

**Energy Efficiency Labeling for Real Estate:
A Literature Review Addressing Four Policy-Relevant Issues**

A Report For the National Association of REALTORS®

January, 2017

Stuart Sessions
Environomics, Inc.
4405 East-West Hwy., Suite 309
Bethesda, MD 20814

This literature review was funded under a grant from the National Association of REALTORS®. The findings and opinions expressed in this report are those of the author. They do not necessarily represent the views or positions of the Association.

Table of Contents

Executive Summary	ES-3
Introduction	Error! Bookmark not defined.
1. Impact of Energy Efficiency Labeling on the Market Value of Labeled Properties	Error! Bookmark not defined.
Impact of labeling for residential properties.....	Error! Bookmark not defined.
Impact of labeling for commercial properties	Error! Bookmark not defined.
2. Impact of Labeling and Disclosure in Encouraging Energy-Saving Investments	Error! Bookmark not defined.
Results of programs in the U.S.....	Error! Bookmark not defined.
Results of programs in Europe	Error! Bookmark not defined.
Results of programs in Australia	Error! Bookmark not defined.
3. Could an Energy Label Serve to Reduce a Property’s Market Value? ..	Error! Bookmark not defined.
Loss in market value for energy-inefficient properties after “bi-directional” labeling	Error! Bookmark not defined.
The market responds to energy-inefficiency similarly as to other environmental concerns	Error! Bookmark not defined.
4. Stigma Associated With a Negative Energy Label	Error! Bookmark not defined.
Cachet and stigma for labeled homes in Australia	Error! Bookmark not defined.
Cachet and stigma for labeled homes in the Netherlands.....	Error! Bookmark not defined.
Cachet for green-labeled homes in California	Error! Bookmark not defined.
Cachet for green-labeled homes in 3 U.S. cities.....	91
Cachet for Energy Star label for office buildings in the U.S.....	Error! Bookmark not defined.
The market response to an energy label reflects mostly cachet and stigma	Error! Bookmark not defined.
Designing an energy label to limit cachet and stigma	Error! Bookmark not defined.
5. References	106

Executive Summary

There is increasing interest in developing information about a building's energy efficiency and making that information available to the participants in real estate transactions involving the building. The rationale is generally the same for both residential and commercial properties: labeling proponents argue that information suggesting that a building is energy-efficient will indicate to prospective purchasers that the property will have lower operating costs and perhaps other amenities, and purchasers will be willing to pay a higher price in recognition of these benefits. The owner/potential seller of a building, the reasoning continues, would in turn recognize a dual value in making investments to improve the energy efficiency of his building. Not only will the owner get the benefits of the reduced operating costs and other potential amenity values during the time while he remains the owner, but the owner will also gain a higher selling price when he sells into a market that recognizes the capitalized value of the ongoing stream of these reduced operating costs and amenities. Additionally, the purchaser of the building, if the label includes information such as an energy audit indicating what can be done cost-effectively to increase the building's energy efficiency, will also have a helpful road map suggesting high-payoff investments that he may wish to make in his new purchase. Labeling or somehow otherwise making apparent to the market the energy efficiency of buildings will thus encourage energy conserving investments in buildings, which in turn will save money, reduce emissions of greenhouse gasses and other pollutants, and contribute toward energy independence for the U.S.

Skeptics about labeling, however, doubt that these benefits in theory will be realized in practice. A label may prove to be misleading and/or inaccurate. Energy usage in a building depends very much on how the building's owners and occupants manage and use it as well as on the physical assets themselves. The new owner of a labeled building may find that its energy performance is different from what he or she had been led to believe by the label. If this happens frequently, the label may distort the market rather than inform it. And, another concern if labeling becomes nearly universal in some geographic area rather than limited to only a few exemplary energy-efficient buildings, is that the label will convey negative information about many buildings as well as positive information about others. Neighborhoods or zones that have concentrations of older and less well maintained buildings that are energy-inefficient may suffer a reduction in market value if labeling extends to them.

The following are some of the recent developments involving energy efficiency labeling for buildings:

- Many homebuilding companies have committed to estimating the expected energy performance of their new homes using the Home Energy Rating System (HERS) and then marketing the homes using this rating. More than one million new homes have been rated using HERS since 1995.
- Since June, 2009, Austin, TX has required homes more than 10 years old to undergo an energy audit before they are sold, with the audit results to be provided to prospective

purchasers. Other jurisdictions have considered or are considering a variety of similar audit and/or upgrade requirements applicable at time of sale or lease.

- The U.S. Department of Energy (DOE) has developed a Home Energy Score for rating the energy efficiency of an existing home in comparison to its peers, and is implementing a program to make the scoring system available throughout the U.S. The owners of more than 59,000 homes have had them scored as of January, 2017.
- In the U.S., mandatory energy rating and disclosure requirements are more common for commercial buildings than for residential buildings. Two States, one county and at least eight of the nation's largest cities have adopted mandatory energy scoring, benchmarking or labeling requirements for various sorts and sizes of commercial buildings. Many more jurisdictions are considering similar requirements.
- LEED and other "green" certifications that owners may seek for high performing buildings address energy efficiency as well as other sustainable attributes. LEED-certified or registered buildings in the U.S. now include more than 8 billion square feet of commercial and institutional properties and more than 83,000 homes.
- The European Union (EU) and Australia have adopted policies requiring disclosure of energy efficiency information at the point of sale for both residential and commercial properties. While progress in implementing these programs has been uneven, the Netherlands, Denmark, Great Britain, Germany and two Australian States or Territories now have at least several years of experience with very large mandatory labeling and disclosure programs. In the European Union, Australia, and several smaller countries, energy labeling and disclosure for buildings is regarded as a key policy measure toward achieving national commitments for greenhouse gas emissions reductions.

This paper examines several policy issues associated with this trend toward energy efficiency labeling of residential and commercial properties. We pose four sets of questions regarding energy labeling, and review relevant literature from the U.S., Europe, Australia and elsewhere to answer the questions. In general, there has been more experience with energy labeling of residential properties and more studies reviewing this experience in Europe and Australia than in the U.S., while the opposite is true regarding energy labeling for commercial properties. The four sets of questions and our conclusions on each are as follows.

1. Impact of energy efficiency labeling on the market value of labeled properties

Is a property's market value affected by making information available on the property's energy efficiency? Does disclosure of energy efficiency information affect variables in addition to property values that are also important in real estate markets, such as length of time on the market or vacancy rate for properties to be leased? What studies or other evidence exists on these questions?

Energy labels or scores for properties have consistently been found to generate a significant market response. Many studies suggest:

- Energy-efficient properties that are scored or labeled will receive favorable ratings, and good scores or labels tend to result in increased market prices and/or higher rents for these properties relative to otherwise comparable unlabeled properties;
- The opposite occurs also. Energy-inefficient properties will receive lower scores or poorer labels, and this negative information tends to cause these labeled properties to be discounted in the market relative to otherwise comparable unlabeled properties.

There are several areas around the world where energy labeling programs have existed for sufficient time and sufficient data has been generated to allow researchers to investigate the impact of a property's energy efficiency and its corresponding label or score on the property's value. Researchers in the better of these studies use statistical techniques to estimate the separate impacts of various key factors -- the property's location, size, age, quality, amenities, etc., as well as the property's energy label or score -- on a property's market value. Good quality statistical studies in California, three U.S. cities, the Netherlands, Australia, Great Britain and Japan have found that a favorable label for a highly energy-efficient home increases the home's market value by roughly 2 - 9 % relative to an otherwise comparable unlabeled home of similar energy efficiency.

Findings have been roughly similar in the larger number of good statistical studies investigating the impact of energy efficiency and energy labels on the market value of commercial properties, mostly office buildings. Each of these studies in the U.S. finds a significant average market premium for green-certified or favorably energy-labeled office buildings (LEED or Energy Star) relative to otherwise comparable non-labeled office buildings, in the form of higher rents, lower vacancy rates, higher sales prices, and/or higher effective rents. Several studies found that the average rent per square foot in Energy Star-rated office building ranged from about 1% to 4% higher than that for a comparable non-rated building. In terms of sales prices per square foot, Energy Star-rated office buildings showed average sales prices roughly 8% to 16% higher than those for comparable non-rated buildings. The studies found that the rental and sales premiums for LEED office buildings typically exceeded those for Energy Star-rated buildings. Several studies of energy labels for office buildings in Great Britain, the Netherlands and Australia suggest that energy-efficient, labeled properties accrue market premiums in rent, sales price and overall value similar to those demonstrated in the U.S.

In sum, there are many studies providing strong statistical evidence that both residential and commercial office space markets in the U.S. and elsewhere give a premium to buildings that have labels suggesting relatively high energy efficiency. The estimated increase in a property's market value associated with a favorable energy score or label can be substantial; occasionally as much or more than a 10% premium.

2. Impact of energy labeling and disclosure programs in encouraging energy-saving investments

How well have energy labeling and disclosure programs worked? Have labeling and disclosure encouraged property owners to make investments in energy efficiency in anticipation of realizing a higher market price when the property is sold? And, perhaps additionally, have the energy audit reports or other materials accompanying many energy labels encouraged the new purchasers of a property to make investments in energy efficiency that they otherwise might not have made?

In our view, the record here is disappointing. Energy labeling and disclosure programs have not elicited the improvements in energy efficiency that proponents of these programs have hoped for.

We have reviewed numerous studies that have evaluated the impact of energy labeling programs on the use of energy in buildings or on the rate at which building owners have implemented energy-saving investments. Most of these studies evaluate experience in Europe and Australia, since labeling and disclosure programs have been more prevalent and have been operated for much longer in these other parts of the world than in the U.S. Most notably, the European Union has conducted several evaluations as its 28 member nations have developed and implemented energy labeling and disclosure programs as the EU requires.

Government programs that have required or encouraged property owners to obtain energy scores/labels have obtained generally disappointing results in the degree to which these programs induce property owners to undertake additional energy-conserving investments. While the market value of homes or office buildings does appear to respond as expected to energy labels, the owners of labeled properties have changed their behavior very little to take advantage of what seem frequently to be attractive financial returns from undertaking additional energy efficiency upgrades. In general:

- Homeowners don't appear to increase their energy-conserving investments significantly in order to generate a better score/label and resulting higher sales price when they eventually sell;
- Recent homebuyers don't appear to implement to any significant degree the energy-conserving investments that have been suggested to them in connection with the scores/labels for their newly purchased homes. (Most programs involving scores/labels at time of transfer include for the purchaser a list of recommended energy efficiency upgrades that is tailored specifically for that particular home.)

A large study in Denmark that tracked energy usage in nearly 4,000 homes for four years following their sale found no statistically significant reduction in energy use for labeled homes relative to unlabeled homes. The author concluded that "We do not find significant energy savings due to the Danish Energy Labeling Scheme." (Kjaerbye, 2008)

In 2002, the European Union adopted the Energy Performance of Buildings Directive, which, among other things, requires member nations to implement energy labeling programs for most

residential and commercial buildings upon construction, sale or rental. The required label, or Energy Performance Certificate (EPC), is to display the energy performance of the building and to compare it against the performance of other buildings of the same sort. In 2011, the EU completed a three-year review of the effectiveness of member countries' EPC programs. The review was explicitly aimed at understanding the apparent lack of success that EPCs have had in motivating homeowners to improve the energy efficiency of their dwellings:

“In countries where the directive has been implemented for a while, the energy label hardly seems to motivate people to improve the energy performance of their dwelling. At the same time, however, improving the dwelling based on the label and the advice given can save the new owner large amounts of money in the long term. (Intelligent Energy Europe, 2012)

The final report from this performance review of European energy labels concluded:

“More than one hundred in-depth interviews and a large-scale survey among more than 3000 homeowners revealed how little impact the Energy Performance Certificate (EPC) currently has on home owners' decision-making. ... Many reasons for this lack of impact have been identified, for example lack of availability, lack of awareness, and lack of understanding. One approach to tackle these issues is, of course, to increase the visibility and availability of the EPC. However, this does not mean that people will pay more attention to it, take it more into consideration and that it therefore will have more impact. ... The most important factors influencing people's considerations are the age and condition of their dwelling, comfort and financial issues.” (ECN, 2011)

Similar conclusions have been reached in Australia regarding the low impact of energy labels in encouraging homeowners to implement energy conserving investments.

One study of the impact of municipal energy benchmarking and disclosure requirements for commercial buildings in four large U.S. cities found a small (2%, but statistically significant) reduction in utility costs some 1 - 3 years following implementation of the requirements. The authors attribute this reduction to the heightened attention that commercial building owners gave to energy costs following benchmarking. We speculate that this reduction in utility costs likely occurred as a result of relatively quick and easy behavior changes (e.g., moderating thermostat settings) that owners may have implemented following scrutiny of their utility bills. We expect that any reductions stemming from new investments in energy efficiency, if they occur, will take longer to emerge.

The problem generally is not that the label fails to create a market incentive for energy conserving investments; instead it is that property owners (homeowners particularly and commercial property owners less so) do not appear to respond vigorously to this market incentive. Property owners have been found often to fail to act on opportunities to improve their properties' energy efficiency, even when the opportunities appear to offer attractive financial returns -- a phenomenon known generally as the “energy paradox”. For homeowners in particular, these disappointing results from labeling are similar to what has commonly been obtained from other sorts of programs aiming to encourage them to reduce their energy use, including subsidies, cost-sharing, loans, technical assistance, free audits, behavior-based strategies (e.g., social marketing, goal setting, smart meters, benchmarking, rewards), and more.

It appears quite difficult by any means to motivate property owners to significantly change their energy-using behaviors or to accelerate their investments in energy efficiency upgrades. Owners of commercial buildings may perhaps be somewhat more likely than home owners to implement energy efficiency measures in order to capture some of the more readily apparent increased economic values (e.g., lower utility costs when the building owners pay them) that result.

3. Could an energy label serve to reduce a property's market value?

Could an energy label have a negative rather than a positive effect on a property's market value? Nearly all of the studies from around the world that we have reviewed suggest that a label or certificate indicating that a home or office building is energy-efficient will increase the labeled property's market value. Could the inverse be true also -- will a label indicating that a property is energy-inefficient serve to decrease the property's market value?

Certainly. The impacts of an energy label have clearly been shown to go in both directions: a property that a label identifies as energy-inefficient will tend to lose value, while a property that the label identifies as energy-efficient will tend to gain value. An unfavorable energy label affects a property's market value in much the same way as does other information suggesting that the property has some environmental shortcoming, such as lead paint, mold, radon, proximity to hazardous waste sites, or ambient air or water pollution. There is an extensive literature documenting the negative impact of environmental impairments on the values of affected properties. In contrast, energy labels are relatively new, and there is only a limited literature on the market impacts of an unfavorable energy label.

Most of the energy labels in common use in the U.S. today (Energy Star, LEED, Green Building Standard, Earth Advantage, etc.) provide only positive or favorable information about the energy efficiency of a property. These programs identify and then label, rate or certify only particularly energy-efficient buildings or, more broadly, particularly "green" buildings. These labels are conferred only on exemplary buildings and they are "unidirectional" in the sense that they convey only good, favorable information about the energy efficiency and perhaps other features of a labeled building. As such, a unidirectional label can only increase the market value of a building that has been awarded the label. In general, the owner of a building that believes he can qualify for a positive unidirectional label will be inclined to seek this validation for his building, while an owner that does not believe his building would likely qualify is not likely to seek the label or certification.

Thus, the unidirectionally positive labels in common use in the U.S. today can provide no empirical information on the degree to which a negative energy label may decrease the market value of a property receiving a negative rating. For such information, we need to look to the European Union or Australia.

Most of the energy labels that are in common use in the European Union and Australia are "bi-directional" in the sense that they can provide either positive or negative (or neutral) information about a labeled building. A label can be bi-directional only if both energy-efficient and energy-inefficient buildings are labeled -- the energy-efficient buildings receive favorable labels or ratings and their market values will tend to increase, while the energy-inefficient buildings

receive unfavorable labels or ratings and their market values will tend to decrease. In practice, a label can function in a bi-directional manner only if inefficient as well as efficient buildings -- *all* buildings of the specified variety -- are *required* to be labeled. If labeling is optional, only the owners of energy-efficient buildings will seek to have their buildings labeled and the label will function in a unidirectional manner.

Three studies in the Netherlands, Great Britain and Australia on the impact of energy labels on home values found that unfavorable labels reduced sales prices by average amounts ranging from \$14,000 to \$30,000 relative to comparable unlabeled homes. One study of commercial offices in the Netherlands found that an unfavorable energy label reduced average rents by 6.5% or about \$1.40 per square foot.

Recently, some State and local governments in the U.S. have made some form of energy labeling and disclosure of the results mandatory for all of certain types of buildings in these jurisdictions. Examples include:

- Statutes in several large cities and two States requiring all commercial buildings and large residential buildings to be scored using EPA's Energy Star Portfolio Manager software, with the scores made public;
- Austin's (TX) requirement for older single-family homes and all multifamily buildings to obtain energy audits and disclose the results in various ways;
- DOE's Home Energy Score (HES) and label can be used to rate homes ranging anywhere from highly inefficient to highly efficient. DOE hopes that State and local governments will adopt HES as a basis for either voluntary or mandatory labeling and disclosure programs for new and existing homes. The HES could serve as a bi-directional label in any jurisdiction that adopts it on a mandatory basis. Several States and cities are trying to encourage wide use of the HES in rating/labeling existing homes, including facilitating the inclusion of HES information in multiple listing services. None, though, have yet made HES scoring mandatory; and
- Santa Fe's (NM) requirement that all new homes obtain and post a HERS rating as a part of the permitting process.

As compliance with these requirements proceeds and market awareness grows, these labels or ratings will function bi-directionally, increasing the value of some properties but reducing it for others. The increasing duration of experience with these bi-directional programs in the U.S. will perhaps soon allow evaluation in the U.S. of the degree to which a negative energy rating adversely affects a property's market value.

We are concerned about the negative impact that a mandatory and thus bi-directional labeling program would likely have on the value of relatively energy-inefficient labeled buildings. Lower income neighborhoods or cities with a preponderance of older, non-renovated, and thus energy-inefficient homes could see a substantial community-wide decline in property values if a

mandatory, bi-directional energy labeling program were implemented. Commercial buildings in older, non-renovated business areas could suffer similarly.

4. Accuracy of an energy label relative to the energy cost differentials underlying the label

Does the gain or loss in market value from a positive or negative energy label accurately reflect the objective information on the property's likely future energy use that underlies the label? Does the gain in market value for a favorably labeled home match the value of the underlying future stream of energy cost savings that the favorably labeled home is likely to accrue relative to a home of average efficiency? Does the loss in market value for an unfavorably labeled office building roughly match the cost of the additional energy that the owners and tenants of this building are likely to use in the future? Is there any sort of systematic difference between the market's response to an energy label and the value of the energy cost differentials underlying the label?

In practice, the market appears to over-react to the energy efficiency information contained in a label or score. An energy-efficient property that receives a favorable label might have projected lifetime energy costs that are, let's say, \$5,000 less than those for a home of average efficiency with a neutral energy score or label, but the market response to the favorable label might then be a \$15,000 gain in value, as suggested by one study. The same sort of result occurs in the other direction also. An inefficient home that receives a low or poor energy score/label might have projected lifetime energy costs that exceed those for an otherwise comparable home of average energy efficiency by \$5,000, but scoring or labeling this inefficient home might reduce its market value by \$15,000; again some \$10,000 more than the impact that can be attributed to the difference in energy costs alone.

Somehow the market appears to interpret most energy labels as signifying something about the labeled property beyond the value of the energy cost differential that the label directly represents. The market interprets the label as indicating that the labeled property is either good or bad in unspecified additional ways that go beyond energy efficiency. We refer to this additional unexplained impact of an energy score or label as "cachet" when the score or label is good and the market value of the property increases by an amount larger than the energy cost differential resulting from the property's greater energy efficiency. "Stigma" occurs in the opposite situation -- when a relatively inefficient property is labeled and receives a poor score or rating and the market value of the property declines by an amount larger than the energy cost differential.

In each of five studies where there is sufficient information to quantify both the magnitude of the energy cost differential underlying the label and the magnitude of the market response to the label, the magnitude of the unexplained cachet or stigma effect on the market value property is much larger than the magnitude of the underlying energy cost differential. Most of the market response to the label consists of cachet or stigma, not energy cost differences.

Five Analyses Evaluating Impacts of Energy Labels	Value of the Label as Established in the Market (A)	Capitalized Value of Difference in Energy Costs (B)	% of Market Impact that is Due to Cachet and Stigma (A-B)/(A)
1. Gain or loss of 1 Star in energy rating (EER) for a median Australian home	±12,822 to 19,808 AUD	±4,193 AUD	67 to 79%
2. Netherlands: A-labeled (very efficient) home relative to G-labeled (very inefficient) home F-labeled (inefficient) home relative to G-labeled (very inefficient) home	+ €34,378 + €5,768	+ €14,190 + €3,548	59% 38%
3. Green-labeled (LEED, Energy Star, Green Point) homes in California	+8.7%, or \$34,800 relative to average home price of \$400,000	≤ \$14,400	≥ 58%
4. Energy Star and 2 local certifications for single-family homes in Austin (TX), Portland (OR) and Research Triangle (NC)	Varies with the certification, city and home vintage. One example: Energy Star in Austin for older homes was worth +5.8% (\$14,504) or \$2,387/yr	Varies. For the Austin example, \$323 to \$697/yr	66 - 97%. For the Austin example: 71 to 86%
5. Energy Star office building in U.S. compared w/non-certified and less efficient but otherwise comparable office building	8 to 26% higher value for Energy Star bldg. Best estimate: 14% premium in value, roughly \$37.50/sq ft	+\$5.90 to \$9.10/sq ft	76 to 84%

One might view this large cachet and stigma effect as suggesting that the market typically over-reacts to these energy labels, making more of the label than what it objectively means in terms of a property's energy costs. Three of the five studies with evidence on this issue found that cachet and stigma accounted for at least twice as large an impact on a labeled property's selling price as did the energy cost differential.

Alternatively, one could view this as evidence that the market ascribes substantial value to some attributes of a property other than energy costs that may also be suggested by the energy label. Perhaps the market interprets a favorable energy label as suggesting that the labeled home will be comfortable as well as energy efficient, with no drafts and an even distribution of heat. Or perhaps the market interprets a favorable label and expected low energy consumption as indicating that a home has been well maintained and that future repair and maintenance expenditures are likely to be low for the home. In sum, we don't know exactly why large amounts of cachet and stigma appear to be generated by energy labels. This is a topic worthy of further research.

The existence of substantial cachet or stigma associated with an energy score or label has both benefits and costs. To the extent that cachet or stigma increase the market value impact of an energy score/label, the desired incentive effect of the score or label in encouraging energy-conserving investments is increased. (Although this incentive effect appears in practice often to

be small.) On the other hand, a large stigma impact for energy-inefficient properties receiving a poor score/label will increase the loss in property values that will occur when homes are scored/labeled in communities with mostly older, energy-inefficient housing that may not have been renovated or well maintained.

On balance, we suggest designing the content and appearance of energy labels so as to minimize the amount of cachet and stigma they generate. We believe that consumers will grow to trust a label more over time if a labeled property is found to deliver energy cost savings or losses that roughly match the premium or penalty in market value initially accorded to the label. In the contrary situation, if the label creates a large amount of cachet and stigma, whether intentionally or not, properties would deliver much less in the way of energy cost savings or penalties than how the market had valued the label, and the credibility of the label would deteriorate over time. We close the report with some suggestions about how to design an energy label that generates a relatively precise market response to energy efficiency information about the property with little in the way of additional cachet and stigma.