



ERNEST ORLANDO LAWRENCE BERKELEY NATIONAL LABORATORY

A New Appraisal- Lessons from the History of Efforts to Value Green and High-Performance Home Attributes in the United States

Evan Mills, *Lawrence Berkeley National Laboratory*

Energy Technologies Area

October, 2015



This page intentionally left blank

A NEW APPRAISAL

Lessons from the History of Efforts to Value Green and High-Performance Home Attributes in the United States

Evan Mills
Senior Scientist
Lawrence Berkeley National Laboratory

October 21, 2015

Contents

Executive Summary	1
Appraisals in Context	4
Past Efforts to Quantify Value	5
Past Efforts to Advance Green and High-Performance Considerations in Appraisals	8
Barriers to Valuing Green and High-performance Attributes	16
Opportunities	24
Conclusion and Recommendations	34
References	36

APPENDIX A: Literature on value of green and high-performance homes

APPENDIX B: History timeline for green and high-performance homes

Acknowledgments

This work was supported by the Assistant Secretary for Energy Efficiency and Renewable Energy, Building Technologies Office, of the U.S. Department of Energy under Contract No. DE-AC02-05CH11231. Steve Dunn commissioned the work and was and contributed ideas throughout the process. Several practicing appraisers, users of appraisals, and green buildings professionals provided useful insights into the residential appraisal process, including Sandra Adomatis (Adomatis Appraisal Service), John Beldock (EcoBroker), Lisa Desmarais (Peak to Peak Appraisals), John “Skip” Laitner (Economic and Human Dimensions Research Associates), and Laura Stukel (Elevate Energy).

Disclaimer

This document was prepared as an account of work sponsored by the United States Government. While this document is believed to contain correct information, neither the United States Government nor any agency thereof, nor the Regents of the University of California, nor any of their employees, makes any warranty, express or implied, or assumes any legal responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by its trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof, or the Regents of the University of California. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof or the Regents of the University of California.

Executive Summary

Rigorous consideration of green and high-performance (“green/HP”) features is rarely included in the property valuation process.¹ To help illuminate why this is the case, this report takes stock of the history of efforts to improve practices, and identifies barriers that have emerged and opportunities for overcoming them. Particular emphasis is placed on what energy and environmental policymakers and other stakeholders outside the appraisal community can contribute to the broader effort to advance professional practices.

The history has unfolded in parallel with turbulent periods in the housing market for which appraisers and their customers are deemed to share responsibility, followed by cycles of regulations, siloing of appraisers in the name of professional integrity, and commoditization of the valuation process itself. This pattern has important ramifications for aspirations that appraisers engage more fully in identifying and valuing the green/HP characteristics of homes. On the one hand, it is legally and ethically incumbent on appraisers to do so, yet on the other hand it is perceived as a risky avenue to follow. Risks arise where findings can be challenged as either over- or under-stating value, together with a market environment in which the complexity of their assignments increases despite downward pressure on appraiser fees.

While efforts to address green/HP considerations date back to the early 1980s, the vast majority of activity has taken place within the past five years. Many players have engaged in the efforts to promote improved valuation practices. These include the Appraisal Foundation, The Appraisal Institute, Colorado Energy Office, Earth Advantage, EcoBroker, Elevate Energy, Fannie Mae, Federal Housing Administration, Home Innovation Research Labs, The Institute for Market Transformation, Northwest Energy Efficiency Alliance, National Association of Homebuilders, National Association of State Energy Officials, National Association of Appraisers, RESNET, USEPA, USDOE and its National Laboratories, the U.S. Green Buildings Council, and the Vermont Green Homes Alliance. Many activities have resulted, ranging from trainings, to data-gathering instruments, and the emergence of a literature attempting to statistically isolate the effects of green/HP characteristics on home values. In some cases, the results of studies have been overgeneralized and oversold, and embodied flawed methods.

Although the green/HP community has encouraged appraisers to focus on exemplary buildings (e.g., LEED or ENERGY STAR Certified), any level of green or energy performance can in fact influence value, including below-average performance (a.k.a. “brown discount”), irrespective of whether or not the building has been formally rated. This overly narrow focus represents a significant missed opportunity. Other surmountable challenges include limitations to non-appraisers’ understanding of the appraisal process (and practical constraints therein). A byproduct of this can be unrealistic expectations of what appraisers can and will do in the marketplace.

¹ This report adopts the terminology used by The Appraisal Foundation and others. “Green” refers to the entire panoply of green building strategies, including sustainable materials, improved indoor environmental quality, site-sensitive siting, water efficiency, and energy efficiency. High-performance refers primarily to energy and indoor environment. The building sector and appraisers alike have long struggled with ambiguity in these definitions.

These challenges notwithstanding, the environment for moving forward has improved. There is better data today (a critical need); expanded efforts to disclose energy use information (characteristics, consumption, bills); improved and more pervasive building energy codes, building rating and labeling initiatives; and a host of federal, state, and local policies that have collectively brought green/HP practices much more into the mainstream. Meanwhile, a renewed focus on professional standards of care and competency for assessing green/HP homes make it increasingly important for appraisers to consider these factors in their assignments.

Despite the past four decades of studies, there is little if any discernible uptake of these practices by the appraisal practice at large. It would behoove interested parties to step back and consider what new strategies might be productive. A key element of any new plan should be to reset the nature of interactions with the industry, with the goal a more collaborative, two-way discussion to help improve outsiders' understanding of the valuation process. It is not only the appraiser that needs to be engaged and could benefit from awareness raising. Homeowners, builders, lenders, utilities, insurance companies should also provide input on how green/HP factors impact property valuations and ways to accurately reflect these considerations in appraisals and real estate transactions more broadly.

Given extensive inertia within the appraisal industry and a mixed history of interactions with the non-appraisal stakeholders, it is unlikely that the *status quo* will achieve much unless followed with more coordinated and persistent efforts. Workshops, studies, and memoranda of understanding will not on their own have much impact, and do not address deeper structural issues. Expectations are often unrealistic and not attentive to real-world constraints faced by appraisers. The report identifies key barriers impeding more thorough consideration of green/HP factors in residential real estate appraisals, and solutions for mitigating them.

Barriers

- Although industry standards of practice caution against bias of any sort, a skeptical predisposition towards “green” is reinforced by information deficiencies.
- Information deficiencies result from the lack or difficulty of obtaining usable data on green/HP features in subject properties as well as valid sales comparisons or cashflow analyses.
- Competency deficiencies, such as lack of conversancy in relevant technical topics, leads to oversights, and disjointed treatment of relevant information.
- Time/cost pressure and process commoditization (e.g., template-based approaches) result from highly constrained budgets, quick turn-around times expected of appraisers, and standardized practices that were not developed with green/HP considerations in mind.
- Professional differences between appraisers and sustainability professionals include divergent objectives, the former being market observers and the latter market influencers.
- Risk aversion arises from multiple concerns including veracity, accuracy, and persistence of energy data, impacts of operational choices, new sources of appraiser liability associated with green/HP assessments, industry pressures not to over-value buildings or suggestion of bias, and concern about spending non-billable time on complex assignments.
- A public policy vacuum has been created by disjointed and uncoordinated efforts from public-sector stakeholders, insufficient efforts to discuss and understand the appraisal industry and process, and a perception by some valuation professionals that green/HP is oversold.

Opportunities

- Elevating the competency of appraisers can be achieved through a combination of improved industry standards of care and equal-access training and professional development offerings.
- Development of better information resources must focus on building-level information that provides robust documentation as well as aggregate sales-comparison data and other contextual information such as local codes, typical upgrade costs, energy prices, etc.
- Improved energy benchmarking and rating tools could provide appraisers with information more well-adapted to their particular needs, which differ from those of typical audiences such as energy managers.
- Better characterizing and managing risk will enable appraisers to cope with uncertainties in performance information, and help identify where risks may be introduced or mitigated by green/HP features, including higher costs or obsolescence of poorly-performing buildings.
- Integrating disaster resilience and sustainability in appraisals would recognize important synergisms among these features, including durability and ability of green/HP buildings to better withstand external hazards.
- Mitigating the problem of additional time/cost for performing assignments is an essential need that can be addressed by providing easier access to information and analytic procedures, perhaps coupled with new resources to defray the associated costs.
- Enhancing demand for improved appraisals is a fundamental need, and depends on owners, developers, lenders, and others soliciting competent appraisers to perform scopes that expressly call out green/HP considerations, and to critically review the work product for compliance before acceptance.
- Engaging new market participants, such as energy utilities and insurance companies can ensure fuller representation and participation of market stakeholders already engaged in green/HP activities and capable of furnishing valuable data and managing associated risks.

Cutting across these individual activities, there is a need for outside stakeholders to formulate and follow a roadmap instead of piecemeal initiatives, bridging the professional/cultural divide between appraisers and green/HP communities, and tracking progress in order to know what is working. A more coherent communication and training strategy is needed, as the appraisal industry is highly fragmented, with two-thirds of appraisers opting out of membership in trade associations.

In sum, while there is no silver bullet for advancing the practice of valuing green/HP features, there are concrete opportunities. Parties seeking solutions must identify barriers they wish to address and select from among potential initiatives that map to those barriers. Close collaboration with the appraisal community is critical, as non-appraisers have historically obtained limited traction with this industry due to lack of understanding of the nuances involved in the valuation profession. Large organizations and agencies should have a united approach; the perception or reality of a fragmented and uncoordinated strategy is unsettling for prospective partners in the appraisal industry. This requires improved communication and education within and among these communities.

Appraisals in Context

Virtually every stakeholder in the real estate ecosystem wants to see homes properly valued. Whether an owner or builder desiring to recover their investment and appreciation, a lender taking care to keep property value above its mortgage amount,² a realtor wanting transactions to move forward, or an insurer properly quantifying replacement cost or professional liability risk exposure, proper valuation is a shared goal.

A home appraisal is just one of many steps that occur during the process of the selling or refinancing a home, and many actors are involved in addition to the appraiser. In the case of a sale, the appraisal is not even “on the table” until a home is in contract and thus does not serve to inform the prospective buyer about the home’s amenities. In the case of a homeowner seeking to qualify for financing for green/HP improvements, the appraised “stabilized” value after retrofit must reflect value enhancement attributable to the proposed improvements. Buyers and sellers, and others facilitating the transaction must have the motivation to mobilize the information needed to enable the value to emerge. This broader context must be kept in mind when the role of an appraisal is considered.

In the view of the longest-standing developer of real estate agent training in the green and high-performance buildings space:³

“EcoBroker’s field research in the real estate industry since 1995 finds that the anatomy of real estate transactions ultimately depends primarily on the presence of a willing buyer and a willing seller. We see that green and high-performance homes (1) sell for more, (2) sell faster, (3) sell when ordinary homes won’t sell, and, in some cases (4) are not even for sale given how satisfied existing owners are with the home. The appraiser’s job is incredibly subtle and difficult. For most of this last decade, the appraiser’s role has been inappropriately blamed for many shortfalls in the valuation of properties with high performance features (including renewable energy, energy efficiency, and other more sustainable building attributes). The appraiser blends and weights as much of the data that can be credibly and reliably collected, and offers a informed opinion as to property valuation. There are so many factors that go into why properties do and/or do not sell at virtually any price point that assigning any blame to the appraiser for the valuation high performance properties is not a productive exercise.”

Appraisers are also often faulted for roller-coaster rides in the broader real estate markets (Andriotis 2014). It is argued that this reflects a misunderstanding of the very process of appraisal, in particular that it observes and codifies rather than drives market behavior and outcomes (Bunton 2014). Sales prices do not necessarily match appraised values. In any event, these concerns serve to make appraisers apprehensive about scrutiny of any valuation

² The recent housing bubble and ensuing recession clearly show that there are conflicting urges within the financial services sector. Front-line loan officers are rewarded more by day-to-day volume than long-term performance of the industry.

³ John Beldock, CEO EcoBroker, Personal Communication August 29, 2015.

increment awarded — including elements of value attributed to green and high-performance (green/HP) features. In contrast to concerns about appraisers contributing to housing price spikes, the National Association of Home Builders (NAHB) has taken appraisers to task for undervaluing homes, particularly green/HP ones.⁴

In common to all critiques is a question of competency. This is likely the strongest driver today of interest in the green/HP subject from within the appraisal industry (Black *et al.*, 2015). When an appraisal is contested, it often results in a new appraiser having to be dispatched (sometimes several rounds of this occur). This raises costs to the owner and prolongs and complicates the transaction. Addressing green/HP features the first time around is one way to reduce this risk.

The Appraisal Foundation's Uniform Standards of Professional Appraisal Practice (USPAP) compel appraisers to consider all influences on a home's value. Indeed, appraisers are ethically and legally bound to provide accurate, unbiased information. They are required to be competent to perform their assignment, and, if necessary, acquire that competency during the assignment period. They are also required to properly identify material characteristics of the property (irrespective of whether they impact value) and be able to substantiate their findings. Whether in the case of a refinance appraisal or a sale appraisal, the homeowner (or builder in the case of new construction) plays a critical role in mobilizing key information (Stukel 2013).

There are vast differences, however, between engineering-economic analyses that, for example, might identify a fast payback time for an energy efficient measure and deem it “cost-effective” and the dollar value an actual market assigns to that measure. In appraisal parlance, the “contributory value” of a green/HP measure may be less than the cost of that measure or the engineering-economic value of any operating savings it generates. Moreover, the degree to which the intrinsic value of green/HP features emerges depends highly on the factors unique to each local market.

In the words of Linda Desmarais, a practicing “green appraiser”:

“Energy is one of many factors influencing home value, and perceptions of the value held by a given home feature vary widely depending on local market conditions. For example, it is probable that a net-zero straw-bale home would have negative marketability or value issues if it existed among historically designated, non-energy efficient seaside cottages. The straw-bale house may have notable green features, but the market may not accept them. On the contrary, other market areas may have an enormous strong demand for homes with notable green features and sustainable building materials, and thus homes lacking these green features would suffer from obsolescence. ”

Past Efforts to Quantify Value

The historical search for value has identified dozens of studies attempting to isolate the value that green/HP factors contribute to homes (a sampling are shown in Appendix A). The earliest of these studies date back to evaluations of transactions in the wake of the first energy crises

⁴ See <http://www.nahb.org/en/research/nahb-priorities/appraisals/appraising-green-homes.aspx>

four decades ago (e.g., Halvorsen and Pollakowski 1981) . The studies vary widely in their framing of the question. In some cases a single contextual factor such as energy prices is the focus, while in others the role of a particular energy-efficient feature (e.g., windows) is studied. Some studies take more of a “whole-house” perspective. Some use actual energy consumption data while others rely on engineering estimates. The estimated contributory value of green/HP features ranges from roughly 0% to 15% when characterized in those terms, but other metrics are used such as value per square foot or per watt of solar PV capacity, or as a multiple of the annual dollar savings. The wide range reflects an undefined mix of differences in methodology and underlying performance among homes within and among the studies.

One review of studies using the hedonic regression methodology (which attempts to isolate the distinct influences of multiple factors on demand or contributory value)⁵ came to unsettling findings (Laquatra *et al.*, 2002). In addition to intrinsic (unavoidable) limitations of hedonic methods, many past studies were found to have methodological flaws—some quite significant—and/or ambiguities that impeded reproduction of the results and thus undercut credibility. Some conclusions were not supported by the data provided; others yielded counter-intuitive results. One recurring issue was improper characterization of basic building science principals by economists performing the studies. Examples include assuming a linear relationship of savings with increasing thermal integrity (rather than diminishing returns), a focus only on partial-year outcomes (irrespective of weather), and disregard for house size as a factor driving energy use.

The legacy of one highly criticized pair of studies (Nevin and Watson 1998; Nevin *et al.*, 1999) combined flawed methodology with heavy overselling of the results by the green/HP community to appraisers. Appraisers are, not fond of this work, and of having their profession misinterpreted by “green experts”. Nonetheless, this study and others reviewed by Laquatra *et al.*, continue to be cited without caveat.

Compounding these problems, experts maintain that hedonic assessment techniques are not particularly useful for the appraisal process, and are not accepted by the secondary market as a basis for valuation (Runde and Thoyre 2010; Bloom *et al.*, 2011; CNT and NHPC 2013; Adomatis 2014).

At best, the usability of these types of studies by appraisers is impeded by the studies’ time-sensitivity (energy prices and many other contextual factors change over time), and by narrow geographic focus (many factors, ranging from economic climate to market attitudes vary geographically). Even the popular media has recognized this fact (Kahn 2011; Harney 2011). Laquatra *et al.*, concluded that none of the studies could be usefully applied by appraisers. The authors offer suggestions for improved methodologies.

More recent analyses have been performed which will hopefully be more well-received by appraisers. However, no meta-analysis or evaluation such as that by Laquatra *et al.*, has occurred.

⁵ Such attributes could range from numbers of bedrooms to levels of insulation. Wikipedia provides a concise explanation of hedonic applications within the real estate sector for non-specialists: https://en.wikipedia.org/wiki/Hedonic_regression#Hedonic_models_and_real_estate_valuation

- Among these, the work by Hoen *et al.*, (2015) included appraisers in the research process. It obtained a large enough and geographically/temporally distributed sample of solar-PV and non-PV homes to arrive at nuanced findings more consistent with issues that appraisers must consider. Among these, value clearly varied by locale (e.g., \$4/watt within California versus \$3/watt for non-California locations), and showed clear dependency of value on system size, decreased value over time (as systems aged), and sensitivity to electricity tariff type. Nonetheless, the authors correctly caution that these results cannot be applied to individual homes, but, rather, characterize the functioning and trends of aggregate markets.
- Khan and Kok (2012) looked for the effect of ENERGY STAR, LEED, and GreenPoint ratings on housing prices in California. The sample consisted of over 4,000 green homes and 1.6 million control homes. Homes with a green rating sold for a premium of 12% on average, all other variables held constant. However, LEED for Homes and GreenPoint did not exhibit a statistically significant difference in sales prices. For homes constructed in the five years prior to the study, the price premium was only 8.7%.
- Wells, *et al.*, (2013) were able to correlate home sales for cohorts with and without performance designations reported in the MLS for three locations in North Carolina, Oregon, and Texas. The analysis included 170,000 home sales between 2005 and 2011. The study found that ENERGY STAR certification increased the sales prices of single-family homes that were built during the first 10 years of the program but had no statistically significant effect on prices for homes built after that (post-2006). Different designations were correlated with different levels of incremental value. Local certifications were more impactful than ENERGY STAR, corresponding to sales price increases of 9% to 20% in Austin, TX and 5% to 12% in Portland, Oregon. Interviews suggested that the labeling systems were regarded as proxies for overall quality, rather than as reflections of the specific value of energy efficiency or other green factors.

Another methodological approach taken is to commission practicing appraisers to assess individual buildings. Perhaps the most instructive of these is the work by Desmarais *et al.*, (2015), which appraised 26 homes of varying levels of efficiency and other green features in the Denver metro area. The methodology was to estimate value by submarket, in recognition of the fact that expectations regarding the level of energy efficiency vary depending on context. In this case, seven market segments were identified. One or more of the three appraisal approaches were applied, depending on available data. In all cases, with the exception of a building that was obsolete to the point of “tear down”, a positive value increment was associated with green/HP features, but that value ranged from 1% to 15%. According to the author, non energy considerations are paramount, e.g.,:

“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.”

Another such study focused on Portland, OR and Seattle, WA and employed an appraiser to develop sales comparisons for 160 third-party certified homes⁶ (Griffin *et al.*, 2009). The 92 certified homes in Portland (304 “comps”) achieved 4.2% value differentials, and were on the market 18 days less than the comps (30% faster sale). The 68 certified homes in Seattle (207 “comps”) achieved 9.6% value differentials, and were on the market 5 days less than the comps (40% faster sale).

Not a single study focused on potential reductions in value among under-performing homes (the “brown discount”). Performance is in fact a continuum, and if a high-performance home has value then a “mid-performing” home would also have some value, and a deficient home should manifest some level of obsolescence and corresponding discount in value. A good analogy here is of the time when elevators began to appear in buildings. This differentiator made walk-up buildings incrementally less valuable, but a two-story building without an elevator suffered much less than a ten-story one. The potentially greater importance of this issue over the elusive “green premium” (Runde and Thoyer 2010) has received little attention. This is exemplified by an appraiser’s comment at the Whitehouse Green Mortgage Roundtable that less than one-half of 1% of homes he has appraised are “green” (George 2014).

Past Efforts to Advance Green and High-Performance Considerations in Appraisals

The following section highlights key events in the rather long history of efforts to integrate energy-efficiency (and later, “green” features) into the home valuation process. The events are in chronological order to the extent documentation is clear on the date of the activity. A more exhaustive list of events, including source document references, is provided in Appendix B.⁷

1970s

- Energy crises of the 1970s set the stage for many energy efficiency policies and programs. By virtue of the resultant energy price spikes, energy rapidly became a much larger component of household expenses and thus a potentially greater consideration to homebuyers. The incremental investment required to attain improvements was in focus from the outset and many began to ask whether these investments would be recovered at the time of sale.
- In 1975, ASHRAE Standard 90-1975 became the first residential energy code.
- The very earliest statistical studies seeking to certain whether energy considerations affect value examined sales from the late 1970s, focusing on the role of energy prices.

⁶ Earth Advantage®, ENERGY STAR® or Built Green® (Four- or Five-Star) standards.

⁷ <https://docs.google.com/spreadsheets/d/1x5HSjj7NzbP-0VFCQQvQKHAGRjyqpcR9Ba06xdGPcKA/edit#gid=0>

1980s

- The first Model Energy Code was released in 1983, with subsequent updates in 1986, 1992, 1993, and 1995.
- Important changes began to occur in the marketplace. Among these, the introduction of appliance and equipment standards, energy-related building codes, product labeling programs (ENERGY STAR), and a host of financial incentives for improved energy efficiency most notably from energy utilities. These events were important to the valuation process because they drove changes in the building stock, created new forms of differentiation among otherwise “comparable” homes, and furnished documentation that would prove useful to appraisers needing to describe the relevant features. Among the more important forms of documentation was the energy audit, which grew in popularity through the 1980s and beyond.
- The 1980s and 1990s included a period of very active application of statistical “hedonic” methods to the question of whether green/HP homes garner added value in the marketplace. See previous section for a more in-depth discussion.
- The Appraisal Foundation was created in 1987, with the mandate to contribute to improved professional standards within the appraisal trade. It would be two and a half decades before they actively engaged in the green/HP discussion.
- With the gradually emerging public awareness of global climate change, a broader notion of “green” and “sustainable” buildings began to take root. With this, considerations of home valuation expanded from strictly energy to a broader array of features including building materials, indoor environment, water, transport, and site considerations.

1990s

- The Savings and Loan crisis of the 1990s had significant ramifications for the appraisal industry. The federal government imposed reforms including passage of the Financial Institutions Reform Recovery and Enforcement Act (FIRREA), which called for state licensing of all appraisers for any assignment associated with FDIC insurance. This, in turn, gave birth to the rigorous Uniform Standards of Professional Practice (USPAP), administered by the Appraisal Foundation, to which state appraiser licensing bodies bind licensed appraisers. These standards laid important groundwork beneath the current rationale for appraisers to objectively consider all factors that may affect a home’s value, and to accept only those assignments for which they are competent.
- In 1992, Hurricane Andrew was an important contextual event, resulting in a considerable increased attention to building vulnerability and resiliency. These are among factors that appraisers must consider. Later research would begin to document positive correlations between green/HP construction and resilience, representing another source of value that appraisers would eventually need to assess.

- The ENERGY STAR program for new homes was launched in 1995.
- The first International Energy Conservation Code (IECC) was released in 1998, with subsequent updates in 2000, 2003, 2006, 2009, 2012, and 2015.

2000s

- After many years in development, the Leadership in Energy & Environmental Design (LEED) rating program issued its first labeling system in 2000. LEED has evolved considerably since that time into many discrete schemes (new, existing, neighborhoods, etc.) This has become the most comprehensive and readily available source of information on green/HP homes. More detailed information on energy attributes (important for appraisals) is provided by the documentation assembled for existing homes participating in Home Performance with ENERGY STAR, launched in 2002.
- The financial meltdown of the mid-2000s triggered scrutiny of the appraisal process. In 2009, the Home Valuation Code of Conduct (HVCC) was launched with the intention of fostering more objectivity and separation between appraisers and the lenders who commission their work and have real or apparent conflicts of interest in the outcome.⁸ Thus, mortgage brokers, loan officers, and real estate agents were prohibited from directly ordering appraisals. Lenders began to turn to clearinghouses (sometimes called Appraisal Management Companies, AMCs) to obtain appraisers. These AMCs have received mixed reviews, with claims that they are overly focused on lowest cost and fast turn-around, as well as succumbing to the same pressures from banks once placed directly on the appraisers (Andriotis 2014; CNT and NHPC 2013). Moreover, they retain approximately half the appraisal fee, effectively cutting in half what the appraiser is paid. These changes inadvertently created barriers to recruiting appraisers known to be adept at appraising green/HP homes and made it even more difficult to allocate time to assess special situations such as green/HP features (CNT and NHPC 2013).
- A tough critique of past statistical studies attempting to quantify incremental value of energy-efficient homes was published by Laquatra *et al.* (2002). This marked an important juncture in history insofar as appraisers were given reason to be skeptical of studies emanating from the green/HP community.
- Hurricane Katrina (2005) rekindled languishing conversations about building resilience, while also raising the question of climate change and natural disasters more so than did Hurricane Andrew. Both of these considerations remain drivers in the discussion of green/HP homes.

⁸ See https://en.wikipedia.org/wiki/Home_valuation_code_of_conduct

- Beginning in 2007, multiple listing services in Portland and Seattle were among the first localities to track home performance certifications. Nearly 900 homes were added in the first year (Griffin *et al.*, 2009).
- Beginning in 2008, Federal investment tax credits for residential solar PV systems helped spur the market.
- The launch of the *Journal of Sustainable Real Estate* in 2009 signaled the “coming of age” of efforts to advance green/HP practices. Much of the useful literature on valuation has been subsequently published in this journal.

2010s

- In response to the recession of the mid 2000s, the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010 (Dodd-Frank Act) brought sweeping changes through the financial sector, including mortgage reform and further scrutiny of appraisal practices.⁹ Appraisers understandably bemoan the Dodd-Frank requirements for “automated valuation models.” In a 2015 survey, appraisers listed these models as their number-one concern (Alltera Group 2015). Among other things, the continued trend towards automation of the analysis and commoditization of the services has progressively made it harder to consider unique or more complex situations such as green/HP features. This is currently being compounded by more automated Collateral Underwriter software control systems set to detect any “outliers” for a second round of review (higher cost, more time).
- Between 2010 and 2013, the State Energy Program (SEP) grant program supported appraiser training of 226 appraisers in Alabama, Massachusetts,¹⁰ Virginia, and Washington. Among other things, appraisers were exposed to the Home Energy Score, the Green and Energy Efficiency Addendum, and general information on home performance policies and programs. Appraisers in each state reported not actively using the information provided by the training, and being unlikely to actively promote energy efficiency unless they saw broader market trends to support it (Cadmus 2014). Low numbers of appraisers made themselves available for subsequent evaluative interviews (22 out of 171 contacted in AL, VA, and WA). Earth Advantage also offered a third-day appraiser certification course for 20 appraisers who became the first “green” certified appraisers in Massachusetts. Many participants described this as their first exposure to the topic.
- In the summer of 2011, a Building America Expert Meeting was held on appraisals and their role in home financing (BIRA 2011).

⁹ See https://en.wikipedia.org/wiki/Dodd-Frank_Wall_Street_Reform_and_Consumer_Protection_Act#Title_XIV_.E2.80.93_Mortgage_Reform_and_Anti-Predatory_Lending_Act

¹⁰ This training did not take place until 2014.

- In further regulation, in September 2011, Fannie Mae mandated that appraisers use the Uniform Appraisal Dataset (UAD) as part of their reporting. Part of the goal was to further standardize descriptions of the quality and condition of the subject property and comparable sales. Some parties saw this as a new source of liability for appraiser, preferring “vaguely stating” the information.¹¹ This view runs at cross-purposes to discerning green/HP features.
- In an important milestone, the 2011 Fannie Mae “Selling Guide” stated:

“Special energy-saving items should be recognized in the appraisal process. The appraiser should compare the energy-efficient features of the subject property to those of the comparable properties in the ‘sales comparison analysis’ grid to ensure that the overall contribution of these items is reflected in the market value of the subject property.”
- In 2011, the Sandia National Lab commercialized their PV Value software, which has become embraced by the appraisal industry as the *de-facto* methodology for determining cashflows from photovoltaic systems.
- In 2011, the Appraisal Institute ramped up its green/HP activities and member offerings. These included a “Valuation of Sustainable Buildings Professional Development Program” comprising trainings and a series of publications and tools.¹² The Appraisal institute also released its Green and Energy Efficiency Addendum for homes.¹³ The Addendum is intended as “one-stop” tool for documenting green/HP features of homes, including collection of inputs required for the PV value calculation. Appraisers are encouraged to incorporate the forms in their official appraisals.¹⁴
- Also in 2011, The Appraisal Foundation and U.S. Department of Energy entered into a multiyear Memorandum of Agreement to collaborate on improved appraisals for residential and non-residential buildings. Major activities have included participating in the development of a trio of documents on competency, non-residential applications, and residential applications. Other activities include mobilization of information and educational materials for appraisers, and exposure of various tools and databases from the DOE establishment to the appraisal community.
- 2011 was an important year in that discussion of the incremental value of green/HP homes appeared in the popular media (Kahn 2011; Harney 2011).

¹¹ See http://appraisalnewsonline.typepad.com/appraisal_news_for_real_e/2013/03/lia-claim-alert-newsletter-revisiting-the-fannie-maefreddie-mac-2005-urar-form-ambiguities-and-liabi.html

¹² See <http://www.appraisalinstitute.org/ai-issues-green-real-estate-valuation-guidance/>

¹³ See <http://www.appraisalinstitute.org/ai-issues-green-real-estate-valuation-guidance/>

¹⁴ See <http://www.appraisalinstitute.org/ai-issues-green-real-estate-valuation-guidance/>

- Circa 2011, the National Association of Realtors incorporated an introduction to energy efficiency in its General Accredited Appraiser training program (Doyle and Bhargava. 2012).
- In 2012, the Green MLS was first implemented nationally, although localities had been implementing fields in the MLS for some years already. This took the form of the first instantiation of Greening the MLS fields in the data system as indicated by the Real Estate Standards Organization's Data Dictionary 1.0, This first edition included four fields indicating green verification body, program, rating, and version (CNT and National Home Performance Council).¹⁵ By 2014 185 of the 850 MLSs in the country had implemented the four fields, although only a small fraction were populated (McGraw Hill 2014). Subsequent enhancements have been made, including addition of more fields.
- In 2012, NEEA and National Association of Appraisers released a "Cost Addendum for High-performance Homes."¹⁶ This type of information collection is a critical part of coping with the common lack of comparable home sales data used in the "Sales Comparison" appraisal method. The "Cost Approach" is far more commonly used in non-residential real estate, but is applicable to homes. While summing the incremental costs to increase the performance of the home is one sort of proxy for added "value", it omits many important factors, not the least of which are impacts on operating costs.
- Also in 2012, the Colorado Energy Office and the Appraisal Institute enter into an MOU to study trends in valuation of energy-efficient homes in Colorado.. The Colorado Energy Office performed an extensive field study, which was reviewed by the local chapter of the Appraisal Institute (Desmarais *et al.*, 2015).
- Sometime in the 2000s, NAHB issued a "Green Toolbox"¹⁷ with the aim of equipping homebuilders to better inform appraisers and other stakeholders about the attributes of the homes they offer to the marketplace (NAHB no date). NAHB also encourages builders to request revisions of appraisals that fail to consider these attributes.
- In 2013, citing concerns about appraisal quality (in this case undervaluation of homes), NAHB called for major reform of national residential appraisal system.¹⁸ NAHB has noted elsewhere that this problem is particularly likely for green/HP homes.¹⁹
- Among the National Association of Realtors (NAR) long-standing efforts to oppose mandatory energy efficiency efforts, in 2013 the organization granted \$200,000 to the

¹⁵ See <http://www.prweb.com/releases/2012/5/prweb9496321.htm>

¹⁶ See <http://neea.org/neea-newsroom/press-releases/2012/10/15/northwest-appraisers-welcome-real-market-green-building-cost-data>

¹⁷ See <http://nahbclassic.org/page.aspx/generic/sectionID=2648>

¹⁸ See <http://www.nahb.org/en/research/nahb-priorities/appraisals.aspx>

¹⁹ See <http://www.nahb.org/en/research/nahb-priorities/appraisals/appraising-green-homes.aspx>

Greater Boston Real Estate Board to fund a report in opposition to a city proposal requiring mandatory energy audits at the point of sale.²⁰ From NAR's website: "NAR supports incentive-based approaches to assist homeowners in making energy efficiency improvements to their homes. NAR is opposed to labeling homes for energy efficiency and is opposed to point-of-sale requirements for energy audits or energy retrofiting."²¹

- In 2013, CNT (affiliated with Elevate Energy) and the National Home Performance Council published a substantial report entitled "Unlocking the Value of an Energy-Efficient Home", recommending a seven-point strategy for program design. This is one of the few thorough efforts to map a broad strategy.
- In 2013, DOE launched its Home Energy Score Program, offering a national home energy rating platform.²² The availability of a low-cost asset-scoring process opened up the possibility that appraisers can utilize the information in the valuation process. Asset rating also addresses a major barrier posed by relying on ephemeral utility data that is subject to behavioral influences unrelated to property characteristics.
- Also in 2013, BPI released their Residential Energy Efficiency Upgrade Certificate Standard, BPI-2101-S-2013, which offered a standardized and auditor-verified documentation of home energy improvements. Independent verification stands to help address an important risk factor faced by appraisers. The standard is aligned with the Real Estate Transaction Standard (RETS), used to power the MLS.
- As of 2013, The Vermont Green Homes Alliance (VGHA) — a collaborative of state trade groups including builders, mortgage bankers, appraisers, real estate agents, and MLSs — worked through trade organizations to map out a process where a completed Green and Energy Efficiency Addendum will act as a trigger for assigning the a qualified appraiser (CNT and NHPC 2013).
- In 2014, Lawrence Berkeley Laboratory launched the *Information Atlas for Appraising Green and High-Performance Buildings*, an information clearinghouse for appraisers.²³
- In 2014 a Missouri-based green homebuilder/remodeler collaborated with banks to incorporate stipulations in sales contracts that potential appraisers of the property be trained to assess green/HP features. The Appraisal Institute endorsed the language and NAHB publicized it.

²⁰ See <http://www.realtor.org/articles/nar-funds-opposition-to-mandatory-home-energy-audits>

²¹ See <http://www.realtoractioncenter.com/for-associations/issues-mob/policies.html>

²² <http://homeenergyscore.gov>

²³ See <https://sites.google.com/site/appraisinghpbuildings/>

- Also in 2014, the Appraisal Institute collaborated with RESNET to automate the population of their Green and Energy-Efficient Addendum by home rating software. DOE's Building America Program collaborated as well.
- Green/HP appraisal issues received national attention during a Whitehouse Green Mortgage Roundtable in 2014.²⁴ Notably, the Appraisal Institute flagged indoor air quality as an important topic (George 2015).
- In 2015, the Appraisal Foundation's Appraisal Practices Board released Valuation Advisory on the determinants of competency for appraisers of green/HP buildings (Black *et al.*, 2015). Another Advisory remained in preparation, which will focus on application of green/HP practices. Participants outside the valuation community include the Institute for Market Transformation, NAHB, the U.S. Department of Energy, and the U.S. Green Buildings Council.
- In 2015 important policy declarations were made regarding the value of PV systems. These systems are of particular focus because of the complication that in many cases they are leased and thus not formally part of the subject property. The FHA policy handbook provided guidance on solar PV valuation: "A mortgagee may add the cost of an [owned] solar energy system to the mortgage up to 20 percent above than the maximum insurable mortgage limit." In an important related finding, in 2015 Fannie Mae determined that leased solar systems or those covered by Power Purchase Agreements can not be included in residential appraisals (Fannie Mae 2015), while owned panels can be included. This reflects concerns about encumbrances on properties that do not have title to these assets. This is an important development, given that the vast majority of residential PV systems are leased or installed under some sort of PPA contract arrangement. Press reports indicated that homes with leased systems were harder to sell (Wade 2014).
- In continued efforts to promote the Appraisal Institute's Green and Energy Efficient Addendum, beginning in late 2014 builders in the National Green Building Standard (NGBS) Green Certification program will receive a partially-completed version of the Addendum for every certified single-family home. Builders will be encouraged to add additional information about the home's features and provide the Addendum to the appraiser assigned to the home (or the homeowners for use at resale, in the case of remodeling projects).²⁵
- In 2015 the California Public Utilities Commission engaged Build it Green and the Energy Network to provide six appraiser trainings in Southern California.
- In 2015, The U.S. Department of Energy recommended particular levels of building science literacy for a range of professions, including appraisers (USDOE 2015b).

²⁴ See <https://adomatis.wordpress.com/2014/03/16/green-mortgage-appraisal-roundtable-at-the-white-house-conference-center/>

²⁵ See http://www.homeinnovation.com/about/news_and_events/home_innovation_news/2014_1215_home_innovation_agreement_with_appraisal_institute_to_issue_green_addendum

- Also in 2015, under its “Better Buildings Accelerators” initiatives, the U.S. Department of Energy partnered with the many industry interests, including The Appraisal Institute and the National Association of Realtors to improve the availability of information on energy efficient homes that can be used in valuation.²⁶
- Continuing a very public and deep rift spanning at least five years, the Appraisal Institute was accused²⁷ of engaging in legislative activities said to undermine the Appraisal Foundation and lessen federal oversight of appraisers. Some observers believe the underlying issue is the Appraisal Institute’s desire to control marketable educational offerings and underlying ethical high ground (Harrison 2010). This dynamic only serves to splinter the two organizations’ efforts on green/HP buildings and further dilute their effect in the marketplace.
- The valuation of green/HP homes again received visibility in the popular press (Mooney 2015).

Barriers to Valuing Green and High-performance Attributes

In part a reflection of the evolving economic and regulatory environment faced by appraisers, the demographics of the trade (residential and non-residential) indicate a shrinking and aging workforce with fewer new appraisers entering the field (Appraisal Institute 2015; O’Rourke 2013). Nearly two-thirds of appraisers are over 50 years old, with 80% having a bachelor’s degree or less education. Median income is under \$53,000 per year (Bureau of Labor Statistics 2015). As of mid-2015, there were 78,500 active real estate appraisers²⁸ across the U.S., about three-quarters of which are men. The actual number has fallen by about 8,000 from the year 2011, or at the rate of 3% per year. The advent of AMC clearinghouses has cut the fees received by appraisers by up to 50%, leading to a less skilled and motivated workforce. Approximately 80% of appraisers report dropping fees in 2015 (Alltera Group 2015). Two thirds of these are sole proprietors, an important indication of the lack of support possessed by many appraisers. Only 4% of appraisers exclusively practice commercial appraising, 80% exclusively residential, and 15% both. Two-thirds of appraisers do not belong to any trade association. Trade association membership is very fragmented, the top three being the Appraisal Institute, with membership representing about 43% of the those being members of any association, followed by State Coalitions (~25%), NAR (~20%), and NAIFA (~15%). This complicates outreach efforts. Only 22% of appraisers are optimistic about the future of their profession.

²⁶ “Better Buildings Expanding to Help Increase Efficiency in Homes,” The U.S. Department of Energy (May 28, 2015) <http://energy.gov/articles/better-buildings-expanding-help-increase-efficiency-homes>

²⁷ See <http://www.appraisalinstitute.org/statement-from-the-appraisal-institute-on-its-withdrawal-from-the-appraisal-foundation/> and https://www.ncreif.org/documents/event_docs/Chicago2015/Chicago2015_AppraisalFoundationLegislative.pdf and <http://appraiserincome.com/2015/09/09/an-open-letter-to-the-valuation-profession-from-the-appraisal-foundation-regarding-the-rift-with-the-appraisal-institute/>

²⁸ Another 20,000 or so are licensed or certified but not active.

Table 1. Appraisal vs building energy efficiency terminology.

Appraisal Terminology	Analogous Buildings Energy Terminology
Asset (property)	Asset (an energy-using feature that is integral to the building, such as windows, as distinct from features that are not, such as computers.
Competent management	Strong energy management culture
Contributory value	Portion of measure cost and or engineering-economic value of operating cost savings that is actually reflected in the valuation. Incremental value minus whatever discounting the “imperfect” market ascribes
Deferred capital expense	Retrofit candidate
Deferred maintenance	Building out of tune
Habitability	Thermal comfort, indoor environmental quality, disaster resilience
Highest and best use: new construction	Compliant with green/HP building codes and ordinances
Market value	Market failure to adequately value energy-efficiency
Obsolescence: External	Impeded solar access, energy price volatility; poor outdoor air quality (out of control of owner)
Obsolescence: Functional	Energy inefficient; overbuilt
Operational (expense)	Operational (behaviorally or decision-driven energy use, e.g., temperatures, schedules)
Risk management	Commissioning and performance tracking/persistence
Stabalized utility expenses	Post-retrofit energy costs
Superadequacy	Not cost effective (e.g., oversized PV)
Third-party documentation	Energy audits, commissioning reports, benchmarks and ratings

Beyond general workforce considerations, Runde and Thoyre (2010) note that two high-level hurdles are “stalling the evolution of the appraisal industry: (1) lack of systematic, conceptual approach to valuing green buildings and (2) lack of well-defined terminology.” A more pragmatic list of barriers impeding increased attention to green/HP features in residential appraisals was articulated at a 2014 Whitehouse “Green Mortgage Appraisal Roundtable” (March 14, 2014). The latter list included:

1. The lack of data
2. Multiple Listing Services (MLS) that have inadequate green fields, inaccurately populated green fields, or no green fields at all
3. No central database to research the certifications for a property

4. Databases inaccessible to appraisers or real estate agents, lack of knowledge of green building and its benefits, guidelines unclear on alternative methods for valuing energy efficiency or underwriters that refuse to accept any method other than paired sales (particularly Fannie Mae and Freddie Mac)
5. Lenders and AMCs not properly qualifying appraisers for the assignment
6. Inadequate appraisal fees for those appraisers with green-valuation competency

Given the aforementioned need for willing (and knowledgeable) buyers and willing sellers, the real estate agent is key in the equation (Desmarais 2015). Importantly, the real estate industry in general, and the National Association of Realtors in particular, has been largely opposed to any sort of mandatory rating, labeling, or disclosure efforts (CNT and NHPC 2013). Bond (2015) attempted to survey real estate agents in Florida, and upon receiving only 9 responses the effort was dropped. Subsequently sending an invitation to 5000 real estate agents in California yielded only 110 responses. The survey found that few respondents had experienced demand for green/HP homes and had a distorted view of the cost of EE measures. This does not bode well for the role real estate agents play in conveying green/HP information to appraisers.

The leading barriers to advancing property valuation practices that better address green/HP considerations can all be addressed most effectively through interaction and two-way information exchange between the appraisal and green and high-performance buildings communities and associated policymakers. Impeding this process are literal differences in how language is used and the meanings ascribed to terms. Table 1 provides a sampling of how some key appraisal terminology maps buildings energy terminology. The energy and broader green-buildings communities are not yet very adept at communicating value in appraisal parlance. Emblematic of an even deeper divide is the familiar use of the language and concept of “cost-effective” measures as determined by engineering analyses. This abstract form of economics has little bearing on “sub-optimal” values buyers actually place on building attributes.

These issues notwithstanding, a reasonably finite number of barriers impact the aspirational process of incorporating green/HP considerations in real-estate appraisals. These factors are far-reaching and emerge repeatedly throughout the process.

1. *Skeptical predisposition towards “green”.* An undercurrent of skepticism colors some appraisers’ view of green/HP factors. For appraisers with a long history of practice, this is perhaps rooted in earlier times when the science and practice of sustainable building practices was less established. Information deficiency and lack of competency today reinforce knee-jerk reactions. The Appraisal Foundation’s recent Valuation Advisory on core competency cautions against this sort of bias (Black *et al.*, 2015).

2. *Competency deficiency.* Many appraisers are not conversant in even the basic concepts and metrics of green/HP. In a survey conducted in the Pacific Northwest, only 5% of builders believed that appraisers were able to recognize the value of green features (Griffin *et al.*, 2009). One result is that the mistake can be easily made of viewing green/HP as a single feature or reducing to a single metric and thus expected to either be present or not present in a subject property, rather than manifest as a granular continuum such that each and every building’s performance becomes a consideration. One consequence of limited competency is that energy considerations may be appended, at best, to a traditional appraisal rather than treated in a more integral fashion. Another consequence is the inclination of some appraisers to pessimistically assume that entirely new methods will be needed to address green/HP issues, when in fact the existing methods can fully accommodate these issues as long as appropriate data are gathered and considered. Further hampering appraisers, key market factors applicable to green/HP are largely non-overlapping with those that appraisers traditionally track, and the sources of that information (e.g., buildings receiving performance labels or ratings, energy codes, energy incentives) are unfamiliar to appraisers. Additional inertia has been introduced due to the insertion of Appraisal Management Companies (AMCs) as middle-men in the process. According to one DOE-sponsored report, “the AMC typically selects an appraiser from a pre-approved list with little to no regard for areas of expertise or competency” (Doyle and Bhargava. 2012).

3. *Information deficiency.* Timely availability, accessibility, and usability of green/HP information is a barrier that vexes the entire domain of high-performance buildings. Due to privacy concerns, some key data, such as ENERGY STAR and Home Energy Score home details, are not readily available. Appraisers are one constituency that is particularly adversely impacted. Appraisers must be able to substantiate and defend their analyses. The problem manifests in two broad ways. Firstly, obtaining and making sense of often highly technical information produced by other professions is no small feat. However, the appraiser needs only to understand (not verify or certify) the findings of specialists. Certain transaction structures imply additional inertia, e.g., the insertion of third-party AMCs into many appraisal projects or other sorts of firewalls that are erected between lenders and appraisers. Secondly, information rarely assembled with the appraiser in mind, the information is often far more or less granular than the appraiser requires. For example, an energy audit, commissioning report, or indoor-environmental quality inspection can easily be daunting to the appraiser, and locating the “nuggets” therein is not easy. Foremost among the information needed by the appraiser is a

quantitative estimate of energy savings that the subject building achieves over a standard building. Compounding the problem, much of the 'generic' information in the energy field (e.g., typical energy savings for particular measures) and many studies and claims about how this translates into asset value is either too highly generalized (perhaps using national averages) or is from a specific market not relevant to that where the user is practicing. In practice, the value of a green/HP building will vary widely depending on factors as diverse as prevailing energy prices and sentiments of prospective buyers. Traditional appraiser training has not emphasized these considerations, although that is now changing. Lack of information also impedes an owner's ability to compel an appraiser to consider a property's green/HP features and performance. Even with good information available, the highly fragmented appraisal industry and its professional organizations²⁹ provides no single turn-key pathway for reaching all practicing appraisers. The Appraisal Foundation and the Appraisal Institute are the only industry bodies with significant sustained interest and effort in this area. Yet, approximately two thirds of appraisers do not belong to any trade association (Alltera 2015).

4. Time/budget pressure & process commoditization. As noted above, appraisers are under considerable time/budget pressure to complete their assignments. Green/HP, particularly in the context of non-residential buildings, is a complex topic and enormous amounts of documentation can be presented to the appraiser for assessment. In the words of one appraiser after conducting dozens of residential green/HP appraisals (Desmarais 2015):

"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."

One appraiser estimated that they can only spend 1% to 8% of their allowed time examining green/HP issues. With the national average appraisal fee today just over \$300 (only half of which goes to the appraiser,³⁰ this affords very little time for this aspect of the assignment.

The aforementioned barriers associated with competency and information only serve to amplify the effort to process this additional layer of information. This barrier rears its head in the case of the Green and Energy Efficient Addendum. Gathering many of the inputs, e.g., HVAC efficiency, PV technical specifications, etc., are well beyond both the appraiser's competence and time availability. Anecdotal reports from the field suggest that few appraisers will ever be able to afford the time to utilize this tool, which is estimated at 45 minutes once the data have been

²⁹ Examples include the Appraisal Institute, The Appraisal Foundation, American Society of Appraisers, Royal Institute of Chartered Appraisers, and the American Society of Farm Managers and Rural Appraisers.

³⁰ See <http://www.homeadvisor.com/cost/inspectors-and-appraisers/hire-a-property-appraiser/> and <http://www.foxbusiness.com/personal-finance/2011/04/19/paying-500-appraisal-costs-200/>

gathered.³¹ It is thus critical to engage other parties in marshaling this information on behalf of appraisers, and this is fully the intent of the Addendum's developers. Meanwhile, the process of scoping, bidding, and performing appraisals has become more commoditized and standardized, which has the tendency to reduce flexibility and the ability to consider non-standard factors.

5. Professional differences between appraisers and green/HP professionals. Those who design, build, or otherwise promote the development of markets for green/HP efficient buildings view themselves as agents of change and advocates of improved practices. They seek to change markets. The appraiser does not view themselves in this way. They do not drive value or actively shape markets, but, rather, observe market behavior and codify it.³² In other words, appraisers are the messengers of how markets function, whereas energy policymakers focused on these issues are projecting how markets will behave if they function according to idealized theory where costs and benefits are fully optimized. Lack of appreciation for these differences in posture towards this issue can thwart well-intended efforts to unify these two communities. Although appraisers' passive role has been pointed out in past reports (e.g., Doyle and Bhargava 2012), energy advocates often expect more. Compounding the problem, the terminology used in the valuation industry differs, sometimes fundamentally, from that used in the green/HP community (Table 1).

6. Risk aversion. While a central goal of appraisals is to identify project-related risks and incorporate them in the valuation, risk abounds in the appraisal process itself. Appraisers are understandably adverse to this second type of risk, as their reputations and profits rest upon it. Undertaking an assignment for which the appraiser is not competent is a key risk. This, in turn, invites the risk of over- or under-valuing the property and being taken to task (in the review process or even in post-assignment litigation). Running afoul of appraisal standards, including any appearance of bias or undue influence, places appraisers at risk. A particularly important risk arises in appraising recently retrofitted properties, as utility expenses are typically substantiated by analyzing *past* experience. Very robust savings projections are needed order to defend stipulated "stabilized" post-retrofit utility expenses. Assumptions about often complex utility tariffs are yet another variable. This kind of energy engineering analysis is beyond even well-trained appraisal expertise, the third party report conclusions are best relied upon. By using third-party reports, risk is thus transferred from the appraiser to the third-party expert. A more pragmatic risk is ending up with an insufficient fee as a result of underestimating the effort that may be entailed in performing an appraisal. Contrary to the stated desire for more information, some observers protest the trend toward increased disclosure as inviting new risks (Davis 2013), when analysis is beyond the appraiser's competency, conclusions can still be used. While these liabilities have not yet manifested in litigation (e.g., one long-standing appraisal law blog has no occurrences of the terms "green", "green buildings," or "energy-efficiency"³³) the risk is there. An illustration in the case of completing the Appraisal Institute's Green and Energy Efficient Addendum, the president of Capital City Bank in Gainesville, FL, says that "appraisers

³¹ Personal communication, Sandra Adomatis, September 8, 2015.

³² "Market behavior" can include incorporating actual utility expenses into valuations.

³³ See <http://www.appraiserlawblog.com/>

Table 2. Barriers and opportunities.

Barriers ==> Strategies V	Skeptical predisposi- tion towards “green”	Compe- tency deficiency	Informa- tion deficiency	Time/budget pressure & process commoditi- zation	Professional differences between appraisers and sustainability professionals	Risk aversion	Public policy vacuum
Elevating the competency of appraisers							
~ Professional Standards of Care	x	x	x		x	x	
~ Enhancing training and professional development	x	x	x		x	x	x
Developing better information resources							
~ General information	x	x	x			x	x
~ Building-specific information	x	x	x	x	x	x	
~ Aggregate market information	x	x	x	x		x	
Improved energy benchmarking and rating tools		x	x	x		x	x
Better characterizing and managing risk		x	x	x		x	x
Integrating disaster resilience and sustainability		x	x			x	
Mitigating the problem of additional time/cost for performing assignments		x	x	x		x	
Enhancing demand for improved appraisals	x					x	
Engaging new market participants							
~ Utilities		x	x	x	x		
~ Insurers		x	22 x			x	

either don't want to learn it or they aren't comfortable filling it out because they don't want to take on the liability."

7. Public policy vacuum. Efforts by environmental policymakers to foster collaboration between the appraisal and green/HP buildings communities have been highly fragmented, short-lived, and of limited effectiveness. A wide cognitive and technical void separates these policymakers and valuation professionals, resulting in lack of mutual understanding. Appraisers often feel "dictated to" and over-sold by policymakers, rather than engaged in two-way dialogue and joint problem solving process. Appraisers are also wary of the consistently glowing characterization of green/HP proffered by public agencies — they know there can be downsides, but see those being ignored or downplayed. While the policy community has great expectations for the use of labeling and rating programs (LEED, ENERGY STAR, etc.) in the valuation process, practicing appraisers express doubt about the applicability. Appraisers see the policymaking community as having a poor grasp of the appraisal process and standards of care, resulting in recommendations that are in-actionable. A common example are rules of thumb about applying standard capitalization rates to stipulated energy savings in order to estimate contributory value, when in reality the calculation has to be modified to reflect a myriad of factors including but not limited to local conditions, prospective buyer types, and a host of related risk factors such as energy savings volatility and persistence. Moreover, appraisers apply other methods in addition to cashflow-analyses prior to reaching a final determination of value. Moreover, some appraisers are deterred from engagement with federal initiatives by a perception of a siloed and uncoordinated approach towards green appraisals, and lack of staying power for problems that require patience and tenacity.

* * *

Each of the preceding broad categories of barriers reflects opportunities, a number of which are outlined below. Most opportunities address multiple barriers (Table 2).

Opportunities

This section explores how the various actors/processes can be better aligned to address the gaps/disconnects/barriers. Recommendations are distilled in the Conclusions section. Our findings are consistent with other reviews (e.g. CNT and NHPC 2013), although this report also seeks to go well beyond the (important) goal of providing better data, i.e., addressing deeper underlying market barriers and frictions. Doyle and Bhargava (2012) focus primarily on the case of homeowners attempting to finance retrofits; they echo our finding that homeowners and lenders need to be proactive and engage appraisers.

1. Elevating the competency of appraisers

Professional standards of care

We are not aware of any surveys that have been conducted to characterize the level of knowledge and competency among commercial appraisers, or the obstacles they see to enhancing their practice. This would be a natural place to start in order to inform efforts to improve competency.

Recent public-domain work by the Appraisal Foundation (Black *et al.* 2015) together with publications of The Appraisal Institute lay important groundwork for more systematically incorporating green/HP considerations in the standards of care for valuation professionals. There is room for more elaboration and training to build competency, particularly in such a rapidly changing field. A recent example of areas needing attention is the trend towards Net Zero Energy buildings, which invokes some particularly special considerations for appraisers (Runde 2015).

While the Appraisal Foundation advisories are voluntary, states may adopt elements of these guidelines and make them required for appraisers in local markets. Policymakers may seek to work with localities towards this end. The Foundation also manages the Uniform Standards of Professional Appraisal Practice (USPAP).³⁴ These currently allow for an appraiser to identify competency gaps and to obtain that competency during the course of the relevant assignment. Requiring competency before an assignment is accepted would be a more effective way to safeguard the process. By analogy, following concerns about competency and ethics in the over-valuation of conservation easements, some jurisdictions now require the appraiser sign an affidavit that they possess the education/experience required for these assignments.

As discussed more fully below, liability insurance companies that underwrite appraisers can also play a role here, as a key risk-management strategy is to equip appraisers with the ability and incentive to employ best practices in their assessments of green and high-performance buildings.

³⁴ See <https://netforum.avectra.com/eweb/DynamicPage.aspx?Site=taf&WebCode=USPAP>

Training and professional development

Training and professional education address many barriers, and enable appraisers and other participants in the process to obtain sufficient competency. No particular training on green/HP issues is currently required as part of an appraiser's education. Training could also be valuable for other parties such as appraisal reviewers, lenders, builders, property owners, and policymakers. Of note, the administrative staff to whom appraisal requests are handed within lending institutions are typically less familiar with the project in question and also have less training than the presiding loan officer. Training focused on these individuals could be particularly value.

In a recent report, DOE identified appraiser education as a leading policy goal. They noted that the states of Alabama and Colorado have subsidized appraiser education on green buildings (USDOE 2014). According to one report, only 14 residential and 7 commercial appraisers in California had completed the Appraisal Institute's "Valuation of Sustainable Building Professional Development Program" (California Energy Commission 2015). This compares poorly with the 11,000 licensed appraisers in California as of January 2015. The Appraisal Institute is reported to have trained 700 appraisers on solar PV valuation (Hoen *et al.*, 2015), which is certainly progress but still a tiny fraction of the practicing appraiser population. An aforementioned multi-state SEP grant supported some appraiser training in Alabama, Massachusetts, Virginia, and Washington (Cadmus 2014); no information was provided on numbers of appraisers reached. The Appraisal Institute is reported to have had 257 appraisers complete one or more courses in their sustainability program as of 2014; about 1% of membership (McGraw Hill 2014).

Training efforts have thus far been largely piecemeal. Several are offered by the Appraisal institute (introduction to "green", case studies for residential and commercial buildings, solar valuation, and residential green description). The U.S. Department of Energy's (DOE) Guidelines for Building Science Education are aimed at residential and non-residential appraisers.

Improved depth can no doubt be offered on topics such identifying third party experts and how to vet them and incorporate their conclusions into the valuation process; codes and standards; market data; finding and judging various models and data sources; how to read a solar lease or PPA. DOE is currently developing appraiser training in benchmarking and rating tools.

The use of case studies is a traditional teaching methodology. Many case studies have been performed for individual residential buildings, although not many have made their ways into training.³⁵ The same imbalance applies for regional or national statistical studies. Future case study work and associated training should also focus on whether under-performing buildings received below-average valuations (the so-called "brown discount").

Increased scale in training deployment is needed. For example, trainings offered by a given professional society are generally only available to its members. Reciprocal training is also needed for those in the green/HP community (e.g., program designers; code officials) who seek

³⁵ A catalog can be found here: <https://sites.google.com/site/appraisinghpbbuildings/valuation>

to engage constructively with appraisers. CNT and the National Home Performance Council (2013) offer additional insights into training strategy.

2. Developing better information resources

General information

New green/HP research is published on a regular basis, but seems to have little visibility or effect in mainstream appraisal circles. Policymakers may seek to mount an informational campaign to enhance access to the products of their own research and that of the broader “green/HP community”. DOE has sponsored an initial effort along these lines in the form the Information Atlas for Appraising Green and High Performance Buildings.³⁶

There is a need to improve the design and quality control of valuation research and methodologies as applied to green/HP buildings. Given the methodological flaws in many past studies, (Laquatra *et al.*, 2002), efforts should be made to produce more useful analyses of case-study and macro-level market data. The literature since that of the late 1990s could also be independently reviewed. Groups could attempt to work with the Appraisal Foundation to help improve hedonic methods already utilized in the Uniform Standards of Professional Appraisal Practice (USPAP). Better methodologies (e.g., Bayesian probability approaches) are now available, and it is easier than in the 1980s and 1990s to assemble large datasets with nuanced information about green/HP property characteristics. Care must be taken not to generalize findings into over-simplified rules of thumb. Of particular importance, studies should also test the hypothesis that sub-average performance (sometimes referred to as “brown discount”) erodes property value.

Building-specific information

In the case of a green/HP property, assertions of energy efficiency are not very defensible *in lieu* of robust utility data as well as detailed descriptions of the physical characteristics to which performance is being attributed. Appraiser reliance on stipulated or “default” values can understate value when the subject building is high-performing. To fully access the required information, it may be necessary for appraisers to tap third-party experts. Data and tools are needed to help appraisers identify the energy codes to which a subject home and sales comparisons are constructed. LEED point lists are also convenient sources of information.

The problem is far more difficult for less tangible factors such as indoor environmental quality (IEQ), which appraisers would characterize under the rubric of “Habitability”. Equipping consumers and appraisers with actionable information on indoor environment is an important step towards valuation. The Green and Efficient Addendum could be enhanced to capture more useful information of this sort, and appraisers could be empowered to extract more of this

³⁶ See <https://sites.google.com/site/appraisinghpbbuildings/>

information from home inspections and associated measurements and mitigations. Certain IEQ attributes do not require expert assessment.³⁷

As previously noted, homeowners are a key source of information and more efforts could be made to support them in conveying useful information about green/HP features to appraisers.

Providing green market intelligence

In an ideal world, existing databases of property sales would provide all the information necessary for appraisers to conduct sales comparisons.³⁸ Multidisciplinary efforts could improve the rigor and availability of these kinds of databases and associated analyses. The Green MLS project is the leading effort in this regard, and is only beginning to get on the radar of appraisers. For example, as of 2011, only 1% of MLS listings in Austin, TX and Portland, OR indicated green certifications, while in Research Triangle, NC the value was just over 7%.

The green/HP community has stood up various databases of high-performance buildings. Some are program specific while others attempt to aggregate databases (e.g., GBIG). For applications to the valuation process, these efforts are lacking in two respects. Firstly, the databases do not contain sales information and thus are not directly useful in sales-comparison studies. Secondly, these focus on ostensibly exemplary buildings, whereas best practice for appraisers is to consider the entire performance spectrum. The Building Performance Database (BPD) is an important effort in this direction (including buildings irrespective of their level of energy use), but is not paired with real-estate sales data and is not intended to be representative of the overall building stock. Valid comparisons must encompass energy data, physical characteristics, and operational factors. RESNET has opened up its home registry, making one new information source available (HERS Scores for homes rated in 2012 or later) for potential correlation with home sales.³⁹ Participants in green/HP programs should be enabled to archive key documentation in a way that it can be readily accessed by appraisers in the future and to proactively request qualified appraisers. Data gathered under such programs (e.g., ENERGY STAR, Home Energy Score, etc) and software (e.g., PV Value) should be better mobilized to the Green MLS, Green and Energy Efficient Addendum, and into local market analyses, while preserving consumer privacy — an opt-in system could be offered in this regard. About 60% of appraisers report being willing to contribute to a shared database if they were paid for contributing data (Alltera Group 2015).

Aside from individual building characteristics, appraisers require data on prevailing conditions and contextual factors such as weather, energy prices, building codes, policies, and public attitudes. Some elements of this were captured in the Green Building Opportunity Index (for non-residential buildings) combining general market conditions and investment outlook with green adoption and implementation, mandates and incentives, state energy initiatives, and

³⁷ See <https://sites.google.com/site/appraisinghpbldings/key-topics/indoor-environmental-quality>

³⁸ Appraisers typically require 4 to 6 sales comparison, or one highly identical paired sale.

³⁹ See <http://www1.resnet.us/registry/home.aspx>

“green culture”. It is unfortunate that this service (created in 2010 by NEEA and Cushman & Wakefield) is no longer in place; it should be revived, updating annually, and expanded to include residential property types. CBRE’s Green Building Adoption Index for the commercial sector provides a potentially key element, capturing the penetration of ENERGY STAR and LEED buildings by market (offices only, and only leasable space), but going no further than that in terms of providing broader contextual information on the disposition of the surrounding market (Kok and Holtermans 2014). No counterpart is yet available for homes; the Green Home Market Barometer is a hypothetical illustration of what such an index could look like (Figure 1).⁴⁰ While this information is readily gathered by energy-literate analysts, doing so by appraisers would be far more time-consuming and thus unlikely.

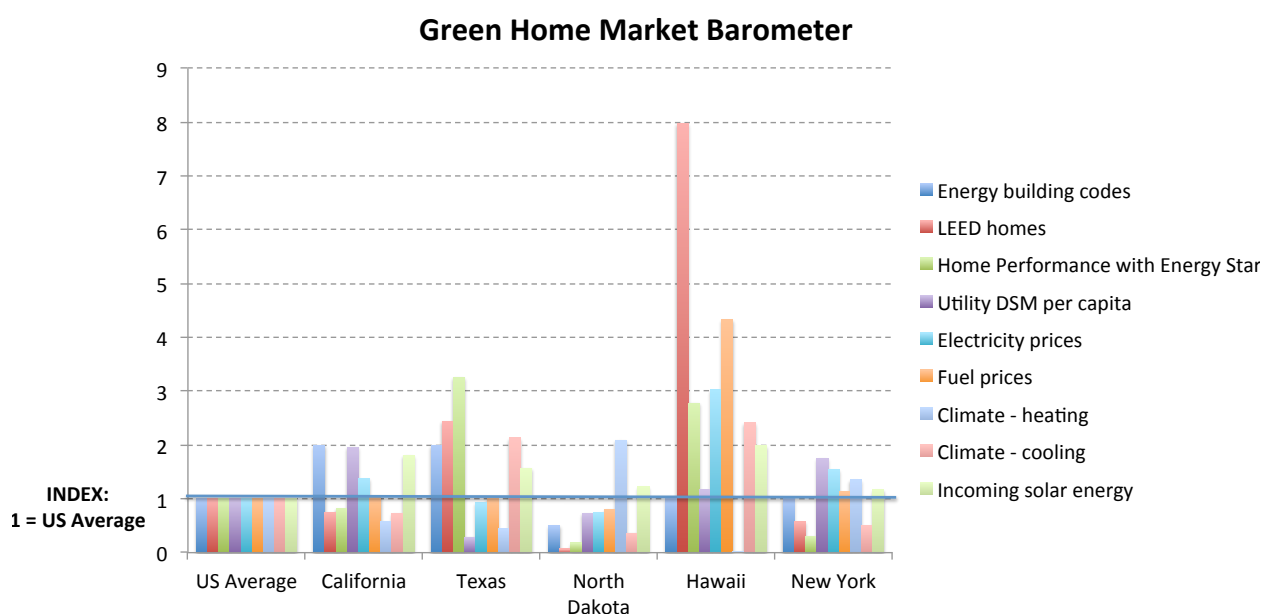


Figure 1. Example of distilled market data that could be of use to appraisers. The Green Building Barometer is a proposed approach; Samples have been produced only for a few illustrative markets.

The existing playing field is highly fragmented by compartmentalized (and sometimes feuding) professional organizations focus only on members and thereby do not effectively reach the larger appraisal community. Many appraisers are not members of any particular trade organization, and thus represent a particularly important target group. An appropriate third party may be able to provide a valuable clearinghouse role.⁴¹

⁴⁰ See <https://sites.google.com/site/appraisinghpbbuildings/market-data>

⁴¹ The Information Atlas for Appraising Green and High Performance Buildings is an existing low-level DOE activity in this regard: <https://sites.google.com/site/appraisinghpbbuildings/>

3. Improved energy benchmarking and rating tools

The existing body of tools and software for green/HP buildings assessment is bewildering at best and unknown at worst to most appraisers. The language is foreign and the subject-matter knowledge required to use and interpret results is out of reach.

Leading rating and benchmarking tools have limited utility for appraisers, which is not surprising given that they were not developed with appraisers in mind. Some (e.g., BPD or the Home Energy Score) do not provide essential baseline energy expenses. The vintage of the characteristics data within these tools is not always specified or filterable, leaving the appraiser uncertain as to whether a given view is representative of *current* market conditions.

These tools, however, do have value in helping to obtain descriptive information on green/HP features, and to garner some metrics and ratings that may have contextual value. Moreover, third-party endorsed energy analyses bolsters an appraiser's ability to credibly deviate from industry defaults in discounted cashflow analyses. Moreover, the advent of asset scoring removes important uncertainties in the estimation of standardized energy use independent of user behavioral drivers, geography, and year-to-year weather variations.

Incremental improvements may be made to some of these tools to increase their value to appraisers, an illustration of which might be allowing the Building Performance Database data to be filtered by data vintage, thereby providing the appraiser with a clearer picture of market practices at given points in time. Any tool that helps reduce the time/effort required to access disclosure data on energy bills would be valuable to appraisers.

As many of these tools have application programming interfaces (APIs), an effort could be made to collaborate with appraisal software vendors who may be interested in pulling relevant data fields into their tools and reporting them in a context and format more familiar to appraisers. Recent efforts to enable residential energy audit software to automatically populate the Appraisal Institute's Residential Green and Energy Efficient Addendum⁴² provide an example. The same should be done with other data sources.

4. Better characterizing and managing risk

A key function of the appraisal process is assessing the risks and uncertainties associated with property valuation. Indeed, as noted in The Appraisal Foundation's advisory on competency, there is risk in insufficient knowledge or experience that results in "assigning value, or no value, to green components without market support" (emphasis added) (Black, *et al.*, 2015).

Green/HP buildings can mitigate certain risks, but can also bear their own unique risks, such as water damage from vegetated roofs, solar panels on rooftops posing a hazard and impediment to firefighters, etc. Energy savings persistence is likely foremost among these risks. Appraisers must understand the techniques used to reduce uncertainty, including sub-metering and savings

⁴² See <http://www.appraisalinstitute.org/assets/1/7/Interactive820.04-ResidentialGreenandEnergyEfficientAddendum.pdf>

tracking, regular O&M programs, commissioning, and application of well-validated simulation models to savings estimation.

On the up side, green/HP buildings are intrinsically subject to reduced utility price volatility, when properly executed have significantly better indoor environmental quality, and are more durable and disaster resilient.

5. Integrating disaster resilience and sustainability

Natural hazards are a contextual factor that appraisers are expected to consider in the valuation process. Appraisers are arguably more attuned to natural hazards and the vulnerability of properties than they are to green/HP issues. That green/HP properties can be more disaster resilient merits consideration as appraisers assess what is known as “functional utility”. Some building professionals assert a high-performance building cannot be deemed truly green or sustainable if it is not durable in the face of extreme events or every-day factors that stand to degrade the facility.

Natural hazard events and associated economic costs continue to rise, impacting property value through proxies such as rising insurance premiums and fortification costs. The private insurance industry is engaging efforts to promote resilience, incentives for disaster-resilient practices, and adjusting premiums to reflect building code quality and enforcement.⁴³ The Institute for Business and Home Safety (IBHS) offers guidelines on disaster-resilient buildings; some insurers assess lower premiums to these buildings. Conversely, insurance premiums may be adversely impacted by sub-par ratings within the Building Code Effectiveness Rating Scale.⁴⁴

As recognized by IBHS, LEED, the U.S. Department of Energy and others, certain sustainability attributes enhance a property’s every-day durability and ability to endure or adapt following natural disasters.⁴⁵ Examples include the water-damage resilience of closed-cell foam insulation or the fire-resistant properties of multi-pane windows. Sustainability attributes can shorten or even eliminate business disruptions following a power outage due to backup generators or on-site energy storage. The correction of discovered defects often translates into enhanced equipment life, improved tenant comfort, avoided premature equipment failure, and early detection of fire hazards.⁴⁶

Some appraisers are specifically trained to perform this work on behalf of the Federal Emergency Management Agency (FEMA), federal agencies, or insurance companies. Others may be called upon by a lender or a client to appraise a property immediately following a disaster or to estimate the value of a property before a disaster took place.

⁴³ See https://www.disastersafety.org/building_codes/rating-the-states_ibhs/

⁴⁴ See the Building Code Effectiveness Grading Scale: <http://www.isomitigation.com/bcegs/0000/bcegs0001.html>

⁴⁵ See “The Link Between Hazard Mitigation and Livability: Planning for a Sustainable Future” –FEMA Publication No. 364 September 2000 <http://www.fema.gov/media-library/assets/documents/2110>

⁴⁶ See <https://sites.google.com/site/appraisinghpbbuildings/key-topics/quality-assurance>

Efforts could be made to enhance the existing treatment of natural hazards and other durability considerations to include these linkages with green/HP considerations, and to consider these attributes in property valuations.

6. Mitigating the problem of additional time/cost for performing assignments

One barrier noted above is concern about the additional time and cost to gather information and evaluate green/HP features. The LEED building checklists provide convenient data on relevant building characteristics. New tools such as the Appraisal Institutes Green and Energy Efficiency Addendum help structure the collection and presentation of relevant data, although a User Guide is needed for the Addendum. Mobilizing more and better data on sales and market characteristics (energy prices, building codes, etc.) in a form appraisers can use would also make the process more efficient. For each appraiser or firm to individually gather such data is time-consuming and creates significant redundant effort; a public-goods, open-access directory would be a welcome resource in the industry. Widespread existing efforts to compel disclosure and public access to utility data is an existing example of pooled data that is readily accessible by appraisers.⁴⁷ The U.S. Department of Energy has supported this work in the past.

Third-party incentives or financing of the incremental costs of information acquisition (e.g., by utilities, as mentioned below, or other stakeholders) may be feasible. Training is a second-order cost to appraisers, and incentives to defray training costs would also be of value.

7. Enhancing demand for improved appraisals

In the absence of demand for green appraisals, the incentive for appraisers to make the added effort and investment in training will remain limited. Owners who have invested in improving their property clearly have an interest in recovering their investment during the holding period and upon sale. Lenders need to fully understand collateral value and associated performance risks. Third-party stakeholders such as insurers have their own objectives, and policymakers seek to undue market failures resulting from non-valuation of green and high-performance elements of the building stock.

Those who order appraisals are of course in the best position to stipulate that green/HP features be considered. In one example, the Vermont Green Homes Alliance (VGHA) has worked to help market actors assign the right appraiser (CNT and NHPC 2013).

Owners of green and high-performance buildings should compile all information and communicate it to each prospective lender. Within the cover letter, owners are advised to identify the collateral as a green/high performance building, that specific features should be considered in the valuation assignment, and state the expectation that the appraiser have competency in line with the assignment complexity. It is critical that owners and those who order appraisals fully articulate expectations and disclose key factual information at this early, critical stage of the process.

⁴⁷ See <https://sites.google.com/site/appraisinghpbbuildings/key-topics/disclosure-1>

One way to facilitate these interactions is through model language for expected appraiser qualifications, due-diligence expectations, owner letters, etc. Thus far, the the Appraisal Institute's Green and Energy Efficient Addenda represent the key effort in this area, and it could be improved through more precise characterization of the property and reconsideration of which questions are asked. The Appraisal Institute has also promulgated model SOW language for residential appraisals, which calls for competency in green/HP as well as citing a national "Green Value Score" upon which appraisers can rely.⁴⁸ As noted above, Appraisal Management Companies (AMCs) oversee many appraisal projects and could be an effective intermediary between banks/clients and appraisers for deploying improved methodologies, although their reputation is to oversimplify the process rather than to improve its quality.

In an example for residential real estate, a builder of high-efficiency homes introduced language into his guidance to lenders to help identify qualified appraisers.

*"This home is being built/renovated/updated to nationally recognized standards above prevailing code. It is designed and constructed with unique features and materials and with high efficient equipment and in accordance with high efficiency standards. The Lender shall choose an Appraiser educated and knowledgeable in this type of valuation of these specialized Homes, preferably an appraiser who holds a professional appraisal designation that requires advanced education on such issues as the valuation of sustainable buildings (e.g., MAI or SRA designations from the Appraisal Institute). The appraiser shall provide verification of green valuation education of 14 hours or more from a qualified educational provider and knowledge to be permitted to conduct the appraisal for this project."*⁴⁹

Another opportunity arises near the conclusion of the appraisal assignment, when the draft is reviewed. A new level of arms-length technical review could be created, e.g., by interested utilities, state energy offices, or universities. Clients may elect to contest an appraisal that they feel has not adequately addressed the property's green/HP features.

Legislating better practices for these entities at the federal level or as augmentations to Federal minimum requirements at the State level could be explored. Recent efforts to do so indicate the need for further refinement.⁵⁰

8. Engaging New Market Participants

While the real-estate valuation "ecosystem" is already a busy landscape, certain potentially valuable non-appraisal trades and professions with bearing on green/HP are absent or only peripherally engaged.

⁴⁸ See http://mts.sustainableproducts.com/certified_products/Model%20Green%20Home%20Valuation%20Scope%20of%20Work%2010-27-12.pdf.

⁴⁹ See <http://www.nahb.org/en/research/nahb-priorities/appraisals/appraising-green-homes.aspx>. Language "reviewed and enhanced" by the Appraisal Institute

⁵⁰ See <http://www.usgbc.org/articles/senate-energy-committee-approves-comprehensive-energy-legislation>

Energy Utilities and Other Energy Efficiency Program Agents

To the extent that utilities and other parties are compelled to support the improvement of energy efficiency within their customers' premises, they may align themselves with efforts to ensure that appraisals capture the value. To the extent that property owners understand the extent to which their investment will be recouped, they will be more likely to participate in utility programs.

It is worth revisiting a relatively rare effort that was made on the part of utilities to assess the role that real-estate appraisers could play in their programs (Roger Starch Worldwide 2003). Residential appraisers were found to have limited awareness of utility or federal energy efficiency activities, and few addressed it in their work. As this effort was nearly 15 years ago, utilities should be polled to determine whether other efforts have been made, lessons learned, remaining opportunities.

Many utilities have offered, sometimes free or discounted, energy education to appraisers. These include Georgia Power, Duke Energy, Arizona Public Service, The Salt River Project, and others. However, there is a much broader array of ways that utilities can engage.

New efforts could be made to engage utilities. In addition to an educational role, this could include a role in mitigating the "lowest-bidder" syndrome through provision of financial incentives to appraisers to defer the additional time spent incorporating green/HP analysis into the traditional appraisal, or, if this is problematic, utilities could underwrite the costs of third-party experts to facilitate data gathering, analysis, review, etc. Where utilities interoperate with lenders, they can insist on the careful application of competency criteria during the appraiser selection process. A key caution in any new form of third-party engagement is to avoid any real or perceived conflict of interest or potential to introduce bias into the process. Extreme care must be taken to manage any potential risk in this regard.

Insurance Industry

Insurers and appraisers have a variety of overlapping goals and interests, yet insurers have not been engaged in the green/HP appraisal discussion.

- Appraisers are sometimes commissioned to prepare an "insurance value" appraisal, which is a variant on full valuations insofar as certain items, e.g., land or excluded features are not included. Green/HP features should be part of such an assignment.
- Business interruption insurance claims are indexed to rents and vacancy rates, and thus any effect of green/HP characteristics on those metrics is of interest in the underwriting process.
- An increasing number of insurers are associating their in-house operations as well as corporate strategy and public posture with sustainability. They are investing in green buildings and will thus be as interested as any owner in seeing that the incremental value created is recognized during the appraisal process.

- Insurers engage in efforts to promote disaster resilience, in some cases adjusting premiums to reflect the quality and enforcement of local pertinent building codes. The Institute for Business and Home Safety offers guidelines on disaster-resilient buildings and some insurers reward compliant buildings with lower premiums, which, in turn, positively influence a property's cashflow.
- Insurers and appraisers alike are concerned about associated (inadvertent) downside technical risk, ranging from energy savings persistence to health and safety factors. Insurers, for example, have created energy-savings insurance products coupled with engineering oversight to help address performance risk (Mills 2003). Collaboration on identifying and managing these risks could be mutually advantageous.
- Lastly, appraisers carry Errors & Omissions liability insurance,⁵¹ which has the potential of being triggered if there are disagreements around the handling of green/HP issues. Insurers have an interest in loss prevention. This is more of a prospective than current issue in the industry, but analogous litigation has been seen involving architects and engineers.⁵²

Appraisers assume legal, reputational, and ethical risks by overlooking green features, utilizing unsupported or inappropriate adjustments to value, or having any real or perceived bias toward or against green/HP (Black *et al.*, 2015). Liability claims can arise, for example, if the appraisal is contested for inadequately treating green or high-performance features or overestimating value. Undervaluing green/HP features could result in an appraisal coming in below a contracted selling price, which could in turn scuttle a transaction and spark disputes. Appraisers may turn to insurers to help them manage these risks. Insurers thus have an interest in proactively enhancing appraiser competency and quality assurance during the appraisal process and in tailoring their products and services to recognize these risks and reward best practices through policy terms and conditions. Insurers are proponents of risk management, illustrated by the benefit of Green MLS in reducing liability associated with undocumented claims (NAR 2014).

Conclusion and Recommendations

This report reviewed the history of efforts to integrate green and high-performance building considerations in the residential property appraisal process. While efforts date back to the early 1980s, the vast majority of activity has taken place within the past five years. A variety of largely uncoordinated strategies have been attempted, and expectations are often out of synch with what appraisers are really able to do. These are overlain onto a tumultuous market and regulatory environment faced by appraisers, characterized by constant questions of appraisal ethics and independence from client (particularly lender) interests. This juxtaposition is an important one, as it impedes any outcome that assigns higher values for special conditions. The regulatory changes made after the financial crisis seem to also impact the appraisal profession's structure and how appraisals are conducted, while adding substantial transactional costs.

⁵¹ A leading Errors & Omissions liability insurer for appraisers is LIA, <http://www.liability.com/>

⁵² See <http://www.greenbuildinglawblog.com/>

The challenge is daunting given the very limited progress to-date. Prospects are hampered by a contracting appraisal industry highly deficient in the skills needed to assess green/HP homes. Lack of a strategic plan and long-term commitment on the part of the energy/environmental policy community is also a hindrance. Given the extensive inertia within the appraisal industry and mixed history of interactions with the environmental policy community, it is unlikely that historical activities will achieve much unless followed with more coordinated and persistent efforts. Workshops, studies, and memoranda of understanding will not on their own have much impact, and do not address deeper structural issues. We find that expectations from within the energy/environmental policy community are often unrealistic and not attentive to real constraints faced by appraisers.

The report identified major categories of barriers impeding more thorough consideration of green/HP factors in commercial real estate appraisals, and broad categories of solutions for mitigating these barriers. Efforts on the part of policymakers and advocates have the potential to be more successful than in the past because the information environment has improved, as have drivers for energy efficiency (climate change concerns, energy prices, better data, tighter building codes, more incentives, vibrant PV industry, and more research on value.)

Addressing barriers and capturing opportunities requires collective engagement and input from every stakeholder. In addition to the topical opportunities already identified, following are some cross-cutting activities that could help interested stakeholders be more effective:

- **Develop a roadmap for action.** A strategic process would be best initiated with an industry-wide survey to characterize the level of knowledge and competency among commercial appraisers, and the obstacles to enhancing their practice. Key needs and issues could then be identified, further vetted with stakeholders, and then mapped to likely facilitators.
- **Bridge the professional/cultural divide between appraisers and policymaker communities.** Appraisers have little interaction with the environmental policy stakeholder communities. Indeed there is indifference if not distrust. The history has been punctuated by dictates, without much insight into how the appraisal process works and how much time appraisers actually have to consider green/HP features. Concerted efforts are needed to build mutual respect and trust and clearer lines of two-way communication. Practicing appraisers have already called for this (Adomatis 2014). Past federally sponsored work with role-playing exercises around similar energy issues may yield better understanding of appraisal industry needs (Ruth *et al.*, 2007). Simple efforts to help appraisers understand terminology are a good starting point. DOE's "Building America Building Science Translator" is a resource that could be promulgated more widely in the appraisal community (USDOE 2015).
- **Track progress.** We have found no public-domain efforts to quantify and track the uptake of "green" appraisal practices. Existing information may be regarded as proprietary and, in any case, no one actor has market-wide experience. An entity is needed to objectively poll practitioners to obtain an ongoing progress report, which, among other things, would be useful in identifying barriers and prioritizing and targeting new initiatives.

There is no silver bullet for advancing the practice of valuing the green/HP features of buildings. Interested parties in the public policy community must identify barriers they wish to address and select from among the initiatives described above that map to those barriers. Close collaboration with appraisers is critical. Large organizations and agencies should have a united approach that includes all stakeholder perspectives; the perception or reality of a fragmented and uncoordinated strategy is unsettling for prospective partners in the appraisal industry. This requires improved communication and education within and between these communities.

References

Adomatis, S. 2014. "Green Mortgage Appraisal Roundtable at the White House Conference Center," March 16 and "Valuing Energy Efficiency Improvements, Certifications and Savings," Presentation. 7 pages.

Alltera Group. 2015. "2015 National Appraiser Survey," 16pp. <https://www.appraisalbuzz.com/2015-national-appraiser-survey-results-announced/>

Andriotis, A. 2014. "Dodgy Home Appraisals Make a Comeback," Wall Street Journal, December 1. <http://www.wsj.com/articles/dodgy-home-appraisals-are-making-a-comeback-1417480386>

Black, M., J.F. Finlay, P. Rusin, and E. Mills. 2015. "APB Valuation Advisory #6 - Valuation of Green and High Performance Property: Background and Core Competency." The Appraisal Foundation, Washington, DC., 46pp. <https://appraisalfoundation.sharefile.com/share#/view/s5f8aa66a58a41f09>

Bloom, B., M. Nobe, and M. Nobe. 2011. "Valuing Green Home Designs: A Study of ENERGY STAR Homes," *Journal of Sustainable Real Estate*, 3(1):109-126.

Bond, S. 2015. "Californian Realtors' Perceptions towards Energy-efficient "Green" Housing," *Journal of Sustainable Real Estate*, in press.

BIRA. 2011. *Final Expert Meeting Report: The Role of Appraisals in Retrofit Financing*, September Stockton, CA, Building Industry Research Alliance, <http://www.bira.ws/energy-retrofit-financing.php>

Bunton, D. 2014. "Appraisers Are Being Unfairly Targeted," *National Mortgage News*, December 24.

Cadmus. 2014. "Multi-State Residential Retrofit Project: Process Evaluation: Final," Prepared for the National Association of State Energy Officials, 233pp.

CNT Energy and the NHPC. 2013. "Unlocking the Value of an Energy Efficient Home: A Blueprint to Make Energy Efficiency Improvements Visible in the Real Estate Market," CNT and the National Home Performance Council, 38pp. http://www.homeperformance.org/sites/default/files/nhpc_white-paper-unlocking-the-value-of-an-energy-efficient-home_201308.pdf

Desmarais, L, R.T. Desmarais, W. Butler, M. Baldrige. 2015. "An Early Look at Energy Efficiency and Contributory Value." Colorado Energy Office, 192pp.

Doyle, V. and A. Bhargava. 2012. "The Role of Appraisals in Energy Efficiency Financing," National Renewable Energy Laboratory, Building America, U.S. Department of Energy, 22pp.

Fannie Mae. 2015. Selling Guide: B2-3-04: Special Property Eligibility Considerations (07/28/2015). <https://www.fanniemae.com/content/guide/selling/b2/3/04.html#Properties.20with.20Solar.20Panels>

George, M. 2014. "Professional Real Estate Appraisal Perspectives on Residential Energy Efficiency," Whitehouse Green Mortgage Appraisal Roundtable, March 16, PowerPoint presentation.

Griffin, A., B. Kaufman, and S. Hamilton. 2009. "Certified Home Performance: Assessing the Market Impacts of Third Party Certification on Residential Properties," Earth Advantage Institute, 36pp.

Harney, K. 2011. "Is Green Good for Home Resale Value?" Washington Post, August 26.

Harrison, H.S. 2010. "Appraisal Foundation vs. Appraisal Institute," Real Estate Valuation Magazine, <http://www.revmag.com/fall2010/editorial/>

Halvorsen, R. and H. O. Pollakowski, 1981. "The Effects of Fuel Prices on House Prices," *Urban Studies*, 18, pp. 205-211.

Hoen, B., S. Adomatis, T. Jackson, J. Graff-Zivin, M. Thayer, G. T. Klise, and R. H. Wiser. 2015. Lawrence Berkeley National Laboratory.

Kok, N. and M. Kahn. 2012. "The Value of Green Labels in the California Housing Market: An Economic Analysis of the Impact of Green Labeling on the Sales Price of a Home," University of California, Berkeley.

Kahn, M. 2011. "Do 'Green Buildings' Come with a Higher Price Tag"? Christian Science Monitor, August 30.

Laquatra, J., D. J. Dacquist, P. Emrath, and J.A. Laitner. 2002. "Housing Market Capitalization of Energy Efficiency Revisited." Proceedings of the ACEEE Summer Study on Energy Efficiency in Buildings, pp 8.141-8.151.

McGraw Hill. 2014. "Green Multifamily and Single Family Homes: Growth in a Recovering Market." McGraw Hill Construction, McGraw Hill Financial, 60pp.

Mooney, C. 2015. "How to get the real estate market to properly value green homes," The Washington Post (May 28) <http://www.washingtonpost.com/news/energy-environment/wp/>

2015/05/28/how-to-make-the-real-estate-market-value-green-homes-for-what-theyre-really-worth/

National Association of Realtors. 2014. "Green MLS Implementation Guide." 76pp.

NAHB. no date. "NAHB Green Toolbox: Overcoming Appraisal Challenges," 2pp.

Nevin, R., C. Bender and H. Gazan, 1999. "More Evidence of Rational Market Values for Energy Efficiency", *The Appraisal Journal*, Vol. 67, No. 4, pp. 454-460.

Nevin, R. and G. Watson, 1998. "Evidence of Rational Market Values for Home Energy Efficiency", *The Appraisal Journal*, Vol. 68, pp. 401-409.

Runde, T. and S. Thoyre. 2010. Integrating Sustainability and Green Building into the Appraisal Process," *Journal of Sustainable Real Estate*, 2(1):221-248.

Ruth, M., C. Bernier, A. Meier, and J. Laitner. 2007. "PowerPlay: Exploring Decision Making Behaviors in Energy Efficiency Markets." *Technological Forecasting and Social Change*, 74:4-470-490. <http://www.sciencedirect.com/science/article/pii/S0040162506000874>

Stukel, L. 2013. Fixing "Green Appraisal Issues at the Source" Blog. <http://www.notyetgreen.com/fixing-green-appraisal-issues-at-the-source/2186/>

USDOE. 2015. "Building America Building Science Translator," U.S. Department of Energy. 17pp.

Wade, 2. 2014. "Rooftop Solar Leases Scaring Buyers When Homeowners Sell," Bloomberg, <http://www.bloomberg.com/news/articles/2014-06-23/rooftop-solar-leases-scaring-buyers-when-homeowners-sell>

APPENDIX A: Literature on value of green and high-performance homes

Pub Year	Title	Description/findings
2015	An Early Look at Energy Efficiency and Contributory Value	Comparing 86 energy-efficient Meritage homes to others in the same subdivisions showed incremental value
2015	Selling Into the Sun: Price Premium Analysis of a Multi-State Dataset of Solar Homes	Analysis for homes in 8 states--18,871 non-PV homes (including 6,036 newly built homes) and 3,951 user-owned PV homes (including 1,444 newly built homes)--found an added resale value of \$4 per PV watt, or \$15,000 for an average 3.6 kW/system.
2013	Exploring California PV Home Premiums	Each 1-kW increase in solar photovoltaic system size equates to a \$5,911 higher sales premium, and each year systems age equates to a \$2,411 lower premium
2013	Is Energy Efficiency Capitalized into Home Prices? Evidence from Three US Cities	The estimated home price premiums from certification imply annual energy cost savings that are sizeable fractions of estimated annual energy costs for homes in our sample, in some cases even above 100 percent.
2013	The Impact of Photovoltaic Systems on Market Value and Marketability	22 of 30 case studies in the Denver Metro Area indicated PV systems contributed \$1,400 to \$2,600 per kW to market value.
2012	The Value of Energy Performance and Green Attributes in Buildings: A Review of Existing Literature and Recommendations for Future Research	Compiled 5 studies.
2012	The Value of Green Labels in the California Housing Market: An Economic Analysis of the Impact of Green Labeling on the Sales Price of a Home	Analysis of 1.6 million homes sold in California, found that homes labeled by Energy Star, LEED for Homes and GreenPoint Rated sell for 9 percent more ($\pm 4\%$) than comparable, non-labeled homes.
2011	An Analysis of the Effects of Residential Photovoltaic Energy Systems on Home Sales Prices in California	Analysis of 122,000 home sales near existing or proposed wind energy developments found no adverse effect on property values.
2011	Valuing Green Home Designs: A Study of ENERGY STAR Homes	Sale prices were analyzed using hedonic regression analysis. Results indicate that ENERGY STAR homes originally sold for \$8.66 more per square foot than non-ENERGY STAR homes.
2009	Certified Home Performance: Assessing the Market Impacts of Third Party Certification on Residential Properties	160 homes: Portland: avg of +3%-- +5% sales price premium for certified homes and sold an avg of 18 days faster. Seattle: avg of +9.6% sales price premium but sold slightly more slowly
2002	Housing Market Capitalization of Energy Efficiency Revisited	This paper critically reviews published research on capitalization of energy efficiency, with a focus on studies that have applied the hedonic regression methodology.
1998	Evidence of Rational Market Valuation for Home Energy Efficiency	Regression analysis of American Housing Survey data of broad market outcomes found that home buyers assign a value of \$10 to \$24 for every \$1 reduction in annual energy bills

1989	Estimating the Implicit Price of Energy Efficiency Improvements in the Residential Housing Market: A Hedonic Approach	At the average efficiency level of homes in the sample, an efficiency improvement which results in a \$1 decrease in the level of expenditures necessary to maintain the house at 65°F (in the average heating season) will increase the expected selling price of the house by \$11.63.
1989	Economic Efficiency v Energy Efficiency: Do Model Conservation Standards Make Good Sense?	Based on estimates of the energy savings and market value of single family houses (ie electrically heated, high thermal efficiency) an average discount rate for homebuyers is estimated of approximately 8%.
1986	Housing Market Capitalization of Thermal Integrity	Energy efficiency is capitalized into house sale price, with a unit decrease in the Thermal Integrity Factor (TIF) resulting in an increase in house sale price of \$2510.
1986	Impact of Consumers' Personal Characteristics on Hedonic Prices of Energy-conserving Durables	There tended to be much variation in significance of coefficients of energy-conserving variables by demographic characteristics indicating that features valued by some consumers were irrelevant to others.
1981	The Effects of Fuel Prices on House Prices	Analysis of sample of 269 homes sold in a single neighborhood in Seattle, Washington between 1970 and 1975 found that the marginal impact on market value of having natural gas heat rather than oil heat was \$4,597 during the first half of 1975.

APPENDIX A: Literature on value of green and high-performance homes

Pub Year	Title	Description/findings
2015	An Early Look at Energy Efficiency and Contributory Value	Comparing 86 energy-efficient Meritage homes to others in the same subdivisions showed incremental value
2015	Selling Into the Sun: Price Premium Analysis of a Multi-State Dataset of Solar Homes	Analysis for homes in 8 states--18,871 non-PV homes (including 6,036 newly built homes) and 3,951 user-owned PV homes (including 1,444 newly built homes)--found an added resale value of \$4 per PV watt, or \$15,000 for an average 3.6 kW/system.
2013	Exploring California PV Home Premiums	Each 1-kW increase in solar photovoltaic system size equates to a \$5,911 higher sales premium, and each year systems age equates to a \$2,411 lower premium
2013	Is Energy Efficiency Capitalized into Home Prices? Evidence from Three US Cities	The estimated home price premiums from certification imply annual energy cost savings that are sizeable fractions of estimated annual energy costs for homes in our sample, in some cases even above 100 percent.
2013	The Impact of Photovoltaic Systems on Market Value and Marketability	22 of 30 case studies in the Denver Metro Area indicated PV systems contributed \$1,400 to \$2,600 per kW to market value.
2012	The Value of Energy Performance and Green Attributes in Buildings: A Review of Existing Literature and Recommendations for Future Research	Compiled 5 studies.
2012	The Value of Green Labels in the California Housing Market: An Economic Analysis of the Impact of Green Labeling on the Sales Price of a Home	Analysis of 1.6 million homes sold in California, found that homes labeled by Energy Star, LEED for Homes and GreenPoint Rated sell for 9 percent more ($\pm 4\%$) than comparable, non-labeled homes.
2011	An Analysis of the Effects of Residential Photovoltaic Energy Systems on Home Sales Prices in California	Analysis of 122,000 home sales near existing or proposed wind energy developments found no adverse effect on property values.
2011	Valuing Green Home Designs: A Study of ENERGY STAR Homes	Sale prices were analyzed using hedonic regression analysis. Results indicate that ENERGY STAR homes originally sold for \$8.66 more per square foot than non-ENERGY STAR homes.
2009	Certified Home Performance: Assessing the Market Impacts of Third Party Certification on Residential Properties	160 homes: Portland: avg of +3%-- +5% sales price premium for certified homes and sold an avg of 18 days faster. Seattle: avg of +9.6% sales price premium but sold slightly more slowly
2002	Housing Market Capitalization of Energy Efficiency Revisited	This paper critically reviews published research on capitalization of energy efficiency, with a focus on studies that have applied the hedonic regression methodology.
1998	Evidence of Rational Market Valuation for Home Energy Efficiency	Regression analysis of American Housing Survey data of broad market outcomes found that home buyers assign a value of \$10 to \$24 for every \$1 reduction in annual energy bills

1989	Estimating the Implicit Price of Energy Efficiency Improvements in the Residential Housing Market: A Hedonic Approach	At the average efficiency level of homes in the sample, an efficiency improvement which results in a \$1 decrease in the level of expenditures necessary to maintain the house at 65°F (in the average heating season) will increase the expected selling price of the house by \$11.63.
1989	Economic Efficiency v Energy Efficiency: Do Model Conservation Standards Make Good Sense?	Based on estimates of the energy savings and market value of single family houses (ie electrically heated, high thermal efficiency) an average discount rate for homebuyers is estimated of approximately 8%.
1986	Housing Market Capitalization of Thermal Integrity	Energy efficiency is capitalized into house sale price, with a unit decrease in the Thermal Integrity Factor (TIF) resulting in an increase in house sale price of \$2510.
1986	Impact of Consumers' Personal Characteristics on Hedonic Prices of Energy-conserving Durables	There tended to be much variation in significance of coefficients of energy-conserving variables by demographic characteristics indicating that features valued by some consumers were irrelevant to others.
1981	The Effects of Fuel Prices on House Prices	Analysis of sample of 269 homes sold in a single neighborhood in Seattle, Washington between 1970 and 1975 found that the marginal impact on market value of having natural gas heat rather than oil heat was \$4,597 during the first half of 1975.

APPENDIX B: History timeline for green and high-performance homes

Year	Month	Contextual events	Energy information environment	Appraisal industry events	Activities by non-appraiser entities	Notes
1970s		OPEC exercises market power; world oil prices soar	Early energy crises; energy efficiency begins to be discussed			
1970s					Early academic work on valuing energy efficiency	
1980s		Climate change enters national political discussion. IPCC formed, etc.	Early scale-up of utility-funded energy efficiency programs Voluntary and mandatory building and appliance standards Energy Star product-labeling program invented			
1987				Appraisal Foundation created		https://www.asc.gov/Resources-For/Real-Estate-Appraisers/AppraisalFoundation.aspx

Year	Month	Contextual events	Energy information environment	Appraisal industry events	Activities by non-appraiser entities	Notes
1990s		Savings and Loan meltdown		The federal government imposed reforms that included the passage of the Financial Institutions Reform Recovery and Enforcement Act (FIRREA) which called for state licensing all appraisers for assignments which include FDIC Insurance. The passage of FIRREA brought in a much needed rigorous set of appraisal standards, called the Uniform Standards of Professional Practice (USPAP)—run by the Appraisal Foundation—to which state appraiser licensing bodies bind licensed appraisers.		
1992	August	Hurricane Andrew				
1995			Energy Star for Home program for new homes launched			
2000			First International Energy Conservation Code (IECC) - multiple updates in subsequent years			http://www.iccsafe.org/codes-tech-support/codes/2015-i-codes/iecc/
2000			LEED Program Launched			https://en.wikipedia.org/wiki/U.S._Green_Building_Council

Year	Month	Contextual events	Energy information environment	Appraisal industry events	Activities by non-appraiser entities	Notes
2002			Home Performance with Energy Star for existing homes launched			
2002	August				Tough critique of past statistical studies attempting to quantify incremental value of energy-efficient homes	Laquatra, J., D. J. Dacquisto, P. Emrath, and J.A. Laitner. 2002. "Housing Market Capitalization of Energy Efficiency Revisited." <i>Proceedings of the ACEEE Summer Study on Energy Efficiency in Buildings</i> , pp 8.141-8.151.
??					Green MLS initiated	Familiar and standardized comparable-sales data source for appraisers — http://www.greenthemls.org
2005	August	Hurricane Katrina: heightened national discussions about climate change as well as resiliency				Effects on property values

Year	Month	Contextual events	Energy information environment	Appraisal industry events	Activities by non-appraiser entities	Notes
2007	May				Beginning in 2007, multiple listing services in Portland and Seattle were among the first localities to track home performance certifications. Nearly 900 homes were added in the first year.	Griffin, A., B. Kaufman, and S. Hamilton. 2009. "Certified Home Performance: Assessing the Market Impacts of Third Party Certification on Residential Properties," Earth Advantage Institute, 36pp.
2008	January		Federal investment tax credit (ITC) for residential photovoltaic systems			
2009	May	Financial crisis		Home Valuation Code of Conduct (HVCC)		https://en.wikipedia.org/wiki/Home_valuation_code_of_conduct
2009					First issue of Journal of Sustainable Real Estate	http://www.josre.org/about-josre/
2010	July			Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010 (Dodd-Frank Act).		https://en.wikipedia.org/wiki/Dodd-Frank_Wall_Street_Reform_and_Consumer_Protection_Act#Title_XIV_.E2.80.93_Mortgage_Reform_and_Anti-Predatory_Lending_Act

Year	Month	Contextual events	Energy information environment	Appraisal industry events	Activities by non-appraiser entities	Notes
2010	September			Appraisal Institute withdraws from the Appraisal Foundation	This set the stage for fragmented efforts regarding green/HP homes, and a rival that extended into the future.	http://www.appraisalinstitute.org/statement-from-the-appraisal-institute-on-its-withdrawal-from-the-appraisal-foundation/ http://appraisalinsight.blogs.realtor.org/2010/06/25/appraisal-foundation-in-dispute-with-appraisal-insitute/
2010					Through a set of coordinated SEP competitive grants, DOE funded work that included appraiser training in AL, MA, VA and WA. Trainings in AL, VA, and MA took place between 2010 and 2013; MA in 2014. Earth Advantage also offered a third-day appraiser certification course for 20 appraisers who became the first “green” certified appraisers in Massachusetts.	Cadmus. 2014. “Multi-State Residential Retrofit Project: Process Evaluation: Final,” Prepared for the National Association of State Energy Officials, 233pp.

Year	Month	Contextual events	Energy information environment	Appraisal industry events	Activities by non-appraiser entities	Notes
2011	September				In September 2011, Fannie Mae mandated that appraisers employ the Uniform Appraisal Dataset (UAD) as part of the URAR form. The goal was to standardize information supplied by the appraisers on the forms, especially as to descriptions of quality and condition of the subject property and comparable sales.	http://appraisalnewsonline.typepad.com/appraisal_news_for_real_e/2013/03/lia-claim-alert-newsletter-revisiting-the-fannie-maefreddie-mac-2005-urar-form-ambiguities-and-liabi.html
2011					Fannie Mae 2011 Selling Guide states: "Special energy-saving items should be recognized in the appraisal process. The appraiser should compare the energy-efficient features of the subject property to those of the comparable properties in the 'sales comparison analysis' grid to ensure that the overall contribution of these items is reflected in the market value of the subject property."	http://www.cdfifund.gov/what_we_do/resources/Fannie%20Mae%20Single%20Family%20Selling%20Guide.pdf
2011	January			Appraisal Institute endorses PV value	PV Value software from Sandia National Laboratory	Commercialized by Energy Sense Finance, LLC in 2015 http://www.appraisalinstitute.org/ai-issues-green-real-estate-valuation-guidance/

Year	Month	Contextual events	Energy information environment	Appraisal industry events	Activities by non-appraiser entities	Notes
2011	January			Appraisal Institute launches “Valuation of Sustainable Buildings Professional Development Program”		Suite of training offerings on this subject http://www.appraisalinstitute.org/ai-issues-green-real-estate-valuation-guidance/ http://www.appraisalinstitute.org/ai-issues-green-real-estate-valuation-guidance/
2011	June			Establishment of Memorandum of Understanding between The Appraisal Foundation and US Department of Energy		
2011	August				Discussion of green valuation in the popular media (examples)	Kahn, M. 2011. “Do ‘Green Buildings’ Come with a Higher Price Tag”? <i>Christian Science Monitor</i> , August 30. Harney, K. 2011. “Is Green Good for Home Resale Value?” <i>Washington Post</i> , August 26.
2011	September			Appraisal Institute publishes Green and Energy Efficient Addendum		http://www.appraisalinstitute.org/ai-issues-green-real-estate-valuation-guidance/

Year	Month	Contextual events	Energy information environment	Appraisal industry events	Activities by non-appraiser entities	Notes
??					NAHB publishes “Green Toolbox”	http://www.nahb.org/~media/Sites/,-w-,NAHB%20Tagging/General%20to%20be%20Tagged/NAHB-Green-Toolbox-Overcoming-appraisal-challenges_2011.ashx?la=en
2012	May				First instantiation of Greening the MLS fields. Real Estate Standards Organization Announces the Data Dictionary 1.0, This first edition included four fields indicating green verification body, program, rating, and version. Subsequent enhancements have been made.	PRWeb, http://www.prweb.com/releases/2012/5/prweb9496321.htm CNT Energy and the National Home Performance Council. 2013. “Unlocking the Value of an Energy Efficient Home: A Blueprint to Make Energy Efficiency Improvements Visible in the Real Estate Market,” 38pp.
2012	October			NEEA and National Association of Appraisers release Cost Addendum for High-performance Homes		http://neea.org/neea-newsroom/press-releases/2012/10/15/northwest-appraisers-welcome-real-market-green-building-cost-data

Year	Month	Contextual events	Energy information environment	Appraisal industry events	Activities by non-appraiser entities	Notes
2012	October			Colorado Energy Office and the Appraisal Institute enter into an MOU to study trends in valuation of energy-efficient homes in Colorado		Desmarais, L, R.T. Desmarais, W. Butler, M. Baldrige. 2015. "An Early Look at Energy Efficiency and Contributory Value." Colorado Energy Office, 192pp. No visible engagement by The Appraisal Institute as of summer 2015. Colorado Energy Office performed a valuable field study.
2013	January				NAHB calls for "Overhaul" of national residential appraisal system. References risk of underappraisal of green homes in a separate document.	http://www.builderonline.com/money/mortgage-finance/nahb-calls-for-overhauling-the-appraisal-system_o http://www.nahb.org/en/research/nahb-priorities/appraisals.aspx http://www.nahb.org/en/research/nahb-priorities/appraisals/appraising-green-homes.aspx

Year	Month	Contextual events	Energy information environment	Appraisal industry events	Activities by non-appraiser entities	Notes
2013	March				Among the National Association of Realtors (NAR) long standing efforts to oppose any mandatory energy efficiency efforts, in 2013 the organization grants \$200,000 to the Greater Boston Real Estate Board to fund a report in opposition to a city proposal requiring mandatory energy audits at the point of sale. From NAR's website: "NAR supports incentive-based approaches to assist homeowners in making energy efficiency improvements to their homes. NAR is opposed to labeling homes for energy efficiency and is opposed to point-of-sale requirements for energy audits or energy retrofitting."	http://www.realtor.org/articles/nar-funds-opposition-to-mandatory-home-energy-audits http://www.realtoractioncenter.com/for-associations/issues-mob/policies.html

Year	Month	Contextual events	Energy information environment	Appraisal industry events	Activities by non-appraiser entities	Notes
2013	August				Substantial report recommending broader seven-point strategy for program design: 1 Consistently document energy efficiency improvements 2 Report on the growing inventories of energy efficient homes 3 Capitalize on existing education and training opportunities 4 Work with the real estate community to reflect these improvements in local for-sale listings 5 Ensure data is incorporated into the appraisal process 6 Develop standardized IT solutions 7 Work with partner financial institutions to ensure selection of qualified appraisers	CNT Energy and the National Home Performance Council. 2013. "Unlocking the Value of an Energy Efficient Home: A Blueprint to Make Energy Efficiency Improvements Visible in the Real Estate Market," 38pp.
2013			Home Energy Score Program Launched			

Year	Month	Contextual events	Energy information environment	Appraisal industry events	Activities by non-appraiser entities	Notes
2013	September				BPI launches their Residential Energy Efficiency Upgrade Certificate Standard, BPI-2101-S-2013, which offers a standardized and auditor-verified documentation of home energy improvements. The standard is aligned with the Real Estate Transaction Standard (RETS), used to power the MLS.	http://www.bpi.org/news_expansion.aspx?selectedID=1532
2013					The Vermont Green Homes Alliance (VGHA) is a collaborative of state trade groups including builders, mortgage bankers, appraisers, Realtors, and MLSs. The alliance provides a leading example of how the appraiser assignment process can be recalibrated to better ensure a competency match. VGHA is working through the trade organizations to map out a process where a completed Green and Energy Efficiency Addendum will act as a trigger for assigning the right appraiser.	CNT Energy and the National Home Performance Council. 2013. "Unlocking the Value of an Energy Efficient Home: A Blueprint to Make Energy Efficiency Improvements Visible in the Real Estate Market," 38pp.

Year	Month	Contextual events	Energy information environment	Appraisal industry events	Activities by non-appraiser entities	Notes
2014 (?)					Missouri-based green homebuilder/remodeler collaborates with banks and incorporates stipulations in sales contract that potential appraisers of the property be trained to assess green/HP features. Appraisal Institute endorses the language and NAHB publicizes it.	http://www.nahb.org/en/research/nahb-priorities/appraisals/appraising-green-homes.aspx
2014				Appraisal Institute collaborates with RESNET to enable energy audit tool to auto-populate AI's Residential Green and Energy Efficient Addendum		
2014	March			Whitehouse Green Mortgage Roundtable		https://adomatis.wordpress.com/2014/03/16/green-mortgage-appraisal-roundtable-at-the-white-house-conference-center/
2014	March			TAF Valuation Advisory on competency considerations for appraisers of green and high-performance buildings		https://appraisalfoundation.sharefile.com/share#/view/s5f8aa66a58a41f09
2014	July				In 2014, Lawrence Berkeley Lab launched the Information Atlas for Appraising Green and High-Performance Buildings, an information clearinghouse for appraisers.	https://sites.google.com/site/appraisinghpbbuildings/

Year	Month	Contextual events	Energy information environment	Appraisal industry events	Activities by non-appraiser entities	Notes
2014	December				In continued efforts to promote the Appraisal Institute's Green and Energy Efficient Addendum, beginning in late 2014 builders in the NGBS Green Certification program will receive a partially-completed version of the Addendum for every certified single-family home. Builders will be encouraged to add additional information about the home's features and provide the Addendum to the appraiser assigned to the home (or the homeowners for use at resale, in the case of remodeling projects).	http://www.homeinnovation.com/about/news_and_events/home_innovation_news/2014_1215_home_innovation_agreement_with_appraisal_institute_to_issue_green_addendum
2015					FHA Policy Handbook "A mortgagee may add the cost of a solar energy system to the mortgage up to 20 percent above than the maximum insurable mortgage limit."	
2015		Drought: Increased attention to water in household sector		TAF Valuation Advisory on residential green and high performance homes (forthcoming) TAF Valuation Advisory on residential green and high performance non-residential buildings (forthcoming)		

Year	Month	Contextual events	Energy information environment	Appraisal industry events	Activities by non-appraiser entities	Notes
2015	March				US Department of energy publishes "Guidelines for Building Science Education", which proposes concepts it deems important for appraisers.	DOE Guidelines for Building Science Education (PNNL)
2015	March				Workshop for appraisers, sponsored by Connecticut Green Bank and Renewable Energy and Efficiency Business Association (REEBA)	NEREJ (2015)
2015	May - September				In 2015 the California Public Utilities Commission engaged Build it Green and the Energy Network to provide six appraiser trainings in Southern California.	http://www.appraisalinstitute.org/appraisal-institute-expands-green-education-offerings-/
2015	May			Under its "Better Buildings Accelerators" initiatives, the U.S. Department of Energy partners with the many industry interests, including The Appraisal Institute and the National Association of Realtors to improve the availability of information on energy efficient homes that can be used in valuation.		"Better Buildings Expanding to Help Increase Efficiency in Homes," The U.S. Department of Energy (May 28, 2015)

Year	Month	Contextual events	Energy information environment	Appraisal industry events	Activities by non-appraiser entities	Notes
2015	July				B2-3-04: Special Property Eligibility Considerations (07/28/2015): Fannie Mae determines that leased solar systems or those covered by Power Purchase Agreements can not be included in residential appraisals	https://www.fanniemae.com/content/guide/selling/b2/3/04.html#Properties.20with.20Solar.20Panels
2015	June		Falling world oil prices			
2015	June			Appraisal Institute legislative activities said to undermine the Appraisal Foundation and lessen federal oversight of appraisers		https://www.ncreif.org/documents/event_docs/Chicago2015/Chicago2015_AppraisalFoundationLegislative.pdf