Valuing Energy Efficiency in the Real Estate Community

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ABSTRACT

Market Transformation with respect to home energy retrofits is often written about but has proved elusive to enact. The United States' 130,000,000 homes are responsible for over 20% of our country's energy use, but the pace of retrofits has us on a 10,000 year path to systematically upgrading the performance of the nation's building stock (Zarker 2011). A critical question is: how does the industry ramp up its efforts? The local real estate market in particular is a microcosm of energy efficiency industry barriers and opportunities. It involves home buyers and sellers, loan officers, contractors, real estate agents, home inspectors, appraisers, and often energy efficiency program implementers. This market also has a real need for sharing validated data on energy improvements among the aforementioned stakeholders. For example, it has been historically difficult for the home performance industry to quantify the benefits of energy efficiency for the real estate market. The lack of documented value of retrofit measures is a barrier to many homeowners doing upgrades - as most appraisals do not include energy improvements in their comparables, and the home's future sale can prevent the homeowner from earning a return on their investment via lower energy costs. Once the industry develops a process for valuing the energy improvements, it can unlock the significant potential for retrofit work through market pricing signals (energy efficient homes are worth more) and enhanced access to capital for those purchasing a more efficient home (energy efficient homes improve borrowers' cashflow because they cost less to operate).

Energy Efficiency and the Real Estate Market: Barriers

The energy efficiency industry is increasingly becoming a data driven industry: auditors need data for home energy modeling, customers want data to calculate financial payback, regulators use retrofit data for utility cost recovery, program implementers need it for grant reporting and cost effectiveness testing, and importantly to this paper's subject: appraisers must be able to access data to properly value energy improvements for the real estate market. The moderate to high investment needed to increase the home's performance must compete with a multitude of other retrofit options to improve resale value, such as upgrading the kitchen or master bathroom, or replacing an old roof or deck. Homeowners typically think of these kinds of improvements before energy improvements (Newport 10), and in terms of their valuation, a kitchen or bath remodel is more easily quantified in an appraisal. A $15,000 investment in a new HVAC unit, air and duct sealing, and attic insulation will significantly lower utility bills and improve the comfort of the home, but in most markets it is a lost investment when compared to other home improvements. Appraisers may in theory realize that a more efficient property should command a higher value, but without the supporting documentation they cannot capture that value (Stovall et al. 8).

This barrier to a homeowner or a potential home seller's pursuit of an energy efficiency upgrade stands in contrast to what homebuyers are actually looking for. According to the National Association of Realtor's *2011 Profile of Homebuyers and Sellers*, 87% of homebuyers

thought heating and cooling costs were at least somewhat important when considering purchasing a home (NAR 6). Given also that new home purchases were just 16% of the market and that the average age of homes purchased in 2011 was 1993, there are a large number of dwellings being bought and sold which were built prior to code updates that included energy efficiency (NAR 6).

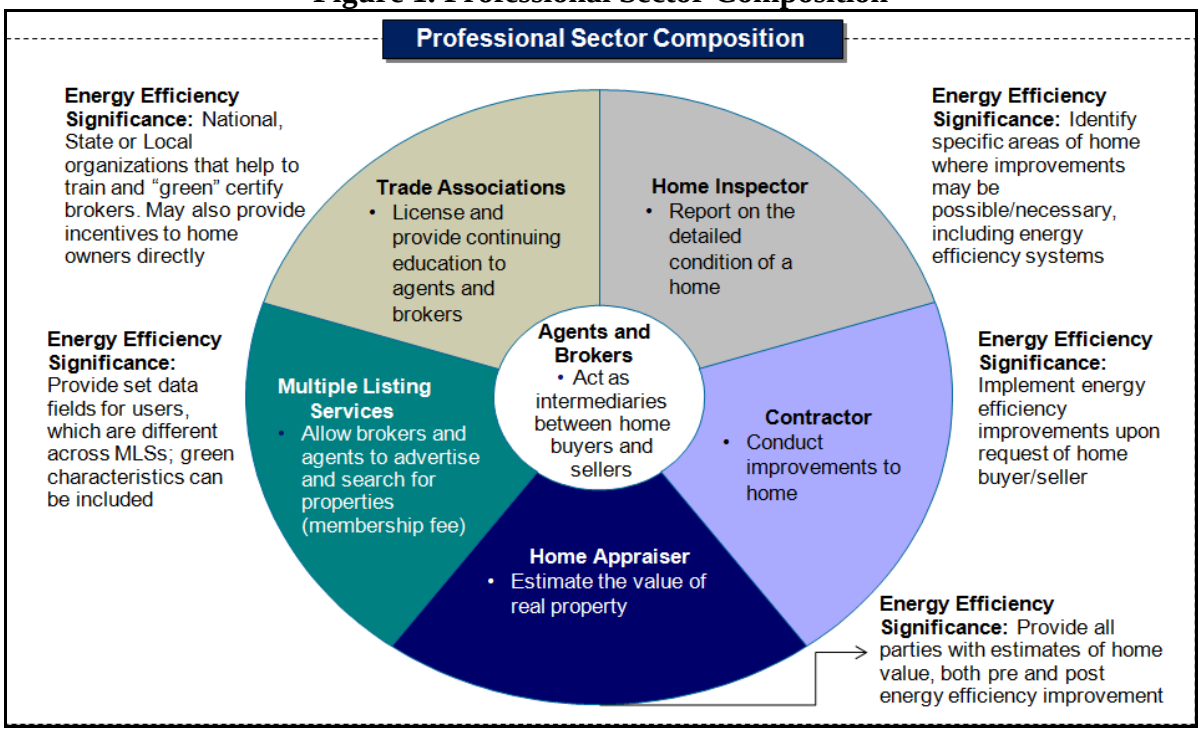
The Multiple Listing Service is the proverbial filter which displays a home's data, and because it is the primary source of information used by all important stakeholders in the real estate transaction, it plays a critical role in the valuation of energy improvements (Stovall et al. 7). In fact, the MLS is *the* source for information for comparable pricing that appraisers use when valuing an existing home. As a private database paid for and maintained by real estate professionals, it is local or regional in scope and can be fully accessed only by those who are licensed to do so, although many agents or companies make some information from it available for free to their customers. Standard information found on the MLS includes asking price, location, lot size, home age, square footage, number of bed and bathrooms, special amenities like a garage or fireplace, and often some photos of the home. MLS systems also usually include basic data fields on heating and cooling (heat pump, furnace, central ac), but most do not include fields for high efficiency equipment, windows, insulation, etc.

Typically, fields in the MLS are linked to the Uniform Residential Appraisal Report (Fannie Mae Form 1004 or Freddie Mac Form 70), required by the nation's largest secondary market mortgage buyers. Since most banks sell their mortgages to Fannie or Freddie to improve their liquidity, the appraisers lenders hire to value properties use Fannie or Freddie's URAR form. This form includes little in the way of energy efficiency information – the only mention being in one notes field called "Additional Features" – in spite of the fact that energy efficient homes have lower operating costs to homeowners, thus improving their cash flow and ability to pay back a loan. There are special (and rarely used) loan products, such as the Energy Efficient Mortgage or the Energy Improvement Mortgage, which take these improvements into account, but the required data needed for these mortgages comes in the form of a HERS rating, not an appraisal.

While certification programs for new homes such as ENERGY STAR, Earthcraft, and LEED-H are gaining traction in some local real estate markets, nationally most Multiple Listing Services are not searchable for energy efficiency certifications, improvements, or other home performance features (Stovall et al. 8). If energy improvements are not easily identifiable in the MLS, then home appraisers cannot assign value to them either: "It is important to convey to the appraisal management company, lender, realtor, homeowner, or builder the necessary documentation used to complete an accurate report of a high performance house. This may take some tenacity on the part of the appraiser" (Adomatis 196). If an appraiser does not have access to this information when creating comparisons there is no quantifiable way for homeowners to recoup their investment through increased market value of their home at resale. Hence, the MLS itself is a market barrier as the data it displays are not comprehensive enough to allow for energy efficiency valuation for the home.

Within the real estate community, what information is available on the home's energy performance depends on the stakeholder involved. Figure 1 illustrates the many players within the professional market, each of whom accesses and/or provides data on the home but in different ways and for different reasons.

Figure 1. Professional Sector Composition



Source: Booze Allen slide presentation "Analysis of Real Estate Agent Model"

In order for the MLS to display useful data on a home's energy improvements, several related issues must also be addressed:

- What data should be captured?
- Who should capture it?
- Who should disclose it?
- Should it be validated and if so, by whom?

In terms of the kind of data that should be captured and displayed, who the audience will be for that data is a very important consideration. Real estate associations who manage the local or regional MLS prefer the streamlined approach offered by certifications and ratings; whereas appraisers prefer multiple data points that can be organized into searchable fields for comparisons between listings (CNT 4). Homebuyers prefer to get their data in the form of a label or report delivered by an independent third party (Newport 4). To truly engage the real estate community such that it becomes an engine to help drive demand for retrofits, each of these stakeholder's needs for data must be addressed.

With respect to who should capture and disclose the energy performance data, homeowners themselves are limited in terms of what they can offer, simply because most are not educated in building science and cannot provide technical information on their home or its systems. Presumably homeowners do have access to their utility bills and could share that data with a potential buyer, but the caveat here is that it requires the buyer to rely on the home's operational data as opposed to asset level data to judge its efficiency. Home inspectors can

provide limited information on the home's potential energy performance, but unless they are trained as energy auditors, insulation or HVAC specialists, they likely do not have the expertise or experience to comment on the home's potential performance. Trained contractors and energy auditors can provide technical information on the home, but without third party validation there is the possibility that this information will be biased or inaccurate. Third party validation can come via a program administrator or independent auditor who performs a quality assurance inspection as part of a certification process. This third party validation is important for real estate agents in particular as they have strong concerns about professional liability with respect to the highly technical field of energy efficiency and want to be sure their data come directly from the seller, builder or contractors, or a certifying organization (Stovall et al. 9).

Energy Efficiency and the Real Estate Market: Opportunities

To develop solutions for addressing the data related barriers described above, the DOE supported the convening of industry stakeholders for a Green MLS/ BetterBuildings Roundtable meeting – an important two day event which took place in Chicago in September 2011 and was sponsored also by the Energy Foundation. This roundtable meeting included seven BetterBuildings Neighborhood grantees who brought with them a realtor and an appraiser from their local market. Also participating were representatives from the National Home Performance Council, the Building Performance Institute, the National Association of Realtors, the Appraisal Institute, and the Department of Energy's Home Energy Score program. The purpose of the event was to "to accelerate fair value at closing for energy efficient homes. The roundtable focused on communities where the inventory of homes with energy efficiency improvements is expected to grow" (CNT 1).

Data standardization was identified as a critical need to valuing energy efficiency (CNT 4). Also underscored was the importance of the quality of data with respect to its source: self-reported energy improvements, either by the builder or the homeowner, carried less weight than those which were verified by a knowledgeable, independent third party – such as a program administrator or inspector/assessor. Industry stakeholders attending the meeting thought it important that if a monetary value is to be attached to the improvements, then a properly trained and licensed and/or certified professional should verify that the energy efficiency improvements exist and were properly installed. It would be difficult to engage the real estate community's and financial institutions' support without addressing the potential for green-washing or fraud. However, it was also pointed out that there is no existing industry standard to certify an existing home as energy efficient – in terms of data collection or process.

As a result of the Roundtable meeting, the Building Performance Institute and National Home Performance Council have undertaken an effort to establish an ANSI standard for Home Performance Certification through BPI Working Group-9, governed by the Title and Scope for *BPI-2101-S-2011 Standard Requirements for a Certificate of Completion for Whole-House Energy Efficiency Upgrades*. The Working Group's responsibility is to develop a consensus draft on what data should be collected for a Home Performance Certificate to be displayed on the MLS and who should collect and verify the data for it. The consensus draft standard will be presented to BPI's Standards and Technical Committee (STC) and Standards Management Board (SMB) for approval as a BPI Standard. Participants in the Working Group include representatives from the major real estate, financing, and appraisal organizations; as well as energy offices and program administrators, the building science community, and federal

agencies. Meetings of the Working Group are ongoing, but the goal is to have the consensus draft completed by Q3 2012. If the Working Group's recommendations are accepted, the real estate community will finally have a standard way to collect and display home energy data.

Another recent development which will assist the appraisers in collecting the data they need is the Appraisal Institute's issuance of an optional addendum to Form 1004, called the "Residential Green and Energy Efficient Addendum." This addendum includes data fields for kind and R-value of insulation, SEER rating of heat pump, certifications such as Home Performance with ENERGY STAR, ENERGY STAR appliances, HERS rating, solar panel information, etc. Created by the largest professional organization of appraisers, it is a first and important step in providing an industry template for capturing needed data on the energy efficiency of the home. This form can be requested by lenders of appraisers, and real estate agents can have their sellers fill it out for the fields' inclusion on the MLS.

The BPI Home Performance Certificate data collection standard should provide real estate agents with the kind of data they need, and the Appraisal Addendum should provide appraisers with the data they need. Yet, the industry has one other important stakeholder to satisfy and engage: the homebuyer. The homebuyer's preference is for an easy means to compare homes – in fact, one promising study found that 46 percent of the survey respondents who received a home energy score said they thought an energy score would be useful if they sold their home, and 83 percent said they would want to see the score if they were buying a home (MetaResource 8). Building labels and energy scores are one way through which to address the homebuyer's need for useful data at a high level, but residents also want to understand what improvements to focus on first and what savings to expect as a result (Newport 4). Therefore, some kind of a report which provides this information is also valuable.

There are a number of certifications which are currently being used by contractors and homeowners, some of which are captured in special fields added to an MLS such as the one used by the state of Colorado (Stovall et al. 17). As was mentioned earlier, these include ENERGY STAR for New Homes and LEED-H. These certifications are different from a home energy score as they are based on a prescribed set of new construction techniques that are standardized. Home energy scores are based on the occupant's actual utility data, the as built home itself and its mechanical systems, or a combination of the two. This paper will briefly discuss four different kinds of scores: The Home Energy Yardstick (HEY), the HERS Score, the Energy Performance Score (EPS), and the HEScore - each of which include a recommendations report for the homeowner. An operational score, such as the Home Energy Yardstick, is generated from energy usage data. Its counterpoint is an asset-based score where utility bills are not referenced, and energy use not related to the attributes of the building is held constant (e.g., thermostat set points) to remove the behavioral element from consideration. Like the HEY score, the asset ratings for HERS and HEScore use source energy in their calculations, as opposed to site energy. This means the score takes into account the energy used to bring the fuel needed to the home. As a result, electric energy has a higher multiplier than natural gas. The EPS uses site energy except for its carbon score component – the carbon number uses a source energy data point. Note, that the terms "building label" and "score" are often used synonymously, but they are not necessarily the same. A new home may earn an ENERGY STAR label, but when scored against another home, it may be score lower than one has not received an ENERGY STAR label.

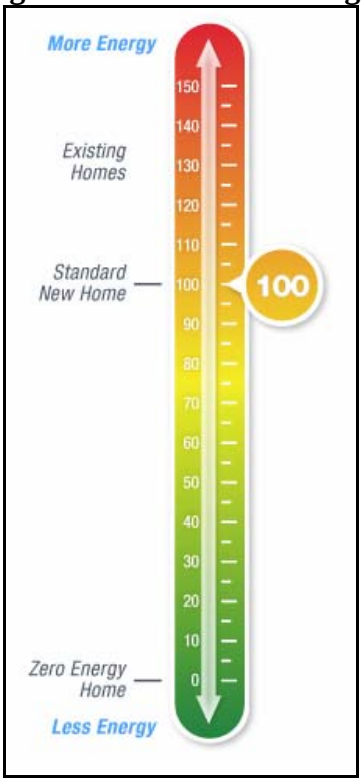
The Home Energy Yardstick

The Home Energy Yardstick was created by the Environmental Protection Agency and is based on the resident's utility usage and the home's location, square footage, and number of occupants. The HEY score's data is input by the homeowner, and the score ranks that home against others using statistics gathered from the Energy Information Administration. The HEY score is considered an operational rating, since energy usage is the primary weighting mechanism for comparing homes. While the HEY score is a useful tool for the occupant, in that a homeowner can benchmark their home's energy usage against others for no cost, it is less useful for a homebuyer since it is more behavior and less building dependent. There is no independent validation associated with this score, and the home's particular energy assets are not taken into account when creating it.

The HERS Rating

As was mentioned earlier in the paper, the HERS score has been used since the early 1990's to qualify homes for special mortgage products, as well as to qualify new homes for ENERGY STAR labels and the federal energy tax credit for new homes. The HERS was created by RESNET, a nonprofit member organization of energy raters or auditors. It must be generated by a certified professional rater, so it includes the necessary independent third party verification,

Figure 2. The HERS Rating



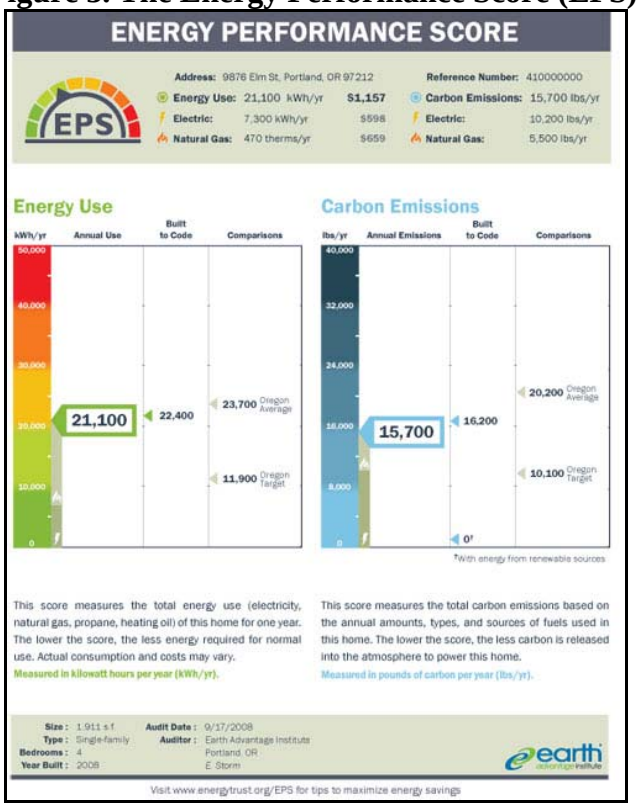
Source: RESNET's website: http://www.resnet.us/understanding-the-hers-index

and it is an asset rating. However, the HERS rating does not benchmark against other homes, but rather it compares the proposed home to a HERS reference home. From this perspective the HERS score works well with new homes to calculate the delta of improvement from the reference home with the installation of additional energy efficiency measures. Scores are displayed on a 0 – 150 point scale, with 100 being the reference home built to 2004 IECC code and 0 being a net zero energy use home. To create a HERS rating, an energy auditor must collect information for approximately 100 data points, which adds significantly to the time it take to perform the audit and run the model. Hence, a rating can run between $300 - $800, which when wrapped into the mortgage of a new home is less of a cost burden for the homeowner than paying out of pocket as they might with an existing home (HUD 2012). The HERS score is available in most areas of the US where there are RESNET raters.

The Energy Performance Score (EPS)

The EPS was developed by Earth Advantage Institute in cooperation with the Energy Trust of Oregon. The EPS is currently being used in programs in Oregon and Washington state for new and existing homes, and is being piloted in programs in Massachusetts, Alabama, and Virginia. As was mentioned earlier, the EPS uses site energy in its calculations and presents a score which captures the energy use per home, as opposed to the energy use per square foot.

Figure 3. The Energy Performance Score (EPS)



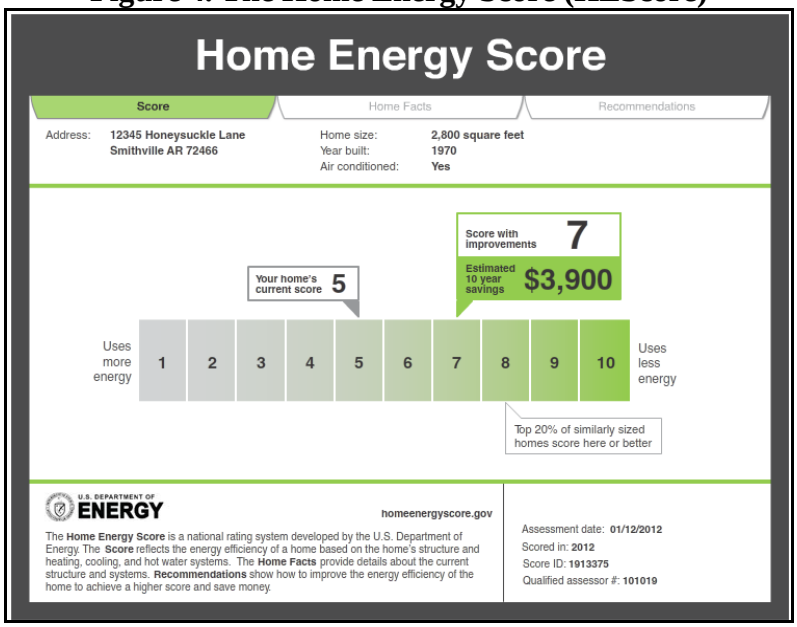
Source: Report provided by LEAP

Total energy use is converted to a kWh number and displayed for homeowners in comparison to similar homes in their state and area. The EPS is created through a proprietary tool and cost to the contractor has been advertised at $45 to run a report, which also includes a list of recommended improvements and potential energy and utility bill savings resulting from doing the upgrades. The contractor must be a Certified BPI Building Analyst or RESNET Rater to create the score. Unlike the HERS rating, the data input is designed with the minimal amount required in mind; the EPS has only 32 required data fields to generate the score. Like with the HERs, it is available in areas where there are trained and certified assessors who can access it.

The Home Energy Score

In 2009 the White House Council on Environmental Quality released their *Recovery through Retrofit Report,* calling for the creation of a national home performance label to assist homeowners and lenders in identifying energy efficient homes (CEQ 2). The Department of Energy engaged industry stakeholders over the course of a year to develop the Home Energy Score. The Home Energy Score (HEScore) is another asset rating scoring tool, and it was created to standardize a national score or home label. As with the EPS, the score can only be created by a

Figure 4. The Home Energy Score (HEScore)



Source: Report provided by LEAP

Certified BPI Building Analyst or RESNET Rater. Once the contractor passes an online test, he is able to use DOE's software free of charge. Contractor credentials and training are monitored by a DOE partner organization which also provides Quality Assurance on at least 5% of the scores. Contractors cannot generate scores independent of a partner organization. It remains to be seen if the partner organizations will charge a fee for their administration of HEScore in their area. Launched as pilot with nine partners in January 2011, DOE's HEScore does more than just rank a home on a 1 – 10 scale, it also provides homeowners with a list of suggested improvements, what their score would be if they made the improvements, a savings estimate for each improvement, and how they compare to a similar home. Only improvements which have a

payback of 10 yrs or less are displayed. Post-pilot, the DOE has made several important changes, which include adding climate zones, an API for software vendors to be able to exchange data with DOE's scoring tool, the ability for partners to brand their score reports and to substitute their own recommendations page, and a revision of some of the base algorithms for accuracy. The DOE expects to relaunch the HEScore nationwide in the June 2012 timeframe.

With respect to home scoring or building labeling, it remains to be seen which scoring tool will gain nationwide traction: HERS, EPS, or HEScore. States such as Washington, whose legislature has directed its Commerce Department to select an energy performance scoring tool and develop a means for implementation, are currently taking a wait and see approach. They want more information on how the market responds to both EPS and HEScore before choosing one over the other (EPS is currently in use in some areas of Washington) (Weed 6). Other leading states such as Oregon are digging deeper into the pros and cons of different scoring tools, too. The Energy Trust of Oregon recently completed their study, *Home Energy Performance Scores: Efforts to Date with Modeling Tool Comparison and Summary of Key Issues*, which discusses outstanding issues with the different scoring tools but does not make a specific recommendation for one tool over the others (MetaResource 3). Given the local nature of the MLS, it is possible that different regions (counties or states) could choose to use different scores.

Case Study: The Local Energy Alliance Program (LEAP)

The Local Energy Alliance Program or LEAP is nonprofit energy efficiency program implementer based in Charlottesville, VA. It administers Home Performance with ENERGY STAR programs in central and northern Virginia and is also a BetterBuildings subgrantee under the Southeast Energy Efficiency Alliance. LEAP was selected as one of nine partners to pilot the HEScore, and they included utilities, nonprofits, and local governments in different climate zones. These partners scored a total 983 homes (LEAP scored 44 homes) over approximately a five month period from 1/2011 – 6/2011.

Initially, LEAP was to work with Central Virginia Electric Co-op as a marketing partner to perform the Home Energy Scores. CVEC was motivated to provide its members with an inexpensive assessment as their rates were set to increase markedly with the renegotiation of a new contract for power supply which would take effect in March 2012. However, after the pilot partners were announced, CVEC elected not to participate as they thought the score unfairly penalized electric power purchasers since source and not site energy was used to calculate it. This left LEAP without a major utility partner to help fund and drive participation in the pilot. LEAP elected to take a market-based approach, whereby energy assessors from their HPwES program would perform the HEScore assessments and charge appropriately.

To help promote the HEScore, LEAP gave a presentation to the Charlottesville Area Association of Realtors (CAAR) Green Team, had earned media stories about it on the local news, and included a coupon for it as part of their Better Basics insulation or HVAC limited time rebate. LEAP also mentioned it during their radio promotions of the Better Basics rebate. Six assessors from LEAP's HPwES program took the DOE's online test and were approved to create the HEScore. Assessors' pricing to score homes ran between $100 and $150, with the number of windows being the determining factor for increasing cost. Assessors had to measure the window area for a data point, and this could become time consuming depending on the configuration of the house. The real estate community was very interested in the score as an inexpensive means to get an in home assessment that could be incorporated into a home inspection, but they were also

hesitant to recommend it to their clients. Real estate agents expressed concern that the score would change after the pilot, and their customer's investment in getting one would be wasted. They were also worried about the accuracy of a new and untried product. In sum, a market-based approach was a very hard sell when there was not market in which to sell it.

Two other relevant takeaways from LEAP's pilot experience came from independent contractor assessors themselves, who were more inclined to offer the score over a subcontractor specialist (insulation, HVAC). Given that they were trying to keep costs down for the customer, which corresponded to amount of time they spent in the home, some auditors found themselves focusing only on collecting data for the score. As a result, they reported missing other energy or home performance related opportunities to share with the customer, such as register boots not being affixed properly, moisture or health and safety issues. Some of the homes scored went on to become jobs, and contractors were surprised at what they missed when going back to the house. In other words, they contractors assessed the home with just the "test" in mind – not as an open book to be read carefully and analytically. In addition, contractors shared that customers contacted them primarily about the score because they were looking for a low cost audit, but once they found out the limitations of the assessment (no diagnostics, pared down report, limited physical inspection), the assessors were often able to upsell the customer into doing a BPI comprehensive audit instead, and at that point the score for the homeowner was superfluous if they had no immediate plans to sell their home. Because of these experiences, contractor assessors saw the most value in the HEScore being used prior to the home sale transaction (such as during a home inspection) or even after the sale to help the new homeowner prioritize remodeling work. As a means to answer the question, "Should I do something about my home, how does it compare to others on the market?", the HEScore was a good tool. However, for those homeowners who knew already they wanted to do something, just not what, a comprehensive assessment was their better choice from the start. Homeowners noted that the recommendations given in the HEScore report seemed vague and did not amount to an actionable workscope.

LEAP remains committed to promoting a scoring tool so that homeowners and buyers are able to understand the relative energy efficiency of the home in the same way that car buyers understand the mileage of the car – via an MPG rating for the home. They are also committed to helping institutionalize market change through the valuation of energy improvements and the energy efficient home. Having important standards and tools in place are critical first steps, i.e., a standardized Home Performance Certificate and inexpensive options for calculating a home score. However, if no one actually uses these tools, then market transformation will remain elusive. Stakeholders, such as program administrators and local champions such as real estate professionals, must lead the way in engaging their respective communities to assist in creating market demand.

LEAP has strong industry alliances including its program financing partner, the UVA Community Credit Union (a PowerSaver pilot lender), and the Charlottesville Area Association of Realtors (CAAR). Each organization has motivated energy efficiency champions who have helped educate others within their organization. In addition, the past president of CAAR participates with LEAP on the BPI Working Group-9, which is developing the data collection standard for the Home Performance Certificate. CAAR has formed a Home Performance Project Team, which includes fifteen real estate agents, two of LEAP's program contractors, the Credit Union, and LEAP. This Team's goal is to truly engage the local real estate community so that they begin using the Appraisal Institute's Addendum and educate their customers on energy efficiency and the resources available to them locally. To that end, CAAR's Home Performance

Project Team held a panel luncheon in February 2012, which included representatives from the DOE HEScore program, LEAP, CAAR, the Credit Union, a local contractor, and an appraiser. The luncheon was attended by over 60 real estate professionals. Each panel member made a short presentation, followed by open Q&A from the attendees. At the luncheon LEAP announced a free in home energy assessment giveaway to five real estate agents, and the discussion of their homes' reports became part of a subsequent meeting that included the participation of 15 agents from different brokers. Trainings for real estate agents and appraisers on the HEScore and EPS are scheduled for July 2012, and the Credit Union and a local contractor also held CEU courses for realtors on filling out the Appraisal Addendum and the nuts and bolts of an energy assessment. The outcome of this stakeholder engagement has had one very tangible effect: CAAR has added a field to their local MLS to capture the Home Performance with ENERGY STAR certificate LEAP gives to customers who complete their program. Realtors can now search for homes which have achieved a 20% projected efficiency gain based upon energy upgrades, the baseline standard to earn the HPwES certificate in LEAP's program.

Prior to the DOE announcing its HEScore, LEAP also participated in a proposal to the DOE for a Multi-State SEP award, "Catalyzing the Home Energy Retrofit Market." A proposal partner on the grant was the Earth Advantage Institute, whose EPS scoring and modeling tool was integral to the proposal's goal of a 2% market penetration for energy efficiency. Because of LEAP's grant commitment, they are now working with both EAI and the DOE with respect to these home scores. EAI has revised its EPS to include a HEScore that is automatically generated by an API to DOE's tool. Contractors will not have to enter the information twice and will still be able to provide homeowners with both scores' information. It will be a challenge to present and discuss these scores in such a way that homeowners are clear on what they mean, and special contractor training will be necessary. Part of LEAP's SEP award evaluation will include looking at the reception of these scores by homeowners, contractors, and other stakeholders.

Conclusion

The energy efficiency industry is a complex and difficult system in which to create market change. The federal government, trade associations such as ACI, nonprofit advocacy groups like ACEEE, and even utilities have sought to scale comprehensive energy improvements for decades. One persistent barrier to widespread adoption has been a lack of engagement from the real estate community and an inability to capture market value in a home's appraisal for the energy improvements made. While program administrators can promote an energy upgrade as a great investment that pays back over time, the average length of time a person lives in their home is five years, and thus many residents are reluctant to spend thousands an upgrade for which they will not be around to enjoy or recoup their investment. Clearly the industry needs a standardized way to capture and display home efficiency related data on the MLS so that comparables can be made and the improvements properly valued. The development and adoption of the Appraisal Addendum created by the Appraisal Institute is an important step forward, as would be a data collection standard for the MLS. With the adoption of these tools and a home energy score that could be incorporated into a home inspection, it could be that the home performance industry finally has the ability to effectively engage the real estate community. The next steps are left then to stakeholders and program administrators like LEAP to carry out: education, outreach, and engagement of their local communities. Once the tools are in place, it will take an active

champion to bring them to bear on the market itself, encourage their adoption, and ultimately drive change.

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