	Code Model Name (and version)
Building/Dwelling	*IBC 2009, IRC 2006*
Structural	*IBC 2009, IRC 2006*
Plumbing	*IPC 2009*
Mechanical	*IMC 2009*
Electrical	*NEC 2008*
Fire/Life Safety	*IPC 2006*
Accessibility	*ICC/ANS 117.1 2003*
Energy	*IECC 2009*
Gas	*IFGC 2009*
Boiler	*ASME Boiler*

In other words, "code" is just a generic term referring to whatever building rules a specific municipality opts to adopt.

For the purposes of this report, only one code book will be discussed in detail: the International Energy Conservation Code.

The International Energy Conservation Code

The International Energy Conservation Code ("IECC") is a nationwide code book consisting entirely of building codes that address the energy efficiency standards for both residential and commercial buildings. The very first IECC was published in 1998, yet it was not the first nationwide code addressing energy efficiency standards ("energy code") in the United States. The first nationwide energy code for residential buildings came into existence in 1975, primarily as a result of the 1973 World Oil Energy Crisis, when oil went from $3 per barrel to $12 per barrel[12].

[12] Wikipedia, "1973 Oil Crisis."

This first energy code was the "ASHRAE Standard 90-1975." Since then, the energy codes have not only been updated every two to three years, but they have also undergone various name changes, from "*ASHRAE Standard 90,*" to "*Model Energy Code,*" to its current name, the "*International Energy Conservation Code.*" This most current version, the IECC, is updated every three years. As of this writing, the most current version of the IECC is from 2012. A new version will be published in 2015.

Why Changes to the Energy Code Matter to Appraisers

Changes in the energy code have resulted in noted improvements in the overall energy efficiency of new homes. Starting with the ASHRAE Standard 90-1975 energy code, all subsequent energy codes have continued to address energy efficiency in homes. To date, the energy code versions have continued to strive to improve overall energy efficiency levels in homes.

Approximate energy savings from one code level to the next are as noted below[13]:

NAME OF ENERGY BUILDING CODE:	Projected Energy Savings compared to the ASHRAE Standard 90-1975 Energy Code:
Model Energy Code (MEC) 1983 and 1986	0%
Model Energy Code (MEC) 1992 and 1993	10%
Model Energy Code (MEC) 1995	12%
International Energy Conservation Code (IECC) 1998	13%
International Energy Conservation Code (IECC) 2000 and 2003	13%
International Energy Conservation Code (IECC) 2006	14%
International Energy Conservation Code (IECC) 2009	19%
International Energy Conservation Code (IECC) 2012	44%

What stands out in the table noted above is the marked improvement in energy efficiency from 2006 to 2012. Specifically, the 2012 IECC made the biggest impact on energy efficiency levels than any of its predecessors. Additionally, most sources report that the goal for the 2015 IECC is to increase energy efficiency even more. Based on the trends noted above for energy codes, everything indicates that governments will continue to strive for more and more efficient homes. This is in keeping with what has already been happening in most of the developed world. The United States is catching up.

Adoption of Energy Codes

Just because a new version of the energy code is released does not mean that it goes into effect right away, or even at all. Since Colorado is a home rule state, every jurisdiction (of which there are over 300) can choose which code it wants to adopt and enforce. However, the State of Colorado did set a floor of the 2003 IECC for any jurisdiction that adopted an energy code. This rule went into effect July 1, 2008**.** Even so, there is still a great variance across the state in applicable energy codes.

[13] U.S. Department of Energy "*State Building Energy Codes are Increasing Energy Efficiency.*"

To understand how diverse the adoption of energy codes can be in Colorado, we sent a survey to many of the municipalities in the greater Denver metro area. We asked each municipality when it adopted various versions of the energy code. A summary of those that responded is below.

Effective Date of Applicable Energy Codes by Municipality (as of April 2014)[14]

(Only those municipalities that provided information are included on this list)

	1995 MEC	1998 IECC	2000 IECC	2003 IECC*	2006 IECC	2009 IECC	2012 IECC
Aurora	Followed the 1989 MEC			n/a	02/01/07	02/28/11	n/a
Arvada	Followed the 1978 MEC			07/01/04	03/17/08	03/15/12	n/a
Boulder	Other code	Other code	06/05/01	Other code	Other code	Other code	01/31/14
Broomfield	09/19/01	n/a	n/a	12/10/03	02/28/08	03/07/11	03/15/14
Centennial						Yes	
Cherry Hills Village			11/19/02	n/a	01/15/08	08/17/10	10/07/13
Commerce City	No specific energy code			11/01/05	n/a	06/04/12	
Denver	04/05/99	n/a	n/a	06/04/04	08/01/08	06/14/11	
Edgewater	No specific energy code			01/29/04	07/19/07	06/01/11	n/a
Erie	Unknown				09/19/2008	n/a	n/a
Golden							03/04/13
Lafayette	No specific energy code		07/16/02	08/16/05	08/18/08	06/17/11	1/1/2014
Lakewood	No specific energy code			08/30/03	10/01/06	09/01/11	n/a
Littleton							01/01/14
Longmont	n/a	04/01/00	06/01/02	01/01/05	01/01/07	01/01/10	01/01/13
Louisville	No specific energy code			n/a	n/a	01/12/2010	03/31/14
Northglenn						Yes	
Parker	No specific energy code			01/01/04	01/07/10	01/01/10	12/31/12
Thornton	No specific energy code			10/26/04	07/01/07	08/02/10	08/05/13
Westminster	Followed the 1986 MEC		09/01/02	n/a	01/01/07	10/02/10	n/a
Wheat Ridge					05/10/10	n/a	n/a
Adams County	Unknown				Adopted	n/a	n/a
Arapahoe County	CABO	n/a	n/a	10/01/04	01/01/08	11/15/10	Will adopt
Boulder County							01/01/13
Broomfield County	09/19/01	n/a	n/a	12/10/03	02/28/08	03/07/11	03/15/14
Denver County	04/05/99	n/a	n/a	06/04/04	08/01/08	06/14/11	n/a
Jefferson County	No specific energy code		10/01/01	01/01/04	07/01/07	01/01/10	n/a
Weld County	No specific energy code			01/01/04	07/01/07	n/a	n/a

Per Colorado state law effective July 1, 2008, 2003 IECC (at a minimum) applies to all jurisdictions that adopt and enforce codes.

What These Adoption Dates Demonstrate

The chart above shows how energy efficiency levels in new homes are trending for different areas. Until about 2003 or 2004, the emphasis on the energy efficiency levels of homes was not even on the radar of most jurisdictions in Colorado. However, in 2009, 95 percent of all new homes in Colorado were built to

[14] It is important to note that while many jurisdictions may adopt a certain version of the IECC, it is common for them to amend some of the requirements to fit their needs. Therefore, it is important to check with each individual municipality to see if it has adopted any amendments to the specific version of the energy code it is using.

the 2009 IECC or higher[15]. And around 2010 and 2011, it started to become clear that jurisdictions were very much on-board with following the most current version of the nationwide energy codes.

Additionally, the chart shows that understanding which energy codes are applicable in various locations is a difficult prospect in Colorado. The chart emphasizes the relevance and significance of geographic competency among appraisers.

How to Read the IECC

The IECC is a technical and lengthy document that requires the specialized knowledge of an expert, such as a contractor or building inspector, to fully interpret. Therefore, understanding the details of the IECC will typically be beyond the scope of work for the vast majority of appraisal assignments. Even so, there is some information that proved useful both while conducting this study and while reading HERS reports.

The IECC energy code is organized into three categories:

Mandatory Code
Prescriptive Code
Performance Code

Mandatory Codes

As their name implies, these regulations are mandatory. In a jurisdiction adopting IECC, a builder is not able to opt out of any of these codes (however, there is one exception to this statement, which will be addressed later under the heading "How Jurisdictions Impact the IECC"). If the appraiser understands nothing else about the code, just knowing some of the mandatory requirements can be quite helpful when inspecting a home.

A comparison of some of the mandatory requirements of the 2009 IECC and the 2012 IECC are noted below:

Mandatory Requirements of the 2012 IECC	Mandatory Requirements of the 2009 IECC
All items in Chapter R3 are mandatory.	All items in chapter 3 are mandatory.
401.3: A permanent certificate shall be posted on the or in the electrical distribution panel.	401.3: A permanent certificate shall be posted on the or in the electrical distribution panel.
402.4: Air Leakage (The tightness of the building shall be verified with **BOTH** a blower door test and a visual inspection).	402.4: Air Leakage (The tightness of a building shall be verified with **EITHER** a blower door test or a visual inspection).
403.1: A programmable thermostat is required.	403.1: A programmable thermostat is required.
403.2.2: Mandatory duct tests if ducts are located outside of the thermal envelop (to test for **TOTAL LEAKAGE**).	403.2.2: Mandatory duct tests if ducts are located outside the thermal envelop (to test for **LEAKAGE TO OUTDOORS**).
403.2.3: Building cavities cannot be used for supply **OR RETURN DUCTS.**	403.2.3: Building cavities cannot be used for supply ducts.

[15] Colorado Energy Office

403.3: Specification for mechanical system piping insulation. 403.4: Circulating hot water systems piping insulation and auto shutoffs. 403.5: For mechanical ventilation, gravity dampers are required on outdoor air intakes and exhausts.	403.3: Specifications for mechanical system piping insulation. 403.4: Circulating hot water systems piping insulation and auto shutoffs. 403.5: For mechanical ventilation, gravity dampers are required on outdoor air intakes and exhausts.

Of note is that some codes changed while others did not. With each new version, it is typical for the IECC energy code to undergo updates such as those noted above. However, what may seem like insignificant word changes can have a notable impact on the overall level of energy efficiency of the homes being built to that code.

Prescriptive Codes & Performance Codes

While builders must meet the mandatory requirements set forth in the code, they then have a choice: meet either the "Prescriptive" codes or the "Performance" codes. The difference between the two can be described below by using the 2012 IECC as an example:

Prescriptive codes provide a concrete example of one very specific way to build a house so as to satisfy all of the 2012 IECC building codes. This is meant to help those who do not have the time, resources or experience to consider the literally hundreds of different solutions that can result in a 2012 IECC code compliant home.	***Performance codes*** allow the builder to design a home using any reasonable building method, technique and material, as long as s/he is able to predict the annual energy use of the proposed home (by having an energy rater use energy modeling software) and at a minimum, meet the energy efficiency standards of the 2012 IECC.

In the end, a builder will meet either the mandatory *and* the prescriptive codes, or the mandatory *and* the performance codes. Most builders in the greater Denver area elect to meet the mandatory *and* performance codes. As a result, it is very common for the builders (who have to meet the 2012 IECC) to obtain a full energy assessment with a HERS rating and submit that to the building department. This document then becomes public and the appraiser can request a copy, assuming the building department retains the document on file (which only some in our area do).

Because of this performance code option, there are innumerable ways for a builder to achieve compliance with the 2012 IECC. Without specialized training in both code compliance and construction methods, it is not possible for an appraiser to determine whether or not a property meets the IECC code requirements. Even so, reading the IECC and learning the basics about what to look for is incredibly helpful in understanding what one can expect to see in a home with numerous energy efficient features.

How Jurisdictions Impact the IECC

Jurisdictions are allowed to decide which versions of the code they will adhere to and what date the versions will become effective. Additionally, jurisdictions can opt out of any particular portion of the code. As an example, one jurisdiction may think the R-value requirements for insulation are too stringent and then opt to strike (or modify) that section of the code.

Therefore, it is a good idea to check the actual applicable code for every jurisdiction in which the appraiser works. The appraiser should ask not only what version of the IECC the jurisdiction adheres to, but also when compliance with that code became effective and what changes (if any) the jurisdiction elected to make to the code. Following the research, it would be prudent to disclose the results of the research in the appraisal report along with a statement that the appraiser is not an expert in matters of energy efficiency and that credible information provided by others is assumed to be correct through extraordinary assumption.

Energy Rating Certificates

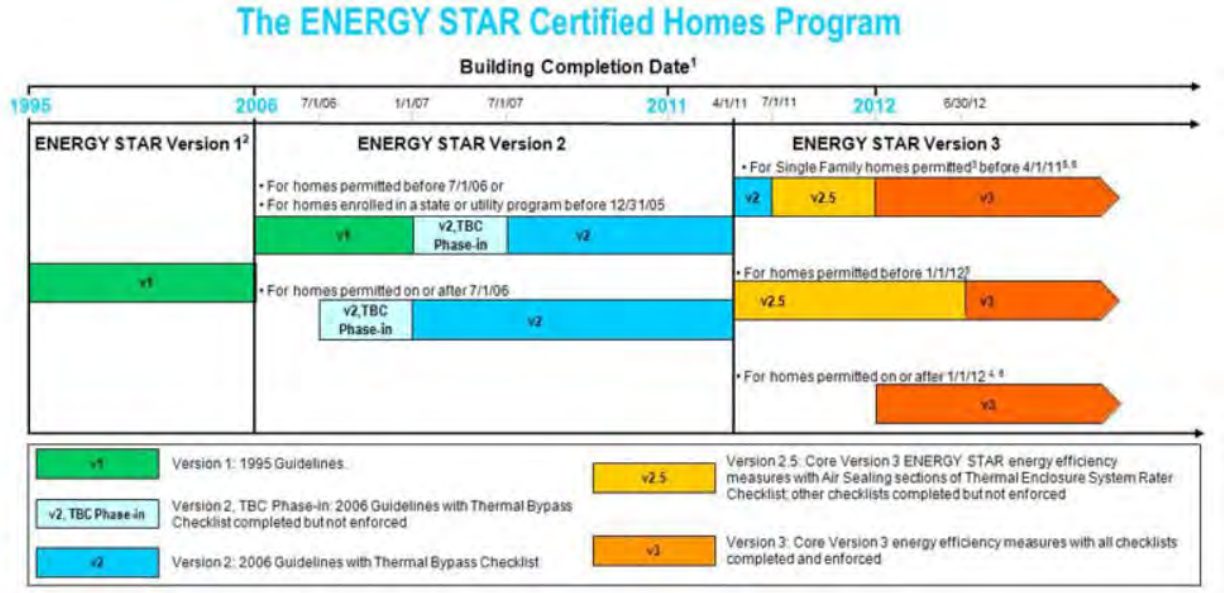
Types of Energy Certificates and Ratings

Nationally, numerous systems and programs are used to rate or certify various levels of energy efficiency. Locally, the common systems are: HERS (Home Energy Rating System) and ENERGY STAR. While other rating systems exist (such as EPS, HES, HEY), we will not discuss these here, as they are not actively being utilized in this market area.

ENERGY STAR®

ENERGY STAR-certified homes are very common in the Denver metro market area and, as a result, most consumers are aware of the existence of these certificates. An ENERGY STAR certificate will identify a home that is "ENERGY STAR-Qualified," meaning that it passed the minimum requirements to receive a certificate. ENERGY STAR does not label different levels of energy efficiency. A home either meets the ENERGY STAR criteria or it does not. ENERGY STAR certifications are only available for newly constructed homes.

While ENERGY STAR has been around since 1995, its certificates have undergone numerous changes. The different versions of ENERGY STAR are *Version 1*, *Version 2, Version 2.5*, and the current *Version 3*[16]. The table below shows the dates at which different versions of the program came into existence:



ENERGY STAR Version 1 met a HERS score of approximately 86 on the pre-2006 scale, which equated to 30 percent more efficient than a home built to the 1992 code.

[16] The graph provided is from the www.EnergyStar.gov website.

ENERGY STAR Version 2 met a HERS Index rating of 85, which equated to a 15 percent more efficient home than a home built to meet the 2006 IECC.

For the ENERGY STAR Version 3, there is no minimum HERS rating, as a unique HERS rating is generated for each home. HERS raters in the greater Denver area, however, generally report that the median HERS rating for Version 3 has hovered around 73.

HERS®

While ENERGY STAR certificates typically have HERS ratings on them, HERS ratings are more complicated to understand. Appraisers will require a good deal of information about HERS before being able to grasp what types of elements are rated and what the ratings mean.

What A "HERS" Rating Is

"HERS" is an acronym for Home Energy Rating System, which was introduced and maintained by a non-profit known as the Residential Energy Services Network (RESNET). HERS is an index rating system that was first introduced in 2006, after RESNET replaced a prior version.

*Prior to 2006, a HERS **score** expressed an energy rating where a HIGHER number was better. After 2006, a HERS **Index rating (or score)** expressed an energy rating where a LOWER number was better.*

The pre-2006 HERS score is no longer in use. However, it is not uncommon for individuals to mistakenly use the incorrect terminology when referring to a specific HERS rating. While the terminology is often confused, it should be noted that during the course of this study, all parties who referred to a HERS number meant it in relation to the HERS Index (where a LOWER number is the better), even if they incorrectly used older terminology. "HERS score."

A HERS Index rating is expressed as a number that is meant to rank the overall energy efficiency of a specific building. The number represents the efficiency level a specific home has relative to a less efficient version of itself. Thus, a very large home can have a HERS rating of 50 but still be designed to consume much more energy than a very tiny home with the same HERS rating.

The easiest way to convey the concept is to use a parallel example of two human beings:

Human One is 9 feet tall and weighs 250 pounds.
Human Two is 4 feet tall and weighs 80 pounds.
Each human has an energy efficiency rating of 50.

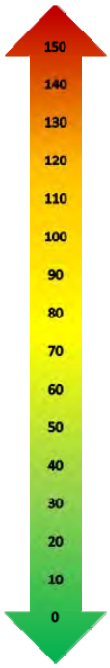
Are both humans designed to consume the same amount of energy?

No. Human One is designed to consume more energy.

A HERS rating will only tell you how efficiently designed one specific home is and estimates the amount of energy it will consume. The HERS rating will not tell you how much energy the home is designed to consume compared to a different home located nearby. This will be discussed in detail toward the end of this section.

How the HERS Rating Is Expressed

The exact index that is used to express HERS ratings is illustrated on this scale:



HERS 130 = A typical existing home

HERS 100 = A home that meets the 2006 IECC

HERS 0 = A net zero energy home

A home with a HERS rating of 0 (or lower) is at its most energy efficient, while a home with a HERS rating of 150 (or greater) is much less energy efficient. If a home has a HERS 0, it is what is known as a "net zero" property, meaning it produces as much energy as it consumes.

There is no upper limit to the scale, just as there is no lower limit. (A home can be net positive and thus, produce more energy than it consumes.) However, ratings over 600 and under -10 were never found over the course of this study.

Some important things to note about the HERS Index ratings are:

- *Very old homes (60 to 100 years old) that have not had any energy upgrades can easily have HERS ratings in the 200+ range.*
- *It is often incorrectly stated that "a typical new home has a HERS rating of 100."*
- *If rated, the vast majority of existing homes in the Denver area would fall within the 130-140 range (since the typical home was built in the late 1980s).*

The differences in ratings equate directly to energy efficiency. Every point difference equals a 1 percent change in energy efficiency. A home with a HERS 80 is 20 percent more efficient than if it were rated a HERS 100. Likewise, a home with a HERS 140 is 30 percent less efficient than if it were rated HERS 110.

Estimating A HERS Rating Based on Year of Construction

As noted earlier, ENERGY STAR often had minimal HERS rating requirements, and the most current version of the IECC often results in properties having HERS ratings. Even the HERS rating itself is based on the fact that a home built to meet the 2006 IECC will have a maximum HERS rating of 100.

However, one cannot *technically* estimate what HERS rating a property might have based on its year of construction. That being said, on a very broad and general level, depending on which code the property was built to meet (and assuming the home has been well maintained but not notably updated), age can be a general indicator of a home's most probable HERS rating (if it has one).

To demonstrate how this might work, Melissa Baldridge of GreenSpot Global created a HERS rating chart[17]. The chart – titled Vintage Houses and HERS Ratings – compares numerous hypothetical homes, constructed in different years, to one another. To do this, Baldridge used various assumptions based on the general and standard building practices for that time period.

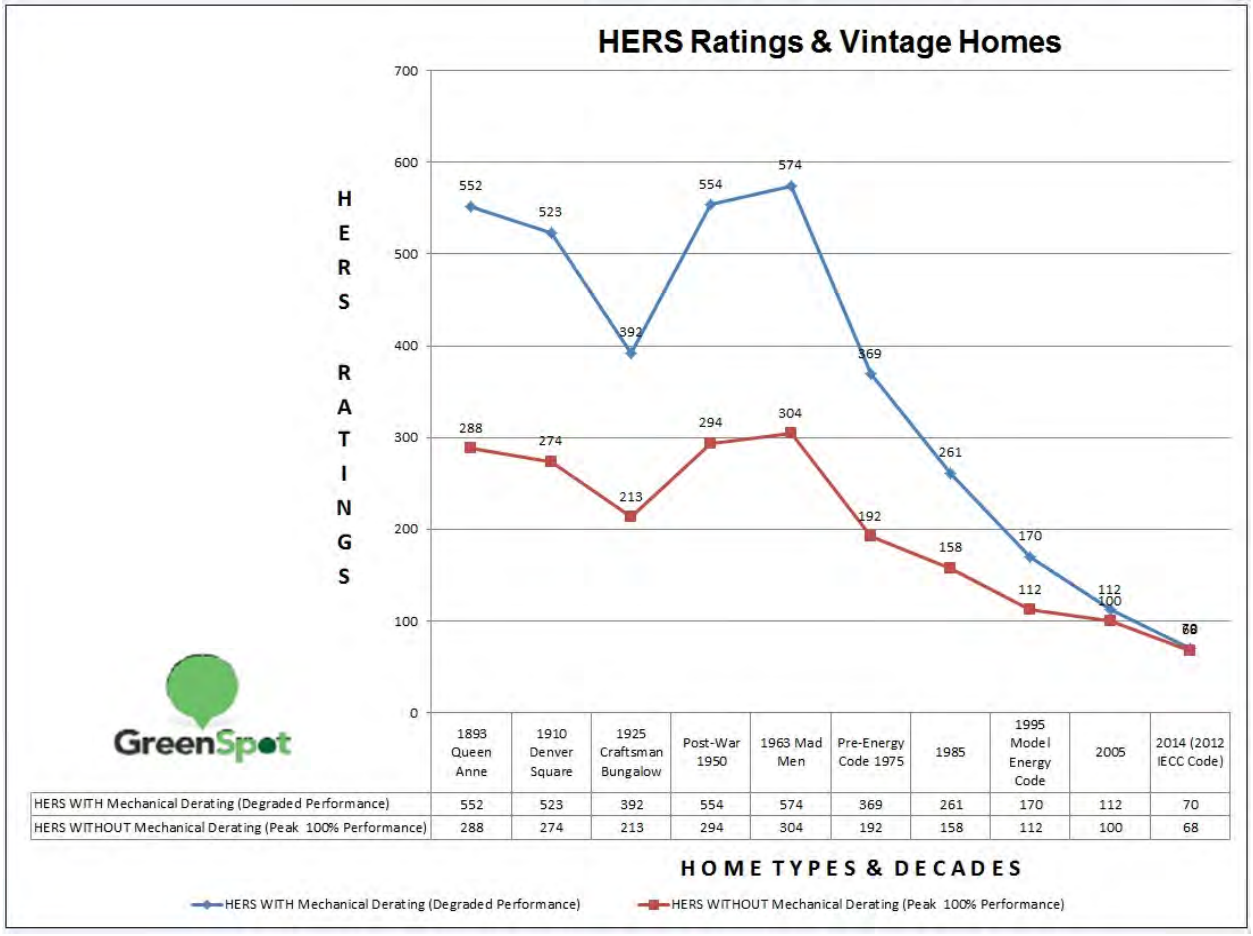
[17] This copyrighted chart is used with the permission of GreenSpot Global. For assumptions associated with this chart, please see the addendum at the end of this report.

GreenSpot

VINTAGE HOUSES & HERS RATINGS										
	1893 Queen Anne	*1910 Denver Square*	*1925 Craftsman Bungalow*	*Post-War 1950*	*1963 Mad Men*	*Pre-Energy Code 1975*	*1985*	*1995 MEC*	*2005*	*2014 (2012 IECC Code)*
Foundation Walls (FW)	8 inches stone/brick	8 inches stone/brick	8 inches concrete	8 inches concrete	8 inches concrete	8 inches concrete	8 inches concrete	8 inches concrete	8 inches concrete	8 inches concrete
Basement	Uninsulated, R-0	Uninsulated, R-0	Uninsulated, R-0	Uninsulated, R-0	Uninsulated, R-0	Uninsulated, R-0	Uninsulated, R-0	Uninsulated, R-0	R-11	R-15 Draped
Crawlspace	Uninsulated, R-0	Uninsulated, R-0	Uninsulated, R-0	Uninsulated, R-0	Uninsulated, R-0	Uninsulated, R-0	Uninsulated, R-0	Uninsulated, R-0	R-11	Sealed, R-15 Draped
Slab Floors	If concrete, R-0. If dirt, unsealed.	If concrete, R-0. If dirt, unsealed.	If concrete, R-0. If dirt, unsealed.	If concrete, R-0. If dirt, unsealed.	If concrete, R-0. If dirt, unsealed.	If concrete, R-0. If dirt, unsealed.	If concrete, R-0. If dirt, unsealed.	If concrete, R-0. If dirt, unsealed.	R-9, 4 ft.	R-10, <=2 feet
Frame Floors	2x8", R-0	2x8", R-0	2x8", R-0	2x8", R-0	2x8", R-0	2x8, R-13 batts	2x8, R-13 batts	2x11.5, R-38	R-30	R-30
Rim & Band Joists	Joist spacing 16 o.c., R-0	Joist spacing 16 o.c., R-0	Joist spacing 16 o.c., R-0	Joist spacing 16 o.c., R-0	Joist spacing 16 o.c., R-0	Joist spacing 16 o.c., R-0	Joist spacing 16 o.c., R-11	Joist spacing 16 o.c., R-11	R-11, III	R-19, III
Above-Grade Walls	Masonry, R-1	Masonry, R-1	Masonry, R-1	Framed 2x4, R-0	Framed 2x4, R-0	Framed 2x4, R-11	Framed 2x6, R-15	Framed 2x6, R-19	R-22	R-20, III
Knee Walls	Uninsulated, R-0	Uninsulated, R-0	Uninsulated, R-0	Uninsulated, R-0	Uninsulated, R-0	Uninsulated, R-0	Uninsulated, R-0	R-19	R-19	R-19
Windows	Single-pane, wood, no-e	Single-pane, wood, no-e	Single-pane, wood, no-e	Single-pane, metal, no-e	Single-pane, metal, no-e	Single-pane, metal, no-e	Double-pane metal, no-e	Double-pane, vinyl	U-0.35, SHGC NR (0.35)	U-0.32, SHGC NR (0.35)
Doors	Solid wood, 1-3/4", R-2.17	Solid wood, 1-3/4", R-2.17	Solid wood, 1-3/4", R-2.17	Wood panel, 1-3/4", with storm	Wood panel, 1-3/4", with storm	Wood panel, 1-3/4", with storm	Wood panel, 1-3/4", with storm	Wood panel, 1-3/4", with storm	Wood panel, 1-3/4", with storm	Wood panel, 1-3/4", with storm
Ceilings	2x4" ceiling joists, 4" insulation, R-12.5	2x4" ceiling joists, 4" insulation, R-12.5	2x4" ceiling joists, 3.5" insulation, R-12.5	2x4" ceiling joists, 4" insulation, R-13	2x4" ceiling joists, 4" insulation, R-13	2x4" ceiling joists, 6" fiberglass batt, R-21	2x4" ceiling joists, 12" fiberglass, R-38	2x4" ceiling joists, 12" fiberglass, R-40	2x4" ceiling joists, R 38	R-49
Heating	200 kBTU gravity-fed boiler (45AFUE), 50% adj.	45AFUE 200 kBTU boiler, 50% adj.	200 kBTU boiler, 50% adj.	60AFUE gas furnace, 150 kBTU, 50% adj.	60AFUE gas furnace, 100 kBTU, 50% adj.	68AFUE gas furnace, 100 kBTU, 50% adj.	68AFUE gas furnace, 100 kBTU, 60% adj.	78AFUE gas furnace, 100 kBTU, , 65% adj.	80AFUE gas furnace, 80kBTU, 80% adj.	90AFUE gas furnace, 48kBTU, 95% adj.
Cooling	-	-	-	15 SEER, 60 kBTU evap cooler	15 SEER, 60 kBTU evap cooler, 50% adj.	15 SEER, 60 kBTU evap cooler, 50% adj.	9 SEER, 36 kBTU, 50% adj.	10 SEER, 36 kBTU, 65% adj.	10 SEER, 36 kBTU, 80% adj.	13 SEER, 24 kBTU, 95% adj.
Hot Water	0.47 EF Gas Tank, 50% adj.	0.47 EF Gas Tank, 50% adj.	0.47 EF Gas Tank, 50% adj.	0.47 EF Gas Tank, 50% adj.	0.47 EF Gas Tank, 50% adj.	0.47 EF Gas Tank, 50%, adj.	0.47 EF Gas Tank, 50% adj.	0.56 EF Gas Tank, 50% adj.	0.67 EF Gas Tank, 85% adj.	0.67 EF Gas tank, 95% adj.
Programmable T-stat	-	-	-	-	-	-	-	Y	Y	Y
Ducts	-	-	-	Uninsulated, R-0, thru crawl	Uninsulated, R-0, thru crawl	Uninsulated, R-0, thru crawl	Uninsulated, R-0, thru crawl	R-6.5 in unconditioned space	R-8 in unconditioned space	All within conditioned space
Air Infiltration (Blower Door)	1 NACH	0.75 NACH	0.60 NACH	0.60 NACH	0.75 NACH	0.60 NACH	0.50 NACH	0.40 NACH	0.35 NACH	<=3 ACH50
Fridge	1620 kWhs	1620 kWhs	1620 kWhs	1620 kWhs	1620 kWhs	1620 kWhs	1620 kWhs	1620 kWhs	1152 kWhs	550 kWhs
Dishwasher	RESNET default	RESNET default	RESNET default	RESNET default	RESNET default	RESNET default	RESNET default	RESNET default	RESNET default	Medium efficiency
Clothes Washer	RESNET default	RESNET default	RESNET default	RESNET default	RESNET default	RESNET default	RESNET default	RESNET default	RESNET default	Medium efficiency
Dryer	RESNET default	RESNET default	RESNET default	RESNET default	RESNET default	RESNET default	RESNET default	RESNET default	RESNET default	Medium efficiency
Lighting (high-efficacy?)	-	-	-	-	-	-	-	-	50% high-efficacy	75% high-efficacy
Whole-House Ventilation	-	-	-	-	-	-	-	-	30-watt exhaust	16-watt exhaust
HERS w/Mechanical Derating (Degraded Performance)	552	523	392	554	574	369	261	170	112	70
HERS w/o Mechanical Derating (Peak Performance)	288	274	213	294	304	192	158	112	100	68

This *Vintage Homes & HERS Rating* chart[18] can be graphed for a better understanding. The graph is noted on the following page.

[18] This graph is copyrighted material used with permission of GreenSpot Global.



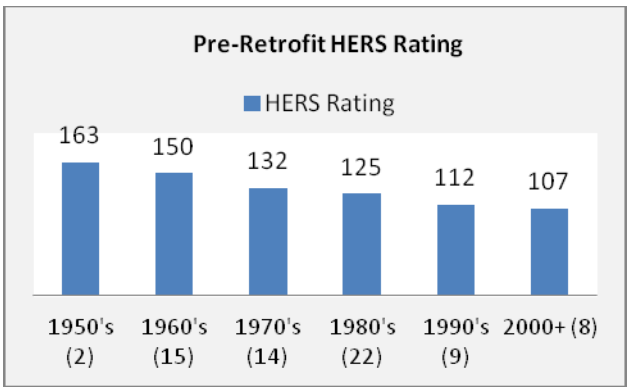
Clearly, the overall energy efficiency of homes has been steadily improving since the 1960s, when homes were at their least efficient.

Another example of how homes have become more efficient over the years is demonstrated in a case study[19]:

> *In 2012, 70 very similar homes in the state of Florida were given deep energy retrofits to identify the best pathways to achieve high performance in older homes and to help determine the most cost effective way to achieve this[20]. Prior to the retrofits, the median HERS ratings of the 70 homes was 129. Note the general difference in HERS ratings by year of construction[21]:*

[19] *Cost-Effective, Energy-Efficient Home Improvements for Florida Homes,* August 8, 2012 by Karen Sutherland of the Florida Solar Energy Center

[21] After retrofit, all of the homes in the case study saw improved HERS ratings. (The improved ratings chart is not included here, as it is not relevant to this study).



Both the *Vintage Home & HERS Rating* and the *Pre-Retrofit HERS Rating* charts show that, in general, energy efficiency has improved over time. Though every individual house will be different, this information gives a broad understanding of how an appraiser can apply a general understanding of HERS ratings to homes based on age. This general data can come in handy when an appraiser is evaluating an entire neighborhood, especially one with different ages of homes.

Estimating the HERS Rating for A Home Built to Minimally Comply with A Certain Version of the IECC

Technically, it is not possible to estimate the HERS rating for a home that was built to minimally comply with a certain version of the IECC, but very generally speaking, it can be done. An appraiser will never know whether a specific home met code without proper documentation. However, it is not unreasonable for the appraiser to sometimes make extraordinary assumptions about the level of energy efficiency a home or a group of homes will most likely have.

Since the 2006 IECC was issued, each version of the code has improved the required minimal level of overall energy efficiency. As a result, a very general trend has emerged that relates the HERS rating to a minimally compliant property:

2006 IECC = approximately HERS 100
2009 IECC = approximately HERS 85
2012 IECC = approximately HERS 70

The Meaning of the Statement, "A Typical New Home Has A HERS 100"

The two statements, "A typical new home has a HERS 100," and, "A home with HERS 100 is one that is minimally compliant with code," are common statements found in publications and articles talking about the HERS Index, but they are slightly misleading. A HERS Index rating is based on a *specific* code, not just any code. If the statement, "A typical new home has a HERS 100" is made, it should be clarified to the following: "A typical new home built to be minimally compliant with the 2006 IECC has a HERS rating of 100." This will avoid the common misconception that every new version of the code means a minimally compliant typical new home has a HERS rating of 100.

What the HERS 100 Rating Is Based On

According to Steven Baden, the executive director of RESNET, HERS is based on the 2004 IECC. This, however, is the easy answer. Most appraisers can leave their understanding of the HERS 100 rating at that. We'll offer a more detailed explanation, merely because it is quite interesting.

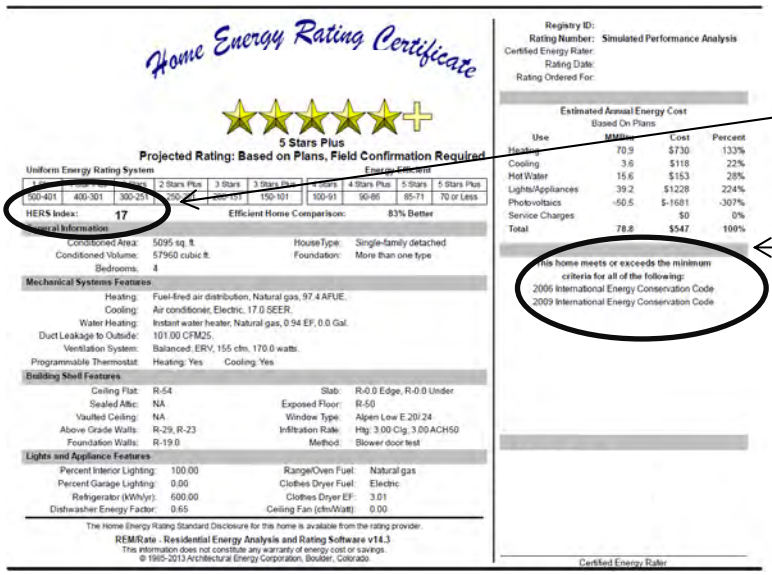
As just noted, the HERS is based on the 2004 IECC. A home that is minimally compliant to the 2004 IECC will have a HERS rating of 100. That being said, it is common for people to also state that the HERS is based on the 2006 IECC, and this does create some confusion. The simplest explanation is the 2004 IECC was never officially its own version; rather, it was published only as a "supplement" to the 2003 IECC and was eventually rewritten into what became the 2006 IECC. Thus, for appraisal purposes, it is acceptable to identify a HERS 100 home as being minimally compliant with the 2004 IECC (a supplement) and/or the 2006 IECC (a complete version of the code), even though there are some small differences between the two versions.

Because the IECC is updated every three years (after 2003, the 2006, 2009 and 2012 versions were released), the level of energy efficiency required in a new home has improved with each version. So, for example, a new home that is minimally compliant with the 2009 IECC will have a HERS rating *below* 100 (and closer to 85).

In other words, a HERS 100 represents only a home that is minimally compliant with the 2004/2006 IECC. If the municipality *requires* that home to be built to the meet the 2012 IECC, then the highest HERS rating it could obtain and be compliant with code would be generally around a HERS 70.

Determining the HERS Rating of A Property

If a property has a Home Energy Rating Certificate, the rating will be identified on the certificate. Below is a sample rating certificate that is typically found in this market area:



Home Energy Rating Certificate

5 Stars Plus

Projected Rating: Based on Plans, Field Confirmation Required

HERS Index: 17

Efficient Home Comparison: 83% Better

This home meets or exceeds the minimum criteria for all of the following:
2006 International Energy Conservation Code
2009 International Energy Conservation Code

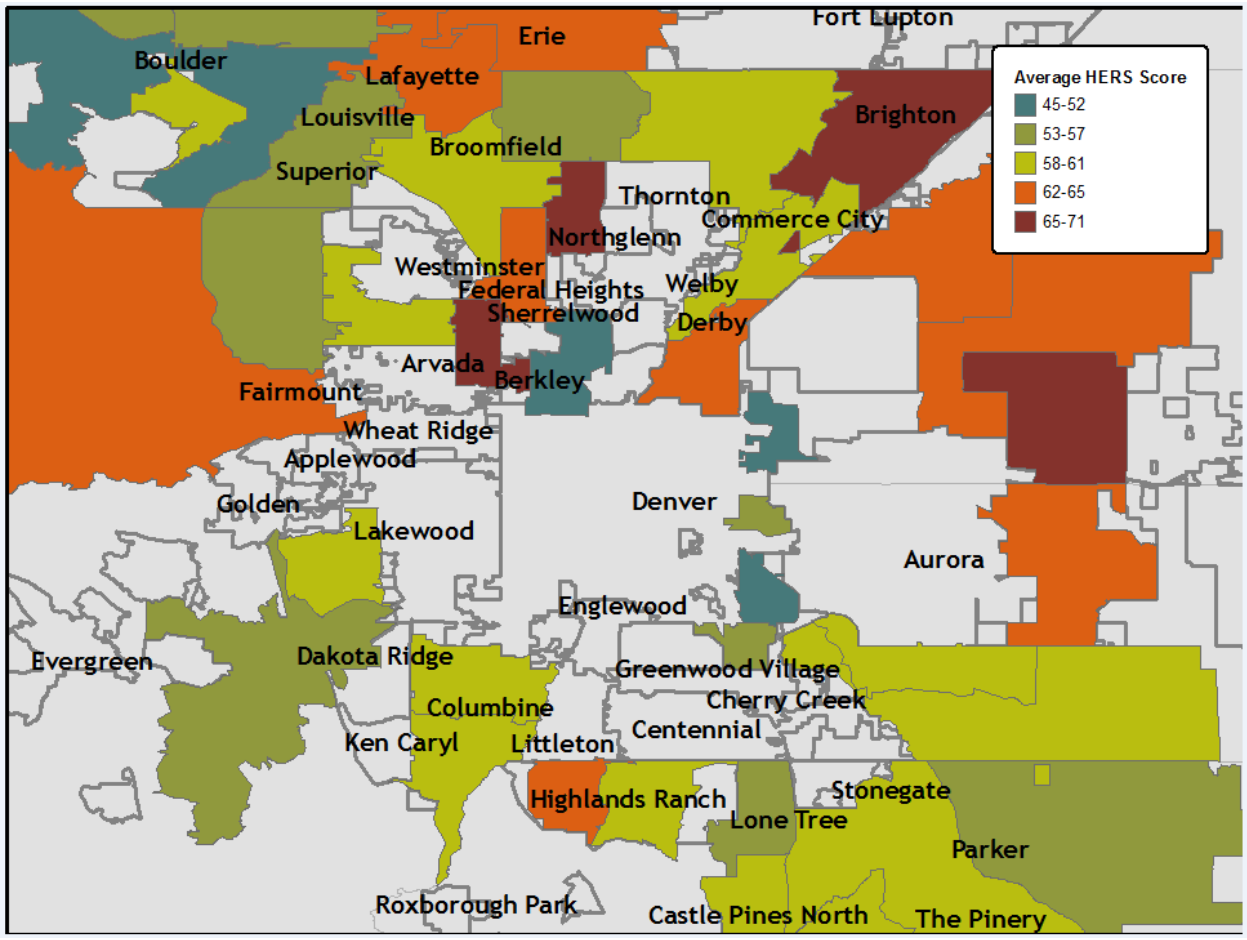
This shows the HERS Index rating. In this case, the property is a HERS 17 (which is an extremely energy-efficient home).

This certification also shows which versions of the IECC the property currently meets or exceeds.

It should be noted that while the five yellow stars are visually the most prominent feature on the certificate, they more of a marketing item than a relevant indication of the precise level of energy efficiency noted in a home.

Typical HERS Ratings for New Homes in Colorado

While data is not available for every market area, the Colorado Energy Office has compiled the following HERS rating chart. The data below pertains to all new homes built in 2013:



How A HERS Rating Is Calculated

Without belaboring the many complexities of HERS, only the most relevant points for appraisers will be discussed. The most important thing to know when calculating a HERS rating is its relationship to the "reference home."

To develop a HERS rating for a property, RESNET uses a software program to compares two homes: a reference home and the subject property.

- The reference home is the subject property AS-IF it were constructed to meet code only.
- The other home is the subject property as it will actually be built (or is built).

In appraiser terms, the reference home is the hypothetical home and the second home is the subject property as it actually exists (or will exist, if this is planned new construction). The HERS rating will be generated based on the INDEX difference between these two homes.

Here is another way to look at it: A HERS rating is comparable to the classic "before" and "after" pictures seen in weight loss advertisements. The pictures show how one specific person has physically changed as a result of changes s/he made to his or her diet and exercise programs. As such, HERS compares a "before" home (i.e. a home built to the 2006 IECC standards) to the "after home" (i.e. a home built to more stringent energy efficiency standards).

The reason this is so important to understand is that, when comparing HERS ratings of one property to another, there can be differences to take into consideration. The actual HERS rating does not tell us exactly how much energy a home is designed to use; it only tells us how energy efficient the home is compared to an alternate, less (or more) energy efficient design of that same home.

As an example, below are two different actual homes with the same HERS rating:

	4147 Clifton Court		**1570 Spring Creek Drive**	
HERS Rating	60		60	
Conditioned Space	2007 sq. ft.		4984 sq. ft.	
	Estimated Annual Energy Costs			
	2009 IECC	As Designed	2009 IECC	As Designed
Heating	$312	$219	$1177	$945
Cooling	$83	$40	$161	$134
Water Heating	$103	$103	$183	$183
Lights & Appliances	$688	$678	$1300	$1279
Photovoltaics	$0	$0	$0	$0
Service Charge	$213	$213	$0	$0
TOTAL:	$1398	$1253	$2821	$2541
		$0.62 per sq. ft.		$0.50 per sq. ft.

The property located at 4147 Clifton Court has estimated annual energy costs of $1,253 and a HERS rating of 60. This means the property is 40 percent more efficient than if it had been built to meet the 2006 IECC. The property located at 1570 Spring Creek Drive also has a HERS rating of 60 and is also 40 percent more efficient than if it had been built to meet the 2006 IECC. The properties, however, have very different estimated annual energy costs.

The Relationship between HERS Ratings and Energy Bills

While a HERS rating is an excellent first general indicator of the overall designed energy efficiency level of a home, it cannot indicate whether energy bills will be “low” or even “high.” Note the data used in the prior example, which shows very different estimated annual energy costs.

Obtaining A HERS Rating via An Energy Audit

An energy audit might or might not include a HERS rating. If an energy audit provides a Home Energy Rating Certificate or even an ENERGY STAR Version 3 Home Report, then these two reports will typically provide estimates of energy costs and usage.

The Home Energy Rating Certificate and the Annual Energy Cost Compliance are often included in energy audits. Both are shown below, and the areas circled show the estimated annual energy costs. (Note: the examples below are taken from two different properties.)

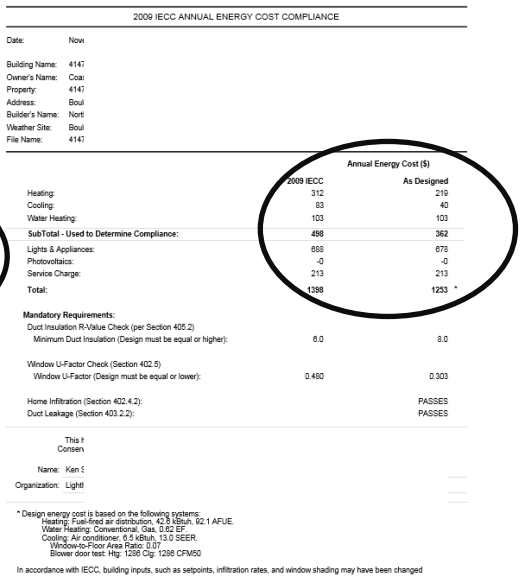
Home Energy Rating Certificate:


Home Energy Rating Certificate

5 Stars Plus

Projected Rating: Based on Plans. Field Confirmation Required

Annual Energy Cost Compliance:


2009 IECC ANNUAL ENERGY COST COMPLIANCE

Annual Energy Cost ($)

	2009 IECC	As Designed
Heating:	312	219
Cooling:	83	40
Water Heating:	103	103
SubTotal - Used to Determine Compliance:	498	362
Lights & Appliances:	688	678
Photovoltaics:	-0	-0
Service Charge:	213	213
Total:	1398	1253 *

Mandatory Requirements:

Duct Insulation R-Value Check (per Section 405.2)		
Minimum Duct Insulation (Design must be equal or higher):	6.0	8.0
Window U-Factor Check (Section 402.5)		
Window U-Factor (Design must be equal or lower):	0.480	0.303
Home Infiltration (Section 402.4.2):		PASSES
Duct Leakage (Section 403.2.2):		PASSES

* Design energy cost is based on the following systems:
Heating: Fuel-fired air distribution, 42.9 KBtuh, 92.1 AFUE.
Water Heating: Conventional, Gas, 0.62 EF.
Cooling: Air conditioner, 8.5 KBtuh, 13.0 SEER.
Window-to-Floor Area Ratio: 0.07
Blower door test: Htg: 1298 Clg: 1298 CFM50

In accordance with IECC, building inputs, such as setpoints, infiltration rates, and window shading may have been changed

The Use of HERS Ratings that Mean Different Things for Different Homes

While exact HERS ratings mean different things (in terms of expected energy costs) for different homes, the information is still quite useful. Even if the actual energy cost differences are not known for any particular property, knowing the general HERS ratings of various properties proved useful in this study.

After completing this study, it became evident that small differences in HERS ratings were relatively meaningless. However, large differences (of approximately 20-25 points or more) were sometimes excellent indicators of differences in either the overall quality of construction, the level of updating and/or the condition as it related to overall energy efficiency.

Why is this so? Currently, the typical existing home, which is about 25 years old in our market area, has a HERS rating of around 130. Additionally, homes that are 50 to 100 years old can easily have HERS ratings in the 200+ range. From a cost perspective, it is relatively easy and affordable to improve any property with a HERS rating over 90. As the HERS rating gets lower, the costs and planning efforts required to improve the HERS rating even more can become incrementally more expensive and complex. It is helpful to think of it as running the 100-meter dash. If a person can run it in 20 seconds flat, it would take little effort to reduce the time to 19 seconds. If, on the other hand, s/he can run it in 10 seconds, it would take considerable effort to reduce the time to 9.69 seconds[22].

As was discovered in this study, when a home achieved a HERS rating of around 45 to 50, the costs to reduce the rating by even 5 more points began to generally involve either more expensive technological solutions, advanced design strategies, or some combination of the two. However, while costs can *typically* increase as the HERS rating decreases, this is not always the case. Some builders are making a study of finding a balance between improving the energy efficiency of a home through purposeful design, and doing so using the most cost effective methods.

One can never conclude that a home costs more to construct simply because it achieves a very low HERS rating (compared to being built to be minimally compliant with the 2006 IECC), but that is currently most often the case.

Examples of HERS Ratings Related to Estimated Energy Costs

Since the relative costs to improve a HERS rating might become more expensive as the HERS rating gets lower and lower (and understanding that every single home is different), below is an example of how energy costs can be improved in relation to the HERS rating of a specific home as that HERS rating decreases:

HERS Rating[23]:	Estimated Savings Per Year:
100	$0
90	$180
80	$359
70	$539
60	$718
50	$898

HERS Rating:	Estimated Savings Per Year:
40	$1078
30	$1257
20	$1437
10	$1616
0	$1796

How Long A HERS Rating Is Considered Reliable

While it has yet to be established how long a HERS certificate is considered reliable in any market area, here are a few notes from around the world:

- In Ireland, a “Building Energy Rating” certificate is good for 10 years, or until the home is upgraded.

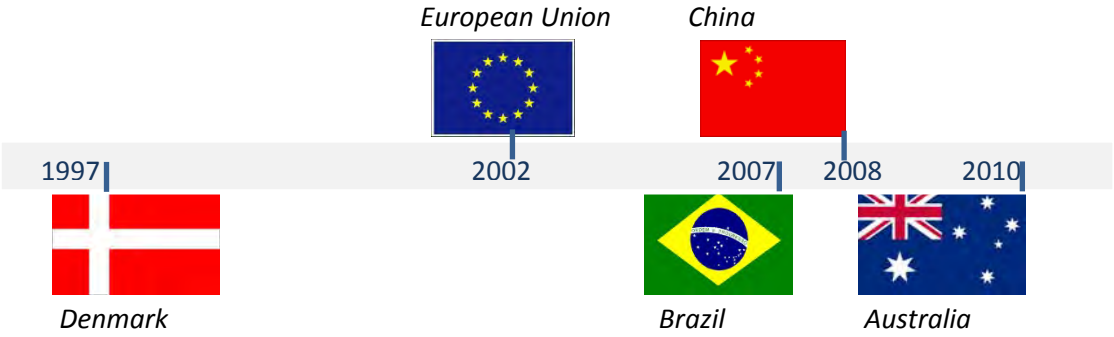
[22] The world record currently held by Usain Bolt.
[23] Data from the RESNET website.

- In England, the Energy Performance Certificate for the rental market has a shelf life of 10 years.
- In Spain, the certificate is valid for 10 years.

Given that HERS ratings have only been around since 2006, it is reasonable to assume a HERS rating will also be considered generally reliable for up to 10 years, assuming the property is well maintained and does not undergo any notable changes.

Why Appraisers Should Be Concerned with Energy Rating Certificates

Energy rating certificates are not a fad. The United States is actually a bit behind the rest of the world when it comes to requiring energy rating certificates on homes. Several countries even require all homes to have energy rating certificates at the time of sale. The first countries to have such requirements are illustrated in the chart below:



Energy rating and disclosure is actually required by more than 35 countries worldwide. In the United States, the following states, cities and counties have adopted requirements for residential disclosure of energy efficiency ratings: South Dakota; Alaska; Kansas; New York; Maine; Santa Fe, New Mexico; and Montgomery County, Maryland[24].

Here is one quote from the Energy-Efficient Homes of Ireland website:

> *"In the future it is quite likely that a financial penalty will be imposed on home owners who live in homes with a [high][25] energy rating and will result in a lower valuation at resale stage."*

Energy Modeling vs. Actual Energy Performance

HERS rating reports include figures that estimate the energy consumption one specific home will have. This estimate is the result of "energy modeling." Energy modeling differs from actual energy use in that it reflects the *predicted* energy consumption and not the *actual* energy consumption of any given property. Actual energy consumption only relates to a particular set of occupants and thus is not very predictable.

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[24] According to BuildingRating.org's "*U.S. Building Benchmarking and Disclosure Policies*" map, updated 02/20/2014.

[25] Ireland's rating certificates are the inverse of HERS ratings; therefore, this word was changed to reflect the meaning of the sentence relative to HERS ratings.

For appraisal purposes, knowing how much energy a particular occupant uses in a single family home is not very useful information. Not only do appraisers typically estimate market value based on a "typical" homebuyer, and not one specific homebuyer, actual energy use is almost impossible to reliably predict because it is so widely variable. Therefore, actual energy use is not a predictable element, and in turn does not lend itself to measurability.

In the following quote, Trish Holder, the publisher of *Greenspiration Home*, hones in on this same point:

> "*Consumers need to understand that [calculating the value of energy savings] for a specific property] is a very complex question. I write extensively in the commercial and industrial industry about facilities that spend millions on energy upgrades, but can never supply me with hard data about how much they are saving. And they have sophisticated BMS systems and engineers on staff*."

Whether the HERS Rating Can Vary Based on the Rater

Developing a HERS rating for a property is similar to appraising real property. Each individual rater has influence on the final number, based on his or her competency, experience and assumptions. The HERS rater, like an appraiser, has to make qualitative and quantitative judgments in the report. Thus, two different raters could very well give slightly different HERS ratings for the same property. This demonstrates why, as the market has shown, exact differences in HERS ratings (i.e. differences of about 15 or so rating points) are within an acceptable margin of variance and are not viewed as a major point of significance.

The Cost of Energy and Energy Use

To be able to understand whether energy efficiency impacts the value of a home, it is necessary to understand how much energy costs and how much energy typical occupants use.

The Cost of Energy

In Colorado, the vast majority of homes use natural gas for heat, and electricity for all other energy needs. The cost of electricity and natural gas has changed accordingly over the years:

Average Electricity Rate ($/kWh) [26] for Colorado												
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Residential	0.074	0.072	0.083	0.085	0.091	0.088	0.090	0.103	0.098	0.111	0.112	0.111
Commercial	0.053	0.053	0.066	0.069	0.077	0.074	0.075	0.089	0.082	0.093	0.095	0.085
Industrial	0.040	0.041	0.052	0.049	0.056	0.058	0.055	0.065	0.057	0.064	0.065	0.060

Average Natural Gas Rate ($/Dth) for Colorado												
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Residential	9.06	*	*	*	*	*	8.63	9.71	7.98	7.73	7.86	7.62
Commercial	8.16	*	*	*	*	*	7.80	8.96	7.35	*	*	*
End User	8.76	*	6.31	8.09	9.88	9.84	8.38	9.49	7.80	7.51	7.68	7.44

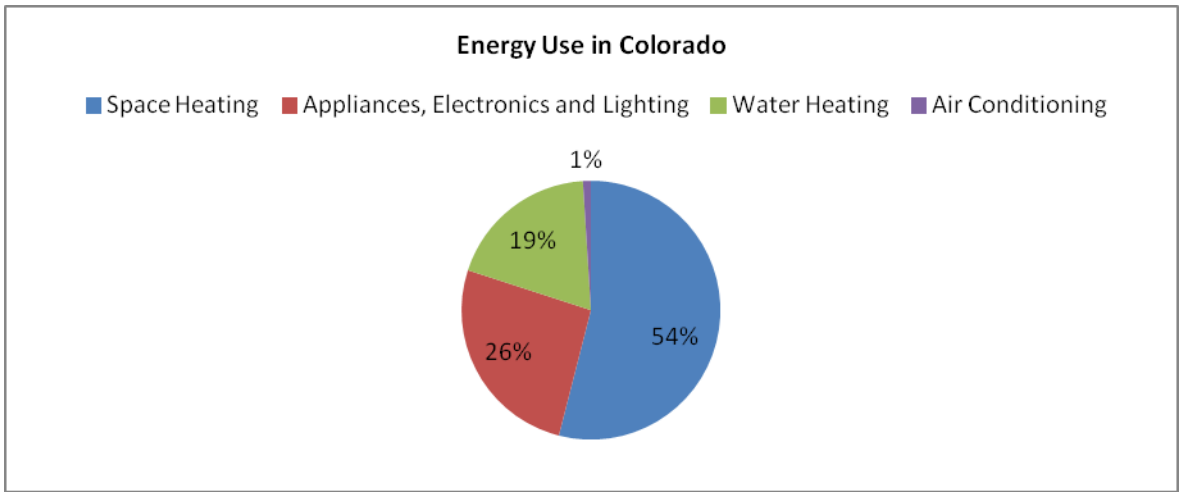
**=information is not available*

Energy Use in the United States and in Colorado

In 2012, residential homes consumed 40 percent of all energy used in the United States. Even so, *total* energy use for all residential homes has actually remained very steady over the last 30 years. This is mainly due to the fact that the increase in the number and the square footage of residential homes is being offset by improvements to energy efficiency construction practices. Thus, increases in energy efficiency measures are making dramatic impacts on overall energy consumption.

In Colorado, energy use per household is actually 15 percent higher than that of the average U.S. household[27]. Most of this energy use goes toward space heating, as illustrated below:

[26] *Data provided by the Colorado Energy Office*
[27] www.eia.gov/consumption/residential/ (2009)



Even though our state's consumption is above average, we actually *spend* about 23 percent less on energy costs than the national average. In fact, as a state, we actually have the second-lowest in energy expenditures in the nation. This is largely due to the fact that Colorado's natural gas prices are much lower than in many other states.

Energy Use per Household

By definition, appraisers seek to understand the "typical" homebuyer, and not specific homebuyers. As such, it is useful to understand the average energy expenditure per household[28] in Colorado:

Energy Expenditures per Year		
Per Household:	*Per Household Member:*	*Per Square Foot:*
$1,551	$667	$0.74

The average household spends $1,551 per year on energy expenditures. It is important to know what the typical homebuyer can expect to spend per year for energy, as this will give an idea about how relevant (irrelevant) energy efficient measures are in a home. The average energy expenditure per month is $129 per household. To put this in perspective, most households have higher bills for internet and cell phone connection. In essence, energy costs are relatively very inexpensive in Colorado.

While the above data reflects the average energy expenditure, homes can vary greatly in size and year of construction, and therefore, a more detailed chart of energy usage per household was considered relevant to this study. It is noted below.

Energy costs per year (for Colorado) can be broken down as follows[29]:

[28] U.S. Energy Information Administration 2009 Residential Energy Consumption Survey: Final Energy Consumption and Expenditures Tables

	Per Household ($)	Per Household Member ($)	Per Square Foot ($)
Year of Construction			
Before 1940	1,408	574	0.86
1940 to 1949	1,240	471	0.83
1950 to 1959	1,491	520	0.98
1960 to 1969	1,395	515	0.96
1970 to 1979	1,527	569	1.02
1980 to 1989	1,429	542	0.85
1990 to 1999	1,878	669	0.90
2000 to 2009	1,872	662	0.87
Number of Household Members			
1 Person	1,072	1,072	0.83
2 Persons	1,663	832	0.91
3 Persons	1,677	559	0.97
4 Persons	1,787	447	0.96
5 Persons	1,852	370	0.94
6 or More Persons	2,018	291	0.96
Total Square Footage[30]			
Fewer than 500	742	436	2.05
500 to 999	940	403	1.22
1,000 to 1,499	1,368	482	1.10
1,500 to 1,999	1,716	621	0.99
2,000 to 2,499	1,940	679	0.88
2,500 to 2,999	2,174	715	0.80
3,000 to 3,499	2,408	745	0.75
3,500 to 3,999	2,690	915	0.72
4,000 of More	3,102	890	0.59

Energy Use per Individual[31]

The data noted above reflects the average energy expenditure of the typical household. In actuality, however, individuals consume energy in very different amounts. Occupant behavior is the single-most important factor relating to actual energy use for any specific household.

Does this mean the appraiser should gather and study individual energy bills for the subject property and for the comparable sales as well? The answer is typically no, and this is for two distinct reasons.

First, utility bills in Colorado are not public information, and it is not currently common practice for Realtors and sellers to disclose utility information (unless they are specifically asked by potential buyers). Thus, gathering information relating to actual energy use at the time a specific property was sold is not currently feasible.

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[29] US Census 2010

[30] Includes all conditioned space.

[31] Numerous data points noted in this section are from Martin Holladay's blog post "How is a Home's HERS Index Calculated?" dated June 10, 2011.

Secondly, actual energy use is varied. Per John Straube, a building scientist, "*Energy use variation between the lowest and highest energy users – the bottom 10 percent of users and the top 10 percent - varies by a factor of 2, [while] a study of 17 identical homes in Oklahoma showed a factor of 3 variation. Even in Germany, the ratio of domestic hot water use varies by a factor of 4 from the low-end users to the high-end users*."

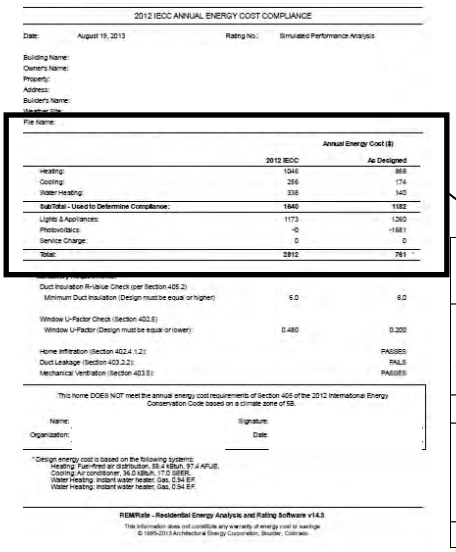
Weighing the Importance of Actual vs. Estimated Energy Use per Household

The estimated average energy use per household is more important. Per Jeff Ross Stein, an author for *Home Energy Magazine*, "*As a research project for Lawrence Berkeley National Laboratory, Alan Meier and I compared home energy ratings with actual utility billing data for about 500 homes. …In general, we found that HERS ratings can be remarkably accurate at predicting average annual energy costs for groups of homes. Predictions for individual homes were less impressive."*

Thus, the HERS data is useful on a large scale, but not terribly indicative of how much energy the occupants of any one specific home will end up using. This is a good thing. Appraisers study the typical buyer, and a typical buyer is most often one who uses an average amount of energy.

Estimated Energy Use, Based on An Energy Audit

Typically, an energy audit that contains a HERS rating is between 30 and 60 pages long. One of the more telling pages is the one noted below:


2012 IECC ANNUAL ENERGY COST COMPLIANCE

Date: August 19, 2013 Rating No.: Simulated Performance Analysis

Building Name:
Owner's Name:
Property:
Address:
Builder's Name:
Weather Site:
File Name:

	Annual Energy Cost ($)	
	2012 IECC	As Designed
Heating:	1046	868
Cooling:	256	174
Water Heating:	338	140
SubTotal - Used to Determine Compliance:	1640	1182
Lights & Appliances:	1173	1260
Photovoltaics:	-0	-1681
Service Charge:	0	0
Total:	2812	761 *

Duct Insulation R-Value Check (per Section 405.2)		
Minimum Duct Insulation (Design must be equal or higher)	6.0	6.0
Window U-Factor Check (Section 402.5)		
Window U-Factor (Design must be equal or lower)	0.480	0.200
Home Infiltration (Section 402.4.1.2):		PASSES
Duct Leakage (Section 403.2.2):		FAILS
Mechanical Ventilation (Section 403.5):		PASSES

This home DOES NOT meet the annual energy cost requirements of Section 405 of the 2012 International Energy Conservation Code based on a climate zone of 5B.

Name: Signature:
Organization: Date:

* Design energy cost is based on the following systems:
Heating: Fuel-fired air distribution, 88.4 kBtu/h, 97.4 AFUE,
Cooling: Air conditioner, 36.0 kBtuh, 17.0 SEER,
Water Heating: Instant water heater, Gas, 0.84 EF,
Water Heating: Instant water heater, Gas, 0.84 EF,

REMRate - Residential Energy Analysis and Rating Software v14.5
This information does not constitute any warranty of energy cost or savings.
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	Annual Energy Cost ($)	
	2012 IECC	As Designed
Heating:	1046	868
Cooling:	256	174
Water Heating:	338	140
SubTotal - Used to Determine Compliance:	**1640**	**1182**
Lights & Appliances:	1173	1260
Photovoltaics:	-0	-1681
Service Charge:	0	0
Total:	2812	761

In this example, the energy report compares two homes: the "As Designed" subject property and its less energy efficient twin built to meet the 2012 IECC. The 2012 IECC figures noted above reflect the energy costs of the subject property as if it had been built just to meet the 2012 IECC minimum standards. The "As Designed" column shows the actual estimated annual energy costs for the subject property as it was actually designed. In other words, the "2012 IECC" column is a hypothetical home and the "As Designed" column is the subject property, as it will be constructed (or is constructed).

How the Various Levels of Energy Efficiency are Labeled

Residential appraisers complete the majority of their work on behalf of Fannie Mae, the largest purchaser of residential mortgages. Therefore, the most effective way to label and talk about energy efficiency is to do so in a way that is similar to other labeling systems Fannie Mae uses.

In keeping with the *Condition* and *Quality* rating labels used in residential appraisals for Fannie Mae, a similar labeling system was developed[32] and is used for each case study in this report. For example, the Fannie Mae labeling system divides both *Condition* and *Quality* into six distinct levels and gives each level a name. Energy efficiency can also be divided into six distinct categories and each level given a name. This is done for ease of communication and comparative purposes only. While this labeling system may or may not be applicable to other situations, it provides the reader and analyst a consistent method for evaluative purposes and can be used for most valuation assignments regardless of property type, value range or scope of work where energy efficiency is being considered.

Definitions and examples of each rating ("Excellent," or most efficient, through "Poor," or least efficient) are located on the following page.

Please note: The labeling system is for ease of comparison only. The value and relevance of actual energy features and the overall actual energy efficiency level will be developed and presented by the author on a case-by-case basis

[32] The Energy Efficiency Rating labeling system was designed and created by Lisa Desmarais, SRA.

Definitions of Energy Efficient Levels

E-E (Excellent)

The entire house has been designed with energy efficiency in mind. Energy efficiency is a dominant feature of this property. The whole house functions as one cohesive energy-saving unit and, as a result, the property likely has no utility bills, has minimal utility bills, or possibly even produces an energy surplus. It is probable that the home has an energy rating certificate, and often a green building certification.

(*For this study, "E-E" indicates that HERS ratings were typically under 30.*)

E-VG (Very Good)

Energy efficiency is a relevant and evident feature of this home. The house functions as one cohesive energy-saving unit. However, not every possible high-performance building method or product was used. The home likely has minimal utility bills. It is probable that this home has an energy rating certificate.

(*For this study, "E-VG" indicates that HERS ratings were typically between 25 and 50.*)

E-G (Good)

There is evidence that consideration was given to energy efficiency functioning as one unit. However, more importance was placed on cost-effective techniques and products than on overall high-performance. In addition to older homes with notable energy efficient updates, this is the typical category for newer homes that were built to meet the 2009 IECC. If this home has an energy rating certificate, it is most often not available for viewing.

(*For this study, "E-G" indicates that HERS ratings were typically between 45 and 80.*)

E-A (Average)

The home is comfortable and may have a few energy efficient features here and there, but no attempt has been made to unify the function of each feature. Most homes built to the 2000, 2003 and 2006 IECC energy codes will fall into this category. Energy rating certificates are generally only noted for older homes (i.e. homes over 50 years old) with major updating to their overall level of energy efficiency.

(*For this study, "E-A" indicates that HERS ratings were typically between 75 and 120.)*

E-F (Fair)

The property is functional, but offers little in the way of purposeful energy efficient features. The thermal boundary of the home has notable air penetrations. Most homes in this category were built to the 1998 and earlier energy codes (and have had minimal or no energy efficient updating) will fall in this category.

(*For this study, "E-F" indicates HERS ratings were typically above 130- more or less.*)

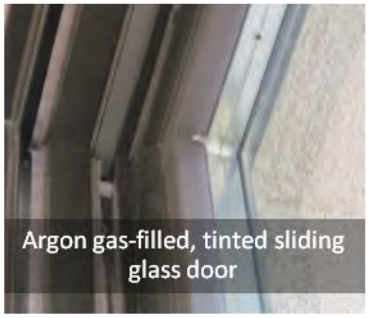
E-P (Poor)

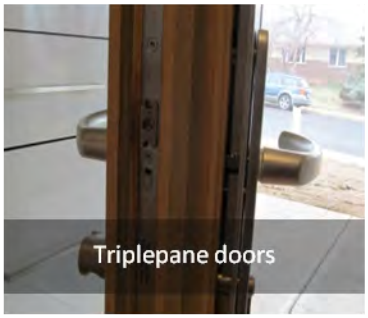
The efficiency of the home is sub-standard and might not even have insulation (or ineffective insulation). Heating and ventilation systems are likely very inadequate and have possibly reached the end of their economic life. Air-sealing is typically non-existent. The thermal boundary of the home likely has extensive air penetrations. Deferred maintenance has clearly impacted the energy efficiency capabilities of the property.

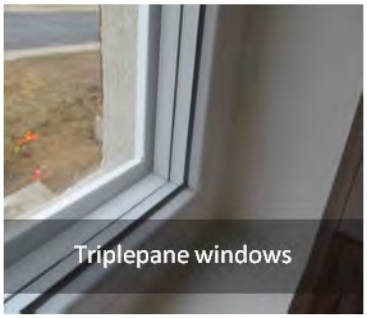
(*For this study, "E-P" indicates HERS ratings are too high to be relevant.*)

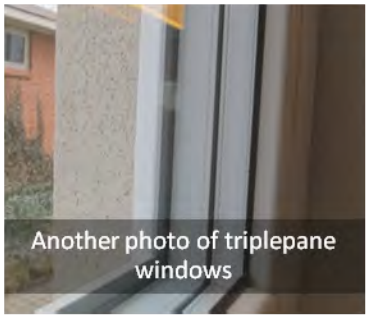
Excellent: Photos of Sample Features of An “E-E” Home

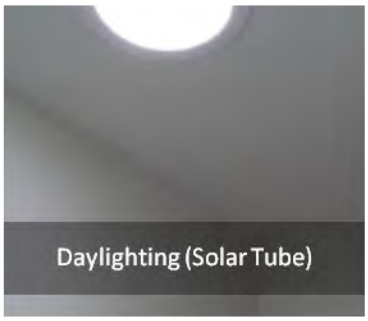
2012 HERS rating: 8

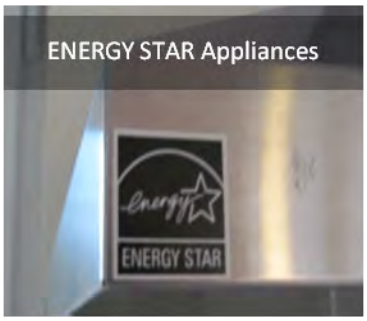


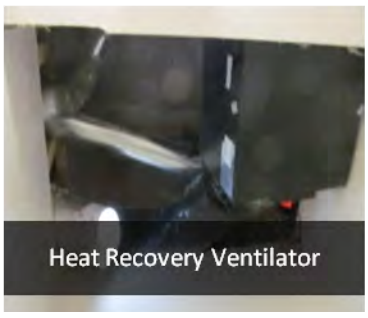








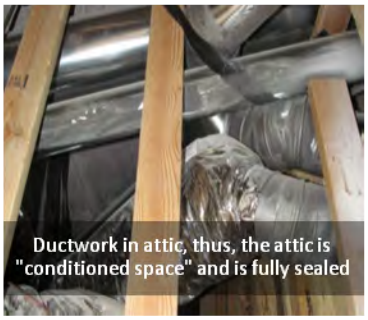


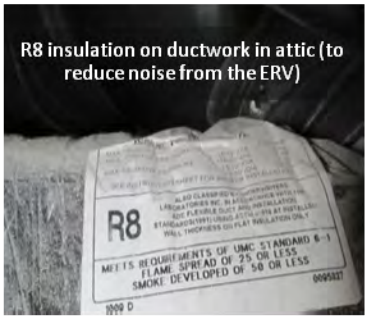


“E-E” continued:


No eave vents as the subject property has a "hot roof" design

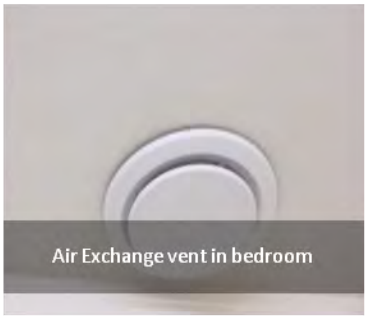

Cellulose insulation on attic ceiling with netting to hold firmly in place

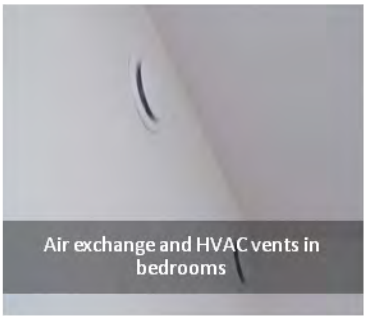

Ductwork in attic, thus, the attic is "conditioned space" and is fully sealed

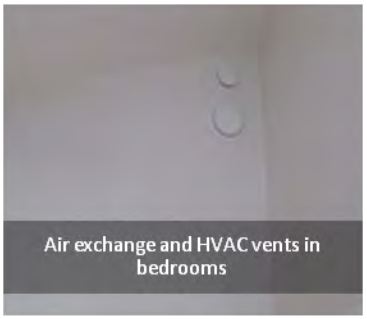


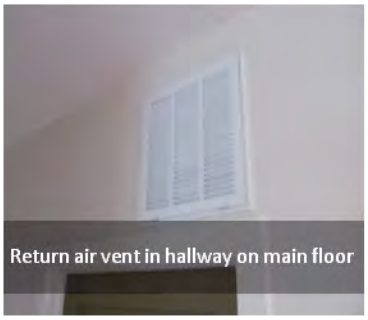
R8 insulation on ductwork in attic (to reduce noise from the ERV)

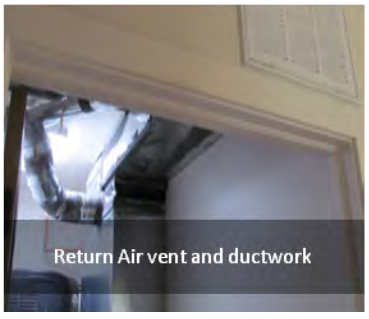

ERV ducts in conditioned attic space


Air Exchange vent in bedroom

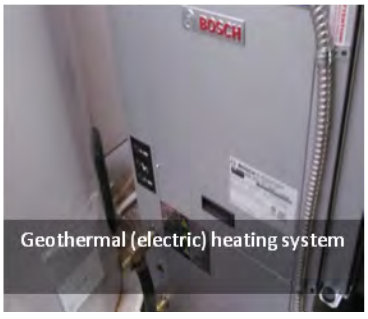

Air exchange and HVAC vents in bedrooms


Air exchange and HVAC vents in bedrooms


Return air vent in hallway on main floor


Return Air vent and ductwork

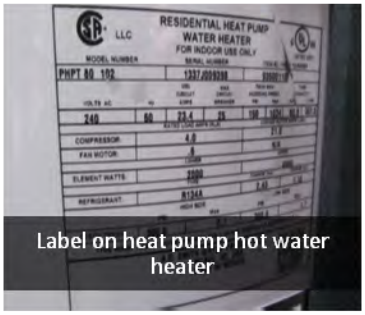

Return air and hot air delivery ducts (all sealed)



Geothermal (electric) heating system

“E-E” continued:


High efficiency heat pump hot water heater



Label on heat pump hot water heater


Geothermal (ground loop) pumps in crawlspace

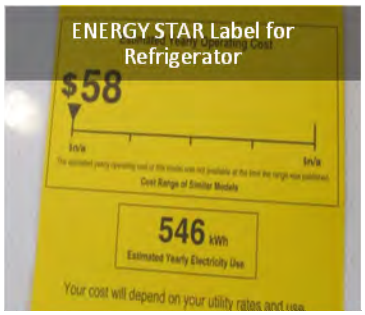

Fully insulated crawl space walls


Spray foamed rim joists and penetrations in crawl space


Vapor barrior on crawl space floor (no gaps, no tears in plastic)


Insulated duct work


Spray foam insulation to seal penetrations in crawl space

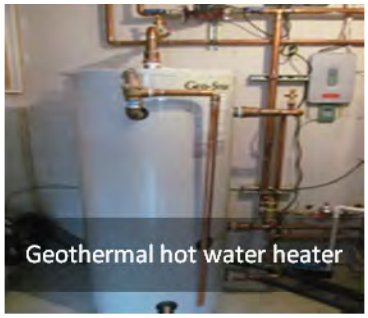


ENERGY STAR Label for Refrigerator

Very Good: Photos of Sample Features of A "E-VG" Home

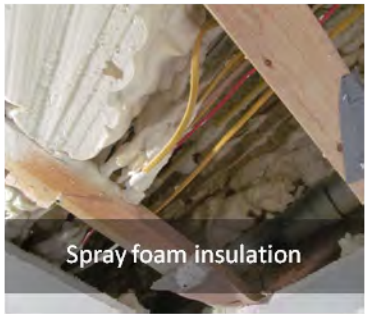
2012 HERS rating: 30

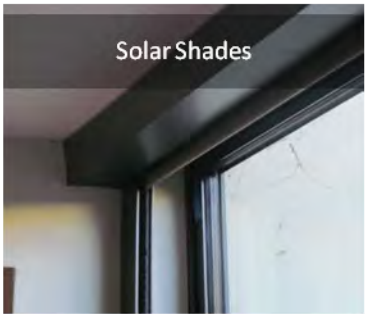

Geothermal furnace


Geothermal hot water heater


Geothermal ground loop pump


Indications the property has a PV system on its flat roof


Spray foam insulation


Solar Shades


Heat Recovery Ventilator


Insulated slab (note blue foam material under concrete)

High efficiency evaporative air cooling

Good: Photos of Sample Features of A "E-G" Home

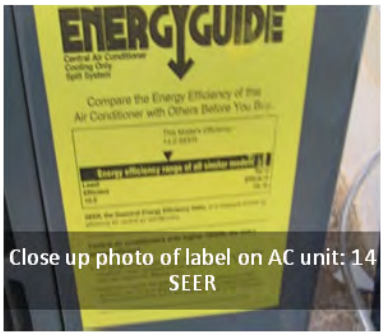
2009 HERS rating: 62


Weather proof exterior electrical outlet


Exhaust for high efficiency furnace (located on the side of the house)


..or..exhaust for high efficiency furnace (located on the roof)


Air Conditioner unit with label

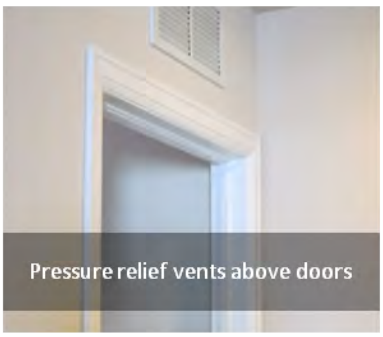


Close up photo of label on AC unit: 14 SEER


Return Air Duct in hallway


CFL lights


Fan in laundry room, automatically turns on and off


Pressure relief vents above doors


Attic acess is sealed

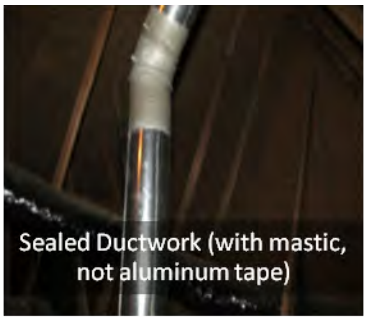

Close up view of attic access: gasket sealed opening

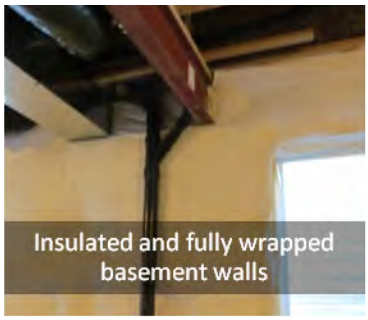

Attic- Spray foam insulation on ceiling of attic

"E-G" continued:

2009 HERS rating: 62

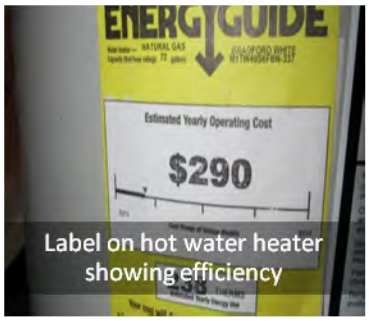

Conditioned attic (ceiling has spray foam)


Sealed Ductwork (with mastic, not aluminum tape)


Insulated and fully wrapped basement walls

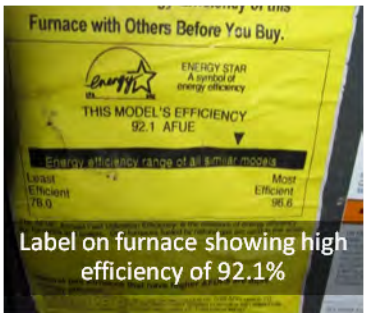

Foam insulation sealed perimeter


High efficiency conventional storage hot Water heater



Label on hot water heater showing efficiency


High efficiency furnace

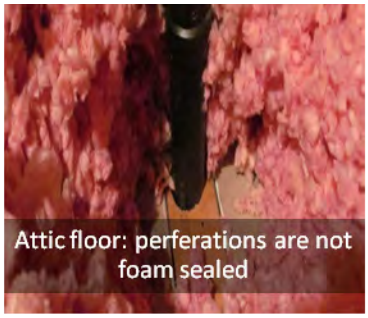


Label on furnace showing high efficiency of 92.1%


ENERGY STAR appliances (labels are typically missing)

Average: Photos of Sample Features of An "E-A" Home

No HERS rating


Attic floor: perferations are not foam sealed


Attic insulation is only R16


Attic access door is not sealed


No foam sealing around canned lights in attic


Gaps in crawl space vapor barrier


Ductwork has duct tape


Poor installation of insulation


Spotty insulation between the outside and inside walls


Air space between joists is used for return air

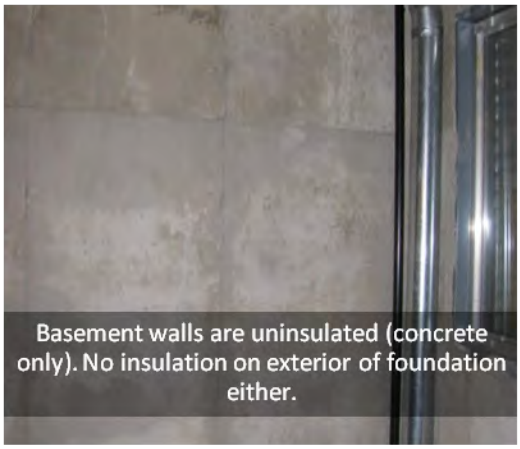

Fresh air vents on outside of house are not sealed

Low efficiency hot water heater


Low efficiency furnace

“E-A” continued:

No HERS rating



Basement walls are uninsulated (concrete only). No insulation on exterior of foundation either.

Older, high energy-use light bulbs

Conditioned crawl space walls have vapor barrier, but no insulation

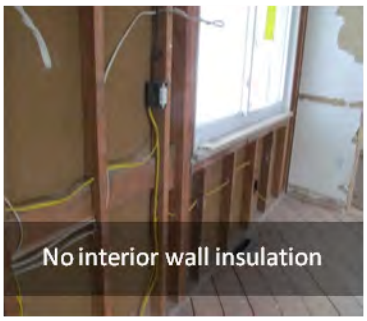
low efficiency appliances

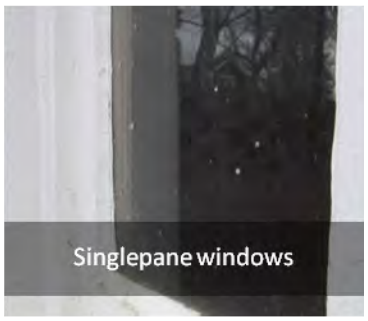
Outlets on outter walls do have gaskets, but there is no foam sealant around the actual box inside the wall. This is an exterior wall.

Fair: Photos of Sample Features of A “E-F” Home

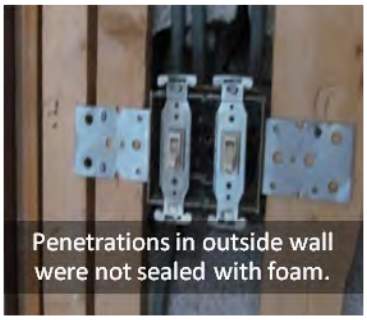
No HERS rating

The following photos show a 1960's home. The interior drywall was removed in anticipation of a remodel. There was no insulation in the home.


No interior wall insulation


Singlepane windows


Air space between joists are being used for return air


Penetrations in outside wall were not sealed with foam.


No basement insulation


No insulation in conditioned basement

Also: No attic or ridge vents, low efficiency furnace, mostly single pane windows, low efficiency appliances, no vent fans in bathrooms


Minimal attic insulation, unsealed attic access

Poor: Photos of Sample Features of A "E-P" Home

No HERS rating

Appraisal Methodologies

Gathering Data and Using Appraisal Methodologies

In the United States, energy efficiency levels in new homes and retrofit homes have been improving most noticeably over the last five to 10 years. As a result, a notable percentage of market participants (for example, building departments, contractors, buyers, sellers, Realtors and appraisers) have begun to actively work together to discover the best ways to *communicate* and *understand* the various levels of energy efficiency noted in all different types of homes. As a result, the documentation and verification about energy efficiency has slowly become something sought by various market participants. To date, the market is still working out the most effective way to do this. Even without a clear solution at hand, however, one thing is clear: the overall residential real estate market has a general desire to understand how the different levels of energy efficiency compare among various properties.

Because communication, verification and documentation about energy efficiency are of interest to the general market, data is slowing becoming available to appraisers. Appraisers must be trained and encouraged to take the data that is available, apply the applicable methodologies and arrive at a supported opinion of value for energy efficiency. This section of the study will cover topics such as:

- What data is currently needed and what data is currently available
- The inherent strengths and weaknesses of the available data
- How, if, and when various appraisal methods can be used to extract an opinion of market value for the energy efficient amenities

Gathering Data

Information Needed to Know the Level of Energy Efficiency of A Home

Certainly, the required level of information needed will vary on a case by case basis. Ideally, however, the following information, if it exists, is often beneficial to appraisers:

- Energy audits (such as HERS certificates, ENERGY STAR certificates, energy audit reports, green building certificates)
- Code compliance (the IECC version the property was intended to meet or exceed)
- Estimated annual energy costs
- Estimated annual energy savings
- Costs of energy upgrades (cost to install)
- Applicable rebates
- Photovoltaic system details
- Actual energy bills
- Average energy expenditures for a typical home in the subject property's neighborhood

While the vast majority of this information is in existence, it is rarely available to appraisers – for example, utility billing information may be private, building departments may not retain certain information, and other limitations. As a result, studying the impact of energy efficiency on market value is greatly restrained by the lack of availability of substantial and comparable data points.

How Information Can Be Obtained

There is never just one solution to the challenge of gathering information. Every market area has its own nuances related to how data is shared. Throughout the course of conducting this study, we explored many different data sources. A summary of some of the experiences we encountered is included below, along with notes as to why the data is useful.

1) Available Energy Reports

ISSUES WITH THIS DATA

Since energy reports are available in all different packages, what appraisers receive can vary from a one-page certificate simply stating, "This home is ENERGY STAR-qualified," to a one-hundred page document containing an inordinate level of detail. We found every possible combination of data in the available energy reports, and were never able to consistently obtain information. It was very time consuming to figure out how to read each report, and to determine whether the report was credible, the version of the energy rating program that was used, where the necessary information was contained in each report, and whether certain information would even be available.

WHY THIS DATA WAS IMPORTANT

Some energy reports provide data that can be used in the cost, sales comparison and income approaches. For example, they may include a list of the technical details for the home, recommended energy upgrades, estimated upgrade costs, estimated energy savings and rebate information. Some also include the actual utility billing information compared to estimated energy savings.

With this information, the appraiser can sometimes develop support for an opinion of value. Specifically, an appraiser can support conclusions regarding costs of specific upgrades and use estimated energy savings, along with a GRM, to help develop the income approach, or to develop capitalized benefits for adjustments in the sales comparison approach. Again, this depends on how credible, current, realistic and applicable the appraiser finds the information in the energy audit.

2) Interview with the HERS Rater Who Created A Specific Report

Risking overstatement, an interview with the HERS rater proved to be the most ideal and fruitful opportunity to collect information. Melissa Baldridge, a local HERS rater, dedicated an expansive amount of time to this study to not only provide information on various properties, but also to explain how to read various reports. Baldridge even went so far as to spend an entire day with this author touring a property to explain what details should be observed in a home to be able

to generate a HERS rating. In the end, we concluded that determining the level of energy efficiency of a home should be left to HERS raters. The amount of knowledge, time and expertise required to develop a HERS rating is as much work as appraisers typically spend on an entire appraisal.

Nothing can compare to having access to the actual primary HERS data that was developed and confirmed by the rater for a property. The name of the HERS rater is located on the HERS certificate, and sometimes, the homeowner may allow the HERS rater to discuss the property with the appraiser (HERS raters, similar to appraisers, are under confidentiality constraints). The appraiser may be able to request the exact documents and the needed data directly from the HERS rater. This way, all desired and necessary data in relation to energy efficiency can be obtained. However, it is rare that an appraiser would be able to directly request and receive the exact energy audit data needed from a HERS rater.

3) Copies of the Utility Bills for the Past Year

Utility bills are very informative in circumstances in which a home has a photovoltaic system, as the bills will confirm whether the system is producing as much energy as was predicted or not. However, in most circumstances, the actual utility bills for this study were not useful. Energy usage for any specific home can vary three-fold based on the habits of the occupants, so the actual energy usage should only be considered as a very general piece of data. Additionally, since it was not possible to obtain utility billing information for neighboring homes (all utility billing in the Denver area is private information), there was nothing to compare against the subject property's utility bills.

Another situation in which utility billing information is useful is when a property has been reported to be net zero. If bills reveal that the owner is paying an average of $150 per month for energy costs, this alerts the appraiser to do more investigating, as a utility bill totaling $150 clearly indicates that the property is not, in fact, net zero.

In conclusion, actual utility billing information is typically not very useful. When it was available for this study, it proved most informative as ancillary data, and not as the prime indicator of energy efficiency for the home.

4) Copy of A Full HERS Report Provided by the Homeowner, Realtor or MLS

HERS reports are similar to appraisal reports: there are many different reporting options and formats. Not all HERS reports are alike. After having reviewed many different HERS reports, the following forms were found to be the most useful for this study:

- The filled out Residential Green and Energy Efficient Addendum
    - This is currently the most important form that can be provided to appraisers. In mid-2014, RESNET made it possible for HERS raters to prepare this form.

- Home Energy Rating Certificate
    - At a minimum, the certificate states the actual HERS rating, year issued, estimated annual energy costs and the energy features of the home.

- Building Summary
    - This provides a detailed summary of the features of the home that relate to energy efficiency.

- Energy Cost and Features
    - This provides the annual energy costs and a summary of the subject's energy features.

- 2005 EPACT Energy-Efficient Home Tax Credit (13-001)
    - This tells the appraiser whether the homeowner qualifies for a tax credit or not.

- IECC Energy Cost Compliance
    - This provides the "As Designed" annual energy costs and the energy costs compared to a specific version (2006, 2009, or 2012) of the IECC. The appraiser knows exactly what the estimated energy savings are above and beyond code.

- Improvement Analysis Report
    - This was one of the more useful reports; however, it was rarely provided. It is typically filled out when a property is going to undergo a major remodel. The builder obtains a "before" and "after" HERS rating, and the report is generated, giving the specific list of improvements related to energy efficiency, and their estimated cost.

- Energy Report (for Fannie Mae)
    - This is provided for a "before" and "after" remodel project. This form lists the exact items that will be upgraded to improve the home's energy efficiency.

- Energy Efficient Mortgage Worksheet and FHA EEM Certificate
    - These are filled out when a borrower is looking for an Energy Efficient Mortgage. This is a most useful form with cost estimates, estimated savings and present value calculations (which the appraiser should not automatically rely upon unless s/he verifies the accuracy and applicability).

- Home Performance With ENERGY STAR (Energy Rating Certificate)
    - This presents the HERS rating and estimated annual savings. One thing to be cautioned about, however, is that the estimated annual savings on this certificate are compared to a HERS 130 home (not a HERS 100 home). Thus, the

savings on this page may be higher than reported on other pages in the report (as the other savings noted typically compare the home to a HERS 100). Reading the fine print is necessary to understand what HERS rating the savings amounts are based on.

The HERS reporting options are many. The key is that, regardless of which forms are provided, the HERS rater has the capability of producing many different useful documents for the appraiser.

END NOTE: After this study was completed and in the final editing stages, RESNET, the organization that oversees the HERS Index Rating, provided a public registry that captures the HERS Index Score for every home built from 2012 that received a HERS Rating. The information can be found at the following link:

http://www1.resnet.us/registry/home.aspx

5) *Details about the Home in the Absence of A Utility Cost Estimate*

If the information in the chart below is available, one can refer to www.hespro.lbl.gov/pro/ to develop an estimate of utility costs for a specific property. That estimate of utility costs might be used to develop the income approach.

Direction the front door of the home faces	Air sealing (yes or no)
Number of stories above grade	Square footage of window area per side
Heated and cooled floor area	Type of windows (double-pane, etc.)
Type of foundation	Water Heater (size, fuel, year purchased)
Ceiling insulation (R rating)	Heating (type, fuel, efficiency level, capacity)
Roof insulation (R rating)	Cooling (type, year purchased, SEER, capacity)
Attic type (Unconditioned attic, etc.)	Duct location
Existence of wall insulation (yes or no)	Ducts are insulated?

In reality, finding this type of information was very difficult in this study, and as a result, did not prove to be a useful tool.

6) *Permit Information*

In this market area, permit information typically only proved useful for getting information pertaining to photovoltaic systems. This is due to the fact that the majority of municipalities retain information regarding the size of the system, the actual cost of the system, the year the system was installed and many more details.

Other than that, permit information proved fruitless to this study for various reasons. Some of those reasons include the following:

- In one city that requires all new construction and major renovations to obtain a HERS rating, once a permit is finalized, the HERS report is not recorded and the documents are discarded.
- It is very common for those who fill out the permits to understate the actual costs associated with the project. The only exception to this was the photovoltaic permits. As a result, accurate costs cannot be obtained from permit information (except for photovoltaic systems).
- Some municipalities do not offer a way to search permits by property address or project type. Some only issue a yearly report listing all of the permits; these reports are issued in a non-searchable PDF format.
- Energy audits are not labeled in the permit files. Finding an audit, and determining whether one even existed, required us to manually search through the files.
- Building departments only allow up to three files to be viewed per visit.

In summary, random permit information was available here and there. It was a very time-consuming process and resulted in such a small amount of verifiable and complete data that, in the end, we abandoned it as a data source for this study. That said, on a case-by-case basis, we recommend that appraisers determine on their own what type of data they can obtain from permit files.

Conclusion

Above all, these examples demonstrate that appraising different levels of energy efficiency requires that specific documents be provided to appraisers, and that finding those documents is a very real struggle. Energy efficiency is not like any other feature in a home, such as a deck, a bathroom or a kitchen. Energy efficiency cannot be easily observed and quantified. Understanding how energy efficient a home is requires a multi-hour inspection and specialized training, and is not something an appraiser can determine over the course of a normal inspection of the property. Determining the actual level of energy efficiency of any home is beyond the normal scope of work of an appraiser, and typically beyond the knowledge and experience of an appraiser. Appraisers need third-party certified and verified energy efficiency documentation.

Using Appraisal Methodologies

The three appraisal methods available for any given assignment are the income approach, the cost approach and the sales comparison approach. Each approach offers a different valuing perspective. For any particular assignment, it is the appraiser's job to determine how many of the three approaches are applicable and which need to be developed. The relevance of each approach depends not only on how buyers in a particular market area purchase homes, but also on the type, quality and quantity of data available to the appraiser.

For this study, we considered all three approaches. However, typically, we were able to credibly develop only one (or none) of the approaches. Details on the quality, quantity and type of data available for each approach utilized are noted on the following pages. Also, it must be reiterated that this study is not, nor should it be, construed as an appraisal assignment. The goal of this study is to determine whether energy efficient amenities are value-added to a significant degree.

Appraisal Methodologies: Sales Comparison Approach

For residential properties, the sales comparison approach is usually the strongest and most reliable approach to developing an opinion of market value. The sales comparison approach was used to compare properties with different levels of energy efficiency to one another.

All other features being equal (or adjusted for), the difference in adjusted sale price can be attributed to the market's reaction to energy efficiency as a value-added amenity. It is important to note that, as seen in this study, a value-added amenity in one market is not necessarily a value-added amenity in another market, in terms of difference in either dollar amount or percent. Appraisers may look at these results as a basic indication, but must test the specific market they work in to see if the base developed in this study actually applies to the assigned specific property. Again, this study is not an appraisal of amenities; it simply demonstrates an indication of whether energy efficient amenities may add value in the researched residential markets.

When available, the subject property for each case study was compared to sales of similar properties. This proved to be an effective and relevant approach to quantify the market's reaction to various energy efficient amenities. When appropriate data was available, this approach was typically given the highest consideration as an indication of energy efficiency as a benefit to the property.

Other than the normal weaknesses inherent in a sales comparison approach, the approach was just as relevant to this study as it is for the majority of residential appraisal assignments.

Appraisal Methodologies: Income Approach

The income approach to value is applicable when buyers consider "the income from a property as a reason to purchase"[33] a specific home. Income can be generated actively or passively. For example, homeowners can opt to actively rent their property out (and thereby actively collect income via monthly rental payments) or they can opt to *passively* generate income by having higher energy efficiency (and thus lower utility bills) than a comparable property.

Saving money on utility bills *does result* in keeping more income, and therefore, not spending money has the same net result to homeowners as collecting rent does. How, then, does one determine the income generated as a result of money *not being spent* as opposed to money being earned?

The appraiser must exercise care in this type of analysis. If an appraiser uses reduced utility expenses to justify an increase in rental income, it would be inappropriate to calculate value based on the dynamic caused by greater gross income and reduced expenses working in combination with each other.

Four examples of data that is potentially available to an appraiser to understand what "income" looks like in an energy-efficient home include:

1) Utility bills
2) Estimated annual energy savings
3) Estimated annual energy costs
4) Average (or expected) energy costs

1) Utility Bills

Specific utility bills were not available for any of the case studies noted in this report. In the Denver metro area, utility billing information is private and is not available for public viewing. While individual homeowners can opt to share their particular energy billing information with anyone they choose, they are never required to share that information. Also, it is not typical for home sellers in this market area to routinely disclose utility billing information, or for homebuyers to request such information. Therefore, in the vast majority of cases, listing agents do not have any knowledge as to what the actual utility costs are for any particular property.

Even if utility billing information were available, it was found to not be reasonable to use that data to develop the income approach for residential properties. Actual energy usage for any specific home is heavily dependent on occupant behavior. Thus, two sets of identical homes can show a three-fold difference in actual energy use over the course of a single year based on the habits of the occupants. An appraiser cannot ascertain whether actual utility bills are the result

[33] *Appraising Residential Properties*, The Appraisal Institute, fourth edition 2007

of occupant behavior, the overall energy efficiency of the home, or some combination of the two.

Utility bills could, however, be analyzed as a "proof of performance" for three scenarios. (1) If an appraiser suspects s/he is appraising a net zero home, s/he should expect to see utility bills that are essentially zero (minus any service fees the utility company may charge). (2) If a property has a photovoltaic system, the appraiser can compare the electric bills to the predicted energy production to ensure the panels are operating correctly. (3) If a homeowner performs energy upgrades, the before and after billing can be compared to one another (assuming the occupants did not change their energy habits after the upgrades, which often happens). In summary, in most circumstances, obtaining actual utility billing information for this market area would only be highly useful to the appraiser in a few circumstances.

Generally, more data is better. If the utility billing information is available, it would certainly be beneficial to determine whether the information is useful before simply dismissing it. However, as noted earlier, it was not available for any of the case studies.

An Additional Note on Occupant Behavior

ENERGY STAR does have what is called a "Home Energy Yardstick." This particular rating program does address the actual energy habits of the home occupants. Anyone can simply enter in the actual utility bills realized by a particular homeowner (along with some details about the home) to understand how the occupants are impacting energy usage in the home. This may prove to be a useful tool going forward; however, since utility billing information was not available for this study, the Home Energy Yardstick was not a tool that could be utilized.

2) *Estimated Annual Energy Savings*

It is typical for energy audits and HERS reports to include estimates of how much money a homeowner can save on his or her utility bills for specific energy efficient features. But are these figures relevant? They can be.

In a *Home Energy* article, Jeff Ross Stein, a former research assistant at Lawrence Berkeley National Laboratory, commented that, *"[When we] compared home energy ratings with actual utility billing data for about 500 homes… in general, we found that the HERS can be remarkably accurate at predicting average annual energy costs for groups of homes. Predictions for individual homes were less impressive. Some individual ratings significantly over predicted or under predicted energy costs, especially for older homes."*

For appraisers, this is ideal. The energy predictions are not based on any particular person's observations; rather, they are based on the expected result that is common to the majority of homes. When appraising homes for lending purposes, appraisers do the same thing: they do not value a home based on the value to a particular buyer; instead, they value a home assuming the

value to a typical buyer. A typical buyer is a "collective perception" and not the "interest of a particular individual." Therefore, the estimated annual utility savings fit the definition of market value most often used by appraisers, and because of this, the savings estimates are typically reliable.

The data can be used along with a gross rent multiplier to develop capitalized income or expense-saving using the underlying principle of the income approach. The data is then used in a discount analysis.

Discount Analysis of the Estimated Energy Savings

Two free tools are available to appraisers for calculating the present value of future energy savings. One is called "PV Value®" and is used exclusively for photovoltaic systems. This tool was covered in detail in this author's other study: *The Impact of Photovoltaic Systems on Market Value and Marketability,* published in 2013.

The other tool calculates both the rate of return and the net present value of energy savings. This second calculation tool is available at www.energytools.com. On the website is a section titled "Economics of Energy Efficiency," which contains a calculator that does the same thing as an HP12C (without having to memorize a key stroke sequence). While there are a total of seven fields for the appraiser to fill out, only three are mandatory:

Life of Measure (this is the useful life of the items)	*Example: 20 years*
Annual Energy Savings	*Example: $500*
Financing Interest Rate	*Example: 4%*

If the appraiser does not have data to fill out the other four fields, those fields can be zeroed out. Using the above example, the net present value of a $500 annual energy savings is $6,795.

The outputs produced on this website are the identical calculations that are found on the Fannie Mae Energy Report, which is typically filled out by HERS raters. After testing this tool for several case studies, it was found to be reliable[34].

3) Estimated Annual Energy Costs

Estimated annual energy costs are typically provided in a HERS report, and on the HERS certificate itself. Ideally, every property would have a HERS rating and a full HERS report. In this way, the appraiser could quickly compare the estimated annual energy costs between properties.

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[34] The same exercise can also be done on a financial calculator where Life of Measure is the number of periods in years (N key), Annual Energy Savings is the periodic dollar return (CHS key for cash flow direction then PMT key), and Financing Interest Rate is the rate of return (I key), and then sold for Present Value (PV key).

Initially, it seemed it might be possible to do this for several case studies. However, in the end, it did not prove to be reasonably possible.

For example, *Case Study #12* is located in the City of Boulder. Per the code requirements for the City of Boulder, the vast majority of homes being built or undergoing major renovations obtain full HERS reports, or something similar to a HERS report. These reports are submitted to the City when a property owner is applying for a building or remodel permit. In theory, if three recently remodeled homes were sold, then all three HERS reports could be pulled from the permit file. For *Case Study #12,* three similar, recently remodeled homes did sell. However, when trying to gather the HERS reports required when the properties were remodeled, two problems emerged:

- The City discards all HERS reports after a permit has been finalized. No data from the report is intentionally or purposely retained.
- It could not be verified that two of the three comparable sales appear had the necessary remodel permits. Based on an interview with the City, the City will only enforce the lack of a permit if someone officially files a complaint.

Since the only use for the Estimated Annual Energy Costs is for comparative purposes, if the data cannot be obtained for numerous properties, then it is not highly useful information. The only way we could reasonably use the Estimated Annual Energy Costs was to compare those to the average energy costs noted in the census data (located in the section of this study titled "The Cost of Energy and Energy Usage") as a test of the reasonableness of the census data.

4) Average (or Expected) Energy Costs

The census data noted much earlier in this report is, in essence, a reliable report detailing the average energy costs for various types of households. While the census data reflects local information, it is a few years old and does not reflect recent changes in the cost of energy.

Again, there is some data available to estimate the average energy costs for a particular home, but the data is quite general and slightly outdated.

Ideally, appraisers would have access to the average utility costs for specific neighborhoods. The local utility company, Xcel Energy, does track and have this type of data. However, it is not for public viewing and therefore is not available to appraisers (or pretty much anyone).

Appraisal Methodologies: Cost Approach

When attempting to use the cost approach for energy-efficient features, a distinction must be made. While energy efficiency can be reflected in specific products (for example, an 80, 85 or 92 percent energy efficient furnace), energy efficiency is more often the result of an integration of many different elements, such as products, construction techniques or design elements. Because of this, it is easy to find data sources to estimate the exact cost of an individual feature. It is not easy, on the other hand, to estimate the costs associated directly with different energy efficiency levels that are the result of integrated building principles. These issues are discussed in detail below.

Types of Data Available to Complete the Cost Approach

Cost data can come from (1) building cost providers such as Marshall & Swift, (2) local builder costs, (3) cost studies, (4) energy audit reports, or (5) an incremental cost addendum.

1) Building Cost Provider: Marshall & Swift

Marshall & Swift is a subscription-based service that supplies replacement[35] cost data. While there are three ways to utilize the cost data, only two had potential relevance to this study[36]:

- Section A: Square Foot Method
- Section B: Segregated Method

Both of these cost sources assume that a home is standard and typical for the area and, essentially, being built to the code that is most common for the area. Therefore, homes that are built above the local energy code can have different construction costs than the Marshall & Swift cost figures will indicate. As a result, these costs differentials and associated entrepreneurial profit would need to be added to or subtracted from the total cost estimate generated when using the Marshall & Swift cost figures.

However, this is currently not possible to do. Using the Marshall & Swift cost data, it simply was not possible to estimate or determine accurately what these additive or subtractive costs could be. While Marshall & Swift does have a cost section that addresses “green” costs (which can include energy efficiency related costs), there are currently two main issues with the Green Section cost data that made it prohibitive to utilize for this study:

[35] “Replacement Costs” refer to the estimated costs to construct a home that is of like utility and quality compared to a specific home an appraiser is valuing. It is beyond the scope of this paper to explain the various types of cost approaches.

[36] The third method, the quantity survey method, was never an option for this study.

1. **ISSUE ONE:** The Green Section (Section C) lists costs based on the segregated cost method. To use segregated costs, the appraiser must have access to two types of information:
    - **The Physical Measurements.** The segregated cost method requires an appraiser to have physical measurements, such as the square-foot area of the first floor, square-foot area of the basement walls, linear feet of the perimeter, height of the exterior walls, and square-foot area of all exterior gable walls. While this information was not available for this study, gathering this information would normally go beyond the typical residential appraisal. It should be noted, however, that these measurements are available through a knowledgeable HERS rater.
    - **Exact Construction Materials.** To complete the segregated cost method, the appraiser would need to understand the differences between things such as an "*Average quality masonry wall, common brick 8 inch, block backup, 9-10 inches"* and an *"Average quality masonry wall, brick, block backup 8 inch."* Without plans and specifications on a property, this is beyond the scope of expertise of most residential appraisers. This data requires specialized building knowledge and access to precise building specs to be usable.

    In summary, with regard to ISSUE ONE, it is not typical for residential appraisers to use the segregated cost method to develop an opinion of value. Development of the method using these cost figures requires specialized knowledge, access to very precise property data, and extra time, expense and effort.

2. **ISSUE TWO:** The Green Section (Section C) has two cost sections: one that explains how to adjust for additional costs for a green property (compared to a non-green property) and one that addresses retrofit costs of green improvements. A few problems emerged when trying to use these costs:
    - **The costs require the use of the Segregated Method.** As noted above, it was not possible to develop the Segregated Method for this study.
    - **Data not included in Section C.** In the instructions associated with Section C, the appraiser is directed to turn to "Section 70" to obtain the actual building costs needed to develop a lump-sum adjustment for green features. "Section 70," however, is not in the Green Section of Marshall & Swift, nor is it anywhere in the entire Residential Cost Handbook. "Section 70" is only found in the Marshall & Swift Commercial Cost Handbook. While the appraiser can opt to subscribe to this additional cost service, it is not reasonable to expect residential appraisers to do so, at a cost of over $1,200 per year, merely to have access to "Section 70."

In conclusion, the cost data available through Marshall & Swift for calculating the costs associated with improved energy efficiency in a home was currently not in a useable format for this study.

That said, the Marshall & Swift cost data for code-built homes is relevant to those types of properties.

Depreciation and the Cost Approach

For this case study, the typical economic life of a home was found to be generally about 60 years. Based on *Case Study #2*, we see a calculated economic life of 60 years, which is used as the basis for the following discussion. While the home as a whole may have an economic life of 60 years, some of the individual components related to energy efficiency will not last 60 years. According to Marshall & Swift, the expected life span of various components related to energy efficiency are as follows:

Per Marshall & Swift:	**Average Quality (years)**	**Good Quality (years)**
Appliances	12	15
Forced air heat	12	14
Heat recovery ventilator	13	17
AC	13	16
Exhaust fans	13	19
Air duct insulation	15	19
Air ducts	20	25
Batt insulation	18	22
Spray foam insulation	17	21
AVERAGE:	15 years	19 years

The items noted above are short-lived items. In addition to these short-lived items, there are other components of a home that impact energy efficiency and have much longer life spans – for example, the siding, foundation, subflooring and roof decking. Combining the short-lived items with the long-lived items, it is extremely reasonable to expect the overall energy efficiency level of a home to function reasonably well for up to 20 years. Marshall & Swift supports this conclusion and also estimated the overall useful life of the combined features that contribute to an energy efficient system to be 20 years.

In summary, the overall useful life of the level of energy efficiency in a home can reasonably be estimated at 20 years for this study.

2) Local Builder Costs

When building contractors produce cost figures for a construction budget, they typically use a cost method that is known as the “quantity survey method.” While the quantity survey method

is a recognized appraisal method, it is typically above and beyond the expected expertise level of the residential appraiser. To be able to complete this type of cost approach, the appraiser would need to take a detailed inventory of all of the specific items and materials that would be used to build the home. This is too time-consuming for the majority of residential appraisers and requires specialized training. While an appraiser can rely on the cost figures the builder generates, a test of reasonableness is still appropriate and warranted.

For this study, builder cost data proved almost impossible to gather. Some of the case studies include some cost data from builders and remodelers, but most do not.

As a solution going forward, Earth Advantage has created what is called the "Cost Data Addendum for High Performance Homes," which is included in the addendum pages of this study. The intent of the Cost Data Addendum is to provide appraisers with a way to request and receive the actual incremental cost premiums for a house being built with energy-efficient designs[37] that are above and beyond code.

For now, however, cost data related to energy efficiency is extremely complicated and difficult to gather. Therefore, in most instances, cost data was not available for the case studies.

Other Noted Problems with the Cost Approach Data

When researching cost data for energy-efficient homes from builders or cost service providers, it became readily apparent that it would be very difficult for an appraiser to accurately compute the cost differences between two homes with different levels of energy efficiency.

Often, when designing a home, architects and HERS raters work together to discuss the many options available to increase the energy efficiency of a particular home. Choosing to build energy efficiency into a home is not the same as choosing to build a two-car versus a three-car garage. Energy efficiency is not one specific feature a builder decides to tack onto the home as an upgrade amenity. Energy efficiency is an operating system and, as such, is found in all different areas of the home.

As briefly mentioned earlier in the section titled, "An Introduction to Code," builders achieve higher levels of energy efficiency through a give-and-take process. They use computer modeling software to "take" energy efficiency from one area (for example, by adding larger windows) and "giving" it to another (for example, by increasing wall thickness or attic insulation). In other words, if they design one area with decreased efficiency, then to meet energy code, they have to make up that loss in energy efficiency by increasing the efficiency level in another part of the home.

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[37] For an excellent analysis of the form, please visit www.appraisalinsight.blogs.realtor.org and search for the article written by Fiona Douglas-Hamilton on October 23,2013 titled, "*High-performing Homes: New Source on Local Incremental Cost Data.*"

When working to increase the energy efficiency levels of a home, builders are working to decrease the HERS rating and to do it in such a way that it is cost effective. Thus, they try all different combinations of finish features to arrive at a final, acceptable solution. Increasing energy efficiency in a home is not achieved by simply adding more and more items to the home.

For example, if a builder does a better job air-sealing and insulating a home, then the size of the furnace and air conditioning unit can be downsized to fit the needs of the home. In other words, a builder might incur additional costs in one area, but save money in another area.

This is a science unto itself. It is not reasonable to expect the typical residential appraiser to be able to decipher, research and report the precise incremental cost differences between one HERS rating and another.

To illustrate, the following incremental cost study is offered below.[38]

Incremental Cost Analysis	
Cost to construct a home with double walls (two 2 X 4 walls @ 16" on center & 5.5" apart):	
600 studs @1.20 each	$750
1880' plates = 1260 bf $250/m	$315
Headers 425 bf	$137
26 (4' X 8' plywood plate ties)	$142
Framing labor	$1,300
R13 + R22 + R13 fiberglass batt for 2365ft2	$1,242
Installation labor	$382
Costs saved by using the double wall construction technique:	
Used 300 less studs at $1.20 each	Saved $360
Used 940' less plates = 630 bf @ 250/m	Saved $158
Did not use headers	Saved $90
Did not use framing lumber	Saved $700
Did not use R19 batt @ 16' on center for $.30/ft installed	Saved $710
TOTAL NET COST DIFFERENTIAL:	**+$2,221 to build the more efficient home**

As a solution, Earth Advantage offers its "Cost Data Addendum for High Performance Homes" as an opportunity for the building world to understand what kind of data the appraiser needs to facilitate a supportable adjustment that is based on actual, local cost figures. The appraiser, typically, cannot generate these cost figures on his or her own.

That being said, there are general ways for the appraiser to understand what a reasonable incremental cost increase might look like. On a very general level, does it cost -5 percent, +1

[38] While these figures are from a 1989 case study, the relative value difference is what should be noted. These figures are obtained from www.icehouse.net, which is the case study of an energy efficient, passive solar home.

percent, +10 percent or maybe even +50 percent more to increase the energy efficiency of a home above and beyond its 2012 IECC code-built twin?

The answer, of course, depends mostly on how energy efficient the home is designed to be, how old the home is and how new the energy efficient updates are. We will explore each in detail.

Applicability of the Cost Approach If Data is Not Available

In many of the case studies, the cost approach would be applicable. However, given the lack of actual cost data, it was not possible to reliably develop this. Even so, the cost approach can be developed using the standard cost figures (for a code built home) as a test of reasonableness. The cost figures, of course, will not reflect the extra energy efficiency level the home has, but they will offer a baseline to compare against a property's sale price, especially for new construction.

3) Cost Studies

Because the government is continually updating and improving energy efficiency requirements, it also conducts studies to find out how much more the costs will be for construction of the new version of an average and typical home. A summary of several of these studies is below.

Incremental Cost Difference for a Home that Complies with the 2006 IECC vs. the 2009 IECC

To study incremental cost differences, the costs associated with one specific home are studied. This home is referred to as the "Model House." For this study and the study below, the modeled home had the following features:

Model House	
Components	Sq. Feet
Ceiling	1,200
Window (U Factor/SHGC Factor)	357
Wood Frame Wall	2,380
Mass Wall	0
Floor	1,200
Basement Wall (If Applicable)	1,120
Slab (In Linear Ft.) (If Applicable)	140
Crawlspace (If Applicable)	1,200
Improved Duct Sealing/Testing	Standard
Lighting	Standard

Using this model house, the study provided incremental cost figures for different areas of the United States. While exact figures were not available specifically for the Denver area, figures were available for Minnesota (which has a more severe climate zone than Denver). In Minnesota, the incremental cost increase from the 2006 IECC to the 2009 IECC was only $1,896[39] for the model home noted above.

[39] The Building Codes Assistance Project's paper titled, "Incremental Construction Cost Analysis for New Homes, building to the 2009 IECC."

Incremental Cost Difference for a Home that Complies with the 2009 IECC vs. the 2012 IECC

Using the same model house noted in the study above, costs differentials between the 2009 IECC and the 2012 IECC were summarized in one study:

- In Denver, the incremental cost increase would be $1,412[40].
- In Denver, the annual energy savings would be $271-$277.

For this study, incremental costs were calculated using the RS Means Contractor Pricing Guide. Using these figures, the study goes on to estimate that the increased cost to construct the home would result in an additional $5.41 on a mortgage payment, yet would provide a $22.53 per-month savings on energy costs.

Cost-effectiveness of the 2009 IECC and 2012 IECC Compared to the 2006 IECC[41]

A third study compared the 2006, 2009 and 2012 IECC energy codes to reach these conclusions:

Lifecycle[42] cost savings are **$1,528 for the 2009 IECC** compared to the 2006 IECC.
Lifecycle cost savings are **$5,435 for the 2012 IECC** compared to the 2006 IECC.
Simple payback periods are **7 years for the 2009 IECC** compared to the 2006 IECC.
Simple payback periods are **6.2 years for the 2012 IECC** compared to the 2006 IECC.
Net positive cash flow is noted at **2 years for the 2009 IECC** compared to the 2006 IECC.
Net positive cash flow is noted at **2 years for the 2012 IECC** compared to the 2006 IECC.
The annual energy cost difference is about **10% for the 2009** IECC compared to the 2006 IECC.
The annual energy cost difference is about **30% for the 2012** IECC compared to the 2006 IECC.

How Much More It Costs to Build an ENERGY STAR® Home[43]

This fourth study looked exclusively at ENERGY STAR-qualified homes, again, using a model home as an example.

For this study, the model home was a 2,425 square-foot, single-family, two-story home with a gas furnace. The incremental cost differences for this home having a HERS 100 compared to a HERS 85, HERS 70 or HERS 65 are as follows:

HERS 100 to HERS 85: $2,869
HERS 100 to HERS 70: $7,136
HERS 100 to HERS 65: $9,286

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[40] www.energycodesocean.org/incremental-cost-analysis
[41] Colorado Energy and Cost Savings for New Single- and Multifamily Homes, U.S. Department of Energy
[42] This study used a lifecycle period of 30 years. Please refer to the study for additional assumptions and parameters.
[43] A study presented during the 2008 ACEEE Summer Study on Energy Efficiency in Buildings.

These figures are based on data from 2008. We were not able to locate a more current study. As expected, the cost increases as the HERS rating drops.

4) Energy Reports

Going forward, energy reports might prove to be among the most useful sources for estimating the cost of energy-efficient features. While we were rarely able to obtain this data for this study, it is very promising from a use standpoint. For an existing home, some energy audits list the exact energy efficiency improvements recommended for a particular home, along with the estimated costs to implement those updates. While an insufficient number of these types of reports were available to compare to one another, they seem to be something worth examining closer if they should become a common document available to appraisers.

5) Incremental Cost Addendum

Provided as an addendum to this study, the Incremental Cost Addendum would be ideal to provide to an appraiser. For this study, we did not find the addendum to be currently in use in this market area, and it was therefore not applicable.

It is not clear, however, how useful this document will end up becoming. After speaking with several local builders and providing them with the form to review, we found that none of the builders felt the layout of the form reflected the way in which they actually develop a cost budget for a home. As a result, it remains to be seen whether cost budget information becomes collectable via this type of form.

Rebates

It is common for area utility providers and/or municipalities to offer rebates when homeowners and builders install items that are considered to have energy-efficient features. In the Denver metro area, the local natural gas and electric service is run by Xcel Energy.

It is also common for appraisal articles and books about energy efficiency to recommend that the appraiser research and study rebates when calculating the cost of various energy-efficient features. In this market area, there are currently issues with to the ability to obtain and apply rebate information:

- While there is a rebate website (www.dsireusa.org/incentives), the website is currently not useful. This website is meant to aid those interested in obtaining a list of applicable rebates. For this study, we checked the website and found it to be out-of-date. For example, the rebates listed for Xcel Energy (Electric) - Residential Energy Efficiency Rebate Programs had not been updated since 11/05/2012.

- Xcel Energy notes that homeowners may be eligible for additional rebates from “your local community” and directs readers to visit www.rechargecolorado.com. This website is also out of date. For example, the homepage, “Rebate Program Closed as of October 11, 2011.”

- RESNET does contain up-to-date rebate information on its website (www.resnet.us). However, even that data states that the homeowner will need to check directly with Xcel Energy to determine rebates for which they qualify. RESNET is not available to appraisers, but is available to energy auditors.

- Xcel Energy does have a list of current rebates on its website at m.xcelenergy.com/rebates. While some rebates are easy to understand and interpret, most rebates require an expert to understand exactly which rebates a homeowner can receive. See notes below.

As of April 15, 2014, some of the rebates offered by Xcel are as follows:

TYPE OF EQUIPMENT	REBATE DATE	AMOUNT OF REBATE	DETAILS
Evaporative Cooling	Until July 31, 2014	Up to $1000	See website for list of qualifying equipment
ENERGY STAR Rating	No expiration date noted	$100 to $1400	Rebate depends on the final HERS score
ENERGY STAR Dishwasher	No expiration date noted	$10	Rebate offered to Builders who are eligible for a Performance Rating Rebate
ENERGY STAR Clothes Washer	No expiration date noted	$50	Rebate offered to Builders who are eligible for a Performance Rating Rebate
ENERGY STAR Refrigerator	No expiration date noted	$10	Rebate offered to Builders who are eligible for a Performance Rating Rebate
Ground Source Heat Pump	Until July 31, 2014 Install by Dec 31, 2014	$300 per ton, 5 ton limit	See website for list of qualifying equipment
Heating Efficiency	Until July 31, 2014	Up to $100 for boilers Up to $120 for furnaces	See website for list of qualifying equipment
Cooling	Until July 31, 2014	Up to $1000	See website for list of qualifying equipment. Samples include: Evaporative Cooling - Standard System Tier 1 (first time install) $275 Evaporative Cooling - Standard System Tier 1 (replacement) $125 Evaporative Cooling - Premium System Tier 2 (first time install) $625 Evaporative Cooling - Premium System Tier 2 (replacement) $525
Home Energy Audit	July 31, 2014	Up to $200	See website for details
Home Performance with ENERGY STAR	July 31, 2014	Varies from $25 to $1000. Amount equals 20% of total cost, up to a specific improvement rebate from a provided list.	Complete a home energy audit, than pick three improvements from a list.

In conclusion, rebates are too complicated for an appraiser to make an absolute determination about which rebates apply, and when. Upon interviewing one homeowner who built a new, custom, very energy-efficient home, the homeowner stated, “Rebates are difficult.” In order to accurately determine whether a homeowner qualifies for a rebate, an appraiser would need to know:

- What kind of equipment had been installed.
- The installation date.
- If the homeowner applied for the rebate by the cutoff date.
- If the item was a first-time-install or a replacement.
- If the contractor who installed the item was approved.
- The total cost of bill and what percentage of that bill qualified for a rebate (e.g., it may only be 20 percent of the total bill, even though the maximum refund amount is higher).
- If the homeowner had already received a rebate for a similar item on a different home.
- If the homeowner reached the maximum rebate amount through the purchase and installation of other features.

In this market area, understanding rebates is typically beyond the appraiser's scope of work. For this study, we did not research rebates since precise finish details were not available for any of the case studies.

Conclusion

As is normal in the appraisal industry, finding enough data, verifying it, and judging its quality is a very real piece of the puzzle when it comes to developing an opinion of value for energy efficiency. The examples noted above illustrate some of the current limitations regarding available data. As time goes on, these challenges will likely change and evolve, and, hopefully, the data will eventually exist in a format that is useable and accessible to all market participants. As always, the job of the appraiser is to judge how relevant the different levels of energy efficiency are based on what data the market itself looks to.

Case Studies

It is imperative to note that the following case studies do not, nor are they intended to be, construed as statements of value relative to the case study properties. The exercises are illustrative in nature and provide a single-point look at energy efficient amenities and their possible contribution of value relative to the total property. Each case study was selected because of its ability to isolate different energy efficiency elements, and its contributory value was considered from appropriate value measurement perspectives.

It must further be noted and understood that the analyses presented do not represent the only way to look at or consider the data. Because we each view markets and data based on personal experience and perspectives, any conclusion herein could differ from any another analyst's conclusions, given the same set of hard data. This is not viewed as a weakness of the study or its results; it is simply a fact of independent thinking and analysis.

Finally, any reference to value in the following case studies is only as it pertains to the specific energy efficient amenities being addressed, and not to the properties themselves. The goal of the study is to ascertain whether the market has reached a point where energy efficient amenity has contributory value, and if it exists at all, whether it can be adequately measured in a variety of market places. Further, the conclusions reached are for those case studies and specific markets, and do not intend to imply that the results would equally apply to all homes in all markets.

Case Study #1: No HERS Rating and No Energy Efficiency

To begin to answer the question, "*What impact does energy efficiency have on the home buying process?"* it is necessary to start with a home that lacks energy efficiency of any kind. For example, the temperature of a home that lacks any energy efficiency would essentially be the same as the temperature in the outside environment. Any energy dedicated to producing interior heat would be 100 percent wasted and would generally not change the comfort level on the interior of the home.

Essentially, a home that lacked any sort of energy efficiency would offer no better living than a shed with large openings in the wall:

Case Study #1

The above picture shows a shed. For our purposes, we will pretend it is a home.
The home has notable gaps in the walls.
Air, snow, rain, hot air and cold air are allowed to freely reach the interior.

We will pretend there is a furnace in this "home."
Heat produced by the furnace immediately escapes to the outside of the building.
As a result, the inside and outside have no detectable difference in temperature and air quality.

This is a home with basically 0 percent energy efficiency. All energy used is almost immediately wasted.

Clearly, a home with 0 percent energy efficiency would not be livable in the Denver area.

While this is an extreme example, it is necessary in order to understand energy efficiency. Energy efficiency is evident in virtually every modern, livable home in the Denver market area. What this example does is demonstrate that the question, "*What impact does energy efficiency have on the home buying process?"* was just slightly the wrong question to ask for this study. Since every livable home has

some level of energy efficiency, the wording was revised to address this more appropriate question: "*What level of energy efficiency is expected in different market segments and what impact does that have on the home buying process?"*

Since every house will have a level of energy efficiency that is acceptable to its market area, the key to understanding energy efficiency is not WHETHER energy efficiency exists, but rather, whether and when does a home's level of energy efficiency fall *below* market expectations, *meet* market expectations or *exceed* market expectations?

Case Study #1 is being used to show that energy efficiency will likely be present to some degree in every single home in the Denver market area. It demonstrates that the key to understanding energy efficiency is the ability to identify the different levels of energy efficiency.

Conclusion:

A home with a lack of any energy efficiency is uninhabitable.

Energy efficiency will exist, on some level, in all habitable homes in this market area.

Case Study #2: No HERS Rating in Fully Depreciated Homes

In Case Study #1, the subject property was an uninhabitable house with a total lack of energy efficiency. Case Study #2, on the other hand, consists of homes that do have some level of energy efficiency; however, the market places no value on the level of energy efficiency noted in the home. While there are several different ways to demonstrate this concept, the easiest way is to study fully depreciated homes.

A home with no contributory value is a *fully depreciated home.* It is a home that, in our market area, could still be physically sound and technically livable; however, it is so outdated by market standards that homebuyers feel the best approach is to tear down the house and build a new one.

For example, in the Newlands neighborhood in Boulder, it is common for homebuyers to tear down livable 1950s brick ranch style homes and replace them with larger, more modern homes. In this case, the 1950s brick homes have the typical level of energy efficiency for the type and age of home, but the market no longer values the floor plan, size and construction materials in the home. Thus, the level of energy efficiency noted in the home is a moot point.

A case study in which the market places no value on energy efficiency demonstrates that it is not always relevant to report, in detail, the energy efficiency levels for some homes. Case Study #2 is meant to place emphasis on the fact that just because a home has an identifiable level of energy efficiency does not mean it has any value in the marketplace.

This case study is provided as a reminder that no feature will add value to homes in all circumstances. Every house will need to be considered on a case-by-case basis.

Case Study #2 consists not of one particular home, but rather, of a data set of fully depreciated homes.

City of Boulder Fully Depreciated Homes
(Based on Demolition Permits)

#	Address	Year of Demo Permit	Year Home was built	Age of Home at time of Demo	Last Recorded Sale (prior to Demo)
1	2406 Bluff St	2011	1900	111	
2	2332 20th St	2011	1915	96	2007 for $473,000
3	607 Forest Ave	2011	1937	74	
4	1621 Norwood Ave	2011	1951	60	2011 for $275,000
5	2004 Orchard Ave	2011	1956	55	2011 for $425,000
6	1055 8th St	2011	1956	55	
7	797 Gapter Rd	2011	1957	54	
8	1525 Oak Ave	2011	1984	27	2011 for $435,000
9	655 Hawthorn	2010	1930	80	2007 for $930,000
10	916 Juniper Ave	2010	1930	80	2010 for $1,150,000
11	3026 11th St	2010	1948	62	

12	3114 7th St	2010	1950	60	2010 for $510,000
13	2335 Linden Ave	2010	1955	55	
14	1007 Cedar Ave	2010	1955	55	2010 for $475,000
15	1480 55th St	2010	1956	54	2009 for $300,000
16	2290 Linden Ave	2010	1967	43	2009 for $1,150,000
17	2155 Upland Ave	2010	1962	48	2008 for $605,000
18	501 Evergreen Ave	2009	1901	108	2008 for $860,000

All of the homes on the previous chart were torn down shortly after they received their demo permits from the city. In conclusion, every home contributed zero value to the property. Using the sales comparison approach, we can demonstrate that this conclusion is true. Sales 5 and 8 can be compared to one another:

	2004 Orchard Ave	**1525 Oak Ave**
Sold Price	$425,000[44]	$435,000
Under Contract Date	May 2011	July 2011
Sold Date	June 2011	August 2011
Lot Size	.43 acres	.43 acres
Subdivision	Moores	Moores
Style of Home	1 Story Ranch	A-Frame
Actual Age of Home	55	27
Square Footage Above Grade	1117 sq. ft.	1152 sq. ft.
Basement	No basement	1152 sq. ft.
Bedroom/Bath Count	3/1	3/2
Energy Efficiency Level	Fair	Poor

Both homes were very livable and had no significant deferred maintenance noted at the time of sale. The homes had notable differences in style, age, basement size, bedroom count, bath count, and overall level of energy efficiency. It would not, however, be reasonable to adjust for any of these differences. Rather, based on *The City of Boulder Demo Permit* data set noted earlier, there is clear market evidence that the land was the only feature this market area valued.

Immediately after purchase, both properties had demolition permits issued. This showed solid evidence that every feature in the two homes had zero value in the market, including different levels of energy efficiency. In other words, it would not matter if these homes had 40-year-old boilers or brand-new geothermal systems. The market saw no value in the homes, no matter what their finish features were.

Conclusion:

Regardless of the efficiency level of the home, energy efficiency may not be a relevant feature in the market.

[44] Both sales had identical lot sizes and only sold for a $10,000 difference. The $10,000 difference is due to the market increasing slightly from May 2011 to July 2011 (the under-contract dates of the two properties).

Case Study #3: No HERS and Minor Updates to Energy Efficiency

Type of home:	Condo	**Year Built:**	1979
Location:	Boulder, Co 80303		
Subdivision:	**Peppertree Condos** A condominium development built in the late 1970s with average quality units. The area is comprised of many similar-sized, similar-quality condominium complexes. The area is surrounded by average quality tract homes, many of which have undergone major remodeling and updating.		
Price Range:	$160,000 to $200,000		
Applicable IECC Code:	N/A, Built prior to Energy Codes		
Energy Efficiency Range in Subdivision:	Most units are E-F. Energy updates are not common in these units.		
Above-Grade Sq. Ft.	880	**Below-Grade Sq. Ft.**	n/a
Sold Date:	March 2014	**Finished Below Grade:**	n/a
Original List Price:	$192,500	**Bed/Bath Above Grade:**	2 bed/2 bathrooms
Final List Price:	$192,500		
Sale Price:	$196,700	**Garage:**	None
Lot Size:	n/a	**Lot Location:**	Cul de Sac
Days on Market:	40 (under contract in 4 days)		
Days on Market for Subdivision:	59		
Market Conditions:	Increasing values, strong seller's market		

Energy Efficiency Features for This Property

Since the unit was constructed, the unit itself has had no known updates that were specifically meant to improve energy efficiency. The property has an insulated attic, double-pane windows, insulated walls, no noted air-sealing, and no known ENERGY STAR appliances or light fixtures. No utility information was available for the property.

The subject's condo complex was one of the many in Colorado that suffered flood damage in September 2013 when a historic 500-year flood hit the Colorado Front Range. As a result of that flood, the original boiler for the complex (from 1979) was destroyed.

The insurance company agreed to replace the boiler, and the HOA elected to pay a premium to upgrade the boiler to a 95 percent efficient model. The unit owners did not have a special assessment, as the HOA was able to pay the premium difference for this efficient, new boiler from its reserves.

How Buyers/Sellers Reacted to This New Feature

Soon after the boiler was installed, six units in this complex were offered for sale and listed in the local MLS. Of these, three made specific reference to the "95 percent efficient" boiler.

After discussing the boiler with listing and selling agents, we drew the following conclusions:

- In the three circumstances in which the boiler was mentioned, we received the following comments:
  - "Lower utility bills would be fine," however, the appeal was even greater because the boiler "was new" and there would not be a special assessment in the future to pay for a new boiler.
  - The boiler was a "wonderful selling point."
  - "Realistically, it probably didn't add any value."
  - "About 50 percent of investor buyers care intently about monthly fees associated with owning a rental unit," but the agent was "not sure" if this buyer cared about the boiler.
- Several of the listing agents mentioned that the new boiler might result in lower HOA dues.

Applicable Appraisal Methods for This Energy Efficient Element

All three approaches to value were considered. The cost approach was not applicable, because this is a condo unit and the analysis of a common element would require allocation across all units in the complex. There was sufficient data to develop an indication from the income approach. Likewise, there was sufficient volume of sales for comparison purposes, so this approach was developed. A summary of each approach and a final reconciliation are noted below.

Income Approach

In theory, any expense savings associated with an energy-efficient feature is considered an increase in "net operating income." In this circumstance, after the new boiler was installed, actual heating costs did decrease by $7 per month, per unit. Thus, with enough rental data for the complex, the income approach could be considered applicable to this case study.

There was enough rental data available. Of the 42 units in the subject's complex, 22 are tenant-occupied. Therefore, the income approach was considered as adequately supported. A sample of the rental data for the complex is as follows:

UNIT TYPE	RENTAL RATE PER MONTH	SALES PRICE	GRM[45]
880 Sq. Ft. Unit	$1350	$195,000	144
947 Sq. Ft. Unit	$1425	$219,000	153
1049 Sq. Ft. Unit	$1500	$252,000	168

The subject property is an 880 square-foot unit; therefore, a reasonable gross rent multiplier (GRM) for the subject unit is 144. As noted above, the actual savings on heating bills allocated across all units is $7 per month.

[45] A "GRM" is a Gross Rent Multiplier and is calculated by dividing the Sales Price by the Rental Rate Per Month.

To consider the complex overall, the heating expense savings can be "capitalized" as shown below:

$7 X 144 = $1,008 (rounded to $1,000)
$7 X 153 = $1,071 (rounded to $1,070)
$7 X 168 = $1,176 (rounded to $1,175)

Therefore, the income approach indicates that the boiler might have reasonably contributed $1,000 to the overall value of the subject property at the time of sale.

It was therefore reasonable, using the income approach, to conclude that the high-efficiency boiler added between $1,000 and about $1,200 to the value of the units in the complex. This figure, however, was only given a small amount of weight (10 percent) in the overall reconciliation of value indicators. The value indication was given minimal weight because the data showing that lower utility costs were relevant to homebuyers was weak compared to the sales comparison approach.

Sales Comparison Approach

	Subject	Comp 1	Comp 2	Comp 3
Square Footage	880 Sq. Ft.	880 Sq. Ft.	880 Sq. Ft.	880 Sq. Ft.
Floor Location	Second Floor	Second Floor	First Floor	Garden Level Unit
Boiler	95% Efficient Boiler	Old Boiler	Old Boiler	95% Efficient Boiler
Sales Price	$196,700	$200,000	$195,000	$186,500
Updating	Moderate Updates	Just Superior Updates	Moderate Updates	Just Inferior Updates
Sold Date	Sold 03/2014	Sold 04/2013	Sold 06/2013	Sold 12/2013
Days on Market	40	58	53	39

Based on a paired sales analysis of the sales grid, the only notable differences between the subject and Comp 2 are the boiler and the floor location. The sale prices indicated a $1,700 value difference between the two properties.

Conclusion: The Market Value of the Subject Property

The value indications by the income approach and the sales comparison approach were completed. The analysis and result are as follows:

- The income approach had a value indication of $1,000. However, this was based on a relatively weak data set in which there was no clear indication that utility savings were relevant to the majority of buyers in this market area.
- The sales comparison approach indicated a $1,700 value difference between two units. However, this might have been a reaction to the different floor levels. After discussing this with the area Realtors, we drew the conclusion that the $1,700 was not due to the different floor locations, as there was not a noticeable value difference between the first and second floors.

A weighted reconciliation of ($1,000 X .10) + ($1,700 X .90) indicated that the market value of the subject's new boiler was $1,600 (rounded).

Marketability

The boiler was clearly considered a feature worth mentioning by the majority of the listing agents in the area. However, it did not have a direct impact on the property's marketability. The days-on-market for the two properties with the *new* boiler were highly similar to the days-on-market for properties with the *old* boiler. Therefore, a reasonable conclusion is that marketing time was not impacted (negatively or positively) by the new boiler.

Conclusion

The contributory value of the new boiler appeared to be about $1,600 per unit. The new boiler did not impact marketing time, but was viewed as a positive feature by the majority of the Realtors and homebuyers.

Conclusion:

A new boiler in this condo unit contributed about
$1,600 (.8%)
to the value of the property as of March 14, 2014.

Case Study #4: No HERS and Moderate Updates to Energy Efficiency

Type of home:	Single Family Tract Home	**Year Built:**	1998
Location:	Superior, CO 80027		
Subdivision:	**Rock Creek** A tract-home development with homes built between 1990 and 2003. The majority of homes were built by Richmond American Homes. This subdivision is in the "stable" phase of the neighborhood cycle. Homes are extremely well maintained and lot sizes are typically 5,000 to 12,000 square feet.		
Price Range:	$250,000 to $800,000		
Applicable IECC Code:	Unknown, though homes appear to meet at least the 1995 IECC.		
Energy Efficiency Range in Subdivision:	Most homes are E-F; a very few will be E-A. Significant energy updates are not highly typical in this market area, as most homes are only 15 years old.		
Above-grade Sq. Ft.	2728	**Below-grade Sq. Ft.**	1160
Sold Date:	December 2013	**Finished Below Grade:**	580
Original List Price:	$580,000	**Bed/Bath Above Grade:**	4 bed/2.1 bathrooms
Final List Price:	$559,000		
Sale Price:	$557,000	**Garage:**	2-Car Garage
Lot Size:	9017 sq. ft.	**Lot Location:**	Cul-de-sac
Days on Market:	138 (under contract in 102 days)		
Days on Market for Subdivision:	47		
Market Conditions:	Stable values		

Energy Efficiency Features for This Property

This property is located in a large tract-home development about five miles southeast of the City of Boulder. Most of the homes were built in the late 1990s — prior to any notable energy building codes being in effect. Given that this home is 16 years old, it has reached an age at which it would not be unusual for the mechanical systems to need replacement. The sellers had made the following updates: tankless hot water heater, high-efficiency furnace, humidifier and AC, UV air filter, and radon mitigation. The sellers did not apply for a permit for the energy updates they made (it is common to not apply for the required permit in this market area).

Feedback from the Listing Agent and Selling Agent

The listing agent received feedback from potential buyers about the lack of updates on the property and of a three-car garage. The listing agent did list the energy efficient improvements in the MLS, but no one commented on those. The agent was not sure what the energy upgrades cost.

The selling agent provided no feedback.

Sales Comparison Approach

	Subject	Comp 1		Comp 2	
Sold Price	$557,000		$560,000		$609,900
Sold Date	12/2013	03/2014		12/2013	
Above-grade Sq. Ft.	2728	2728		2728	
Basement Sq. Ft.	1160	800	+2500	1414	+1800
Basement	Standard	Standard		Walkout	-10000
Basement Finish Sq. Ft.	580	800	-4600	1368	-18200
Garage Count	2	3	-5000	3	-5000
Updating	Minimal	Minimal		Very Good	-20000
Energy Efficiency Level	E-A	E-F		E-A	
			$552,900		$558,500
Days on Market:	138	92		145	

Comps 1 and 2 were the same identical model of home as the subject property.

Comp 1 was viewed by this appraiser. The home, overall, had very similar interior finish features compared to the subject property. Comp 1 had no energy updates. The sale price was $5,000 less than that of the subject property.

Comp 2, per the listing agent, had similar energy upgrades compared to that of the subject property (a new high-efficiency furnace with heat pump and climate controls, solar ready rough-in, updated insulation and “low energy costs”). The agent provided the utility bills to potential buyers. The agent felt the energy upgrades may have added value and that, “5K was a decent value for these features;” however, the value premium may be due to the fact that the systems were new, and not necessarily because they were more energy efficient than the old systems. This agent felt that most buyers do not understand energy efficiency and that, “energy efficiency is not high on the list” among potential buyers in this market area.

In conclusion, Comp 1 indicated there was a $5,000 value difference for the subject’s energy efficient related features. This was supported by Comp 2, and generally by the comments made by the listing agent for Comp 2.

Income Approach

It was not possible to reliably develop the income approach. More than 85 percent of homes were owner-occupied. Additionally, actual or estimated utility costs were not available for the subject property or for the comparable properties.

Cost Approach

It was not possible to reliably develop the cost approach. The cost figures for the energy efficient improvements were not available, nor were specifics regarding exact details for the energy efficient updates.

Conclusion

Based on the sales comparison approach, it was reasonable to conclude that a moderate amount of updating made in relation to energy efficiency contributed $5,000 to the sale price of the subject property.

Conclusion:

A moderate level of updating to the overall energy efficiency of the home contributed
$5,000 (.8%)
to the sale price as of December 23, 2013.

Case Study #5: No HERS and a PV System

Type of home:	1970s Remodel	**Year Built:**	1976
Location:	Boulder, Co 80301		
Subdivision:	**Palo Park** A tract-home development built in the late 1970s with average- to good-quality homes. The area has many properties undergoing major renovations and additions. The area is surrounded by very good-quality, newer custom homes.		
Price Range:	$400,000 to $615,000		
Applicable IECC Code:	Homes were built prior to IECC.		
Energy Efficiency Range in Subdivision:	Most homes would be E-F, unless they have been renovated. The renovated homes would be E-A. Rarely, a home may reach the E-G level.		
Above-grade Sq. Ft.	2194	**Below-grade Sq. Ft.**	830
Sold Date:	March 2014	**Finished Below Grade:**	600
Original List Price:	$615,000	**Bed/Bath Above Grade:**	3 bed/2.1 bathrooms
Final List Price:	$615,000		
Sale Price:	$615,000	**Garage:**	2-Car Garage
Lot Size:	9,322 Sq. Ft.	**Lot Location:**	Cul de Sac
Days on Market:	68 (under contract in 1 day)		
Days to Contract for Subdivision:	57		
Market Conditions:	Increasing		

Energy-Efficient Features for the Subject Property

The current sellers purchased the home in 2008 for $546,500, after the home had already been remodeled. After the 2008 purchase, the following updates related to energy efficiency were made:

- Addition of a 9.975 kW photovoltaic system (owned)
- Insulation added (type and quantity not known)
- New hot water heater ($1,200)

The only energy-efficient feature that was studied here was the photovoltaic system. The other two features were too insignificant in regard to the overall value of the property, and therefore, it would not be possible to extract their value contribution, if any, from the sale price.

NOTE: At the time of sale, this property had been the highest-selling property in the subdivision for the last 10 years. The property was sold for $615,000, and the next highest sale price was $557,000.

Feedback from Listing Agent and Selling Agent

The listing agent said that the property was sold in one day with multiple offers. The seller had worked for a photovoltaic company in the past and believed in the benefits of a solar system, and as a result installed a PV system on this home.

The selling agent said that the buyers appreciated the benefits having a PV system, especially given its large size.

Income Approach (PV Value®)

The subject property had a very large photovoltaic system. Exact details for the system were available, and so it was possible to use the PV Value tool available on the internet at www.pvvalue.com. Using this tool, the following is the present value of the energy savings realized from the PV system:

$19,600

Cost Approach

Current actual costs (at the time of sale) were $3,500 per kW. This is based on building permits from the City of Boulder. Therefore:

9.975 kW X $3,500 = $34,912 – 16% depreciation (4 years old/25 years useful life) = $29,326 - $10,000 obsolescence (as the market is only willing to pay 2/3rds the actual cost)[46] = $19,326, rounded to $19,000

$19,000[47]

Sales Comparison Approach

We verified all sales. We documented and derived from market data all adjustments for features other than the photovoltaic system. However, for the sake of simplicity, those adjustments are not discussed in detail in this study. All information for the adjustments is retained in the work files associated with this study.

	Subject	Comp 1		Comp 2		Comp 3	
Sold Price	615,000		$551,000		$580,000		$729,900
Location	Palo Park	Palo Park		Kings Ridge		Northfield	
Sold Date	03/2014	09/2013		05/2013		09/2013	
Lot Size	9322	6098		5401	+30000	6534	
View	Residential	Residential		Residential		Park	-45000
Age of home	38	45		22		5	-33000
Above-grade Sq. Ft.	2136	2497	-16200	2052	0	2859	-32500
Bathroom Count	2.1	2.1		3.0	-5000	2.1	
Basement Sq. Ft.	792	0	+15500	1134	-2400	1074	-2000
Basement Finish	712	0	+10000	1000	-4000	800	

[46] For an in-depth analysis of this conclusion, another study this author conducted is available for reference: The Impact of Photovoltaic Systems on Market Value and Marketability.

[47] Extensive research on photovoltaic systems was conducted in *The Impact of Photovoltaic Systems on Market Value and Marketability*, also written by this author. The findings were found to be applicable to the Boulder area as well.

Photovoltaic System	Yes	None		None		Yes/Similar	
PV system owned?	Yes	n/a		n/a		Yes	
Patio, etc.	Sunroom	Deck	+5000	Deck	+5000	Balcony, Pat.	
Level of Updating	Very Good	Inferior	+30000	Very Good		Very Good	
			$595,300		$603,600		$617,400
Days to Offer:	1	17		8		15	

The gross adjustments for the comparable sales were 17.4 percent (Comp 1), 11.3 percent (Comp 2), and 16.8 percent (Comp 3). Comp 1 lacked a PV system which, per the grid above, showed a value difference of $19,700. Comp 2 lacked a PV system and had a value difference of $11,400. Comp 3 had a PV system, and supported the subject's sale price of $615,000. Thus, Comp 1 and 2 indicated that the possible value of the subject's PV system could reasonably be in the range extending from $11,400 to $19,700. However, full weight was given to Comp 1, since this property is located in the same subdivision as the subject property. Comp 1 indicated that the PV system had a contributory value of $19,700.

$19,700

Marketability

The PV system positively impacted marketability. This home was sold for the highest price in 10 years and went under contract in one day for full price. The selling agent confirmed that the PV system was a notable selling point, as it reduced the energy bills to zero.

Conclusion

The income approach had a value indication of $19,600.
The cost approach had a value indication of $19,000.
The sales comparison approach had a value indication of $19,700.

Most weight (80 percent) was given to the sales comparison approach, as this had the most reliable data, and therefore, a final value indication (rounded) of $19,500 was reasonable and supportable.

Conclusion:

Improving the level of energy efficiency of the home contributed
$19,500 (3%)
to the sale price as of March 28, 2014.

Case Study #6: No HERS and Moderate Updates to Energy Efficiency

Type of home:	1950s Remodel	**Year Built:**	1953
Location:	Denver, Co 80211		
Subdivision:	**Sunnyside** This is a very urban market area where many homes are undergoing extensive updating and remodeling. Homes were first built in Sunnyside in 1886 and as late as 2013. The majority of homes in the subdivision were built in 1908, are one-story homes and have an average of 1,000 square feet above grade.		
Price Range:	$115,000 - $766,000		
Applicable IECC Code:	N/A		
Energy Efficiency Range in Subdivision:	Most homes would be E-F, unless they underwent significant updating. Some newer homes are E-VG, as energy efficiency is a very marketable feature in this transitioning neighborhood.		
Above-grade Sq. Ft.	939	**Below-grade Sq. Ft.**	939
Sold Date:	November 2013	**Finished Below Grade:**	90%
Original List Price:	$415,000	**Bed/Bath Above Grade:**	3 bed/1 bathrooms
Final List Price:	$415,000		
Sale Price:	$395,000	**Garage:**	2-Car Garage
Lot Size:	6,250 Sq. Ft.	**Lot Location:**	Typical Interior Lot
Days to Contract:	5		
Days to Contract for Subdivision:	28		
Market Conditions:	Strong, leaning toward a seller's market		

Feedback from Listing Agent and Selling Agent

The listing agent stated that the property actually went under contract before it was officially listed for sale on MLS, and he was, "sure the buyer appreciated [the energy efficient] enhancements, but it came down to its location." Additionally, while the listing agent did note on the MLS listing that a Green Energy Disclosure addendum was attached to the listing, it was blank.

The selling agent did not provide any feedback.

Information Available Regarding the Subject Property

In regard to the overall energy efficiency of the subject property, the only information available is summarized below, as the subject property sold three times between 2009 and 2013:

SOLD PRICE	SOLD DATE	DETAILS OF SALE
$223,800	12/01/2009	Sold as a fixer upper
$337,900	03/24/2010	Sold after the entire home was remodeled. The remodel did not include any noted improvements to the energy efficiency of the home.
$395,000	11/15/2013	Between the last sale and this sale, the following improvements were made to the property: $11,000 new roof $13,000 covered patio w/ skylights and ceiling fan $6,000 new driveway and gate $2,500 landscaping improvements $2,500 built in closets $1,500 built in desk $1,500 wall and ceiling texturing $4,500 high-efficiency furnace $600 high-efficiency evaporative cooler $500 insulation (unknown cost) Triple-pane windows

The home had undergone a standard remodel between 2009 and 2010, but this remodel did not include any improvements specifically aimed at improving the overall energy efficiency of the home. The subsequent homeowner spent $11,000 on energy efficient improvements (assuming the windows cost $5,400, a reasonable estimate per construction data sources) and an additional $38,000 on other improvements.

Between 2010 and 2013, the property increased in value by $57,100 (after having received $49,000 in improvements). There was no information available regarding utility costs.

Data Available for Comparison

After considering comparable sales and market value trends for the area, a paired sales analysis was not feasible for studying the value contribution of just four small items related to energy efficiency (specifically, furnace, windows, evaporative cooler and insulation).

However, one data set is worth highlighting. After analyzing 28 fix-and-flip projects that occurred in the Sunnyside subdivision between January 2009 and December 2013, exactly half made mention of updates related to energy efficiency in their MLS comment sections. Those properties are noted below, along with the exact comments the listing agents used in their MLS listings:

ADDRESS	SOLD DATE	SOLD PRICE	COMMENTS IN MLS RELATING TO ENERGY EFFICIENCY
1838 W 39th Ave	Sold 08/14/2013	$335,000	"New Pella windows, Newer furnace, Newer hot water heater, Newer insulation"
1740 W 40th Ave	Sold 11/01/2012	$389,000	"Top of the line New Trane Furnace"
2964 W 40th Ave	Sold 07/31/2009	$332,000	"New Furnace/H20 heater"
	Resold 11/01/2013	$380,000	"New windows, New Systems"
4023 Alcott St	Sold 05/29/2013	$318,000	"New windows"
4404 Beach Ct	Sold 12/03/2010	$247,500	"All Systems new"
4533 Beach Ct	Sold 04/28/2009 Resold 05/31/2013	$367,100 $435,000	No comments on energy-efficient features "Solar System. No energy bills. Solatube lighting. Newer high-efficiency furnace"
4235 Bryant St	Sold 08/15/2011	$407,000	"All new systems including furnace, electrical, plumbing."
4038 Lipan St	Sold 09/29/2009	$235,000	"New windows, furnace, central AC"
3911 Osage St	Sold 11/21/1011	$280,000	"New furnace, hot water heater, high-efficiency windows"
4156 Quivas St	Sold 04/28/2011	$318,800	"New furnace, H20 heater, updated electrical and plumbing"
3929 Shoshone St	Sold 03/05/2010	$214,000	"New windows"
3900 Vallejo St	Sold 09/23/2010	$277,200	"ENERGY STAR appliances, energy and green updates, Anderson windows, high-efficiency furnace"
4344 Wyandot St	Sold 08/28/2013	$372,500	"TRUE energy efficient remodel, highly efficient, comfortable, ENERGY STAR appliances, tankless hot water heater, upgraded insulation and air sealing, high-efficiency furnace and AC, Whisper Green Fan, THIRD PARTY CERTIFIED"
4344 Zuni St	Sold 12/14/2011	$181,000	"Newer furnace and AC"

Marketability

The subject property went under contract before it was listed for sale, and as a result it cannot be compared to homes that had to be listed for sale in order to obtain offers. That said, the energy-efficient features in the home were of interest to the market, and therefore had a positive impact on marketability.

Conclusion

Given the limited information available for the subject property, it was not possible to develop an opinion of value in regard to the overall level of energy efficiency. However, it was clear that updates related to energy efficiency were an expectation in this market area. For example, buyers expected newer utility systems (and newer systems are much more efficient than older systems).

Because there are indications that this market places value on improvements made to the level of energy efficiency in a home, it would be reasonable to include any value contribution for the new energy efficient features in just one adjustment: an adjustment for overall condition and updating. Thus, energy efficiency is relevant to this property and did contribute to value; however, that value could not be separated from the condition and updating value.

Conclusion:

Increased energy efficiency is an expectation in this market area for updated homes that are over 50 years of age.

Case Study #7: No HERS and Significant Upgrades to Energy Efficiency

Type of home:	1900s Remodel	**Year Built:**	1908
Location:	Denver, Co 80211		
Subdivision:	**Sunnyside** This is a very urban market area where many homes are being renovated. Homes were first built in Sunnyside in 1886 and as late as 2013. The majority of homes in the subdivision were built in 1908, are one-story homes, and have an average of 1,000 square feet above grade.		
Price Range:	$115,000 - $766,000		
Applicable IECC Code:	N/A		
Energy Efficiency Range in Subdivision:	Most homes would be E-F, unless they underwent significant updating. Some newer homes are E-VG, as energy efficiency is a very marketable feature in this transitioning neighborhood.		
Above-grade Sq. Ft.	720	**Below-grade Sq. Ft.**	171
Sold Date:	February 2013	**Finished Below Grade:**	0%
Original List Price:	$249,000	**Bed/Bath Above Grade:**	2 bed/1 bathrooms
Final List Price:	$244,000		
Sale Price:	$244,000	**Garage:**	1-Car Garage
Lot Size:	3,120 Sq. Ft.	**Lot Location:**	Typical Interior Lot
Days to Contract:	46		
Days to Contract for Subdivision:	28		
Market Conditions:	Balanced		

Details Regarding the Subject Property

This home was purchased as a fix-and-flip on July 19, 2012 for $125,000. The property was then remodeled and resold for $244,000. The MLS listing stated that the property had had many updates related to energy efficiency:

NAHB Gold-certified
71% water savings
45% energy savings (save $520 per year)
Non-VOC insulation in attic and crawl space
Efficient light fixtures
HERS test was conducted
High-efficiency furnace and hot-water heater
Newer windows
ENERGY STAR appliances

Feedback from Listing Agent and Selling Agent

The listing agent worked with the seller (who renovated properties) on other renovations of 100-year-old-homes. This property was the first remodel the seller had completed after the MLS listings began to

offer Green Fields, and so the agent was not yet in the habit of putting energy certifications into the MLS. Therefore, the actual certifications and documents associated with energy efficiency were not available for viewing.

In regard to the sale of this home, the listing agent stated that the overall energy efficiency of the home was a deciding factor for the buyers. Typically, this seller will price his remodel projects on the very high-end for the market area. What he has found is that buyers end up justifying paying on the high end for a home because it has so many energy-efficient features. According to the listing agent, that is what happened in this circumstance. There were other renovated properties for sale in the area; however, none had the high-end energy-efficient features this property did.

The selling agent did not provide any feedback.

Income Approach (Gross Rent Multiplier)

As per the MLS listing, the home experiences a 45 percent savings on utility bills. Per the listing agent, this 45 percent equaled $520 in savings per year and was based on the HERS certification. While the $520 figure was not verifiable (the HERS audit was not available for viewing), the information was used as a test of reasonableness. Using a Gross Rent Multiplier (GRM), it is possible to develop an indication of value for the subject property's level of energy efficiency.

Developing a GRM:

> We located one rental property that was identical in function to the subject property, but we could not verify its condition. Its rent is $1,695 per month. The value of this rental would be just less than the subject property, as the rental property does not have a garage. Therefore, a reasonable GRM is $240,000/$1695 = 142.
>
> This GRM was supported by three other rental properties (not disclosed here, but retained in the work file) that were sold at prices between $280,000 and $320,000, with GRMs from 122 to 130. The higher the sale price, the lower the GRM. Thus, the above data supports the conclusion that a GRM of 142 is reasonable for the subject property.

Using the GRM to develop an opinion of value for the subject property's level of energy efficiency:

142 GRM X ($520/12 months) = $6,106 as an indication of value

Given the fact that much of the data noted above was not absolutely verified, the income approach was given no weight in the reconciliation of values.

Sales Comparison Approach

Three nearly identical comparable sales were located in the subject property's immediate market area:

	Subject	Comp 1		Comp 2		Comp 3	
Sold Price	$244,000		$233,500		$232,500		$222,500
Sold Date	02/2013	02/2013		02/2013		01/2013	
Lot Size	3120	3222		6250	-5000	5600	-5000
View	Residential	Residential		Residential		Traffic	20000
Age of Home	105	52		100		65	
Above-grade Sq. Ft.	720	796		788		702	
Bed/Bathroom Count	2/1	2/1		2/1		2/1	
Garage	1 Garage	1 Garage		None	+5000	2 Garage	-5000
Level of Updating	Excellent	Excellent		Excellent		Excellent	
Energy Efficiency Level	E-G	E-F		E-F		E-F	
			$233,500		$232,500		$232,500
Days to Offer:	46	11		32		50	

All comps are verified sales. Like the subject property, all properties have been fully remodeled and updated; however, they did not have notable energy efficient updates, other than new windows. After amenity adjustments, Comps 1, 2 and 3 sold for $10,500, $11,500 and $11,500 less than the subject property.

In conclusion, the sales comparison approach supported a final contributory value of $11,000 for the subject property's superior level of energy efficiency. However, this $11,000 also reflects green updating[48] (and not just energy efficiency improvements).

Marketability

The subject property took longer to sell than the majority of the homes in the area, as the seller purposefully listed the sale price a bit higher than was reasonably indicated for the market. The seller knew that the superior features of the home would command a value slightly higher than all other sales, even though the home would likely take a little longer to sell. In this case, the average home was under contract in 28 days, while the subject property was under contract in 46 days.

Conclusion

As noted, the weakness in the income approach stemmed from the fact that the estimated utility savings data was not verifiable. Therefore, the sales comparison approach was given the full weight in the reconciliation of values.

[48] As noted at the beginning of this study under "Definition of Energy Efficiency," energy efficiency is only one element of green building. If a home is a green building, sometimes, it is not possible to extract the contributory value only of the energy efficiency element, as the "green" features are intertwined with the energy-efficient features.

Conclusion:

The increased energy efficiency **and** *green remodel* of this home had a contributory value of $11,000 (4.5%)
as of February 27, 2013.
(It was not possible to separate the "green value" from the "energy value.")

Additional Note

Even though the income approach was not given any weight, it is interesting to note that it had an indicated value contribution of roughly $6,000. The income approach only reflected the value contribution for increased energy efficiency.

The sales comparison approach, on the other hand, indicated that the combination of the green remodel features and the increased energy efficiency of the home contributed a total of $11,000 to the property's sale price.

It is plausible, then, that of the $11,000, $6,000 of the value applied to energy updates and $5,000 applied to green remodel updates.

Case Study #8: HERS 118

Type of home:	1940s Remodel	**Year Built:**	1941
Location:	Denver, Co 80220		
Subdivision:	**East Colfax** A starter home subdivision consisting of WWII homes. The average home was built in 1938, is less than 900 square feet above grade and has no basement. Many homes in the neighborhood are being remodeled and updated; however, there is still a notable percentage of homes needed significant updating.		
Price Range:	$115,000 - $260,000		
Applicable IECC Code:	N/A		
Energy Efficiency Range in Subdivision:	Most homes would be E-P or E-F, unless they underwent significant updating. Homes with significant updating may have levels as high as E-A.		
Above-grade Sq. Ft.	843	**Below-grade Sq. Ft.**	157
Sold Date:	February 2014	**Finished Below Grade:**	0%
Original List Price:	$189,000,	**Bed/Bath Above Grade:**	2 bed/1 bathrooms
Final List Price:	$189,000		
Sale Price:	$189,000	**Garage:**	None
Lot Size:	6,100 Sq. Ft.	**Lot Location:**	Typical Interior Lot
Days to Contract:	94		
Days to Contract for Subdivision:	39		
Market Conditions:	Balanced		

Details Regarding the Subject Property

This home was purchased as a fix-and-flip on November 16, 2011 for $118,000. The property was then remodeled and resold for $189,000 – a 60 percent increase.

HERS Rating

The HERS rating for this property was 118. Homes of this vintage, market area and quality of construction (with specific energy upgrades) would typically have HERS ratings much higher than 118 (see the *Vintage Homes & HERS Rating* chart noted earlier in this study). Comparatively, this property was assumed to be notably more efficient than other homes directly surrounding it.

Energy Efficiency Features for This Property

The home was built in 1941 and, prior to its most recent sale, had undergone a major remodel. During the remodel, the home received new high-efficiency lighting, R-50 attic insulation, R-15 basement/crawl space insulation and other general energy efficiency updates.

The MLS did not include a copy of the HERS certificate or the Green Disclosure, but it did indicate that those documents were available to potential buyers.

Comments by Listing Agent and Selling Agent

The selling agent stated that the buyers were considering buying this property as well as a near-identical property that had a lower list price. The near-identical property did not have energy efficient updates, and so the buyers opted to pay more to purchase the subject property, which had energy efficient updates. The buyers did believe that they would be saving money on utility costs, and this was a factor they took into consideration when opting to pay more for the subject property.

The listing agent provided excellent feedback. This particular listing agent is highly educated in all matters concerning green building and overall energy efficiency. As a result, she creates specific marketing materials that are visually easy-to-read and understand. Per this listing agent, energy efficiency "is not in most people's top-5 wanted items," however, "if you show them a property with EE and tell them why it's good, then they become aware of it and are typically willing to pay for it." Additionally, the agent noted that education was a key to buyers' willingness to pay more for energy efficiency, as "EE is something they are typically not aware of until they are educated about it."

Sales Comparison Approach

The sales comparison approach was applicable in this case. Two comparable sales were located from the subject's immediate subdivision:

	Subject	Comp 1		Comp 2	
Sold Price	$189,000		$191,000		$164,200
Sold Date	02/2014	01/2014		10/2013	
Other	No	No		Yes*	+10,800
Above-grade Sq. Ft.	843	1201	-9000	886	
Basement Sq. Ft.	147	0	+1500	0	+1500
Basement Finish Sq. Ft.	0	0		0	
Bathroom Count	1	2	-5000	1	
Garage Count	0	1 Carport	-2000	0	
Quality of Remodel	Good	Good		Good	
Energy Efficiency Level	E-A	E-F		E-F	
			$176,500		$176,500
Days on Market:	117	150		126	

*Comp 2 had an unusual circumstance that resulted in the $10,800 adjustment. After placing the home on the market, the seller decided to sell the home to her daughter at a reduced price; the $10,800

reflects atypical seller concessions for the buyer. The listing agent confirmed that the actual sale price was $10,800 higher than $164,200, or $175,000.

The two comparable sales had an identical level of updating (sans energy efficient updates) compared to the subject property; however, they sold for approximately $12,000 less.

Marketability

The subject property took longer to sell than most properties in the neighborhood. As the listing agent noted, this was because buyers in this market area needed to be educated with regard to energy efficiency before they recognized its value. The listing agent worked to educate all potential buyers.

Contributory Value for Updating

The subject property was the highest priced home (for its size and type) in the subdivision to have been sold in the recent past. As noted earlier, many buyers fix and flip properties in this subdivision. An analysis of other fix-and-flip properties from the immediate market area showed that the subject property realized the greatest value increase after it was remodeled.

None of the three comparable sales noted below had noted energy efficient updates:

	SUBJECT PROPERTY	**1700 Wabash St**	**1910 Verbena St**	**1145 Alton St**
Subdivision	**East Colfax**	**Montclair**	**Montclair**	**Brooklyn**
Year Built	1941	1948	1949	1950
Sale Price Prior to Remodel	11/16/2011 for $118,000	05/15/2013 for $99,000	03/29/2013 for $96,800	08/23/2013 for $111,900
Sale Price After Remodel	02/18/2013 for $189,000	08/30/2013 for $152,000	07/17/2013 for $142,000	01/30/2014 for $159,900
% Value Increase	60%	53%	46%	43%

Based on the above market data, the subject property had the highest market premium due to its renovation. (*NOTE: There were three other homes in this subdivision that had 63, 86 and 92 percent value increases after renovation. However, all three of these homes sold in the under-$130,000 price range (after remodel), which is a different market segment.)*

The above data supports the conclusion that the increased energy efficiency of the subject property added value in this market area.

Conclusion:

The increased energy efficiency of this home shows a contributory value of
$12,000 (6.0%)
as of February 18, 2014.

Case Study #9: HERS 109

Type of home:	1950s Remodel	**Year Built:**	1958
Location:	Denver, Co 80224		
Subdivision:	**Virginia Vale** Developed in the late 1950s and early 1960s, the majority of homes are brick ranch-style homes. Renovations are common. Lot sizes are typically .17 acres in size and homes vary from 1,100 to 1,800 square feet above grade.		
Price Range:	$176,000 to $364,000 Median: $288,000		
Applicable IECC Code:	N/A (homes were built in the late 1950s and early 1960s)		
Energy Efficiency Range in Subdivision:	Most homes would be E-F, unless they underwent significant updating.		
Above-grade Sq. Ft.	1406	**Below-grade Sq. Ft.**	1107
Sold Date:	April 2013	**Finished Below Grade:**	90%
Original List Price:	$349,900	**Bed/Bath Above Grade:**	3 bed/2 bathrooms
Final List Price:	$335,000		
Sale Price:	$335,000	**Garage:**	1-Car Garage
Lot Size:	7,990 Sq. Ft.	**Lot Location:**	Backs to power line easement
Days to Contract:	25	Total Days On Market:	68
Days to Contract for Subdivision:	40	Total Days on Market for Subdivision:	76
Market Conditions:	Strong, leaning toward a seller's market		

Features for the Subject Property

This property was remodeled in such a way as to specifically maximize its green building rating and its energy efficiency rating. The home is an NAHB Bronze-certified home and has a HERS certification of 118. Features include 70 percent energy savings, 20 percent water savings, ENERGY STAR appliances, upgraded insulation, air sealing, high-efficiency furnace and AC unit and new windows.

Listing Agent and Selling Agent Interview

The selling agent did not believe that the overall energy efficiency of this property was something the buyers cared about. The agent believed the buyers would have paid the same with or without the energy-efficient features. The agent then stated that the home's original appraisal came in $40,000 below contract. The sellers protested the appraisal by noting that the appraiser had made no mention of the green or energy efficient design features. The second appraisal did address said features, and the property was then appraised near (or at) the contract price. These buyers went on to purchase the home at the price noted in the second appraisal.

The listing agent believed that the energy-efficient features were reflected in the sale price of the property. At the time, this had been the highest-selling home in the subdivision since 2007, and the highest price per square foot since 2007.

Details of the Subject Property

The subject property was purchased on November 13, 2012 for $202,000, and then was entirely remodeled. After completing a Third-Party Certified Green remodel (certified at the NGBS Bronze level) and before-and-after HERS ratings, the owner placed the home on the market and sold it for $335,000. A full energy audit and HERS report were provided for this property. Provided were before-and-after estimated utility costs, a list of the exact energy efficiency improvements made, and an estimate of what those changes cost:

Changes Made to The Subject Property				
COMPONENT	**BEFORE REMODEL**		**AFTER REMODEL**	
Ceiling Insulation	R-9	U=0.117	R-38, Blown	U=0.26
Frame walls	Uninsulated	U=0.267	R-13	U=0.094
Rim Joists	Uninsulated		R-13	
Foundation walls	Uninsulated		R-7	
Doors	1¾ Wood Solid Core	U=0.329	Steel Polyurethane	U=0.283
Windows	Single Metal/Storm	U=0.982	Dbl/LoE/Vinyl, JeldW	U=0.340
Frame Floors	None		Uninsulated	U=0.311
Duct Leakage	Leaky, uninsulated		HERS Default	
Heating	100 kBtuh, 90.0 AFUE		66.4 kBtuh, 95.0 AFUE	
Cooling	None		AC, 30.0 kBtuh, 14.0 SEER	
Water Heating	Conventional, Gas, 0.56 EF		Conventional, Gas, 0.65 EF	
Programable Thermostat	No		Yes	
Actual cost of these changes:			$13,608	
Estimated energy costs prior to remodel:			$274 per month	
Estimated energy costs after remodel:			$130 per month	

Comparable Sales Analysis

The subject property was the highest-priced sale to occur in the subdivision in five years. It is common and typical for buyers to fix and flip properties in this subdivision. An analysis of other fix-and-flip properties from the Virginia Vale subdivision is as follows:

	SUBJECT PROPERTY	**814 S Ivy St**	**648 S Jasmine Way**	**916 S Jersey St**
	Virginia Vale	**Virginia Vale**	**Virginia Vale**	**Virginia Vale**
Year Built	1958	1957	1958	1958
Sale Price Prior to Remodel	10/29/2012 for $202,000	08/09/2011 for $190,000	06/28/2013 for $193,400	10/17/2012 for $205,000
Sale Price After Remodel	04/30/2013 for $335,000	12/02/2011 for $280,000	11/08/2013 for $288,000	01/23/2013 for $307,500
% Value Increase	66%	47%	49%	49%

All of these properties were total gut-and-remodel properties. The only difference between them is that the subject property had green and energy efficient upgrades, whereas the other properties did not.

Based on the above data, the total price increase for the subject property was $31,000, $39,000 and $43,000 higher than each of the three comparable sales. This price increase is attributed to the increased energy efficiency of the home and the increased green building features – representing a 9-12 percent market premium for building green and energy efficiently.

Cost Approach

According to the owner, the actual costs of the energy efficiency improvements were $13,608. This can be compared to the various costs estimates provided in the energy audit document, which estimated the following costs:

RECOMMENDED IMPROVEMENT	COSTS	ANNUAL SAVINGS	REBATES
Reduce Water Heater Temp	$0	$15	$0
Replace Lighting with CFL or LED	$80	$79	$40
Insulate Basement Walls	$447	$77	$0
Insulate Walls	$2801	$185	$800
Upgrade Water Heater	$1223	$67	$100
Seal Air Leaks	$636	$29	$160
Add Attic Insulation	$2290	$73	$350
Install New Windows	$10,262	$140	$0
Replace Refrigerator	$1335	$21	$15
Upgrade Heating System	$2986	$38	$200
Seal Duct Work	$200	$0	$0
Programmable Thermostat	$90	$0	$25
Upgrade Cooling System	$2500	$0	$550
Total:	$25,760*		$2240

*The total estimated costs are $25,760 - $2,240 = $23,520.

Actual costs were $13,608. Estimated costs were $27,000. The estimated costs likely reflected retrofit costs (which are higher), as well as profit and overhead for the contractor. The $13,608 figure was the contractor's actual cost, not including profit and overhead. The homeowner stated that it was much cheaper to make energy updates when the entire interior had been gutted and was easy to access. Therefore, part of the explanation for these different cost estimates is that one set appears to be retrofit costs, and the other set of actual costs is the result of having easy access to the interior "guts" of the home.

Income Approach

The present value of the energy savings can be calculated using a discounted cash flow analysis. Calculations were made using www.energytools.com:

Life of Measure:	20 Years
Annual Energy Savings:	$1728
Energy Price Inflation:	3% per year
Operating Costs & Maintenance	3% per year
Financing Rate:	5%
PRESENT VALUE =	$27,587

This figure has no relation to actual costs directly associated with energy efficient improvements, but is similar to the estimated costs.

Marketability

The home was sold nearly twice as quickly as other homes in the subdivision.

Conclusion

Even though these particular buyers were not highly interested in energy efficient (and green features), the majority of the market participants are interested in these features. Since the typical buyer would pay a premium for these features, these particular buyers had to pay that market premium[49] in order to compete. Thus, the energy-efficient features added value at the time of sale.

The sales comparison approach indicated that the subject property experienced a price increase of between $31,000 and $43,000 due to having had both *green* and *energy efficient* updates. From this data, it was not possible to further discern what portion of the premium was due to building green and what portion was due to the improved energy efficiency. Therefore, the sales comparison data was not useful for determining the market value premium of the energy-efficient features alone.

The income approach indicated a value of $27,000 (rounded). This is a moderately reliable indicator, as actual inflation rates and operating expenses are estimated.

The cost approach indicated that actual costs were $13,600 and that estimated costs were $27,000 (rounded). As previously noted, the $27,000 figure appears to be more reflective of retrofit costs. Since the actual costs to the homeowner do not reflect profit and overhead, they are not a true representation of "costs in the market place" and are viewed as a weak indicator. Therefore, the $27,000 contributory value was a reasonable indicator of value added.

The only conclusion we can draw is that trying to separate out the value of green updates from the value of energy efficiency can be complex, and in some cases, may not be very realistic. It is clear, in this case, that improved energy efficiency had a marked impact on value, but it is also extremely likely that that premium is, at least in part, contributed to green updates.

Conclusion:

Improved energy efficiency contributed around
$27,000 (8%)
to the sale price of the property as of April 30, 2013.
(It is highly probable this value premium **included** Green updates as well).

[49] Just as a buyer who has no school-aged children may want to buy a home in an area that includes a highly sought-after school, the buyer will have to pay the market premium to live in the school district in order to compete.

Case Study #10: HERS 90

Type of home:	1970s Remodel	**Year Built:**	1973
Location:	Denver, Co 80211		
Subdivision:	**Sunnyside** This is a very urban market area where many homes have undergone extensive remodeling. Homes were first built in Sunnyside in 1886 and as late as 2013. The majority of homes in the subdivision were built in 1908, are one-story and are an average of 1,000 square feet above grade.		
Price Range:	$115,000 - $766,000		
Applicable IECC Code:	N/A		
Energy Efficiency Range in Subdivision:	Most homes would be E-F, unless they underwent significant updating. Some newer homes are E-VG, as energy efficiency is a very marketable feature in this transitioning neighborhood.		
Above-grade Sq. Ft.	906	**Below-grade Sq. Ft.**	906
Sold Date:	October 2012	**Finished Below Grade:**	90%
Original List Price:	$369,500	**Bed/Bath Above Grade:**	2 bed/1 bathrooms
Final List Price:	$344,500		
Sale Price:	$344,500	**Garage:**	2-Car Garage
Lot Size:	6,098 Sq. Ft.	**Lot Location:**	View of Residential Homes
Days to Contract:	31		
Days to Contract for Subdivision:	28		
Market Conditions:	Strong, leaning toward a seller's market		

Features for the Subject Property

According to the MLS listing, the property is "HERS-rated" and has a Green Disclosure; however, neither of these documents was attached to the MLS listing. The MLS listing did state that the home had a "HERS 90 rating, high-efficiency furnace, high-efficiency water heater, high-efficiency AC unit, water efficient features, ENERGY STAR appliances, new insulation, lower utility bills," and was "10 percent more efficient than a new home."

Listing Agent and Selling Agent Interview

The **listing agent** and the **selling agent** were one and the same. The agent was not available for comment.

Comparable Sales Analysis

While an exact paired sales analysis was not available, we found other data that was relevant. It is common for buyers to fix and flip properties in Sunnyside, and we discovered the following sale/resale properties:

	SUBJECT PROPERTY	3930 Bryant St	4324 Decatur St
Subdivision	**Sunnyside**	**Sunnyside**	**Sunnyside**
Year Built	1973	1907	1905
Sale Price Prior to Remodel	04/20/2012 for $161,700	01/27/2012 for $169,900	07/08/2011 for $175,500
Sale Price After Remodel	10/26/2012 for $344,500	04/18/2012 for $275,000	03/28/2012 for $345,000
% Value Increase	213%	162%	197%

All of these properties were total gut-and-remodel properties. The only difference between them was that the subject property had many energy efficient upgrades, whereas the other properties did not. Based on the above data, the total profit for the subject property was notably higher than the other fix-and-flip properties. Since the only difference between the subject property and the two other properties was the increased energy efficiency, it is reasonable to conclude the value difference was attributed to energy efficiency. However, since no other data was available, and we could not obtain details on the subject property's exact energy efficient upgrades, this one data set is not sufficient to draw a supportable conclusion on contributory value.

Marketability

Marketing times for this home were identical to other homes in the neighborhood.

Conclusion

Little verifiable data was available for this property. The only conclusion we can draw is that this market area values improved energy efficiency. This conclusion is supported by Case Study #6 and Case Study #7 (both of which are located in the subject property's subdivision). Case Study #6 and Case Study #7 indicated value premiums of more than 0 percent and less than 4.5 percent.

Conclusions for this market area:

Improved energy efficiency contributed to market value more than 0%, but less than 4.5%.

Case Study #11: HERS 87

Type of home:	1940s remodel	**Year Built:**	1941
Location:	Denver, Co 80221		
Subdivision:	**Regis** This is a very urban market area with many homes having undergone extensive renovation. Homes were first built in 1900. The majority of homes in the subdivision are one-story homes with an average of 1,000 square feet above grade.		
Price Range:	$96,000 to $459,000		
Applicable IECC Code:	N/A		
Energy Efficiency Range in Subdivision:	Most homes would be E-F, unless they underwent significant updating. Some newer homes are E-VG, as energy efficiency is a very marketable feature in this transitioning neighborhood.		
Above-grade Sq. Ft.	1090	**Below-grade Sq. Ft.**	0
Sold Date:	April 2012	**Finished Below Grade:**	n/a
Original List Price:	$220,000	**Bed/Bath Above Grade:**	2 bed/2 bathrooms
Final List Price:	$220,000		
Sale Price:	$209,220	**Garage:**	1-Car Garage
Lot Size:	6,250 Sq. Ft.	**Lot Location:**	Typical Interior Lot
Days to Contract:	42		
Days to Contract for Subdivision:	42		
Market Conditions:	Balanced.		

Details Regarding the Subject Property

Based on the MLS listing, this property was nominated for NAHB's Green Remodel of the Year.[50]

This home was purchased as a fix-and-flip on November 9, 2011 for $95,000. The property was then remodeled and resold for $209,200. The MLS listing stated that the property had had many upgrades related to energy efficiency:

NAHB Emerald-certified
69% energy savings
WaterSense fixtures
High-efficiency furnace
High-efficiency direct vent hot water heater
Non-VOC insulation, non-VOC paint
Non-VOC paint

[50] This is a part of a nationwide contest. For more information go to www.nahb.org and look under the "Green Awards Information" section.

No actual documentation was available for these features, and the above information is all that was obtained.

Listing and Selling Agent Comments

The listing agent and the **selling agent** for this property were one and the same. The agent sold the property noted in Case Study #7. Her comments for this case study were the same as for that case study. Basically, this seller priced his homes at the top of the market and was able to get those prices because of the green and energy-efficient features.

Sales Comparison Approach

The subject property was sold for $209,220, the highest sale price since the year 2009 for homes with a square footage under 1,100 above grade in the immediate area.

Two nearly identical comparable sales were located in the subject property's immediate market area:

	Subject	Comp 1		Comp 2	
Sold Price	$209,220		$174,500		$175,000
Sold Date	04/2012	04/2012		11/2011	
Lot Size	6250	6250		6250	
View	Residential	Residential		Residential	
Age of Home	71	71		72	
Above-grade Sq. Ft.	1090	1137	-1900	934	+6200
Bed/Bathroom Count	2/2	3/2	0	3/1	0
Garage	1 Garage	None	4000	2 Garage	-4000
Level of Updating	Excellent	Excellent		Excellent	
Energy Efficiency Level	E-G	E-F		E-F	
			$176,600		$177,200
Days to Offer:	42	109		22	

All comps are verified sales. Like the subject property, all properties have been fully remodeled and updated; however, they did not have notable energy efficient upgrades other than new windows.
Of additional note, Comp 1 was previously purchased on September 6, 2011 for $85,000 as a fixer-upper (the subject property was previously purchased on November 9, 2011 for $95,000 as a fixer-upper).

Thus, while the subject property increased by 220 percent after the remodel, Comp 1 only increased by 204 percent after the remodel. Comps 1 and 2 were sold for $32,620 and $32,020 less than the selling price of the subject property.

In conclusion, the sales comparison approach supported a final contributory value of $32,000 due to the subject property's superior level of energy efficiency.

Marketability

Marketing times were the same for the subject property compared to the rest of the neighborhood.

Reconciliation

The sales comparison approach offered the only data. The sales comparison approach had a contributory value indication of $32,000.

Conclusion:

The increased energy efficiency **and** *green remodel* of this home had a contributory value of $32,000 (15%)
as of February 27, 2013.
(It was not possible to separate the green value from the energy value).

Case Study #12: HERS 83

Type of home:	1960s remodel	**Year Built:**	1963
Location:	Boulder, CO 80303		
Subdivision:	**Frasier Meadows** This neighborhood features mostly custom ranch-style homes built in the late 1950s through the late 1970s. Homes are on large, one-third acre lots. Major renovations are common in this market area.		
Price Range:	$340,000 - $1,100,000		
Applicable IECC Code:	N/A		
Energy Efficiency Range in Subdivision:	Most homes would be E-F, unless they underwent significant updating. Homes with major renovations will be E-G or E-VG.		
Above-grade Sq. Ft.	2575	**Below-grade Sq. Ft.**	0
Sold Date:	April 2013	**Finished Below Grade:**	n/a
Original List Price:	$845,000	**Bed/Bath Above Grade:**	4 bed/3 bathrooms
Final List Price:	$845,000		
Sale Price:	$816,000	**Garage:**	2-Car Garage
Lot Size:	16,683 Sq. Ft.	**Lot Location:**	Typical Interior Lot
Days to Contract:	11		
Days to Contract for Subdivision:	88		
Market Conditions:	Balanced.		

Information for the Subject Property

AVAILABLE INFORMATION	INFORMATION NOT AVAILABLE
Listing agent comments in MLS regarding energy efficiency: "5-Star HERS rating"	Utility bills
HERS Certificate is attached to MLS listing. The one-page document gives the following information: Date issued: 08/01/2012 HERS rating is 83 95% efficient furnace 14 SEER AC 65% EF water heaters 215 CFM duct leakage to outside Insulation: R-35 vaulted ceiling, R-40 ceiling, R-13 foundation Windows: low E .27/.25 Air infiltration: Htg:2065 Clg:2065 CFM50 Estimated Annual energy cost will be $2209	Estimated annual energy savings Known range of HERS values for homes in subdivision (though they are very likely in the HERS 130+ range) Full energy audit Permit information Cost of energy upgrades Gross rent multiplier (not a rental neighborhood) HERS ratings for comparable sales

Comments from Listing and Selling Agent

The listing agent actively advertised the HERS rating of the property and stated that the HERS 83 rating was very good for this property. The energy efficiency of the home was a positive marketing feature and it did increase the value of the home "a little" based on "the annual utility savings." The buyers were interested in the overall energy efficiency and did request a copy of the utility bills.

The selling agent stated that the buyers were most interested in the exceptional remodel the property had undergone. The agent thinks the utility bills were reviewed by the buyers. Overall, the lifestyle offered by the home was of greatest interest to the buyers, and the utility bills were just a curiosity for them, but not a deciding purchasing factor.

Income Approach

There was not enough data available to develop a credible opinion of contributory value using the income approach. The only information available related to utility costs was the estimated annual utility costs ($2,209); however, there was nothing to compare against these figures.

Cost Approach

The cost approach would not have been reliable in this circumstance. This is a 50-year-old home that underwent a major remodel. It is not possible to develop a reliable cost approach for a home of this age and featuring both old and new components.

Additionally, no cost figures were available in relation to the actual remodel. Finally, it was not possible to know which precise and exact features were directly associated with the subject's level of energy efficiency. Without knowing *which* features around which to create a cost estimate, there is no way to develop a cost approach.

Sales Comparison Approach

Two comparable properties were sold in the subject's subdivision. Both underwent the same level of renovation as the subject property:

	Subject	Comp 1		Comp 2	
Sold Price	$816,000		$865,000		$857,000
Sold Date	04/2013	06/2013		05/2014	
Lot Size	16683	14462		13939	
View	Residential	Residential		Residential	
Age of Home	50	47		43	
Above-grade Sq. Ft.	2575	2912	-18000	2222	19000
Basement Sq. Ft.	0	800	-11200	1690	-24000
Basement Finish	0	800	-16800	1212	-25000
Bed/Bathroom Count	4/3	3/3		4/3	
Garage	2 Garage	2 Garage		3 Garage	-10000
Level of Updating	Excellent	Excellent		Excellent	
Energy Efficiency Level	E-G	Unknown		Unknown	
			$819,000		$817,000
Days to Offer:	11	13		48	

The two comparable sales did not prove to be useful as value indicators for the subject property's level of energy efficiency. The reasons for this follow.

The City of Boulder requires properties that undergo major renovations to submit an energy audit along with all building permit applications. Boulder requires all major renovations to meet a minimum HERS rating (the minimum will vary by property based on square footage):

Effective February 1, 2008, the City of Boulder a "Green Points" conservation ordinance went into effect. Currently, as part of Green Points, any new home OR any home remodeling more than 500 square feet, would need to apply for a Green Points building permits. As part of that permit process, the home will need to meet the following energy efficiency requirements:

Table 1B – Energy Efficiency Thresholds for Remodels and Addition

Total Conditioned Area	HERS Index	Increased Efficiency Above 2012 IECC
Up to 3,000	70	5 percent
3,001-5,000	60	15 percent
5,001 and up	50	30 percent

(3) Remodels – Limitations. A remodel that doesn't substantially remove the interior finish of the thermal envelope, less than 25 percent of total wall and ceiling areas, of the conditioned space is not required to meet the energy efficiency requirements of Table 1B.

Based on what we could uncover, it appeared that the two comparable sales possibly underwent major remodeling without the necessary building permits. The listing agent was the same for both properties; he had no information in regard to energy-efficient features for either property, and did not know if permits had been pulled. No permits were located in the City of Boulder's files.

The two available comparable sales did not show evidence that they had HERS ratings, which they should have had according to applicable building code.

And so the obvious question to ask is: *Does it matter to the market that these homes were remodeled without the necessary building permits?* The answer is no. The properties that were remodeled without the correct permits would not suffer any negative marketability issues. The owners would only have to remedy the situation if someone were to make active complaints about the homes. Active complaints are very rare in this market area. Therefore, there is no reason to suspect that the lack of proper permits had a negative impact on the market value of the two comparable sales.

General Conclusions from the Information Noted Above

Given that Boulder is a market in which incorporating energy efficiency into the remodel process is a very common occurrence (both based on code and market preference), it is likely that the two comparable sales noted above did have energy efficient improvements.

The paired sales analysis indicated no market value difference (for energy efficiency) between the subject property and the two comparable sales. However, we drew this conclusion by assuming the actual level of energy efficiency for each of the comparable sales. Thus, it was impossible to conclude with confidence whether or not the subject's energy efficiency levels contributed value to the property.

Marketability

Because of the subject property's significant remodel, the property was sold more quickly than comparable homes in the area.

Conclusion

Verification of data was extremely difficult in this circumstance. It is probable that the energy efficiency measures noted in the subject property contributed to the value of the home, but it is impossible to separate this premium from the value of the remodel. Energy efficient upgrades, such as those noted in the subject property, are required by code and very common in this market area.

Based on the paired sales analysis, however, there is no extractable market premium for the subject's level of energy efficiency. Based on the selling agent's comments, the buyers were most interested in the quality of the overall updating, but not specifically in the energy efficiency levels of the home.

Based on the limitations of the data, it would be more appropriate to make an adjustment to the overall level and quality of updating than it would be to make an adjustment just for the subject's overall level of energy efficiency.

While the subject's HERS 83 rating is very good compared to that of the older, original homes in this subdivision, a HERS 83 is extremely typical of a significantly remodeled home in this market area.

Conclusion:

It was not possible to separate the value contribution (if any) for the improved energy efficiency in the home from the value contribution of the property's major renovation.

Case Study #13: HERS 80

Type of home:	1920s remodel	**Year Built:**	1926
Location:	Denver, CO 80211		
Subdivision:	**Sunnyside** This is a very urban market area where many homes have undergone extensive renovation and remodeling. Homes were first built in Sunnyside in 1886 and as late as 2013. The majority of homes in the subdivision were built in 1908, are one-story homes, and have an average of 1,000 square feet above grade.		
Price Range:	$115,000 - $766,000		
Applicable IECC Code:	N/A		
Energy Efficiency Range in Subdivision:	Most homes would beE-F, unless they underwent significant updating. Some newer homes are E-VG, as energy efficiency is a very marketable feature in this transitioning neighborhood.		
Above-grade Sq. Ft.	868	**Below-grade Sq. Ft.**	868
Sold Date:	August 2013	**Finished Below Grade:**	868
Original List Price:	$379,900	**Bed/Bath Above Grade:**	2 bed/1 bathrooms
Final List Price:	$379,900		
Sale Price:	$372,500	**Garage:**	None
Lot Size:	4,690 Sq. Ft.	**Lot Location:**	Typical Interior Lot
Days to Contract:	3		
Days to Contract for Subdivision:	28		
Market Conditions:	Strong, leaning toward a seller's market		

Energy Efficiency Features for This Property

This property was purchased by an investor. The investor bought the home for $249,000 in early 2013, remodeled the home (which included green and energy efficient updates) and resold it a few months later for $372,500. The investor had the property third-party certified. Thus, the property is ICC 700-Certified at the Emerald level and has before-and-after HERS ratings of 201 and 80, respectively. Features in the home include:

96% efficiency furnace	*R-38 ceiling insulation*	*ENERGY STAR appliances*
14 SEER AC	*R-12 Foundation wall insulation*	*.30 U rating windows*
Instant Hot water	*1525 CFM50 Air infiltration*	*Exhaust ventilation system*
Exceeds 2006 IECC	*$575/year reduction in utility costs*	

Listing Agent and Selling Agent Feedback

The **listing agent** and **selling agent** were one and the same. This agent was also the contractor and was responsible for the remodel completed on the property. The agent stated that the buyer was "excited" about the green and energy-efficient features. The agent was very diligent to educate the buyers, and even had a certified energy auditor accompany the buyers on their walk-through to explain the home's various "invisible" energy-efficient and green features. The agent believes that education is of the utmost importance and is fastidious about documenting and providing information to potential buyers.

Entrepreneurial Profit Realized by the Seller

The seller disclosed that she had renovated five homes, all of which had been third-party certified green and HERS-rated renovations. For these five homes, she consistently obtained a higher profit margin than is typical for the market. The seller stated that her entrepreneurial profit has consistently been between 10 percent and 14 percent (whereas the rest of the market tends to realize a profit between 9 and 12 percent).

Four of the five homes this seller has bought and remodeled are noted below (the fifth is the subject property, which will be discussed later).

	HOME #1	HOME #2	HOME #3	HOME #4
Subdivision	**Centennial Estates**	**Evanston**	**Virginia Vale**	**Clayton**
Year of Construction	1960	1937	1958	1907
Purchase Before Remodel:	04/12/2012 for $166,000	06/10/2013 for $213,500	10/29/2012 for $202,000	09/19/2013 for $266,500
Purchase After Remodel:	07/25/2012 for $255,000	11/18/2013 for $343,000	04/30/2013 for $335,000	03/14/2014 for $432,000
% Increase in Value:	53%	61%	66%	62%

We can compare the percent value increase to other remodel projects – which were not identified as green or energy-efficient – obtained from different investors or remodelers within the same subdivisions:

	4326 W Grand Ave	**1101 E Dartmouth Ave**	**814 S Ivy St**	**2911 Vine St**
Subdivision	**Centennial Estates**	**Evanston**	**Virginia Vale**	**Clayton**
Year of Construction	1962	1959	1957	1906
Purchase Before Remodel:	05/08/2012 for $156,500	09/30/2011 for $141,000	08/09/2011 for $190,000	09/20/2012 for $243,000
Purchase After Remodel:	11/30/2012 for $217,500	03/22/2012 for $236,000	12/02/2011 for $280,000	05/02/2013 for $419,990
% Increase in Value:	39%	67%	47%	72%
	3880 W Saratoga Ave	**3154 S Emerson St**	**648 S Jasmine Way**	**3072 Adams St**
Subdivision	**Centennial Estates**	**Evanston**	**Virginia Vale**	**Clayton**
Year of Construction	1967	1952	1958	1951
Purchase Before Remodel:	11/14/2011 for $146,918	04/29/2011 for $168,900	06/28/2013 for $193,400	04/15/2013 for $205,000
Purchase After Remodel:	04/05/2012 for $233,500	09/08/2011 for $295,000	11/08/2013 for $288,000	02/21/2014 for $303,000
% Increase in Value:	60%	75%	49%	48%

	5020 S Meade St	3186 S Emerson St	916 S Jersey St	2110 E 27th Ave
Subdivision	**Centennial Estates**	**Evanston**	**Virginia Vale**	**Clayton**
Year of Construction	1972	1952	1958	1960
Purchase Before Remodel:	05/24/2010 for $163,000	11/07/2012 for $192,000	10/17/2012 for $205,000	11/30/2012 for $124,000
Purchase After Remodel:	01/06/2011 for $225,000	03/15/2013 for $320,000	01/23/2013 for $307,500	09/04/2013 for $180,900
% Increase in Value:	38%	66%	49%	46%

For seven out of the twelve sales, the four properties owned by the subject property's seller realized higher profits.

The one weak point in this data set is that it was not possible to know how much was spent to remodel each property, and what profit level each seller realized. However, even without that information, it is evident that out of the four properties remodeled by the subject property's owner, the majority realized some of the highest sale price increases for their subdivisions.

The seller also stated that it has become easier to build green and to focus on increasing energy efficiency, since the cost difference (once the homes are gutted to the studs) is typically only about $4,000 to $5,000 for these types of homes in these price ranges.

Cost Approach to Value

According to the cost figures provided by the seller, the costs (including labor) of the energy efficient improvements for the subject property are as noted below. The costs do not include entrepreneurial profit or marketing costs, which are direct costs only.

Insulation	$1,700
ENERGY STAR Refrigerator	$1,800
ENERGY STAR Dishwasher	$850
Tankless Water Heater	$1,500
Low E Windows	$3,900
LED & CFL Lighting	$1,100
WaterSense Fixtures	$700
Low-flow Toilets	$350
Furnace and AC	$5,100
TOTAL:	**$17,000**

Additionally, these costs are the *total costs,* and not the incremental costs above and beyond lower efficiency alternate items. The contractor for this remodel project stated that of the $17,000 in energy efficiency related costs, only about $5,000 can be considered incremental costs associated with energy upgrades. The contractor stated that with a major remodel, many green and energy efficient features can be incorporated into a home with minimal additional expense.

According to the seller, the key to energy efficiency is that a home has to be at a point at which a major renovation is needed. Much of the home has to have depreciated in order to benefit from major energy efficient upgrades. This is because the cheapest and easiest time to add such updates is the time at

which the walls are open and the majority of internal systems are being replaced and updated. The costs to make energy efficient upgrades are extremely minimal when the entire house has been gutted and is being remodeled. The costs to upgrade energy efficient elements would be significantly (and often prohibitively) higher if the home has not had a good deal of depreciation.

Conclusion

According to the contractor (the seller), the incremental costs associated with improving energy efficiency were only about $5,000.

Sales Comparison Approach

	Subject	Comp 1		Comp 2	
Sold Price	$372,500		$335,000		$340,000
Sold Date	08/2013	09/2013		06/2013	
Lot Size	4690	4650		4690	
View	Residential	Residential		Residential	
Age of Home	88	89		89	
Above-grade Sq. Ft.	868	748	4800	838	1200
Basement Sq. Ft.	868	748	1000	838	0
Basement Finish	868	748	3000	838	0
Cooling	AC	None	3000	None	3000
Garage	None	None		2 Car	-5000
Bed/Bathroom Count	2/1	2/1		3/1	0
Level of Updating	Excellent	Excellent		Excellent	
Energy Efficiency Level	E-G	E-F		E-F	
			$346,800		$339,200
Days to Offer:	3	58		48	

Both comparable sales were verified. Comp 2 was sold at a slightly low price. The sellers had listed the home at $325,000 and had multiple offers (some even higher than the $340,000 offer they accepted). Like the subject property, Comps 1 and 2 were both gutted and remodeled. (Comp 1 had previously been purchased on March 20, 2013 for $225,000 as a fixer-upper property; however, that sale occurred outside of the MLS system, and so details of the transaction are not known.)

The subject property was sold for $372,500, which is $25,700 and $33,300 more than the comparables. This is a 7 to 9 percent premium. The seller confirmed that she believed she had received a 9 percent premium on this property for green and energy efficient upgrades. This figure, however, included both green and energy efficient upgrades. It was not possible to separate how much of this premium was attributed to green upgrades, and how much was a result of improvements to energy efficiency.

Conclusion

The green features and improved energy efficiency for this property commanded between a 7 and 9 percent market premium.

Income Approach (Present Value Calculation)

The subject property had rarely available but highly useful documentation: a before-and-after HERS rating. Before renovation, the property had a HERS rating of 201. After renovation, the property had a HERS rating of 80. Per the HERS report, this is an anticipated annual utility cost savings of $575.

As noted in Case Study #15, the estimated annual utility costs savings was considered a reliable figure to use to develop the income approach.

Therefore, using the $575 cost savings to develop the income approach was reasonable for the subject property. A present value calculation was made using the "Economics of Energy Efficiency" tool available at www.energytools.com:

INPUTS:	
Useful life	20 years
Annual Energy Savings:	$575
Energy Price Inflation	3% per year
Annual Operating Costs	n/a
Operation Cost Inflation	3% per year
Financing Interest Rate	4% per year
Net Present Value:	$10,104

The income approach indicated a contributory value of $10,000 (rounded from $10,104).

Income Approach (Gross Rent Multiplier)

Properties in the subject property's market area that are highly renovated have the following rents:

	Above Grade	Below Grade	Above Grade	Rent	Value	GRM
Rental 1	825 sq. ft.	825 sq. ft.	2bed/1 bath	$2400	$340,000	142
Rental 2	1347 sq. ft.	1347 sq. ft.	2 bed/1 bath	$2600	$390,000	150
Rental 3	930 sq. ft.	n/a	2 bed/1 bath	$2100	$310,000	147

The GRM of 148 was reconciled for the subject property. Given the subject's monthly estimated savings of $48 ($575/12):

148 X $48 = $7,104 estimated contributory value of increased energy efficiency.

Marketability

The home was sold in three days with multiple offers – 25 days faster than the average home in the neighborhood.

Conclusion

Based on the sales comparison approach and according to the listing agent, the market placed great emphasis and value on the subject property's green features and its greatly improved energy efficiency. The sales comparison approach indicated that these two features, combined, added between 7 and 9 percent to the total price of the property.

The cost approach was less applicable, because it was not possible to break out the incremental cost differences associated with high efficiency. The cost approach was given no weight.

The income approach had two indicated values: $7,000 and $10,000. Each figure equally indicated the possible value contribution of the subject property, as both had equal amounts of weak and strong points.

In the end, 7 and 9 percent of the total property price was due to the green and energy efficiency improvements. This was a contributory value figure of $25,000 to $33,000. Of this range, between $7,000 and $10,000 was attributed to the energy efficiency of the home, or between 2 and 2.5 percent of the total sale price.

Conclusion:

As of August 28, 2013, the improved energy efficiency contributed
between 2% and 2.5%
to the sale price of the subject property.
(The green and energy efficient upgrades together added 7% to 9% to the value.)

Case Study #14: HERS 80

Type of home:	2010 Tract Home	**Year Built:**	2010
Location:	Erie, Co 80516	**Builder:**	Taylor Morrison
Subdivision:	**Erie Commons** Developed in the early 2000s with tract homes of average-quality construction. There were several builders in this subdivision; all produced generally similar homes on 5,000- to 10,000-square-foot lots. The homes are typically around 2,000 square feet above grade with full basements and three-car garages.		
Price Range:	$245,000 to $400,000		
Applicable IECC Code:	2006 IECC		
Energy Efficiency Range in Subdivision:	Most homes would be E-A or E-G.		
Above-grade Sq. Ft.	2046	**Below-grade Sq. Ft.**	682
Sold Date:	April 2012	**Finished Below Grade:**	0%
Original List Price:	$325,000	**Bed/Bath Above Grade:**	3 bed/2 bathrooms
Final List Price:	$325,000		
Sale Price:	$315,000	**Garage:**	3-Car Garage
Lot Size:	5,665 Sq. Ft.	**Lot Location:**	Standard, Interior Lot
Days to Contract:	79		
Days to Contract for Subdivision:	81		
Market Conditions:	Per listing agent: "Tough market, things took a while to sell."		

Details of the Subject Property

According to the HERS certificate (which was attached to the MLS listing), the home had a HERS 80 as of the year 2010. The estimated energy costs were stated at $2,151 per year. The estimated energy savings was reported to be $303 annually (compared to the 2006 IECC). This is a tract home built by Taylor Morrison. All of the homes built by Taylor Morrison have generally similar HERS ratings in this subdivision. Features associated with the subject property's energy efficiency are as follows:

92% efficiency furnace	*R-38 ceiling insulation*	*13 SEER AC*
Uninsulated ducts	*R-11 Foundation wall insulation*	*.35 U rating windows*
.62 EF water heater	*R-20 above-grade wall insulation*	*.35 ACHnat Air infiltration*
Exceeds 2006 IECC	*$149 annual utility savings*	*ENERGY STAR appliances*

Listing Agent and Selling Agent Interviews

The subject property was sold three times in the last three years. Those prior sales were:

1. $261,259 12/07/2010 Sold as a new home

2. $305,700 07/29/2011 Added landscaping and minor cosmetic updates
3. $315,000 04/11/2012 Added AC

Sale 1: When the home was new, the original builder did not advertise any of the energy-efficient features in the MLS listing. However, the builder did have information on-site for potential buyers to review. When the home was sold new, the buyer was a Realtor. This buyer/Realtor was interested in energy efficiency and made sure to retain the HERS and ENERGY STAR Certifications the builder had provided to her at closing.

Sale 2: In 2011, the owner/Realtor made an effort to promote in the MLS listing the home's energy rating certification and the energy-efficient features. Because of her positive experience with owning an energy-efficient home, the next home this Realtor bought for herself had a level of energy efficiency similar to this one. The Realtor was sold on the overall comfort, lower energy use and quiet interior of this energy-efficient home.

Sale 3: For the 2012 sale, the listing agent and selling agent ended up being one and the same. This agent stated that the overall energy efficiency of the home did not mean anything to the buyers; however, she felt they still ended up paying for these features because they were an expectation in the market area in general. This agent stated that for a home to sell for *more* because of energy efficiency features, it was a necessity that the Realtor educates potential buyers. Education was deemed to be very important.

Comments on the Subject Property and its Surrounding Homes

This subdivision is newer and all homes were built after 2006. The municipality overseeing this development required all new homes receiving a building permit after September 19, 2008 to comply with the 2006 IECC. Prior to that date, the builders had only been required to comply with the 1997 UBC; however, even in 2006, every builder in this subdivision elected to greatly exceed (by at least 30 percent) the 2006 IECC building requirements. This is proof, as the most recent listing agent for this property stated, that energy efficiency is an expectation in this market area.

The builders in this subdivision were Richmond, Taylor Morrison, Meritage and Standard Pacific. The building inspector for Erie stated that of these builders, all but one had HERS ratings around 80. The fourth builder, Meritage, had HERS ratings around 60.

As noted in Case Study #24, at the time of construction, the Meritage homes, on average, were sold for between $2 and $20 more per square foot than homes of any of the other three builders. This demonstrates two things: energy efficiency matters in this market area, and the homes with HERS ratings between 55 and 67 were sold for more (at the time of construction) than the homes with HERS ratings around 80.

NOTE: While the building department did state that it kept a hard copy of the HERS certificates on file (if a property had one), it was not reasonably possible to review each and every file for this study. Thus, we did not review the actual HERS reports.

Marketability

This home had the same marketing time as that of the comparable properties. Given that notable levels of energy efficiency are expected in this market area, it is reasonable to expect that the subject property would have similar marketing times to other homes.

Sales Comparison Approach

	Subject	Comp 1	
Sold Price	$315,000		$321,700
Sold Date	04/2012	01/2012	
Builder	Taylor Morrison	Meritage	
Above-grade Sq. Ft.	2046	2291	-9800
Basement Sq. Ft.	682	1047	-2500
Basement Finish Sq. Ft.	0	0	
Bed/Bath	3/2.1	3/2.1	
Cooling	AC	None	4000
Garage Count	3 Garage	3 Garage	
Age of Home	2 years	New	-4000
Landscaping	Yes	No	10000
HERS rating	80	Apprx. 60	
Energy Efficiency Level	E-G	E-G	
			$319,400
Days on Market:	79	130	

The MLS listing for Comp 1 stated that the home had “extreme energy efficiency = low utility bills.” This particular builder (Meritage) is highly committed to educating buyers about energy efficiency. Per the paired sales data noted above (and Case Study #24), the more efficient Meritage home had a slight market premium above the Taylor Morrison home. Regardless of which sales were used from this subdivision, this turned out to be the case in most circumstances. Interviews with six area agents confirmed that Realtors believed the Meritage homes were often sold for slightly more than the homes built by other builders in the subdivision. However, as energy codes become more stringent, that market premium shrinks, since other builders have risen to the same level of energy efficiency as Meritage.

In conclusion, the slightly inferior energy efficiency level of the subject property compared to a home with better energy efficiency resulted in a $5,000 discount. This equates to a 1.5 percent premium for the difference between a HERS 60- (comparable sale) and a HERS 80- (subject property) rated home.

Conclusion:

As of April 11, 2012, the slightly inferior energy efficiency level of this home resulted in a 1.5% reduction to its sale price.

Case Study #15: HERS 71

Type of home:	1970s remodel	**Year Built:**	1976
Location:	Niwot, 80503		
Subdivision:	**Cottonwood Park** A tract-home development built in the early 1970s with fair- to average-quality homes.		
Price Range:	$143,000 to $320,000		
Applicable IECC Code:	N/A		
Energy Efficiency Range in Subdivision:	Most homes will be E-F. A few may reach E-A and E-G if they have undergone significant remodeling and updating.		
Above-grade Sq. Ft.	1040	**Below-grade Sq. Ft.**	1040
Sold Date:	February 2012	**Finished Below Grade:**	95%
Original List Price:	$329,000	**Bed/Bath Above Grade:**	2 bed/2 bathrooms
Final List Price:	$329,000		
Sale Price:	$317,350	**Garage:**	2-Car Garage
Lot Size:	5706 Sq. Ft.	**Lot Location:**	Interior lot
Days to Contract:	57		
Days to Contract for Subdivision:	110		
Market Conditions:	Stable		

Details for the Subject Property

This home was purchased on August 26, 2011 for $143,500 as a fix-and-flip property (the property had had a kitchen fire and was sold with fire damage). The home then underwent a major remodel and was resold for $317,350 in early 2012. As of 2012, this had been the highest recorded sale in the subdivision since 2007. The next highest sale had been for $301,200 in November 2011 (for the same identical model of home as the subject property).

A HERS certificate, as well as a few pages of the HERS report, were attached to the MLS listing. Thus, some details were available regarding the specific updates for the subject property. In the listing comments, the agent stated that the property had a “new furnace/water heater/AC,” but did not state anything further regarding the energy efficiency levels of the home.

Because this was a major remodel, it was required by Boulder County that this property be renovated in such a way that, after renovations, it would have a HERS rating of no more than 80. The final HERS rating ended up at 71. Finish features included:

Per the HERS Certificate and HERS report attached to the MLS listing:

Date issued: 12/06/2011
HERS rating is 71
95% efficient furnace
12 SEER AC
56% EF water heaters
30 CFM duct leakage to outside
Insulation: R-38 vaulted ceiling, R-38 ceiling, R-11 foundation
Windows: low E .30/.36
Air infiltration: Htg:1334 Clg:1334 CFM50
Estimated annual energy cost is $1266
Annual savings compared to a HERS 130 home: $894

Listing Agent and Selling Agent Feedback

The selling agent did not provide feedback.

The listing agent thought that the improved energy efficiency did not help the sale. She stated that while buyers "love it," she did not feel that they would pay for it. The agent felt that since the home had a HERS rating, she would attach it to the MLS listing.

Income Approach (Present Value Calculation)

The homes in this subdivision were built in the late 1970s, and so it is reasonable to conclude that the majority of homes would have HERS ratings above 130 (which is the number up on which the subject's annual utility savings estimate of $894 is based).

Per the census data noted earlier in this study, a home of this size (2,080 square feet) and the year of construction (1976), the expected utility costs would be $2,121 per year. The actual estimated utility costs, however, are $1,266, for a difference of $855. Thus, the HERS estimate of annual savings at $894 is reasonable and in line with market data.

Using the $894 savings to develop the income approach was reasonable for the subject property. A present value calculation was made using the "Economics of Energy Efficiency" tool available at www.energytools.com:

INPUTS:	
Useful Life	20 years
Annual Energy Savings	$894
Energy Price Inflation	3% per year
Annual Operating Costs	$10 per year
Operation Cost Inflation	3% per year
Financing Interest Rate	4% per year
Net Present Value:	$15,533

The income approach indicated a contributory value of $16,000 (rounded from $15,533).

Comparable Sales Analysis

	Subject	Comp 1		Comp 2	
Sold Price	$317,350		$301,200		$284,000
Sold Date	02/2012	09/2011		10/2011	
Above-grade Sq. Ft.	1040	1040		1219	-7000
Basement Sq. Ft.	1040	1040		1181	
Basement Finish Sq. Ft.	1000	1000		0	+24000
Quality of Remodel	Excellent	Excellent		Excellent	
Energy Efficiency Level	E-G	E-F		E-F	
			$301,200		$301,000
Days on Market:	57	21		123	

Comp 1 was identical to the subject property with a full interior remodel and without improvements to its level of energy efficiency. Comp 2 also had a full interior remodel, also without improvements to its level of energy efficiency, and without a finished basement. Both comparable sales indicated that the difference between the subject property's E-G level of energy efficiency (and the comparable sales) had a contributory value of roughly $16,000.

Thus, the comparable sales approach indicated that the energy efficiency of the subject property had a contributory value of $16,000:

$16,000 /$317,350 = 5% of the property's sale price

Marketability

The home was sold twice as fast as the average days-on-market for other homes in the subdivision.

Conclusion

The sales comparison approach had an indicated contributory value of $16,000. The income approach had an indicated contributory value of $16,000.

Conclusion:

As of February 28, 2012, the energy efficient improvements contributed
$16,000 (5%)
to the sale price.

Case Study #16: HERS 69

Type of home:	1930s remodel	**Year Built:**	1937
Location:	Englewood, CO 80113		
Subdivision:	**Evanston** Most homes were built between the late 1920s and the early 1960s. However, many homes are being remodeled and updated, and there are a few newer homes in the area. This is an urban area with homes located on mostly 6,250-square-foot lots.		
Price Range:	$120,000 to $550,000		
Applicable IECC Code:	N/A		
Energy Efficiency Range in Subdivision:	Most homes will be E-F. A few may reach E-A. E-G homes are rare in this area.		
Above-grade Sq. Ft.	1217	**Below-grade Sq. Ft.**	0
Sold Date:	November 2013	**Finished Below Grade:**	n/a
Original List Price:	$347,500	**Bed/Bath Above Grade:**	3 bed/2 bathrooms
Final List Price:	$347,500		
Sale Price:	$343,000	**Garage:**	2-Car Garage
Lot Size:	6,839 Sq. Ft.	**Lot Location:**	Standard Interior Lot
Days to Contract:	13		
Days to Contract for Subdivision:	21		
Market Conditions:	Stable		

Energy Efficiency Features for This Property

This property was purchased by an investor. The investor had bought the home for $213,500 in early 2013, remodeled the home and then resold it a few months later for $343,000. This was a 61 percent increase in sale price. The investor had the property third-party certified and obtained a HERS rating.

Features of the home included:

HERS Certificate was available

Date issued: 10/10/2013
HERS rating is 69
95% efficient furnace
14.5 SEER AC
Instant hot water, .85 EF

Insulation: R-60 ceiling, R-38 sealed attic, R-12.6 foundation
Windows: .48 U factor
Estimated annual energy cost is $1008
Annual savings compared to a HERS 130 home: $711
7 ACH50 air infiltration

Listing Agent and Selling Agent Feedback

The listing agent was also the contractor and was responsible for the remodel completed on this property. (Case Study #13 shows another property remodeled and sold by this agent/contractor.)

The selling agent stated that the buyers were not looking for a green home (or for one with notable energy efficiency). However, they did like the features after they learned about them. An energy auditor met the buyers at the property to explain all of the features. In the end, the buyers did like the utility savings and the reported increased comfort of the home.

The listing agent believes that education is of utmost importance and is fastidious about documentation and providing information to potential buyers.

Cost Approach to Value

According to the energy audit provided by the seller/renovator, the estimated costs to improve the energy efficiency of the home follow:

Insulate Crawl Space	$400
Programmable Thermostat	$170
Upgrade Furnace	$3400
Insulate Walls	$2200
Seal Air Leaks	$500
Install LED lights	$170
Upgrade hot water heater	$1300
Add Attic Insulation	$1600
Seal Duct Work	$900
Replace Refrigerator	$1400
Add Storm Doors	$800
TOTAL:	**$8700**

Unlike Case Study #9, in which the energy audit included a list of applicable rebates, this one did not. This energy audit had a general rebate list, but it did not specify which ones would be applicable to the subject property.

These cost estimates do not include profit and overhead, and so they are considered to be a low reflection of actual, final costs. Also, from the documents received, it was not possible to decipher exactly which updates were actually made (from the list above) and to what extent those updates were made.

Thus, the cost approach data was used as a very general indicator of costs, but was not considered precise enough on which to base an adjustment conclusion.

Income Approach

According to the energy audit, if all of the items noted previously had been completed, the owners could realize a $850-per-year savings on utility bills. After the home was remodeled, the HERS report estimated the final annual utility savings at $711 (above a home with a HERS 130 rating), so it appears that the owner had made most of the suggested updates.

Prior to the remodel, the subject property had a HERS rating of 140 (the owner opted for a before-and-after HERS report). Therefore, based on the savings estimate from the energy audit and the after-remodel estimated savings from the HERS report, it is reasonable to conclude that the estimated annual savings for the subject property was approximately $800.

Using the $800 estimate to develop the income approach was reasonable for the subject property. A present value calculation was made using the "Economics of Energy Efficiency" tool available at www.energytools.com:

INPUTS:	
Useful life	20 years
Annual Energy Savings:	$800
Energy Price Inflation	3% per year
Annual Operating Costs	$10 per year
Operation Cost Inflation	3% per year
Financing Interest Rate	4% per year
Net Present Value:	$13,881

The income approach indicated a contributory value of $14,000 (rounded from $13,881).

Sales Comparison Approach

	Subject	Comp 1	
Sold Price	$343,000		$355,000
Sold Date	11/2013	08/2013	
Above-grade Sq. Ft.	1217	1434	-10800
Basement Sq. Ft.	0	0	
Bed/Bath	3/2	3/2	
Garage	2 Car	0	7000
Exterior	Frame	Brick	-10000
Garage Conversion	Yes	No	-10000
Quality of Remodel	Excellent	Excellent	
Energy Efficiency Level	E-G	E-F	
			$331,200
Days on Market:	13	63	

The subject property had its garage converted into living space, which is an inferior floor plan in this market area. This resulted in the negative $10,000 adjustment for the functional obsolescence of this property. (As noted in other case studies, all data relating to adjustments is retained in the work file; reporting only data that is related to energy efficiency maintains clarity in the study.)

Thus, after accounting for all differences except energy efficiency levels, Comp 1 was sold for $11,800 less than the subject property.

The above paired sale had a contributory value indication for energy efficiency of $12,000 (rounded).

Marketability

The subject property was sold nearly twice as quickly as comparable properties.

Conclusion

The sales comparison approach, which showed a value contribution of $13,000, was considered to be a less reliable indicator than the $14,000 indicated by the income approach. The comparable sale had a considerable percentage of adjustments, and as a result, the sales comparison approach was given less consideration in the reconcilation of contributory values. The income approach was given the most consideration.

Conclusion:

The improved energy efficiency added
$14,000 (4%)
to the sale price of this property as of November 18, 2013.

Case Study #17: HERS 65

Type of home:	2010s new home	**Year Built:**	2010
Location:	Aurora, Co 80016		
Subdivision:	**Tallyns Reach** A tract-home development built in the early 2000s with average- to good-quality homes.		
Price Range:	$215,000 to $650,000		
Applicable IECC Code:	2006 IECC		
Energy Efficiency Range in Subdivision:	All homes would be E-G or E-A.		
Above-grade Sq. Ft.	2417	**Below-grade Sq. Ft.**	1253
Sold Date:	August 2012	**Finished Below Grade:**	0
Original List Price:	$318,900	**Bed/Bath Above Grade:**	3 bed/2.1 bathrooms
Final List Price:	$318,900		
Sale Price:	$318,900	**Garage:**	3-Car Garage
Lot Size:	6626 Sq. Ft.	**Lot Location:**	Greenbelt & Busy Road
Days to Contract:	8		
Days to Contract for Subdivision:	91		
Market Conditions:	Stable		

Details of the Subject Property

The subject property is a Meritage home built in 2010. The exact HERS rating of this home was not known. However, according to marketing materials and other MLS listings, it is typical for this model of home to have a HERS rating around 65, so this is a reasonable assumption to make about the subject property. The agent did note in the Green Fields of the MLS that this home had a HERS rating of "14," but this was clearly a mistake. Based on other comments the agent made in the MLS listing, it was evident that the agent was confusing the SEER rating on the AC unit with the HERS rating. In the end, the actual HERS rating was estimated at 65, but was never actually confirmed.

The home was sold three times in the last few years:

12/14/2010 $291,000
07/21/2011 $291,000
08/30/2012 $318,900

No notable changes were made between sales, and all sales were standard transactions. Any change in sale price, therefore, would be due to changes in market conditions.

Listing Agent and Selling Agent Feedback

The listing agent made a concerted effort to advertise the overall energy efficiency of this home. Specific language in the MLS included, "*ENERGY STAR-certified builder. Green features include: certified appliances, water efficient fixtures, programmable thermostat, Low VOC, SEER 14 AC. Low utility bills attributed to high energy efficiency HERS rating.*" In the interview, the agent stated that the buyers were already sold on energy efficiency, as the only other homes they had considered buying were other new-construction Meritage homes. The agent believed that the buyers were "tuned in" to energy efficiency and that it was an important feature to them.

The selling agent did not provide feedback.

Income Approach

Actual or estimated annual utility bills were not available. Estimated annual savings compared to other homes was also not available. The MLS listing contained no attachments and no specific data providing details on the overall energy efficiency of the home. No data was available to develop the income approach.

Sales Comparison Approach

Given that this is a tract-home development, there are plenty of sales from the builder of the subject property. Therefore, all of the most relevant comparable sales had the same level of energy efficiency as the subject property. Thus, using comparable sales to extract a possible value premium for energy efficiency would produce ineffectual results, since every property has a similar level of energy efficiency.

What was useful, however, was the ability to track the change in the subject's sale price over time compared to other verified sales in the area. All of the homes noted below were built new in 2010 (just like the subject property), and all are located in the same zip code area as the subject property:

BUILDER	ADDRESS	SOLD DATE	SOLD PRICE	% Change
DR Horton	24306 E Bellewood	05/27/2010	$259,000	
		04/15/2011	$240,000	-7%
Cardel	24345 E Briarwood	08/23/2010	$332,000	
		08/30/2011	$319,800	-4%
DR Horton	5322 S Eaton Park	04/22/2010	$293,290	
		11/30/2011	$288,000	-2%
Cardel	24355 E Briarwood	01/21/2011	$310,000	
		09/16/2011	$320,000	+3%
DR Horton	5366 S Fultondale	08/13/2010	$311,000	
		04/27/2012	$324,999	+5%
Capital Pacific	26615 E Costilla Pl	07/08/2011	$295,000	
		12/14/2012	$309,000	+5%

DR Horton	24764 E Chenango	10/25/2011	$230,796	
		11/19/2012	$244,000	+6%
Meritage	25262 E Indore	12/08/2010	$373,244	
		08/24/2012	$395,000	+6%
Meritage	7198 S Little River	01/19/2011	$343,000	
		05/11/2012	$365,000	+6%
Meritage	Subject Property	07/21/2011	$291,000	
		08/30/2012	$318,900	+10%
Meritage	25140 E Ottawa	10/29/2010	$370,000	
		04/06/2012	$415,000	+12%

The Meritage homes increased in value the most, compared to homes built by any other builder. While the data set was much too small to allow us to conclude that the Meritage homes depreciate less quickly than other homes (or increased more than other homes), the data is worth monitoring going forward.

One additional point to note is that the energy efficiency levels for Capital Pacific, DR Horton and Cardel are not known. However, given that in 2010, the 2006 IECC was the minimum building code for the City of Aurora, it is highly probable that the HERS ratings for these builders were somewhere between 80 and 90.

Marketability

The subject property went under contract in eight days. The market average is 91 days. Thus, the subject property was sold notably faster than homes in the greater market area (including homes built by numerous other builders, not just those built by Meritage).

Conclusion

While the Meritage homes increased in value by the highest percentage between 2010 and 2012, the data set was too small to allow us to draw absolute conclusions. This data set is worth monitoring going forward.

Conclusion:

New homes with higher levels of energy efficiency may depreciate at a slower rate compared to homes with lower levels of energy efficiency.

Case Study #18: HERS 64

Type of home:	2010s new home	**Year Built:**	2012
Location:	Timnath, CO 80547		
Subdivision:	**Timnath Ranch** A tract home development built in the early 2000s with average- to good-quality homes.		
Price Range:	$300,000 to $580,000		
Applicable IECC Code:	2006 IECC		
Energy Efficiency Range in Subdivision:	All homes would be E-G or E-A.		
Above-grade Sq. Ft.	2809	**Below-grade Sq. Ft.**	1245
Sold Date:	March 2014	**Finished Below Grade:**	0
Original List Price:	$372,000	**Bed/Bath Above Grade:**	3 bed/2.1 bathrooms
Final List Price:	$372,000		
Sale Price:	$369,200	**Garage:**	3-Car Garage
Lot Size:	7,324 Sq. Ft.	**Lot Location:**	Backs to busy road
Days to Contract:	40		
Days to Contract for Subdivision:	166		
Market Conditions:	Stable		

Details of the Subject Property

An ENERGY STAR certificate was attached to the MLS listing, as was a MLS Green Property Disclosure addendum. From these documents, the following details regarding the subject property were noted:

.35 U-value windows	*92.3% efficient furnace*	*13 SEER AC unit*
.62 EF water heater	*R-38 ceiling insulation*	*R-11 foundation insulation*
R-20 above-grade insulation	*31.00 CFM @ 25 Pascals air leakage to outside*	*1445 CFM50 air Infiltration*
Uninsulated duct work	*ENERGY STAR windows*	*High-efficiency lighting*
Programmable thermostat	*ENERGY STAR appliances*	

Listing Agent and Selling Agent Feedback

The listing agent was a big believer in promoting ENERGY STAR-qualified homes. For this particular property he noted that people felt the ENERGY STAR certificate was a "bonus." In general, this agent felt that if potential buyers like a particular home, then the ENERGY STAR certificate is something extra they appreciate, as it gives them a sense of quality. The certificate ended up becoming especially important in this case when the buyer and seller negotiated over a $2,000 difference in the sale price. The listing

agent rationalized with the buyers that with an ENERGY STAR home, they will quickly save $2,000 on utility bills.

The listing agent also noted that ENERGY STAR certificates give buyers the feeling that the home is more affordable and that they "will not have to make any energy efficiency improvements." To this agent, certificates are a notable plus when selling a home, as they indicate a strong neighborhood.

When asked about HERS ratings, the listing agent said that 19 out of 20 people will not understand what the rating is, or how it works. Thus, the agent's experience has been that while he has to explain HERS ratings, ENERGY STAR certificates essentially speak for themselves.

The selling agent felt that these buyers were not that interested in looking for a home with high levels of energy efficiency. However, she did state that generally, they did like that the home was considered to be energy efficient. The agent noted that it is probable these buyers did pay $1,000 to $2,000 more for this ENERGY STAR home, just because this feature is common and expected in this market area. In the end, the selling agent believed that the buyers paid up to $2,000 more for the house, but that they were ok with that because they would be saving money on their monthly utility bills.

Sales Comparison Approach

The sales comparison approach yielded no useful information, since it is common and typical for the homes in this subdivision to have high levels of energy efficiency. Additionally, it proved impossible to verify and compare not only the level of energy efficiency in each home, but also the exact construction features that result in increased energy efficiency. Therefore, we did not develop the sales comparison approach. Instead, we conducted an analysis of the data from the area. This was done mainly to show just how limited data is in relation to the overall energy efficiency levels of various homes.

Data from Timnath Ranch

Based on the listing and selling agent statements for the subject property (who noted that Timnath Ranch was comprised of very energy-efficient homes), we conducted research on all of the MLS-sold listings in Timnath Ranch. We conducted the research to show how much information about energy efficiency is being reported, and how much data an appraiser currently has to work with. This was the ideal subdivision to study because there are numerous builders, the subdivision is newer, and all market participants agree that the homes are built with similar levels of energy efficiency.

While the data noted below only represents Timnath Ranch, it should be noted that the limited amount of data pertaining to energy efficiency was not just reflective of this one subdivision. These limitations in data were noted again and again while trying to conduct research for this study.

Timnath Ranch

Timnath Ranch is a very large subdivision with well over 500 home sites. This is a tract-home development that was first developed in 2008 and is still seeing extensive new construction. When tract-home subdivisions such as Timnath Ranch are first being built, it is common for builders to only list *some*

of their homes in the MLS system. Thus, the data set noted below does not represent all of the homes in the subdivision, only those that were listed for sale in the MLS.

Between 2010 and the present, 134 sold listings were recorded in MLS from Timnath Ranch. Each of these 134 MLS listings was reviewed in order to discover not only how often energy-efficient features were referred to, but also how those features were disclosed and discussed.

The chart below shows how many sold listings each builder had, and which fields (if any) that builder used to convey the presence of energy-efficient features in the home. To read the chart, an example is provided:

Baessler	**8 Listings**
Energy/Green Feature	0
Listing Comment	4
Property Features (Energy)	6
Certificate/Info Attached	1

In this example, Baessler (a builder) had 8 of the 134 MLS sold listings. Of these:

- 0 utilized the Energy/Green Feature section of the MLS
- 4 contained specific language in the "Listing Comment" field referring to energy efficiency
- 6 utilized the "Property Features (Energy)" to disclose features
- 1 actually attached an energy certificate to the MLS listing

The 134 sold listings are thus summarized on the following chart:

How Often MLS Listings for Each Builder in Timnath Ranch Communicate Energy-Efficient Features

Walz	**4 Listings**
Energy/Green Feature	0
Listing Comment	0
Property Features (Energy)	0
Certificate/Info Attached	0

Baessler	**8 Listings**
Energy/Green Feature	0
Listing Comment	4
Property Features (Energy)	6
Certificate/Info Attached	1

KEM	**7 Listings**
Energy/Green Feature	0
Listing Comment	1
Property Features (Energy)	7
Certificate/Info Attached	0

Stonefield	**11 Listings**
Energy/Green Feature	11
Listing Comment	1
Property Features (Energy)	10
Certificate/Info Attached	1

Westmark	**14 Listings**
Energy/Green Feature	0
Listing Comment	7
Property Features (Energy)	9
Certificate/Info Attached	1

Sage	**29 Listings**
Energy/Green Feature	0
Listing Comment	12
Property Features (Energy)	28
Certificate/Info Attached	0

Aspen	26 Listings
Energy/Green Feature	0
Listing Comment	15
Property Features (Energy)	25
Certificate/Info Attached	1

Ryland	17 Listings
Energy/Green Feature	0
Listing Comment	0
Property Features (Energy)	14
Certificate/Info Attached	0

DR Horton	2 Listings
Energy/Green Feature	0
Listing Comment	0
Property Features (Energy)	1
Certificate/Info Attached	0

Meritage	7 Listings
Energy/Green Feature	0
Listing Comment	6
Property Features (Energy)	7
Certificate/Info Attached	0

Professional Construction	2 Listings
Energy/Green Feature	0
Listing Comment	0
Property Features (Energy)	0
Certificate/Info Attached	0

Builder not identified	7 Listings
Energy/Green Feature	1
Listing Comment	1
Property Features (Energy)	3
Certificate/Info Attached	2

Summary of MLS Research

The most important information to take away from the above chart is that, of the 134 MLS listings, 111 included some comment or reference to the home being energy efficient. This supports the conclusion that energy efficiency is becoming something of relevance to sellers and buyers in this market area.

Unfortunately, above and beyond knowing that 111 homes were identified as being energy efficient, there is little else the appraiser can take away from these listings. Actual detailed information regarding both the level of energy efficiency (i.e. the HERS rating) and the actual construction features that went into the home are almost nonexistent. For example, of the 134 MLS listings:

- Only **two** reported the actual HERS rating of their properties.
- Only **two** attached the ENERGY STAR and/or HERS rating certificate to the MLS listing.
- Only **one** had a Green Disclosure Energy addendum attached to the MLS listing.
- Only **one** included the builder's property flyer listing the energy-efficient features.
- Only **one** included a utility disclosure addendum (giving actual utility costs).
- Only **one** (the subject of Case Study #19) utilized all four MLS energy-related fields.

Excluding the few properties mentioned above, the rest of the MLS listings were fairly consistent in the verbiage they used or the disclosures they chose to make about energy efficiency for their particular listing. Because the agents had fairly similar reporting methods, we grouped the comments and disclosures to show how many listings included what types of information (keeping in mind that it is common for listings to use more than one phrase, and therefore, any one property is likely to be represented in more than one category).

FIELD	Exact Comment noted in that field	Number of the 111 Listings With this Comment:
Energy/Green Features field:		
	HERS-Rated	1
	ENERGY STAR-Qualified	1
	Green Energy Disclosure	1
Listing Comments field:		
	High-Efficiency Furnace	14
	HERS Rating	2
	ENERGY STAR/Energy-Efficient Appliances	5
	Programmable Thermostat	6
	Water-Efficient Plumbing Fixtures	6
	Fresh Air Intake	6
	Merve 12/Merve 8 Air Filters	7
	Energy Efficient	17
	Cut 1/3 Off Your Utility Bills	11
	Low E Double Pane Windows	10
	Tankless Hot Water Heater	9
	Heat Recovery Ventilator	3
	Dehumidistat	1
	Passive Radon	4
	E-STAR/ENERGY STAR	14
	Built Green	5
Property Features (Energy) field:		
	High-Efficiency Furnace	100
	Demand Control Limiter	2
	Energy Survey Complete	32
	Set Back Thermostat	83
	Energy Rated	85

Essentially, from evaluating all of the available data, the only conclusions an appraiser can draw are that:

- Energy efficiency is a relevant feature in this market.
- Most homes have high-efficiency furnaces.
- Most homes have been energy-rated.

Beyond these conclusions, it was not possible to know how similar or different the energy-efficient features are from one builder to another, what the estimated utility bills are, what the average energy use is for the area, what the range of HERS ratings is for these homes, which homes have which energy features (other than high-efficiency furnaces and set-back thermostats), and what exact level of energy efficiency is present in each home. Essentially, all of the details an appraiser needs to compare one home to another were missing.

In some cases, the appraiser might be able to track down each energy certificate for each property. However, for this study, the effort rarely produced results (or certificates). After attempting to locate

energy rating data for several homes in Timnath Ranch, the task was rendered fruitless after talking to builder representatives, city building inspectors, listing agents, selling agents and homeowners.

In conclusion, there was no way to compare the contributory values of various levels and features of energy efficiency from one home to another. Ideally, the actual energy rating certificates (with specific property details) would be attached to the MLS listings so that multiple homes could be compared.

Conclusion:

Even in an area that is rich with notably energy-efficient homes, there is no way to study how or whether energy efficiency impacts individual sale prices or conclusions of market values without specific details that are both easily accessible to appraisers and available for the majority of homes.

Case Study #19: HERS 63

Type of home:	Tract Patio Home	**Year Built:**	2011
Location:	Louisville, CO 80027		
Subdivision:	**Steel Ranch (Takoda Final)** A brand-new subdivision in 2010. The subject property's builder constructs very energy-efficient homes (with HERS ratings typically between 50 and 60). These are tract-style patio homes located in an infill area just on the outskirts of the City of Louisville. Extensive new construction is evident in this area with several different builders offering new residential properties for sale.		
Price Range:	$350,000 to $800,000		
Applicable IECC Code:	2009 IECC and then later, the 2012 IECC		
Energy Efficiency Range in Subdivision:	Typically, E-G and E-VG		
Above-grade Sq. Ft.	1335	**Below-grade Sq. Ft.**	1335
Sold Date:	January 2014	**Finished Below Grade:**	963
Original List Price:	$518,500	**Bed/Bath Above Grade:**	1/2
Final List Price:	$518,500		
Sale Price:	$515,000	**Garage:**	2-Car Garage
Lot Size:	3,790 sq. ft.	**Lot Location:**	Backs to Alley
Days to Contract:	10		
Days to Contract for Subdivision:	Unknown		
Market Conditions:	Strong seller's market		

Details Regarding the Subject Property

While this builder builds notably energy-efficient homes (with HERS ratings between 50 and 60), almost no information was available in the MLS pertaining to this. The current listing agent did attach to the MLS a copy of the ENERGY STAR certificate, indicating the home had a HERS rating of 56 as of February 9, 2012. By chance, this author was able to tour the identical model of home to the subject property with the on-site contractor. The contractor was able to point out some of the energy-efficient features in these homes:

92% efficient furnace	*Heat recovery ventilator*	*Fresh air intake/exchange*
High SEER AC units	*Tankless hot water heater*	*R-11 foundation insulation*
R-49 attic insulation	*Air sealing*	*Return ducts in all bedrooms*
Sealed duct work	*ENERGY STAR windows*	*High-efficiency lighting*
Programmable thermostat	*ENERGY STAR appliances*	*Sealed attic access*

Listing Agent and Selling Agent Interviews

The listing agent said that having an ENERGY STAR certificate was a benefit, but expressed that it is normal to have to explain to buyers what a HERS rating is and what it means. Most buyers will select a home they like, and if the home has increased levels of energy efficiency, that is just an added bonus. The home had multiple offers.

The selling agent said that the energy efficiency of this home was not the buyer's main focus. However, it was an indication to them that the home was well built.

Comparable Sales

In the year prior to the sale of the subject property, eight comparable homes (all ranch-style that were no more than two years old) were sold. All eight of these, however, had comparable energy efficiency levels. Thus, a paired sales analysis would have yielded no information since every home had the same features.

Additionally, specifics about each home were not available. Buyers in this subdivision are able to select either the builder's standard level of energy efficiency or upgrade various features related to energy efficiency. The exact HERS rating, precise energy-efficient features and projected utility bills for each property were not known. This information was not recorded on MLS and was not readily available from each builder.

Thus, the limitation of data rendered the comparable sales approach not useful in this circumstance.

Income Approach

The estimated utility savings for the subject property was not provided or available. Additionally, this is not a rental area, and so recent rental comparables were not located. Estimated utility costs also were not provided for any of the eight comparable sales referenced above. In conclusion, there was no available utility data and no rental data. Therefore, we could not credibly develop the income approach.

Conclusion:

As with Case Study #18, even in an area that is rich with very energy-efficient homes, there is no way to study how or whether energy efficiency impacts individual sale prices from directly within the subdivision without specific details that are both easily accessible to appraisers and available for the majority of homes.

Case Study #20: HERS 62

Type of home:	Tract home	**Year Built:**	1996
Location:	Highlands Ranch, CO 80126		
Subdivision:	**Highlands Ranch** A massive suburban subdivision originally designed by Mission Viejo in the late 1980s. The subdivision is so large that it has essentially become a city unto itself. The area is comprised of mostly tract homes in a very suburban setting. Each subarea is very homogenous.		
Price Range:	$180,000 to $1,200,000		
Applicable IECC Code:	Depends on year each home was built.		
Energy Efficiency Range in Subdivision:	Mostly E-F, some E-A and rarely, E-G.		
Above-grade Sq. Ft.	2433	**Below-grade Sq. Ft.**	840
Sold Date:	September 2013	**Finished Below Grade:**	410
Original List Price:	$419,000	**Bed/Bath Above Grade:**	3/2.1
Final List Price:	$405,000		
Sale Price:	$405,000	**Garage:**	2-Car Garage
Lot Size:	3,098 sq. ft.	**Lot Location:**	Residential
Days to Contract:	20		
Days to Contract for Subdivision:	26		
Market Conditions:	Strong seller's market		

Energy Efficient Details

The subject property was built in 1996 — prior to the existence of building codes that emphasized energy efficiency. The most recent seller had spent $60,000 in the last few years to upgrade the energy efficiency of the home. The owner was very interested in studying ways to lower his energy bills and thus took great care to create an energy system that worked as one efficient unit.

The HERS certificate was not provided or available. The listing agent stated the property was HERS 62 and that the certificate was issued in 2009. To achieve a HERS 62, the owner had installed a 3 KW photovoltaic system, a 98 percent efficient furnace, a 98 percent efficient water heater, Low E windows and a whole house ventilation system. The listing agent stated that this resulted in average utility bills of around $30 per month.

Note: Specific details about the subject's PV system were not available.

Listing Agent and Selling Agent Feedback

The listing agent commented that the home is located in Highlands Ranch, which is not an area with many "green" or highly energy-efficient homes. Highlands Ranch is a very vast, planned unit development consisting mainly of tract homes built between the early 1990s and the late 2000s. This property was one of the first known homes in the area to sell with many updated energy-efficient features. The agent estimated that the energy-efficient features decreased the utility costs from about $120 per month to around $30 per month, and he estimated that the improved energy efficiency added $10,000 to $15,000 to the total value of the property.

The selling agent indicated that the buyers were either engineers or worked in some type of related field. Both were very educated and "did a lot of calculating" based on the provided utility cost information. The buyers specifically hired an inspector who was qualified to evaluate energy efficiency features. The buyers did pay more to have these energy efficiency features, and they did so after determining that the utility savings they believed they would realize were worth the increased purchase price.

Income Approach to Value

According to the listing agent, the seller had documented a savings of $90 per month, and the buyers relied upon these figures. To develop an opinion of value for the subject property's level of energy efficiency, a gross rent multiplier was developed using the following data:

Address	Rent Per Month	Sale Price	GRM
3965 Blue Pine Cir	$2,100	$319,000	151
10664 Braselton St	$3,000	$370,000	123
673 Tiger Lily Way	$4,000	$517,800	129

The range of GRMs noted above is 123 to 151.

123 X $90 savings per month = $11,070
151 X $90 savings per month = $13,590

The indicated contributory value of the energy savings was between $11,000 and $13,600 (rounded per month). The subject property was most similar to the property with the GRM of 123, and therefore, a value indication near the lower end of the value range ($12,000) was a supportable adjustment. This figure is in line with the listing agent's comments.

Sales Comparison Approach to Value

We studied three sales that occurred at the same time as the subject property's sale. All three sales were located in the same immediate market area as the subject property, and were similar in age, condition, function and quality of construction. For ease of comparison, only the relevant differences are noted on the grid:

	Subject	Comp 1		Comp 2		Comp 3	
Sold Price	$405,000		$415,000		$395,000		$387,000
Above-grade Sq. Ft.	2433	2763	-$15,000	2399	0	2563	0
Basement Sq. Ft.	840	1444	-$7,200	1662	-$10,000	1220	-$4,600
Basement Finish Sq. Ft.	420	0	+6,300	1399	-$15,000	1136	-$11,000
Garage Count	2 Car	3 Car	-$7,000	2 Car	0	2 Car	0
View	Open Space	Open Space	0	Residential	+$23,000	Residential	+$23,000
Energy Efficiency Level	E-A	E-F		E-F		E-F	
			$392,100		$393,000		$394,400

After adjustments, Comps 1, 2 and 3 were all sold for $12,900, $12,000 and $10,600 less than the subject property. This sale price difference was attributed to the superior energy efficiency level of the subject property. In conclusion, the sales comparison approach indicated a contributory value range between $10,600 and $12,900 for the subject property's energy efficiency level. Two of the comparable sales adjusted at or near the $12,000 figure. A reasonable indication of value using the sales comparison approach was therefore $12,000.

Marketability

Because the energy-efficient features in this home were a superadequacy[51], it took longer to sell than the typical home in this market. The MLS indicated that the property had gone under contract in 20 days (compared to the market's average of 26 days); however, this was not accurate, as the property actually had listing price reductions and had been relisted for sale.

Reconciliation

This market area does not typically have homes with this high level of energy efficiency. After generally taking into consideration the cost of the improvements related to energy efficiency, the subject property's level of energy efficiency was considered a superadequacy for the area. Even so, the increased level of energy efficiency did contribute some value to the subject property's final sale price.

Both the income approach and the sales comparison approach indicated a value of $12,000 for the subject property's Average level of energy efficiency. Given that both value indicators were identical, there was no reason to give greater weight to one value indication over the other.

Conclusion:

The level of energy efficiency for this property was a superadequacy for its area.
Even so, the improved energy efficiency added
$12,000 (2.9%)
to the sale price as of September 05, 2013.

[51] According to The Dictionary of Real Estate Appraisal, a superadequacy is defined as "*an excess in the capacity or quality of a structure or structural component; determined by market standards.*" Since the energy efficiency features were superior to what the market expected or desired, they are considered a superadequacy.

Case Study #21: HERS 61

Type of home:	1880s Remodel	**Year Built:**	1885
Location:	Denver, Co 80211		
Subdivision:	**Whittier** This property is located in original Denver. Homes are typically more than 100 years old. Condition and level of updating vary dramatically as gentrification has begun. This is an extremely diverse, urban neighborhood.		
Price Range:	$75,000 to $800,000		
Applicable IECC Code:	N/A		
Energy Efficiency Range in Subdivision:	Most homes would be E-F, unless they have been renovated.		
Above-grade Sq. Ft.	1548	**Below-grade Sq. Ft.**	0
Sold Date:	February 2013	**Finished Below Grade:**	n/a
Original List Price:	$430,000	**Bed/Bath Above Grade:**	3 bed/2.1 bathrooms
Final List Price:	$430,000		
Sale Price:	$430,800	**Garage:**	None
Lot Size:	1,870 Sq. Ft.	**Lot Location:**	Standard, Interior Lot
Days to Contract:	(Sold before it was listed for sale)		
Days to Contract for Subdivision:	51		
Market Conditions:	Balanced		

Details of the Subject Property

The home was purchased as a fixer-upper January 30, 2008 for $200,000. The owner spent several years completing a full remodel. The home was then resold on February 21, 2013 for $430,800. At the time of sale in 2013, the MLS reported that the property had a HERS 61 rating from 2009. No documentation was available (or attached to the MLS), and so this information could not be verified. According to the only comments in the MLS, the home had a HERS rating of 61 and was a "5 Star + ENERGY STAR-Rated Home." No further information was provided or available.

Listing Agent and Selling Agent Comments

The listing agent and **the selling agent** were one and the same. The agent stated that the home went under contract before it went on the market and was sold over list price. The agent stated that the buyers were "really impressed" by the energy efficiency of the home. The agent actively marketed the energy efficiency features and worked to educate the buyers.

Comparable Sales Analysis

Given that details for the subject property were not available, and that this is such a dramatically diverse market area, it was not possible to conduct a comparable sales analysis in order to develop an opinion of market value attributable to the level of energy efficiency.

Marketability

We were not able to study the marketability of the home because the home was sold before it was officially listed for sale in the MLS.

Information on this Market Area

This is a very urban market area experiencing gentrification. It is not uncommon for very modern homes to replace old homes and to be constructed right alongside renovated 120-year-old Victorian-style homes (such as the subject property). Many of the newer homes in this area are more energy efficient (below HERS 60) and feature energy efficient architectural designs and photovoltaic systems.

However, like Case Study #18 and Case Study #19, the MLS listings in this area lacked any specific data pertaining to energy efficiency.

In conclusion, the market is showing that it does appreciate homes with high levels of energy efficiency, but without verifiable details, it is not generally possible for appraisers to develop an opinion of contributory value for different levels of energy efficiency and energy-saving features of various homes.

Conclusion:

As with Case Studies #18 and #19, even in an area that appreciates very energy-efficient homes, there is no way to study how specific elements of energy efficiency impact individual sale prices or market values without specific details that are both easily accessible to appraisers and available for the majority of homes.

Case Study #22: HERS 60

Type of home:	Newer custom home	**Year Built:**	2009
Location:	Denver, CO 80209		
Subdivision:	**Washington Park** This property is located in original Denver. Homes are often more than 100 years old, but average 80 years in this subdivision. Condition and level of updating vary dramatically. This is an extremely diverse, urban neighborhood. This area is in high demand and is a classic example of textbook gentrification, which has been in the process for well over 10 years.		
Price Range:	$191,000 to $1,250,000		
Applicable IECC Code:	2006 IECC		
Energy Efficiency Range in Subdivision:	Most homes would be E-F, unless they have been renovated or are newer construction. The newer homes will typically be E-VG or E-G.		
Above-grade Sq. Ft.	2924	**Below-grade Sq. Ft.**	1303
Sold Date:	June 2013	**Finished Below Grade:**	1200
Original List Price:	$1,200,000	**Bed/Bath Above Grade:**	3 bed/2.1 bathrooms
Final List Price:	$1,200,000		
Sale Price:	$1,180,000	**Garage:**	2-Car Garage
Lot Size:	6,210 Sq. Ft.	**Lot Location:**	Standard, Interior Lot
Days to Contract:	268		
Days to Contract for Subdivision:	69		
Market Conditions:	Balanced		

Details about the Subject Property

The most recent listing identified the home as being an "ENERGY STAR-Qualified Home." This was the only information provided in the MLS listing. This home, however, has been sold several times in the past, and one of those past listings offered more detailed information: "60 HERS rating, solar panels." Beyond that, no further details were available, even from the listing and selling agents.

Listing and Selling Agent Feedback

The listing agent provided no feedback.

The selling agent said that the energy efficiency of this home was a "big deal" and was "great to have." When asked, the agent stated that it is hard to say what it might have added to value.

The Value of ENERGY STAR in Regard to Marketability

Given that the selling agent indicated that the energy efficiency of the home was important (but details regarding the energy efficiency were not available), and the fact that this home has been sold several times in the past few years, we made the decision to test how well this home has fared over time compared to non-ENERGY STAR rated homes:

ADDRESS	SOLD DATE	SOLD PRICE	CHANGE IN VALUE
Subject	05/19/2010	$1,102,000	
	06/14/2013	$1,180,000	+7%
1052 S High St	06/01/2010	$1,214,500	
	05/13/2013	$1,224,250	+1%
919 S Gilpin St	12/01/2009	$1,400,000	
	03/28/2013	$1,491,000	+7%
357 S Vine St	10/26/2010	$920,000	
	04/01/2013	$1,051,000	+14%
719 S Vine St	12/28/2010	$935,000	
	03/28/2013	$1,025,000	+10%

The subject property did not increase the most in sale price from 2010 to 2013, nor did it increase the least. Based on this preliminary data set, we first drew the conclusion that the impact of the ENERGY STAR certification (if any) was not discernible. Thus, we completed more research, noted below.

Homes in the General Area

The subject property was a newer, custom home valued in the $1,000,000 value range, and surrounded mostly by homes built in the 1920s. Therefore, we made a search of other newer homes similar to the subject's age and value range to see if energy efficiency was a feature desired by this market.

Of the 18 similar sales located in MLS, eight listings made explicit mention of the homes being ENERGY STAR-certified, being "built energy efficiently," or the like. Interviews with two other agents confirmed that buyers in this price range and market area expected increased energy efficiency in a new or newer home in this market area. However, other than these statements, no specifics were available.

In the end, it was not possible to compare the homes that did not mention energy efficiency with those that did mention energy efficiency in their MLS listings. It was highly probable that all 18 of the homes were ENERGY STAR-qualified but, for various reasons, that information was not disclosed in the MLS.

Conclusion:

Increased energy efficiency is an expected feature in this market area for newer homes. However, whether or not an MLS listing makes mention of high levels of energy efficiency on a property is not an indication of whether the property is or is not highly energy efficient.

Case Study #23: HERS 55 to 67

Case Study #23 consisted not of data for one home, but of mass data for over 1,300 tract homes built between 2006 and 2013 by several different builders. While we studied the different builders, the builder we focused on was Meritage Homes. Meritage consistently achieve HERS ratings in the 55 to 65 range.

In regard to energy efficiency, Meritage advertising materials state the company's homes come equipped with "$15,000 of included features that work together." It is not clear, however, whether that $15,000 is the incremental cost above and beyond a code-built home (version unknown), or is the total cost for the energy efficiency package. Either way, Meritage builds energy efficient tract homes that, until only most recently, were superior to its competitor's energy efficiency packages.

To develop an opinion of how Meritage compares to other builders, we studied several subdivisions. Before this data is presented, it is important to note that in 2006, Meritage Homes consistently built homes that were more energy efficient than most of its competitors. As energy codes have become tighter and builders have focused more on energy efficiency, almost all new home builders (in the year 2014) build homes that directly compare to the levels of energy efficiency noted in Meritage homes.

Thus, we provide this data set to show how energy efficiency has impacted values over time. We do not expect that the trends noted below will apply to current market sales, given that the Meritage energy efficiency levels no longer differ so noticeably from those of other local builders.

Data

Data for several subdivisions was gathered via MLS and assessor files, and organized according to builder:

Subdivision	Zip Code	Total # of Homes	# of Homes per Builder
Erie Commons	80516	561	Meritage (63) Richmond (38) Standard Pacific (133) Taylor Morrison (327)
North Creek Farm	80602	379	Meritage (109) Capital Pacific (48) Sanctuary (31) Strauss (45) Woodcrest (146)
Fall Brook	80602	338	Meritage (119) Richmond (82) Ryland (49) Beazer (88)
Silver Creek	80026	60	Meritage (49) Markel (11)

All of the homes noted above are of comparable above-grade square footage and thus, their price per square foot was a relevant data point to study. The data noted above was compiled to allow us to study the actual selling prices of different builders over time and by subdivision:

ERIE COMMONS

Year Built	Builder	Range of Sale Prices at Time of Construction ($ Per Square Foot)	Median Sale Price ($ Per Square Foot)	# of Sales
2008	Standard Pacific	115 ---------- 207	138	26
2009	Standard Pacific	109 ---------- 165	130	11
2008	Taylor Morrison	116 ---------- 199	139	54
2009	Taylor Morrison	113 ----------155	126	50
2010	Taylor Morrison	112 ---------- 181	127	62
2011	Taylor Morrison	124-- 133	124	4
2011	Meritage	127 ---------- 167	147	15
2012	Meritage	119 ---------- 193	141	30
2012	Richmond	108 ----------199	127	27

FALLBROOK

Year Built	Builder	Range of Sale Prices at Time of Construction ($ Per Square Foot)	Median Sale Price ($ Per Square Foot)	# of Sales
2008	Beazer	108----------175	117	33
2008	Ryland	101----------222	126	21
2008	Meritage	107----------155	133	35
2012	Meritage	117----------197	125	6
2012	Richmond	111----------190	127	34

Both data sets showed that Meritage had the highest median sale prices in nearly all occasions, with the exception of Richmond Homes in the Fallbrook subdivision in 2012. (As noted earlier, this is likely due to the fact that Richmond increased the level of energy efficiency in its homes in more recent years.)

The Stability of the Value Premium

In theory, if increased energy efficiency was not relevant in the resale market, then the value premium Meritage experienced at the time of new construction would disappear (or decrease) at resale. To determine whether this was true or not, we studied the resale market.

We found that between 2008 and 2013, approximately 135 homes had been sold twice in the subdivisions just noted. We studied all of those sales, and the *change* in their sale price (per square foot) was averaged based on builder. From that data, we created a very concise chart:

BUILDER	SALE YEAR 1	SALE YEAR 2	AVERAGE CHANGE IN PRICE PER SQUARE FOOT
Beazer	2008	2013	-($1)
Ryland	2008	2013	+$2
Meritage	2008	2013	+$6
Meritage	2009	2013	+$5
Taylor Morrison	2009	2013	+$6
Taylor Morrison	2010	2013	+$13
Meritage	2010	2013	+$24

Over the course of time, Meritage sales have not declined in value relative to those of other builders. In conclusion, the value of increased energy efficiency appears to have been retained for at least the first five years of a Meritage home.

Meritage Resale Homes that Emphasized Energy Efficiency in their MLS Listings

Of the 45 Meritage homes that were sold two times between 2007 and 2013, none had their ENERGY STAR or HERS rating certificate attached to the MLS listing. Additionally, only three listings had any type of comment that made reference to energy efficiency. Those comments were:

- "High-efficiency utilities"
- "5-Star energy rating"
- "Green ENERGY STAR-Certified"

When we interviewed the listing agents and asked them why they did not make reference to the energy efficiency features of the homes, they shared the following comments:

- "Everyone is aware Meritage is a quality builder."
- "Sellers do not understand they need to keep the certificate or what it really is."
- "Meritage builds a good home and people like it."
- "It is too bothersome to track down the certificate."
- "Meritage has a great reputation and they are the best. Recently, however, more builders are building a better product and the difference is narrowing."

Thus, Meritage Homes appear to be viewed for its "quality." The market is clearly willing to pay for the extra expenses associated with "quality." In this case, that includes improved energy efficiency, but it does not appear that the market sees energy efficiency as "separate" from the overall quality of construction of the home.

Conclusion:

Energy efficiency has been valued in new home subdivisions like this one since at least the year 2006. Energy efficiency levels that are ENERGY STAR-qualified are expected in new homes in market areas like this one.

Case Study #24: HERS 46

Type of home:	2010s infill house	**Year Built:**	2010
Location:	Fort Collins, 80521		
Subdivision:	**Capitol Hill** The original part of old Fort Collins with a great variety of home ages, styles, level of maintenance and quality levels.		
Price Range:	$129,000 to $970,000 (median of $235,000)		
Applicable IECC Code:	Most were built before any energy codes were applicable.		
Energy Efficiency Range in Subdivision:	Typically homes are between E-G and E-P, though the subject property is E-VG.		
Above-grade Sq. Ft.	2271	**Below-grade Sq. Ft.**	1350
Sold Date:	May 2013	**Finished Below Grade:**	95%
Original List Price:	$725,000	**Bed/Bath Above Grade:**	4 bed/2.1 bathrooms
Final List Price:	$725,000		
Sale Price:	$725,000	**Garage:**	2-Car Garage
Lot Size:	6800 Sq. Ft.	**Lot Location:**	
Days to Contract:	(Sold before it was listed in MLS)		
Days to Contract for Subdivision:	68		
Market Conditions:	Stable		

Details Available for the Subject Property

The MLS listing stated that the home was "HERS-rated, ENERGY STAR-qualified, green built" and had a "5-Star + energy rating." The MLS also stated that the "Green Disclosure and energy rating are located in the additional documents for appraisers." This was the only listing we found that specifically stated that the documents would be useful to appraisers. Since the home was sold before it was listed for sale, the listing agent chose to add the documents to the MLS specifically to help appraisers understand the property.

The home had:

HERS Rating of 46	*R-44 Insulated vaulted ceiling*	*Clothes Dryer (gas)*
Estimated Annual Energy Costs of $1239	*R-44 insulated exposed floor*	*ENERGY STAR appliances*
Programmable Thermostat	*U.34, SHGC .30 windows*	*2 X 6 Framing*
92.1 AFUE Furnace	*R-14 insulated foundation walls*	*Fresh Air System*
0.91, 50 gal hot water heater	*1198 CFM50 Blower Door test*	*Air Sealing*
Passive Solar design	*2.1 kW photovoltaic system*	*Solar hot water heater*

Listing Agent and Selling Agent Feedback

The listing agent and **selling agent** were one and the same. In his comments, he shared that the energy efficiency levels of this home did matter to the purchase price, and that the people who originally built the house believed they got a three-to-one return on their investment because they had consciously built the home with energy efficiency levels in mind. He noted that the value impact, however, would be impossible to extract because it was imbedded in all different elements noted in the home.

Additional information was available from the listing agent who had sold the vacant lot in 2007 (for $106,000) to the people who built the home. His feedback was as follows: The people wanted to build an energy-efficient home OR buy one in this one specific neighborhood, as they wanted the old-town location and they wanted a large garage. In the end, the energy efficiency became the big selling point on this home. However, it could not be separated out from how well-designed the home was, or from the very good quality of construction.

At the time, this had been the highest sale in the neighborhood. Since the home needed to be appraised, the agent worked actively with the appraiser to explain finish features, upgrades and energy efficiency features compared to other homes.

Conclusion

Like several other case studies, this property had been the highest selling home in the subdivision at the time. Also, given that this property is located in an extremely diverse market area, it was not possible to reasonably extract a value premium for energy efficiency. The purpose of this case study was to show how important the listing agent's role was to this transaction.

Conclusion:

It is important for market participants to provide documentation to appraisers so that they are able to understand exactly what features a home has and they can use this data to compare to other properties.

Case Study #25: HERS 42

Type of home:	2000s home	**Year Built:**	2008
Location:	Boulder, 80304	**Builder:**	Tract home
Subdivision:	**Holiday** A very energy efficient- and green building-conscious subdivision. There is a co-housing[52] complex in the development, solar systems are common, and the area can be defined as a "new urbanism"[53] development.		
Price Range:	$400,000 to $900,000		
Applicable IECC Code:	Most current codes, depending on the year the home was built.		
Energy Efficiency range in Subdivision:	All range from E-E to E-G.		
Above-grade Sq. Ft.	1494	**Below-grade Sq. Ft.**	669
Sold Date:	January 2012	**Finished Below Grade:**	90%
Original List Price:	$589,000	**Bed/Bath Above Grade:**	3 bed/3.1 bathrooms
Final List Price:	$589,000		
Sale Price:	$570,000	**Garage:**	2-Car Garage
Lot Size:	3877 Sq. Ft.	**Lot Location:**	Standard, Interior Lot
Days to Contract:	30		
Days to Contract for Subdivision:	89		
Market Conditions:	Balanced		

Data Available for the Subject Property

- LEED Silver Certificate was attached to the MLS
- HERS Certificate was attached to the MLS
  - Indicated HERS 42
  - Annual energy costs: $910
- Sales sheet detailed the finish features
- Green Features addendum

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[52] Wikipedia defines a co-housing community as "*a type of intentional community composed of private homes supplemented by shared facilities. The community is planned, owned and managed by the residents – who also share activities which may include cooking, dining, child care, gardening, and governance of the community.*"

[53] Wikipedia defines new urbanism as "*an urban design movement which promotes walkable neighborhoods containing a range of housing and job types. It arose in the United States in the early 1980s, and has gradually influenced many aspects of real estate development, urban planning, and municipal land-use strategies.*"

Subject Property

Very good data and information were available for the subject property, from finish features related to energy efficiency, to utility cost estimates and the actual HERS certificate. This property was a prime example of the type of data appraisers need to properly compare the subject property to other properties.

Comparable Sales

While numerous properties in this development had LEED certifications and/or HERS ratings, it was very typical for the MLS listings to lack almost all documentation (and mention) of relevant green and/or energy efficient features. As a result, without a massive time commitment to track down the documents, it was not possible to compare the level of energy efficiency of one home to another.

Thus, while it was clear what features the subject property had, what the comparable sales had for energy efficient features was entirely unknown. (The only exception was that some of the MLS listings stated that the homes had photovoltaic systems, but no information on those systems was provided).

Conclusion

Without comparable details, the known facts about the subject property were not useful, because we had nothing against which to compare them. Lack of data was a major obstacle to studying the different levels of energy efficiency in this subdivision.

Conclusion:

A high level of energy efficiency was an expected feature in these homes. As a result, many Realtors did not even mention the features, because it was a given.

That said, it was not possible to directly measure the potential price or value benefit of energy efficiency without the data or property information.

Case Study #26: HERS 27

Type of home:	First Certified Passive House Built in Colorado	**Year Built:**	2013
Location:	Denver, Co 80221		
Subdivision:	**Midtown** This is a newer subdivision with two builders: David Weekley Homes and Brookfield Residential. The first homes were built in 2013. All of the homes are modern architecture-style homes with between 1,500 and 2,400 square feet above grade and located on small (3,000- to 5,000-square-foot) lots. HERS ratings range from 27 to around 65.		
Price Range:	$310,000 to $529,000 Median: $380,000		
Applicable IECC Code:	2006 IECC		
Energy Efficiency Range in Subdivision:	One home (the subject property) is known to have an E-E level of energy efficiency, while all of the other homes are between E-VG and E-G.		
Above-grade Sq. Ft.	2403	**Below-grade Sq. Ft.**	846
Sold Date:	December 2013	**Finished Below Grade:**	0%
List Price:	$569,990	**Bed/Bath Above Grade:**	3 bed/2.1 bathrooms
Sale Price:	$529,000	**Garage:**	2-Car Garage
Lot Size:	4,387 Sq. Ft.	**Lot Location:**	Corner Lot
Days to Contract:	77	Total Days On Market:	107
Days on Market for Subdivision:	This is not trackable, as all homes are new construction and are built to order.		
Market Conditions:	Strong, leaning toward a seller's market. New construction is selling rapidly. Over 60 homes have been sold in the first year in this subdivision.		

Builder Interview

This is the first certified passive[54] home built in Colorado, built by Brookfield Residential. Because the builder needed to design and construct this home very quickly in order to be ready for the subdivision grand opening around August 2013, it was not able to take the necessary time to "tweak" all of the different building elements to design the most cost-effective passive home. As a result, the builder did not make a noted profit; however, the company did not lose money either. The buyer was reported to be energy-savvy and was generally familiar with building science. Even so, the builder stated that it was considered beneficial to take time to further educate and explain the function of the home to the buyer.

[54] Wikipedia defines a passive house as "*a rigorous, voluntary standard for energy efficiency in a building, reducing its ecological footprint. It results in ultra-low energy buildings that require little energy for space heating or cooling*."

The intent in building the home was not entirely for monetary profit. This property was constructed with the backing of the Department of Energy (DOE). Going forward, the DOE will be monitoring the utility usage of this house compared to other homes in the subdivision. Thus, the builder is using this home to study energy efficiency and understand how to build a more cost-effective version of these types of homes in the future.

In regard to the energy efficiency of this property, the builder believed the energy bills in February 2014 to be around $70.

Analysis

The home was sold for the highest price in the subdivision, and the builder had no plans to build other passive homes in the subdivision. The builder clearly indicated that it did not make a reasonable profit for this home, thereby providing evidence that this property was an over-improvement for the area. The super energy efficiency of this home was not a positive feature, as the home was too energy efficient compared to the cost to build it and the market's willingness to pay to have these features.

In a comparison of the property to other homes of the same relative size, and built by the same builder, the subject property was sold for more:

BUILDER	Sq. Ft.	Bsmt. Finish	Sale Price	Price Per Sq. Ft.	Sold Date
Brookfield	2337	1128	$402,700	$172.31	10/25/2013
Brookfield	2366	1037	$412,100	$174.18	9/30/2013
Brookfield (Passive House)	2486	921	$529,000	$212.79	12/3/2013

The subject property was sold for between 28 and 31 percent more than the two non-passive homes. Even so, given the information the builder provided, it was easy to conclude this property was not at its highest and best use, and was an over-improvement.

Even though this home was an over-improvement, we were able to extract other general and useful data from the subject property's subdivision. The following pages contain more data associated with this case study.

Conclusion:

This passive home was an over-improvement, but still commanded a market premium for its super energy-efficient design.

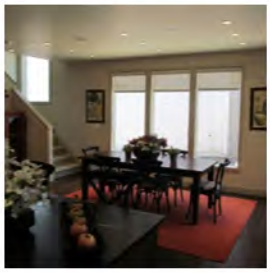
Other Information Gather from this Midtown Development

Midtown is a brand-new subdivision; the first homes were built in 2013. There are only two builders in the Midtown subdivision: David Weekley Homes and Brookfield Residential. David Weekley offers homes that range between 1,500 and 2,400 square feet above grade. Brookfield offers homes that range between 2,000 and 2,400 square feet above grade. Sample photos from each builder are noted below:

Brookfield

Brookfield

Brookfield



David Weekley

David Weekley

David Weekley

Both builders are building similar products. Brookfield builds homes that have average HERS ratings of around 47, while David Weekley builds homes with average HERS ratings around 62. Some of the differences in the energy packages are as noted:

Product:	(Assumes a 2,000-Square-Foot-Home)		
	David Weekley	Brookfield	Incremental Costs
Wall Insulation R Value	R-23	R-27	$3,940
Insulation Type	Fiberglass batt	2" closed cell foam 3 1/2" blown cellulose	For all insulation upgrades. Per Marshall & Swift Cost data for "superinsulated" Properties.
Attic/Ceiling	R-38 blown insulation in ceilings	R-50 blown cellulose and R-60 batts	
Basement Insulation	R-19 vinyl faced fiberglass	R-19 perforated vinyl-covered	
Furnace	92% efficient	93% efficient	Unknown
Water Heater	Rinnai tankless	Ravien tankless	Unknown
Windows	Milguard	Unspecified brand	Unknown
ENERGY STAR Certification	ENERGY STAR 3.0	ENERGY STAR 3.0	n/a
Solar PV	None	1.2 kW (owned) solar shingles	$3,800
Blower Door Test	Not noted	Yes	Unknown

The incremental costs were at least $7,700 for the Brookfield homes, though exact estimates were not known, as precise details regarding construction differences were not known. This cost difference was reflected in the list prices.

List Prices

Each builder offers six Brookfield or eight David Weekley models. Of those models, two sets of homes (one from each builder) that are similar to one another. Those properties have the current base list prices:

Builder	Square Footage	Base Price	Base Price per Sq. Ft.
David Weekley	1943	$365,990	$188.36
Brookfield	1997	$378,880	$189.72
David Weekley	2126	$378,990	$178.26
Brookfield	2140	$390,880	$182.65

The two Brookfield homes were listed for between $1.36 and $4.39 more per square foot (or between $2,715 and $9,394) than the David Weekley homes. A small amount of this difference can be applied to the minor differences in square footage (i.e. the price per square foot tends to decrease as homes get larger). However, in this case, that amount was insignificant, since the homes vary by less than 50 square feet from one builder to the next.

Note: It is typical for buyers to add upgrades when they purchase a home. Therefore, the base price is not reflective of the majority of final purchases prices. A study of actual sale prices became necessary to understand final cost differences between the two builders.

A Comparison of Final Sale Prices

To compare sale prices, we studied all of the recorded sales from the Adams County Assessor. We paired homes according to similar square footage and basement finish. We then compared the prices per square foot to one another based on the builder of each property.

Sold Price per Square Foot (Above Grade):

BUILDER	Sq. Ft.	Bsmt Fin	Sale Price	Price Per Sq. Ft.	Sold Date
Weekley	1960	803	$365,879	$186.67	4/25/2014
Brookfield	2110	312	$393,600	$186.54	10/31/2013
Brookfield	2090	876	$397,500	$190.19	7/30/2013
Brookfield	2090	864	$405,500	$194.02	2/14/2014
Brookfield	2090	864	$405,700	$194.11	2/28/2014
Brookfield	2110	962	$421,000	$199.53	4/25/2014
Brookfield	2090	864	$425,400	$203.54	5/12/2014
Brookfield	2090	864	$437,100	$209.14	3/28/2014
Brookfield	2090	864	$447,473	$214.10	2/28/2014

BUILDER	Sq. Ft.	Bsmt Fin	Sale Price	Price Per Sq. Ft.	Sold Date
Weekley	1960	0	$344,800	$175.92	11/8/2013
Weekley	1960	0	$348,400	$177.76	4/18/2014
Weekley	1960	0	$352,900	$180.05	3/28/2014
Weekley	2008	0	$367,900	$183.22	2/26/2014
Weekley	2008	0	$375,000	$186.75	9/30/2013
Weekley	2008	0	$383,300	$190.89	9/6/2013
Weekley	2023	0	$385,000	$190.31	4/11/2014
Brookfield	2090	0	$413,000	$197.61	3/31/2014
Brookfield	2110	0	$436,100	$206.68	1/28/2014

BUILDER	Sq. Ft.	Bsmt Fin	Sale Price	Price Per Sq. Ft.	Sold Date
Brookfield	2337	1128	$402,700	$172.31	10/25/2013
Weekley	2416	1076	$416,800	$172.52	3/7/2014
Brookfield	2366	1037	$412,100	$174.18	9/30/2013
Weekley	2416	1076	$434,700	$179.93	9/12/2013
Weekley	2416	1076	$437,900	$181.25	9/27/2013
Weekley	2416	1076	$451,200	$186.75	1/27/2014
Brookfield (Passive House)	2486	921	$529,000	$212.79	12/3/2013

BUILDER	Sq. Ft.	Bsmt Fin	Sale Price	Price Per Sq. Ft.	Sold Date
Brookfield	2366	0	$381,000	$161.03	12/31/2013
Brookfield	2337	0	$389,600	$167.14	10/4/2014
Weekley	2416	0	$426,900	$176.70	9/20/2013
Brookfield	2337	0	$437,800	$187.33	3/5/2014

BUILDER	Sq. Ft.	Bsmt Fin	Sale Price	Price Per Sq. Ft.	Sold Date
Weekley	2248	0	$380,000	$169.04	10/18/2013
Weekley	2288	0	$397,738	$173.84	12/20/2013
Brookfield	2216	0	$395,000	$178.25	3/12/2014
Brookfield	2216	0	$415,800	$187.64	3/31/2014

- Of the 15 David Weekley homes noted above, the average sale price was $180.77.
- Of the 18 Brookfield homes noted above, the average sale price was $190.90.

This did not translate into a $10-per-square-foot adjustment, as this was only an average sold price difference and did not take into account upgrade differences, minor differences in square footage and lot premium differences. However, this provided support showing that Brookfield homes sold for more than the David Weekley homes.

Expected Utility Bills for These Properties, Given the Differences in HERS Ratings

Neither utility billing information nor estimates were available. Neither builder provided the HERS reports in the MLS listings, nor did they have any marketing materials estimating the average annual utility costs per property. The only possible source of utility information would be from the census data noted much earlier in this appraisal report.

According to census data, utility costs for homes built between 2000 and 2006 (the most current data) were $0.87 per square foot. From this information, we can very generally make the following conclusions:

- 2,000-square foot home with a HERS 100 = $1,740 per year ($0.87 X 2000)
- 2,000-square-foot-home with a HERS 62 = $1,078 per year ($1,740 X 64%)
- 2,000-square-foot-home with a HERS 47 = $817 per year ($1,740 X 47%)

Based on this information, the overall savings per year among the David Weekley homes and the Brookfield homes could generally be estimated at around $250 per year. However, this is not a precise estimate and should be considered as qualitative information only. The information is intended only to very generally understand the energy savings relationship between the two different builders in this subdivision.

Gross Rent Multiplier (Income Approach)

Using the $250 per-year cost difference, it was plausible to develop a gross rent multiplier, given that one property in the subdivision was rented. This was considered to be a very limited data set. However, given the lack of any data pertaining to overall energy efficiency, this one data piece was taken into consideration.

The one rental property was a David Weekley home:

SOLD DATE	12/30/2013
SALE PRICE	$324,600
Rent	$2250
---	---
GRM	144

Given the (very rough) savings estimate of $250 per year (or $21 per month), a contributory value estimate using the GRM of 144 was as follows:

$21 X 144 = $3,024

Cost Approach (Using Marshall & Swift Cost Data)

The Marshall & Swift cost data was based on the building codes relevant to the 2009 IECC. A home that has been built to meet the 2009 IECC will have a HERS rating around 80. The two builders in this subdivision, however, had constructed homes with HERS ratings near 62 (David Weekley) and 47 (Brookfield). The HERS 62 rating is very similar to the HERS rating for most homes built to the 2012 IECC.

As noted earlier in this report (under "Appraisal Methodologies: Cost Approach"), there is a defined cost difference between a home built to the 2009 IECC and one that is built to the 2012 IECC:

Incremental Cost Difference for a Home that Complies with the 2009 IECC vs. the 2012 IECC

To summarize one study:

- In Denver, the incremental cost increase would be $1,412.
- In Denver, the annual energy savings would be $271 to $277.
- Therefore, the payback period would be 33 to 37 months.

For this referenced study, incremental costs were calculated using the RS Means Contractor Pricing Guide. Using these figures, the study estimated that the increased cost to construct the home would result in an additional $5.41 added to a mortgage payment, yet would provide a $22.53 per-month savings on energy costs.

A home that is compliant with the 2012 IECC has a HERS rating around 62 (i.e. the David Weekley homes). The Brookfield homes are constructed above and beyond the 2012 IECC minimum requirements and thus, have HERS ratings near 42.

Case Study #27: HERS 8

Location	Boulder, Colorado
Property Type	Single-family home
Year Built	2010
Square Footage	2,251 above grade; no basement
Date of Sale	Early 2011
Sale Price	$710,000
Energy Certificate	Yes. The property has a HERS 8 rating The certificate was issued in 2010
Energy Upgrades	See notes below
Energy Efficiency Level	E-E

Energy Efficiency Features for this Property

5 kW Solar Electric System (leased)	Open and Closed Cell Foam	ENERGY STAR Appliances
Solar Hot Water System	Insulation Air Sealing Upgrades	Tankless Hot Water
Sealed and Insulated Crawl Space	South Facing Overhangs	High-efficiency Furnace
Heat Recovery Ventilation System	Passive Solar Design	Hot Water Recirculation Pump
Triple-pane Windows	High-efficiency Lighting	High Eff. Evaporative Cooling

The property is also LEED platinum (a “green” rating). It is typical for extremely energy-efficient homes like this one to have been built using green features and techniques.

Data Sources Available to Verify Energy Efficiency Information

Data sources are indicated in BOLD:

MLS listing	Utility Bills	**Homeowner**
Builder/Contractor	Building Permits	Homebuyer
Listing Agent	**HERS or ENERGY STAR Certificate**	Details for the Photovoltaics
Selling Agent	Cost Estimates	Estimated Energy Savings
Specific Comments on MLS Listing	**Estimated Annual Energy Costs**	

The Buyer's and Seller's View of the Level of Energy Efficiency

The seller was the builder, who took great care to provide education materials about the home. The listing agent also actively worked to educate potential buyers about the various "invisible" benefits associated with this property. One difficultly the listing agent noted was that many of the Realtors (representing potential buyers) did not understand how to view energy efficiency. Also, the listing agent still believed that the majority of buyers consider a property's location first, its overall appeal second, and its energy efficiency potentially third.

Another slight difficulty was that this home was built in an area that is perceived as having a high percentage of rental properties. This home was one of the first pop-tops in the area, though several others were started after this one was sold.

Income Approach to Value

According to the HERS certification, the estimated annual energy costs for this property were $209, or $17.41 per month. Therefore, while we do know that actual costs were estimated at $17.41, we do not know what the actual savings per month are for this home. Typically, this information can be found on the energy audit. The actual energy audit was not provided by the builder.

Additionally, we could not reliably develop a gross rent multiplier. While there were numerous rentals in the subdivision, they were all for homes valued under $400,000. Homes in this price range would have a vastly different gross rent multiplier than homes in the $700,000+ value range.

Cost Approach to Value

A cost comparison approach for the subject property was utilized using the sale price of the subject property compared to cost figures generated from Marshall & Swift.

COST APPROACH USING THE SALE PRICE OF THE SUBJECT PROPERTY

The subject property's lot value was $288,000[55] (based on land sales).

The home was sold for $710,000.

Therefore, costs associated with the home were:

$710,000 - $288,000 = $422,000

-$22,000 for the detached garage

$400,000

$400,000 / 2251 (square feet above grade) = **$178 per square foot**

This data could be compared to the cost figures generated from using the Marshall & Swift Residential Cost Estimator 7 program. The cost figures from Marshall & Swift reflected a home built to code.

[55] Tap fees are included.

COST APPROACH USING MARSHALL & SWIFT

The subject property's lot value was $288,000[56] (based on land sales).
Marshall & Swift indicated that the cost to construct the property (to code) was $670,000[57].

$670,000 - $288,000 = $382,000
-$22,000 for the detached garage

$360,000
$360,000 /2251 (square feet above grade) = **$160 per square foot**

Total cost premium: $40,000, or, 6%

Using the cost approach, it was reasonable to conclude that the market saw a 6 percent premium for the green and energy-efficient features in this home. It was not possible to break out which part of the premium was attributed to the "green" features and which was attributed to the "energy" features, as they are intertwined.

The Sales Comparison Approach

For this study, we did not develop the sales comparison approach, due to the location of the home.

This home is located in a subdivision that was developed in the late 1950s and early 1960s with 800- to 1,200-square-foot brick ranch-style homes. The subdivision still consists mostly of these old homes. The majority of the homes have had only moderate updating and many are tenant-occupied. In 2011, the subject property had been the first new home in the subdivision in over 50 years, and its sale price of $710,000 was, to date, the highest selling home in the subdivision (the next-highest selling home to date was approximately $400,000).

The subject property, however, was not an over-improvement. Given that land values in the subdivision were near $300,000 in 2011, this subdivision was ripe for redevelopment or possible gentrification. Compared to the rest of the City of Boulder, this subdivision was the right choice of location for any builder to construct a new home. The $300,000 land values were lower than any comparable area in town, and so it was inevitable that a builder should choose this area to construct a new home in 2011. After the subject property was constructed, other builders began coming to the area. Other new homes have been and are still being constructed. In conclusion, choosing the comparable sales and reporting

[56] Tap fees are included.
[57] These figures include an added 12 percent entrepreneurial profit, which is currently typical for this market area and price range.

them in this study would result in having to complete a full appraisal on the property to explain all of the market factors associated with value from one area to the other. As a result, for simplicity's sake (and due to the fact that other case studies show examples of the sales comparison approach), we did not develop the sales comparison approach here.

Marketability

The property took longer to sell than average, because it was a new product (and the highest priced home) for the area.

Reconciliation

- The listing agent stated that the property had sold for a premium because of its green and energy-efficient features.
- The builder stated that he made his expected profit, meaning that the market did value the extra expenses he incurred to build the home.
- The cost approach indicates there was a 6 percent premium for the combined "green" and "energy-efficient" features.
- There was not enough information to develop the income approach.
- While there was enough information to develop the sales comparison approach, it was beyond the scope of this study.

Conclusion:

It is probable that the market paid a premium for a combination of green features **and** energy efficiency. That premium was no greater than $40,000, or 6 percent of the sale price.

This conclusion is generally supported by the fact that after this home was sold, the builder went on to build another near net-zero[58] property in this same neighborhood, which again realized the highest selling price to date: $820,750 on June 11, 2014 (for a 2,504-square-foot-home with no basement and a two car detached garage). To date, this builder had built three near-net zero homes in Boulder, all of which have been extremely well received.

[58] Wikipedia defines net zero as: "A **zero**-energy building, also known as a **zero net** energy building, **net**-**zero** energy building, or **net zero** building, is a building with **zero net** energy consumption, **meaning** the total amount of energy used by the building on an annual basis is roughly equal to the amount of renewable energy created on the site."

Case Study #28: HERS *Score* of 160*

Type of home:	1980s Remodel	**Year Built:**	1983
Location:	Boulder, 80304	**Builder:**	Custom-designed home
Subdivision:	**Moores** A very diverse market area typical of the City of Boulder. A great mix of architectural styles, construction materials, lot sizes and level of updating. Very eclectic and a highly marketable area.		
Price Range:	$400,000 to $3,000,000		
Applicable IECC Code:	Varies, based on the year of construction and year of remodel.		
Energy Efficiency Range in Subdivision:	All levels from E-E to E-P		
Above-grade Sq. Ft.	2953	**Below-grade Sq. Ft.**	870
Sold Date:	August 2013	**Finished Below Grade:**	0%
Original List Price:	$850,000	**Bed/Bath Above Grade:**	5 bed/3.1 bathrooms
Final List Price:	$850,000		
Sale Price:	$850,000	**Garage:**	None
Lot Size:	10,493 Sq. Ft.	**Lot Location:**	Standard, Interior Lot
Days to Contract:	14 (three offers, one with an escalation clause)		
Days to Contract for Subdivision:	40		
Market Conditions:	Increasing demand was just starting. Slight seller's market.		

**HERS Score of 160*

The subject property had been renovated in 2005. At that time, the property owner did have a RESNET rater produce a HERS report. The HERS report indicated that the HERS score was around 160; however, in this one case, the high HERS number was a very positive indication of extremely high levels of energy efficiency.

Because the HERS number of 160 had been issued prior to 2006, the number was a *HERS score* and not a HERS *Index rating*. HERS scores run in the opposite direction of the HERS Index rating (which replaced HERS scores around 2004). Thus, in this case, the high HERS score actually indicated that the home was 21 percent more efficient than the building codes required at that time. This fact has been highlighted to show that older HERS scores (prior to 2004) had a different meaning than the more current HERS Index ratings.

Details of the Subject Property

The home was reported to have "every possible" green building feature and energy efficiency components necessary to create a net zero property. The sales history of the property is as follows:

05/04/1999	*$185,000*	*After purchase, the home was transformed into a net zero property*
01/10/2007	*$815,000*	*Net zero property*
08/14/2013	*$850,000*	*Net zero property*

The MLS listing included extensive literature about the subject property, including a marketing flyer explaining the property, a Green Disclosure, a REScheck Compliance Certificate, a REScheck Inspection Checklist, and a Green Point Application (a form that is specific to Boulder).

However, the home was constructed prior to the current HERS rating system, and because of this, the property does not have the standard HERS information available from the 2006 RESNET software system. All documents for the subject property are dated pre-2006. Thus, we know the overall energy utility savings for this home is 100 percent, but compared to what, we do not know.

That said, the finish features of this home include:

Passive solar design
4.2 kW PV
Solar thermal collectors, 80 gallon storage tank with digital controller
Wet blown cellulose (Icynenen)
Exterior rigid foam insulation
Ceiling fans
ENERGY STAR appliances
Cathedral ceiling insulation: R 34
CFL light bulbs
Floor R value: R 21
Slab R value: R 9
Window U factor: U 0.40
High-efficiency water heater
Insulation air sealing
Home orientation (south facing overhangs)
Low VOC paint
Radon mitigation system
Programmable thermostat
Sunshades over rear patio
92% efficient furnace
Energy-efficient appliances
Crawl space R value: R 19
Wall R value: 18

In conclusion, while a HERS rating was not available, all literature and documentation supported the Realtor's statement that this is a net zero-energy home.

Listing Agent and Selling Agent Feedback

The listing agent's assistant said that the property had received two or three offers, one of which contained an escalation clause. The solar elements were extremely important to the buyers and the overall energy efficiency levels were "very impressive" to the buyers. Because the home was so "green," however, one negative feature did emerge. The home did not have a dryer or a hookup for a dryer. (For having a clothes line instead of a dryer, people can receive "Green Point" credits when applying for remodel permits.) Thus, this was addressed during the negotiation process so that the buyers could have an installed, working dryer upon moving into the home.

The selling agent did not provide information. (It was not clear, after going through study notes, whether we had attempted to make contact or if the agent just had not been available.)

Marketability

The home was sold immediately after receiving multiple offers. However, given the strong seller's market, this was not uncommon at the time. Thus, it was not possible to discern whether market demand was high for this property type, or market demand was high for all properties.

Final Notes

Other than the qualitative evidence that the buyers did like the overall energy efficiency of this home, and that the home sold quickly, no other additional data was available to compare to the subject property. This was such an extremely diverse market area that a reliable paired sales analysis was not possible. Additionally, we could not reliably develop the cost approach because specific details about the home were not verifiable, depreciation would be extremely difficult to accurately develop, and there were no similar land sales. Also, this is not a rental area, and we could not reliably develop a GRM. Lastly, utility costs were not available for the other homes in the area (for capitalization purposes) and we could not verify the actual utility savings (in dollars) realized by the subject property.

Conclusion

This was a prime example demonstrating that lack of data could have a negative impact on the valuation of the subject property during the appraisal process. The only fact that an appraiser can rely on is the common availability of green features in the Boulder area. However, given the lack of data, an appraiser would not have been able to derive an adjustment for the near-net zero features this property was reported to have.

Conclusion:

It was highly probable that the market paid a premium for a combination of green **and** energy-efficient features in this near-net zero property. However, there was not any quantifiable data that could be used to derive a supported opinion of contributory value.

Additional Information

Guide to the Residential Green and Energy Efficient Addendum

The Residential Green and Energy Efficient Addendum (RGEEA) was designed by the Appraisal Institute as a way for appraisers to report some of the more common energy-efficient features currently associated with residential homes. While the form has yet to benefit from wide use, that may change. RESNET, the software company that created the HERS rating system, has agreed to provide the form to its energy raters so they may populate the form for appraisers, when applicable.

This tool will be tremendously useful going forward. Given the vast majority of homes that will be built to the 2012 IECC going forward, these homes will have a HERS rating, and appraisers should then have a way to gather HERS information for various homes in a quick and efficient manner.

In anticipation of the relevance of the RGEEA, the fields on the form that relate to energy efficiency are discussed below. In this way, appraisers can understand the meaning of various details on the form and whether they are relevant to their particular assignment.

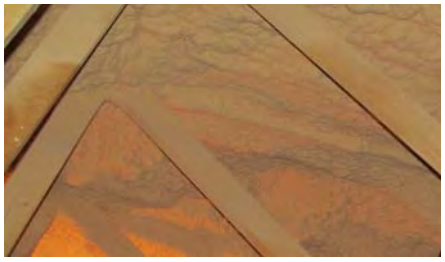
The information on the following pages will only provide details for page two of the addendum (the page that most applies to this study). The information will not include an explanation of any information related to photovoltaic systems, as that was covered in detail in a prior study by this same author.

Insulation

Most common types of modern insulation:

Fiberglass Blown In: R2-R.28 per inch

Cost: $.70 to $2.00 per sq. ft. installed



Spray Foam: R 6.5 per inch

Cost: $4.00 per sq. ft. installed

Dense Pack Cellulose: R3.2-R3.8 per inch

Cost: $2.00 to $4.00 per sq. ft. installed

Fiberglass Batt: R3.2-R3.8 per inch

Cost: $.70-$2.00 per sq. ft. installed

Blown Cellulose: R3.2-R3.8 per inch

Cost: $.70 to $2.00 per sq. ft. installed

Basement Insulation

Insulating basements is a newer practice, and unless a home was retrofitted with basement insulation, many homes only have minimal rim joist insulation, but no wall insulation. Basement insulation can be on the inside or the outside of the foundation. In our area, it is common in newer homes to insulate the interior of the basement.

A typical uninsulated basement in a 40-year-old home.

An insulated basement in a 5-year-old home.

When insulating the interior, the insulation must have an air-barrier wrap so as to stop air infiltration. An air barrier in an unfinished basement typically consists of some type of plastic sheathing. An air barrier in a finished basement typically consists of drywall.

HERS Insulation Installed Rating

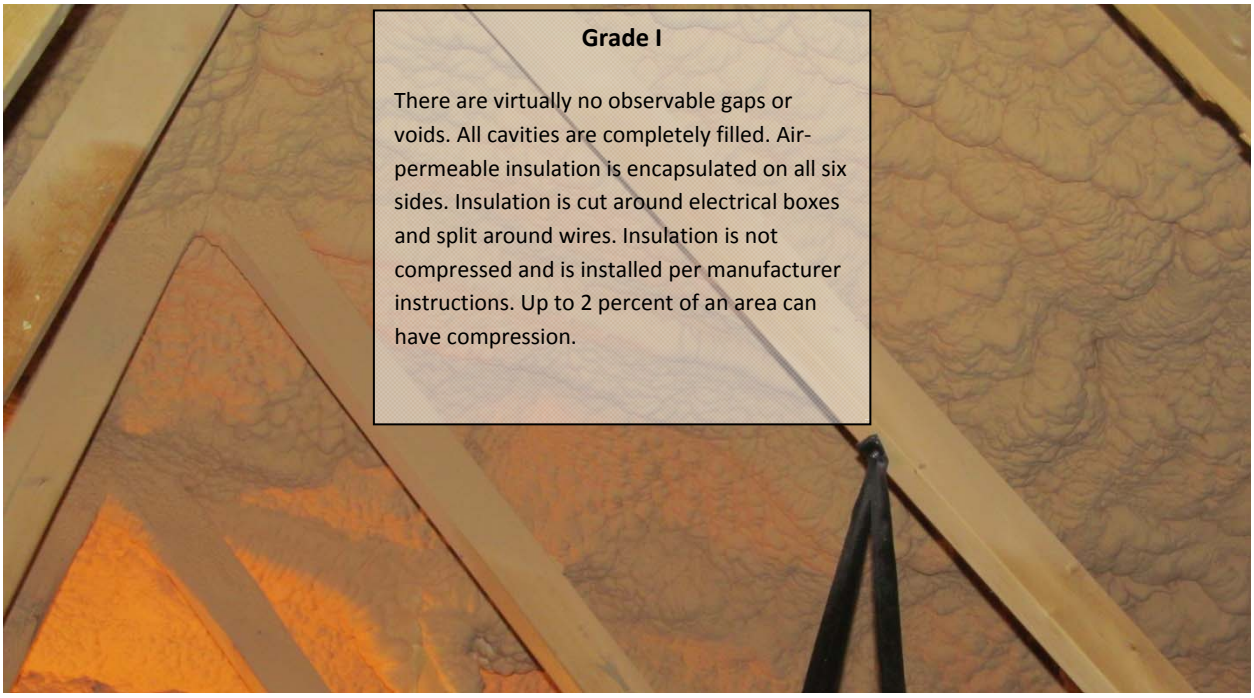
The effectiveness of insulation is greatly dependent upon how well it is installed. The goal is to have a continuous layer of insulating material, with no gaps or voids. Any gap (no matter how small) allows air to uncontrollably leak between one area and the next.

Three rating levels are related to the installation of the insulation[59]:

- Grade I (best)
- Grade II
- Grade III (worst)

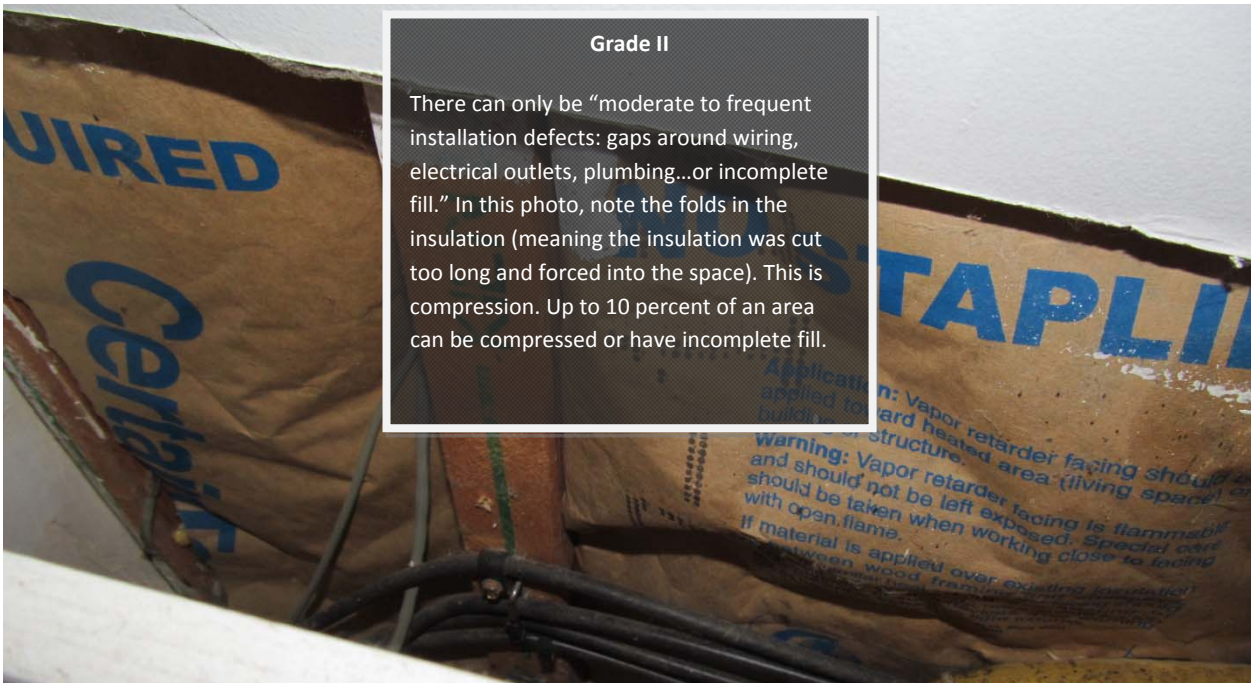
An example and explanation of each grade level is noted below.

[59] *Because the majority of the insulation in a home is encapsulated and is not observable once the home is complete, this is typically something the HERS rater will have to verify during construction. However, if there is an attic or any unfinished areas in the home where insulation is visible, the appraiser can make a very general assessment of the quality of the installation.*



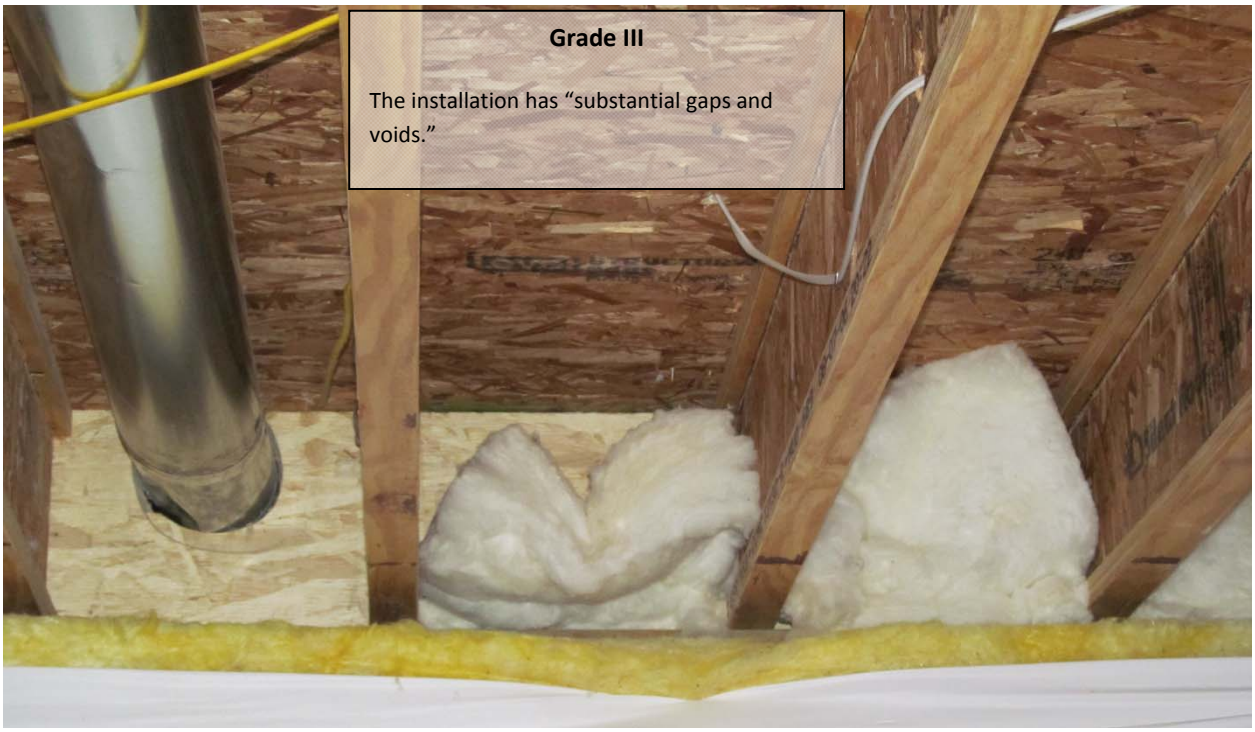
Grade I

There are virtually no observable gaps or voids. All cavities are completely filled. Air-permeable insulation is encapsulated on all six sides. Insulation is cut around electrical boxes and split around wires. Insulation is not compressed and is installed per manufacturer instructions. Up to 2 percent of an area can have compression.



Grade II

There can only be "moderate to frequent installation defects: gaps around wiring, electrical outlets, plumbing…or incomplete fill." In this photo, note the folds in the insulation (meaning the insulation was cut too long and forced into the space). This is compression. Up to 10 percent of an area can be compressed or have incomplete fill.



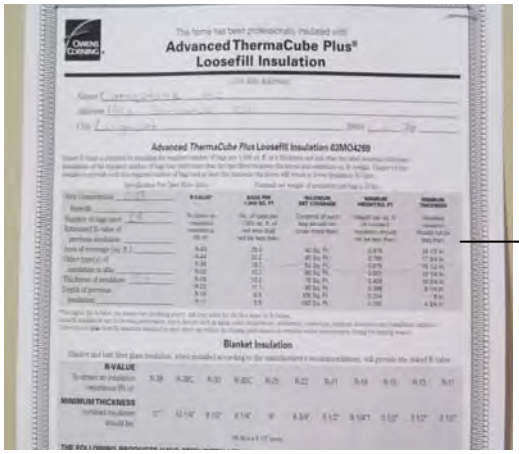
R-Value

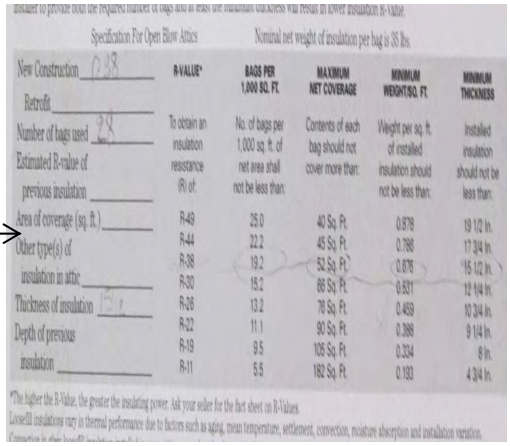
The R-value is a measure that identifies how resistant a certain material is to heat transfer; the higher the R-value, the higher the resistance. It would typically not be easy for an appraiser to inspect a home and know what the R-values of the walls, ceiling and floor are. Also, the R-value for one wall may be greater than it is for another wall in the home.

There are a few ways the appraiser can get a general idea of what the R-values for each particular area of the home are:

1) Sometimes, R-value indicators are posted in the attic. This photo shows that the attic (the “ceiling” of the home) has an R-value of approximately R-34.

2) Sometimes, R-value information sheets are posted in the garage:





3) Sometimes, an energy certificate is posted on the electrical panel, on the furnace or in the attic:

4) Most of the time, however, there are no posted indicators. The majority of the time, an appraiser will need to rely on a report provided by an energy auditor to know what the insulation R-values for a particular home are.

Envelope Tightness

A building envelope is commonly referred to as a "thermal boundary." This thermal boundary is what separates the heated and cooled indoor air from the outside air, as the outdoor air typically has a different temperature.

In a home, air movement between the indoors and the outdoors functions very much in the way water leaks out of a pool. *Any* air gap in the thermal boundary allows air to uncontrollably move from the inside to the outside, or vice-versa. Air is always trying to have equalized pressure and temperature. It is normal for the pressure inside of a house (due to controlled heating and cooling) to be different from the outside pressure. If the home, for example, has just 20 tiny holes (each the size of a dime) scattered throughout, the air will absolutely find those pathways and utilize them day in and day out. This generally results in a very large and negative impact on the energy bill, increased maintenance costs and uncomfortable temperature differences throughout the home.

It is beyond the scope of work for an appraiser to attempt to find all of these air leaks and understand how they impact the overall "tightness" of the home. Therefore, the envelope tightness will need to be determined by an energy auditor using a blower door test.

The envelope tightness will then be reported in one (or more) of the following units:

CFM25, CFM50, ACH50 and ACHnatural

CFM

CFM25 is "the air flow (in cubic feet per minute) needed to create a 25 Pascal pressure change in the ductwork. CFM25 is one of the most basic measurements of ductwork air tightness. A pressure of 25 Pa is equal to 0.1 inches (0.25 cm) of water column. "

CFM50 is identical to the definition above. However, it reports the amount of air flow needed to create a 50 Pascal pressure change in the ductwork.

The difference is that CFM40 reports better consistency at higher pressures than CFM25.

ACH

ACH50 is the number of times (in one hour) the inside air is replaced by the outside air.

ACHnatural is an attempt to turn the ACH50 value into one that reflects normal air pressure differences (i.e. when the home is operating under typical conditions, not with a blower door in place).

Water Efficiency

All water in Colorado is owned by the state. Therefore, we typically have laws that prohibit residential properties from collecting and storing rain water and reclaiming water. For that reason, this section of the glossary will not explain things such as grey water systems, rain barrels, reclaimed water or cisterns[60]. The only water efficiency features we will discuss are WaterSense® fixtures.

WaterSense fixtures use a maximum of 1.5 gallons per minute and need to be identified as WaterSense fixtures by a party other than the appraiser. Once installed, WaterSense fixtures are not visually distinguishable from non-WaterSense fixtures, since the product label is typically only on the packaging and not on the product itself.

A new state law (SB14-103) signed in June 2014 requires that after September 2016, all plumbing fixtures sold in Colorado must be certified under the WaterSense program.

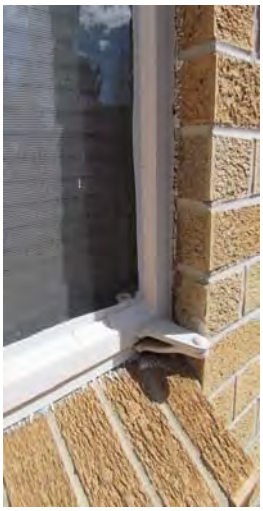
Windows

When windows are new and are being installed, they will have stickers that verify their numerous features. Most city inspectors will require that those stickers remain on the windows only until the inspector is able to make a site visit to the property and verify the windows' various features. By the time an appraiser is visiting a home, those stickers have been removed.

Therefore, it is normal and typical for the appraiser to rely on information about the windows based on an energy auditor's report. While it would certainly be possible to find information about the windows from a building permit, from product literature retained by the homeowner, or through product research, this is typically beyond the normal scope of work for most residential assignments.

That being said, the appraiser can typically and easily identify whether the windows are single-pane, double-pane or triple-pane.

[60] While cisterns are noted outside the greater Denver metro area, they are typically present as a result of a property having no access to either well water or water supplied by a municipality. Therefore, cisterns in Colorado are not considered an energy-efficient feature; rather, they are a necessity in some areas of the state.

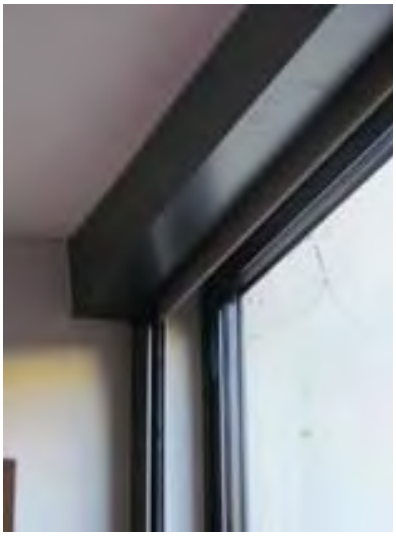


Single-pane window

Double-pane window

Triple-pane window

Additionally, an appraiser should be able to quickly identify whether the property has interior or exterior solar shades. Those shown in the photo below are interior solar shades with automatic controls:



Day Lighting

Day lighting options typically include skylights and solar tubes, both of which are easily identifiable by the appraiser.

ENERGY STAR light fixtures, on the other hand, are not typically identifiable. Similar to WaterSense fixtures, stickers are not typically found on the product itself. Thus, the appraiser will often rely on the information of others to understand whether or not a property has ENERGY STAR light fixtures.

Kitchen Appliances

While most newer appliances are ENERGY STAR appliances, not all are. Some appliances, such as dishwashers or fan hoods, can have a permanent ENERGY STAR plaque or sticker that identifies the appliance as such, but most do not. For ENERGY STAR appliances, the only current requirement is that the appliance be sold to the homeowner accompanied by the following flyer:

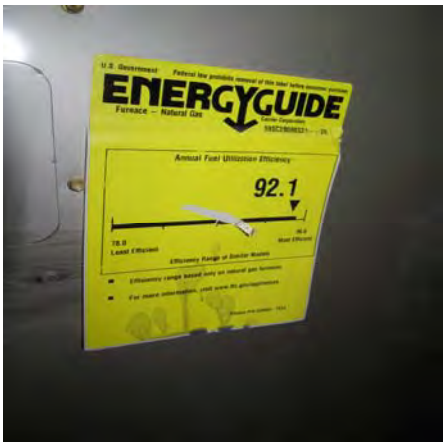
Typically, the flyer is a loose piece of paper that is then discarded (or kept) by the homeowner. Again, it is often beyond the appraiser's scope of work to spend time finding the make and model of the appliance and researching both how old that appliance is and whether it is energy efficient or not. This type of research, on the other hand, is routinely performed by energy auditors.

HVAC

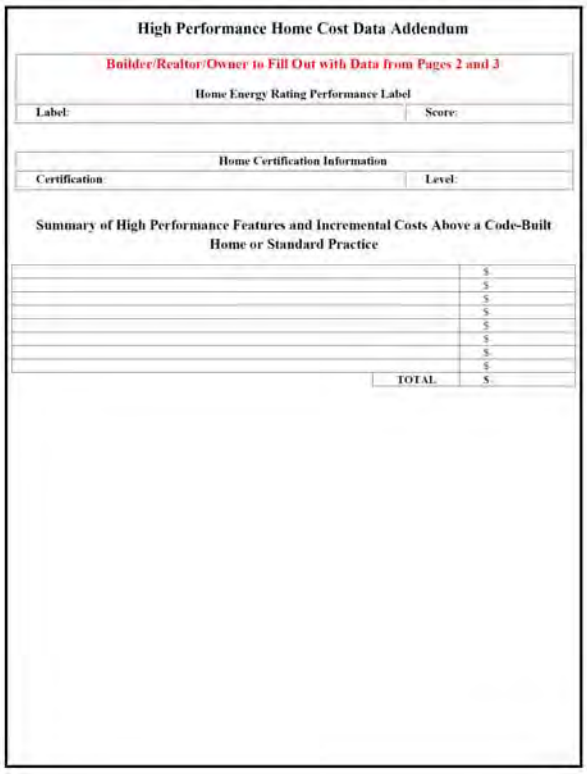
Over the years, furnaces have increased in minimum efficiency levels:

TYPE OF SYSTEM	Pre-1960	1960-1969	1970-1974	1975-1983	1984-1987	1988-1991	1992-Present
Gas Furnace	60%	60%	65%	68%	68%	76%	78%
Gas Boiler	60%	60%	65%	65%	70%	77%	80%

As of 2014, a high-efficiency furnace is defined as one that has an efficiency rating over 92 percent. There are two ways to visually confirm whether a property has a high-efficiency furnace: the presence of either a yellow Energy Guide sticker or two white PVC pipes protruding from the top of the furnace.



High Performance Costa Data Addendum[61]



High Performance Home Cost Data Addendum

Builder/Realtor/Owner to Fill Out with Data from Pages 2 and 3

Home Energy Rating Performance Label

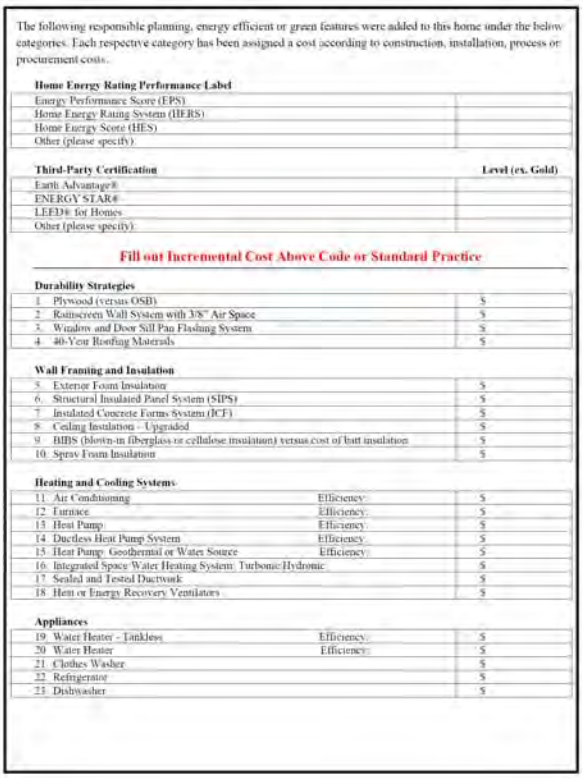
Label:	Score:

Home Certification Information

Certification	Level:

Summary of High Performance Features and Incremental Costs Above a Code-Built Home or Standard Practice

	$
	$
	$
	$
	$
	$
	$
TOTAL	$



The following responsible planning, energy efficient or green features were added to this home under the below categories. Each respective category has been assigned a cost according to construction, installation, process or procurement costs.

Home Energy Rating Performance Label

Energy Performance Score (EPS)	
Home Energy Rating System (HERS)	
Home Energy Score (HES)	
Other (please specify)	

Third-Party Certification	**Level (ex. Gold)**
Earth Advantage®	
ENERGY STAR®	
LEED® for Homes	
Other (please specify)	

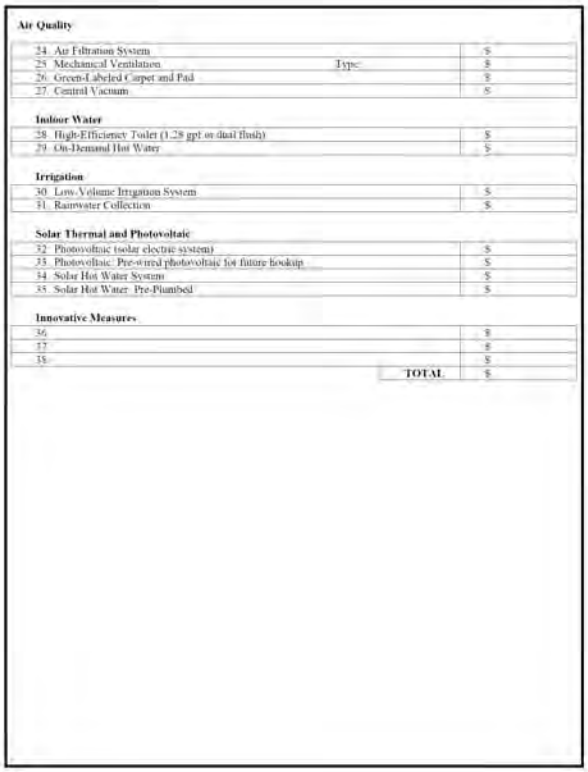
Fill out Incremental Cost Above Code or Standard Practice

Durability Strategies	
1. Plywood (versus OSB)	$
2. Rainscreen Wall System with 3/8" Air Space	$
3. Window and Door Sill Pan Flashing System	$
4. 40-Year Roofing Materials	$

Wall Framing and Insulation		
5. Exterior Foam Insulation		$
6. Structural Insulated Panel System (SIPS)		$
7. Insulated Concrete Forms System (ICF)		$
8. Ceiling Insulation - Upgraded		$
9. BIBS (blown-in fiberglass or cellulose insulation) versus cost of batt insulation		$
10. Spray Foam Insulation		$

Heating and Cooling Systems		
11. Air Conditioning	Efficiency:	$
12. Furnace	Efficiency:	$
13. Heat Pump	Efficiency:	$
14. Ductless Heat Pump System	Efficiency:	$
15. Heat Pump: Geothermal or Water Source	Efficiency:	$
16. Integrated Space/Water Heating System: Turbonic/Hydronic		$
17. Sealed and Tested Ductwork		$
18. Heat or Energy Recovery Ventilators		$

Appliances		
19. Water Heater - Tankless	Efficiency:	$
20. Water Heater	Efficiency:	$
21. Clothes Washer		$
22. Refrigerator		$
23. Dishwasher		$



Air Quality		
24. Air Filtration System		$
25. Mechanical Ventilation	Type:	$
26. Green-Labeled Carpet and Pad		$
27. Central Vacuum		$

Indoor Water	
28. High-Efficiency Toilet (1.28 gpf or dual flush)	$
29. On-Demand Hot Water	$

Irrigation	
30. Low-Volume Irrigation System	$
31. Rainwater Collection	$

Solar Thermal and Photovoltaic	
32. Photovoltaic (solar electric system)	$
33. Photovoltaic: Pre-wired photovoltaic for future hookup	$
34. Solar Hot Water System	$
35. Solar Hot Water: Pre-Plumbed	$

Innovative Measures	
36.	$
37.	$
38.	$
TOTAL	$

[61] Created by Earth Advantage. Copied here with permission.

Assumptions Associated with the Vintage Homes HERS Rating Chart

Written by Melissa Baldridge

This HERS rating energy model describes a house built in Denver, Colorado (climate zone 5) in the years stated. ***THIS IS A HYPOTHETICAL HOUSE,*** and I made the best assumptions I could about building inputs such as mechanical systems, insulation levels, appliances and other HERS inputs based on my research and experience in the field.

Even though the details and dimensions of the home would vary based on the architectural styles, ***I am assuming the geometry for each house is identical, and I'm assuming these homes are as near to original, mint-condition as possible, like a museum.*** I assigned architectural styles and names to help pinpoint the time era for the energy efficiency inputs.

This is not meant to be a "gospel-truth" HERS rating for any house in a given architectural era. It merely represents ratings with the given inputs in this climate zone.

TAKEAWAYS

1) **GENERAL TREND**: The biggest takeaway for appraisers is the overarching trend of HERS ratings over the past 120 years (in Denver). In older markets, such as those on the East Coast, HERS ratings for homes with no or few energy efficiency improvements will parallel the older homes I have modeled here. When a HERS rating is over 200, it indicates a home that uses twice as much energy as a new home. While it may make for great story telling, higher and higher HERS ratings become irrelevant at a certain point – the house is an energy hog.
2) **POST-WAR HOUSING**: Post-World War II housing is the worst and the least of everything: no insulation, no thermal mass (brick or stone as in early 20th-century homes), metal windows for high heat conductivity (right out of the house), single-pane glass with negligible thermal resistance, and the list goes on. What we tell buyers and owners is that that's ***good*** news because post-war homes are typically all upside: any improvement pencils out in terms of its cost-to-energy savings, to say nothing of comfort.
3) **DERATING**: To derate an appliance or mechanical system such as heating or cooling means to downgrade its performance. Stated efficiencies for systems and appliances happen in laboratory-perfect conditions. In most American homes, however, heating and cooling systems function at 60 percent of stated efficiencies due to poor installation, leaky ductwork, exposure to outside temperatures in crawlspaces, and equipment degradation. HERS ratings allow for systems to be downgraded, and in older homes with 30- to 40-year-old or older systems and appliances, this is appropriate. I've seen 100-year-old homes with original boilers that still are the main heat source. Assuming a flawless installation a century ago, those systems aren't functioning at the peak 60 percent efficiency they were then. Therefore, efficiency of those systems must be derated.

(As Ms. Desmarais pointed out, HERS ratings have a shelf life of approximately 10 years. This isn't what I'm addressing here. I'm addressing system age, condition and efficiency, which feed directly into HERS

ratings. For this analysis, I provided two sets of HERS ratings per house – one with mechanical derating, resulting in higher HERS ratings, and one without derating. As one can see on the graph, the newer a system is, the less the differential is in the two HERS ratings.)

ASSUMPTIONS: 2,100-square-foot, 2-story, 3-bedroom home. Basement = 350 s. f. (6.5' ht.). Crawlspace = 650 s. f. (3' ht.). 1st /Main floor = 1,000 s. f. (9' ht.). 2nd floor = 1,100 s. f. (8' ht.). One bath (u.n.o.). Main axis east/west. Modeling assumes one urban in-fill lot (3,125 s. f., on an east-west axis. 18 feet on front and back (east/west) and 55 on north and south. I also assumed that appliances were as old and inefficient as possible, without necessarily being 120 years old.