

Creating Business Ecosystems to Drive Demand for High-Performing Homes

Robin LeBaron, Pearl Certification

ABSTRACT

This paper begins with the premise that one of the key strategies for scaling residential energy involves the creation of a high-performing home value cycle that incentivizes homeowners to improve the performance of their home because they expect a price premium at time of sale, thus creating a self-perpetuating cycle of demand for high-performing homes and home improvements. The paper demonstrates that current efforts to achieve this value cycle have been met with limited success, and outlines a number of challenges that must be addressed to set a value cycle in motion. It argues that the most effective way to create a value cycle is to create a business ecosystem that coordinates and leverages the capacities of multiple market actors. Finally, the paper proposes that the ecosystem of these multiple market actors can be usefully anchored by a technology platform.

Introduction

How do we harvest the tantalizing and allegedly low-hanging energy efficiency fruit: all those cost-effective improvements that National Renewable Energy Laboratory (NREL) analyses indicate could reduce the energy consumption of residential buildings by a fifth or more (Wilson et al. 2017). Over a decade ago, the Obama-era American Reconstruction Act (ARRA) stimulus package funded new and often innovative energy efficiency programs that pointed to new ways to answer this question. In effect, ARRA launched a set of experiments designed to find paths to achieve residential energy savings at a scale that would make a real difference in U.S. carbon consumption.

One of the most interesting answers to the question that emerged from this ferment was the idea that a particularly effective strategy for motivating U.S. homeowners to improve their home's efficiency is to ensure that energy efficiency is properly valued at time of sale or refinance. If homeowners have confidence that energy efficient features will add value to their homes, the theory goes, they will be much more likely to make upgrades, or to select a high efficiency product rather than a low-efficiency alternative at time of equipment breakdown. When a critical mass of homeowners acts on the belief that efficient homes are more valuable, the result is market transformation, characterized by a strong homeowner demand for energy efficient goods and services and by clear and consistent evidence that energy efficient homes sell for a significant premium over comparable but non-efficient homes.

This paper discusses strategies for ensuring energy efficient high-performing homes regularly receive a sales premium within a metropolitan market. The paper starts with the assumption that higher sales premiums for energy efficient, high performing homes will drive uptake of deep energy efficiency, becoming a virtuous "value cycle," in which sales premiums for energy efficient, high-performing homes become widely recognized and drive homeowners to further improve their homes' efficiency and performance, which in turn drive sales premiums

in more homes and establish high-performing homes as the baseline in the local market. This hypothesis is not new: versions of it have been circulating within the energy efficiency and real estate industries for almost a decade. However, this paper suggests a significant modification of this idea: that it is important to think about a *high-performing* value cycle, rather than an energy efficient home value cycle.

The central argument of this paper is that the most effective, and possibly only way to create of a high-performing home value cycle that drives energy efficiency and other high-performing home improvements, is to create a market ecosystem, in which multiple market actors – home builders and contractors, real estate agents, appraisers, lenders, manufacturers, distributors, public agencies and utilities, and potentially others – coordinate their efforts.

The arguments are based on documents related to the broad subject of incorporating energy efficiency into the real estate system, and on interviews, studies, and observations of a wide range of customers and potential ecosystem partners conducted during the work of my firm, Pearl Certification, to establish high-performing home value cycles in a number of markets across the U.S. Pearl Certification was launched in 2017 to drive residential energy efficiency upgrades at scale by making high-performing features visible at time of sale. As the business has developed, the need for ecosystems that support high-performing home value cycles has become increasingly evident over time, as discussed below.

The High-Performing Home Value Cycle

Approximately a decade ago, professionals interested in driving adoption of residential energy efficiency improvements became increasingly interested in a disjuncture between demand and supply in the real estate market. Survey data, in particular the findings of well-publicized studies by the National Association of Realtors and the National Association of Home Builders, indicated that home buyers were interested in energy efficient features, and would potentially pay more for energy efficient homes (Harvey 2013; Quint 2013). The idea that energy efficient homes would sell for more seemed like a compelling way to drive interest and adoption of residential energy efficiency features.

Empirical research suggested that, in fact, energy efficient homes command premiums. Studies conducted in the late 2000s and early 2010s found that homes built to ENERGY STAR or similar standards sold for 2% to 5% more than comparable non-efficient homes (Adomatis 2015, Griffin et al. 2009, Pfleger et al. 2011, Kahn and Kok 2014, Northwest Energy Efficiency Alliance 2015). Efficiency experts took these findings for evidence of latent market demand for energy efficient homes: if buyers could find energy efficient homes, they would pay a premium for them over comparable, non-efficient homes.

Over time, this insight was developed into the theory that a very important strategy for driving consumer interest and adoption in energy efficient homes and home features was the creation of a value cycle. The starting point of the cycle is a home buyer paying more for an energy efficient homes, such that they command a price premium. The cycle develops if:

- A significant proportion of buyers regularly pay a premium for efficient homes;
- Homeowners are aware that buyers (or at least a significant proportion of them) will pay this premium.

If these conditions are met, homeowners have a powerful incentive to increase the efficiency of their homes because they know that they can capture some return on their investment in energy efficient features.

This paper therefore assumes that this cycle is a powerful way to drive demand for energy efficiency. Rather than focus only on energy, however, the paper looks at the creation of a value cycle for a high-performing home. The terminology “high-performing features” is used to denote characteristics that contribute to the way the home performs for its occupants: that is, features that contribute to home occupants’ health, safety, comfort, that make the home more energy and water efficient, that make the home more resilient to natural disasters, or that generate and store energy for the home. A home with many or most of these features is a “high-performing home.” Energy efficient home features, such as insulation, air sealing, and high-efficiency HVAC equipment, are in this definition a subset of the full universe of high-performing features.

“High-performing” is a more useful term than energy efficiency, even for professionals who are primarily interested in energy. Technological innovation and developments in building practices over the past two decades have resulted in a situation in which the performance of most homes in the U.S. could be significantly increased; often at low cost, or even, in the case of energy and water savings, no cost at all over the longer term. Many high-performing features deliver several types of performance benefits; duct sealing, for example, can simultaneously improve a home’s comfort, health, and energy efficiency. Consumers are interested in energy efficiency, but it is typically not central to their buying considerations, and other dimensions of a home’s performance, particularly health and comfort, often matter much more (Brookstein and Caracino 2020). As a result, a value cycle for high-performing, rather than just energy efficient, homes, is theorized to be more powerful: first, because demand for high-performing homes will be stronger than for just efficient homes, and as a result the premium for high-performing homes will be higher; and second, because a value cycle centered on high performing homes will have broader reach, in that it will engage a larger audience of homeowners and home buyers than a cycle centered on efficient homes.

Brookstein and Caracino summarize the value of a high-performing home value cycle:

“If buyers had a clear understanding of the benefits and features of high-performing homes, available evidence suggests that they would pay more for them. This would launch a cycle of market transformation... in which homeowners upgrade their homes not only because these improvements make their homes more livable and less expensive to operate, but also because they can reasonably expect to capture the value of these improvements when they sell the home, similar to expectations of resale value for other types of home improvements.” (Brookstein and Caracino 2020).

The question is: how can a value cycle be set in motion?

Early Efforts

The energy efficiency industry’s attempts to create value cycles for energy efficient and high-performing homes have to date largely focused on the issue of visibility at time of sale. A well-circulated 2013 study entitled *Unlocking the Value of an Energy Efficient Home: A Blueprint to Make Energy Efficiency Improvements Visible in the Real Estate Market* argued that

that data standards and additional multiple listing service (MLS) “green fields” could play a pivotal role in initiating this cycle.¹

“Standardizing the data incorporated into the transaction process also helps establish what premium (if any) markets place on energy efficient existing homes. Knowledge of such a premium, backed by research, would help set in motion a virtuous cycle in which homeowners become more likely to invest in energy efficiency improvements because there is a clearer indication as to how much of the investment might be recaptured at the time of sale.” (CNT Energy and the National Home Performance Council 2013)

To underscore the central argument, the hashtag #VisibleValue was used to support the paper’s release.

Energy efficiency advocates across the U.S. worked to put these principles into effect through the mid-2010’s, and achieved some successes, particularly at addressing specific and limited data-related projects, such as the introduction of green fields into the Real Estate Standards Organization’s data dictionary and adoption of green fields by individual multiple listing services. *Greening the MLS: Bringing High-Performance Homes to Light in the District of Columbia*, a 2013 study published by the Institute for Market Transformation (IMT), provides a succinct explanation as to why multiple listing service fields could play an important role in creating a value cycle for high-performing homes:

“As the central hub for real estate market transactions, multiple listing services (MLSs) play a critical role conveying key home characteristics to potential buyers, who are increasingly interested in not only how many bedrooms and bathrooms a home may have, but also its “green” or high-performance features such as an ENERGY STAR–labeled refrigerator or energy-efficient windows. Recognizing this, a growing number of MLSs now contain fields that highlight the green and energy-efficient aspects of homes. These “green fields” can help buyers seeking a high-performance home (HPH) make more informed purchasing decisions...” (IMT 2013)

Limitations to this strategy had become apparent by the late 2010s, however. The most immediate signal was that when MLS’s adopted green fields, they very frequently went unused: agents didn’t populate them with data about energy efficient homes, and consumers apparently rarely searched for them – possibly because they were so infrequently populated. The 2013 IMT study, for example, found that only one in seven listings of high-performing homes in the DC market included any of the available green fields.

More significantly, a mid-decade push to encourage MLSs to add and use “green fields” slowed as it became apparent that large numbers of real estate brokers and agents did not believe that their clients were interested in efficient or high-performing homes. Without agent demand for green fields, MLS owners were reluctant to go to the time and expense of adding them to their data infrastructure.

Several other major initiatives, including Earth Advantage’s Green Building Registry and the Northeast Energy Efficiency Partnership’s HELIX program, created publicly accessible databases that make high-performing homes visible to both homeowners and the real estate

¹ See Beldock et al. 2011 for an earlier proposal along the same lines.

sector. Both projects made an important contribution to assembling information about the many different types of energy efficient homes, but have not effected the creation of high-performing value cycles in the area where they have most concentrated data, with the exception of Portland, where a local Home Energy Score mandate has required visibility of high-performing homes (See Portland Bureau of Planning and Sustainability 2020).²

In other words, the strategy for creating a value cycle through generating standardized data and making it available in the MLS has not worked as foreseen. The problem is not that these strategies aren't important, but that they do not appear to be sufficient on their own to drive the type of change energy efficiency advocates had intended.

Other initiatives designed to support the proper valuation of efficient homes have not created these valuation cycles on their own. A number of organizations, utilities, and governmental bodies supported real estate education and training: as three examples among many, Build It Green offered real estate education in California for many years, ComEd and Ameren have funded the Midwest Energy Efficiency Alliance to offer real estate education in Chicago and Missouri, respectively, and the state of Alaska funded extensive appraiser trainings. These regional pools of trained agents and appraisers can promote and value high-performing homes effectively, but are limited by the fact that their markets typically have few high-performing homes. Educators have observed that real estate agents who participate in these programs typically want to know how they can enhance their business by developing a specialization in high-performing homes, and are typically discouraged by the difficulties involved in finding high-performing homes to sell (Brookstein, senior project manager, Elevate, pers. comm. Mar. 22, 2022) .

In summary, while the efforts described above have probably had some impact, they have not resulted in the creation of high-performing home value cycles.

Challenges to a High-Performing Home Value Cycle

Each of the initiatives described above has some potential to contribute to a high-performing home value cycle. But none have succeeded in initiating a cycle because they did not fully address several market needs, including:

- information that addresses homeowners' needs and interests;
- a compelling business model for real estate agents;
- appraisal and underwriting practices that address the value of high-performing homes;
- an adequate supply of high-performing homes; and
- an effective marketing strategy.

Information that addresses homeowners' needs and interests: Casual conversations with real estate agents often reveal a profound gap between agents opinions regarding consumer preferences and the data provided by survey research. Surveys, as discussed above, consistently indicate that buyers are interested in energy efficient and high-performing homes: the trend has been consistent for over a decade and has increased over time. Yet many agents, if asked, will

² A mandate can be seen as a strategy to drive the creation of an ecosystem, and more consideration of this issue should be given to Portland's Home Energy Score initiative.

indicate ambivalence about whether buyers really want efficient homes, or will argue that the issue is largely irrelevant.

A study conducted for Pearl by the Chicago-based non-profit organization Elevate illustrates the point (Elevate n.d.). The agents in the study were asked to rank a set of home features according to how much their clients valued them. The agents overwhelmingly ranked “cosmetic” features like open floor plans and stainless-steel appliances above energy and health performance features like air sealing or heat pumps.

Real Estate Agent Responses	
Feature	
1. Open Floor Plan	
2. Finished Basement	
3. Patio/deck	
4. Stainless Steel Appliances	
5. Attic Insulation	
6. Air Sealing	
7. Heat Pump	

Fig. 1: Real estate agent perceptions of the relative value of home features for their homebuyer clients. High-performing features are circled.

Interestingly, when asked to list *features* – i.e. actual physical things – that they wanted in a home, homeowners preferences were very similar to what real estate agents assumed about their preferences, as illustrated below. These limited findings, in other words, might suggest that the agents, not the survey research, may have a better finger on home buyers’ collective pulse.

Feature	
Homeowner	Agent
1. Finished Basement	1. Open Floor Plan
2. Patio/deck	2. Finished Basement
3. Open Floor Plan	3. Patio/deck
4. Attic Insulation	4. Stainless Steel Appliances
5. Stainless Steel Appliances	5. Attic Insulation
6. Air Sealing	6. Air Sealing
7. Heat Pump	7. Heat Pump

Fig. 2: Comparison of real estate agent perceptions of the relative value of home features for their homebuyer clients, and homeowner perceptions of the relative value of home features.

But when asked about *benefits* – that is, when home features like insulation were talked about in terms of the benefits they offered – a gap opened up between what homeowners valued and what agents thought they valued. Homeowners ranked the comfort and energy savings

benefits of heat pumps and attic insulation higher than traditional amenities like open floor plans and stainless-steel appliances. Interestingly, when asked to talk about these issues, the homeowners in the panel often used words, like “cosy” and “well-maintained” that aren’t common in the language the energy efficiency industry uses to talk about benefits, but are very relevant to the broader performance of the home.

Benefit	
Homeowner	Agent
1. Finished Basement	1. Open Floor Plan
2. Heat Pump	2. Finished Basement
3. Attic Insulation	3. Patio/deck
4. Patio/deck	4. Stainless Steel Appliances
5. Air Sealing	5. Attic Insulation
6. Open Floor Plan	6. Air Sealing
7. Stainless Steel Appliances	7. Heat Pump

Fig. 3: Comparison of real estate agent perceptions of the relative value of home *benefits* for their homebuyer clients, and homeowner perceptions of the relative value of the same home *benefits*. High-performing home benefits are circled in illustrate the difference between the relative values attributed to the same high-performing benefit by agents and homeowners.

This illustrates a maxim that many residential contractors who sell energy efficient goods and services will emphasize: sell on health and comfort, *not* energy savings (see Krawcke 2014).

This insight indicates an important condition for a high-performing value cycle. To engage homeowners effectively, the information about a high-performing home should speak as clearly and compellingly as possible to their interests and desired outcomes. This will maximize the chance of achieving a premium at time of sale.

This explains in part why the data- and MLS-centered approaches to creating value cycles failed to gain traction. The data in these projects was typically quite technical: details about home feature specifications (R-values or SEER ratings, for example) or numeric scores and ratings. This information is not valueless, but in a context in which most homeowners know relatively little about high-performing features, it is not ideally designed to engage or drive behavior.

A compelling business model for real estate agents: Even if the home has a compelling and communicative label or certification, the structure and market dynamics of the residential real estate market works against home buyers finding and purchasing efficient homes, and are a significant impediment to the creation of a high-performing home value cycle.

Despite the explosion of online real estate search tools, real estate agents still play a central role in the large majority of real estate transactions and have a strong influence on buyer decisions. Most agents, however, know very little about energy efficiency or other high-performing home features and don’t value them because, as discussed above, they don’t believe their clients value them. Until agents actively choose to market the high-performing features of homes, market transformation is unlikely.

However, agents are unlikely to learn about high-performing homes or take the risk of talking about something they know relatively little about unless they have a clear business reason for doing so. And particularly in a hot market, increased sales price is unlikely to be a sufficient motivator. Agents are typically much more interested in closing the deal than increasing the sales price of the home: the difference between receiving a commission and not receiving one is much more significant than the few extra hundred dollars the agent would receive in commission as a result of an energy efficiency premium. The agent needs a business reason, beyond increased home value, to put effort into marketing an efficient home. And they need easy-to-use labels or certifications that bear a lot of the work of communicating information about the home's energy efficient features to the buyer – if the agent has to do that work themselves, it probably won't happen.

Another impediment to real estate agent interest in high-performing home is scale. An occasional energy efficient home isn't enough to motivate an agent to learn new knowledge or skills, or to change their business model. In a survey conducted by Elevate, agents reported that they would not take a high-performing home label or a certification seriously unless it was associated with at least 10% of listed homes (Brookstein and Caracino 2020). An agent who decides to make the investment in education and other business resources such as marketing materials to position themselves to sell efficient homes not only needs a business model; they need efficient homes to sell, and they need easy ways to be connected to owners of these home. A critical mass of homes can play a crucial role in addressing these problems.

Green field visibility in the multiple listing service appears to be less important than envisioned a decade ago, in part because motivated agents can often find work-arounds, such as displaying a certification in the photos section.

Real estate agent education continues to be important, and as such the work that has been done by states, utilities, and other actors, will probably result in long-term benefits.

Appraising and underwriting practices that recognize high-performing homes: Two other important market mechanisms that need to be addressed for efficient homes to be properly valued are appraising and mortgage underwriting. Appraisers, like agents, typically know very little about energy efficiency, and rarely assign value to efficient features, even very obvious home features like solar panels, despite the existence of high-quality educational resources that provide appropriate methodologies (see Adomatis 2014). Appraiser education is an important short-term solution; the Appraisal Institute offers a three-part class on appraising green and high-performing homes, and maintains a registry of the graduates. However, the number of trained appraisers in most areas of the country remains extremely low (Woody Fincham, SRA, AI-RRS, ASA, RAA, pers. comm. May 8, 2022)

In the long term, changes in the way mortgages are underwritten, so that efficiency is explicitly recognized, would be transformative. Recent legislation introduced by U.S. Senator Michael Bennet and Representative Ed Pearlmutter would require underwriters to select an appraiser qualified to value high-performing homes if they are made aware that the home is high-performing (Office of Michael Bennet 2022).

However, this market change is unlikely to happen soon, and market transformation appears possible without it, as evidenced by the Pearl market studies discussed below.

High-Performing Home Supply: A critical mass of high-performing homes is an important and under-recognized precondition for the creation of a high-performing home value

cycle. As discussed immediately above, real estate agents have much more interest in high-performing homes if they see them as a regular part of the market: “one-offs” are of relatively little interest to them, because agents can’t build a business model around them.

Most markets have many more high-performing homes than are indicated at time of sale or in MLS listings: tens of thousands of homes built to standards such as ENERGY STAR or National Green Building Standard are sold each year without the buyers being aware of the fact, for example (Pearl Certification n.d.).³ The problem is that agents do not frequently fill out existing “green fields” that make high-performing homes and home features visible in the MLS listing. To date, in other words, even in this relatively accessible form the high-performing home information in these databases is not making its way to agents or homeowners in most home sale transactions.

Marketing: An obvious, but often undiscussed, precondition for a high-performing home value cycle is marketing. Without effective marketing, even if a premium is available, homeowners and home buyers will only become aware gradually and organically if a home is a high performing home. Marketing accelerates the creation of the value cycle, and makes it more effective, because the cycle is in large part based on consumer expectations.

The High-Performing Home Ecosystem

These challenges to the creation of a high-performing home value cycle might be addressed piecemeal. But when viewed together, another solution presents itself.

Many market actors have a stake, or a potential stake, in the high-performing home. A non-exhaustive list includes:

- Homeowners
- Home builders
- Residential contractors (of all types, from HVAC to insulation to home performance to solar)
- Energy auditors
- Certification and data organizations
- Manufacturers
- Distributors
- Real estate brokers and agents
- Real estate associations
- Appraisers
- Mortgage lenders
- Home inspectors
- States and municipalities

³ In 2021 Pearl conducted a study of 1,300 homes built to the National Green Building Standard (NGBS), 226 of which were identified as having been resold. Of these 226 re-sold homes, 74% were not marketed with any reference to the NGBS certification or high-performing features, and 26% had a few references in the listing, but not enough information to explain to the buyer what the certification meant or what benefits they would receive. Pearl’s estimate is that approximately \$3M in equity was lost as a result of lack of marketing.

- Utilities
- Non-profit organizations with a focus on high-performing homes

Some of these actors, like manufacturers, builders, and contractors, have relatively straightforward paths to increased revenues and margins as the result of the growth and development of demand for high-performing homes. Other actors, like agents, appraisers, and lenders, *could* have a stake in a high-performing home value cycle, but need the right business model. Public and publicly regulated actors, like states, municipalities, and utilities, often have policy motivations for supporting a high-performing home cycle, including energy savings, carbon reduction, and improvement in the local housing stock.⁴

For the most part, these actors do not work in concert to promote high-performing home value cycles. Residential contractors and builders often function in isolation. Manufacturers and distributors have relatively little connection to local markets. Utilities create programs, but typically within the constraints of narrow program requirements established by their commissions. States and municipalities have not generally found an easy way to engage owners: some have explored “energy disclosure” mandates, but the current political climate is not very conducive to this policy approach, and such mandates typically only address energy, rather than all the performance dimensions of a home.

Coordinating the efforts of these disparate actors would be one way to accelerate the creation of a value cycle. By themselves, even the most motivated actors can do relatively little. Together, they can address the challenges listed above, because they provide different pieces of the puzzle necessary to create the value cycle.

A useful metaphor for thinking about coordinating these actors is the “business ecosystem.” First introduced into business theory by James F. Moore in *The Death of Competition*, originally published in 1996, the concept is complex in detail, but simple in general concept. Moore argues that in the current hyper-competitive, globalized markets, business success is correlated not with the ability to out-compete similar competitors in a bounded industry, but rather with the ability to understand the business context and to create cooperative relationships with a wide range of market actors to *create* and develop markets.

Business ecosystems span a variety of industries. The companies within them coevolve capabilities around innovation and work cooperatively and competitively to support new products, satisfy customer needs, and incorporate the next round of innovation. (Moore 1996)

The concept of the business ecosystem is useful because it provides a useful framework for conceptualizing the work that needs to be done to create a high-performing home value cycle. Moore observes that business ecosystems often evolve around new customer needs, or new ways

⁴ In the overheated post-2020 (i.e. post-pandemic) real estate market, driving further price escalation may not be seen as an unmitigated public policy good. However, in the case of high-performing homes, the increased monthly costs of a higher mortgage and tax bill is offset by lower energy costs. For a low- and moderate-income family, energy price stability is an important consideration: 25% of U.S. homeowners pay more than 6% of their income on energy, and 13% pay more than 10% of their income, and energy costs has been shown to be a significant factor in mortgage default (American Council for an Energy Efficient Economy 2020, Institute for Market Transformation 2013). A modest increase in mortgage payments that ensures predictable, low energy costs is in many cases a good proposition for a low- or moderate-income household.

to serve those needs. The early consortiums around open-source software in the early years of the internet, for example, show how a range of firms can come together to create a new (and only unclearly conceptualized) product that eventually become incredibly influential. Business ecosystems pull in many actors with stakes in products and services, and coordinate their efforts to develop and promote a shared opportunity (Moore 1996).

Interestingly, if the market actors listed above were coordinated in a business ecosystem in order to maximize their potential contributions to a high-performing home value cycle, their collective resources could potentially address the challenges discussed above.

First, the collective resources of builders and contractors, with support from manufacturers and distributors, could address the challenge of providing an adequate supply of high-performing homes and working with a certifying body to ensure that the high-performing homes and their features are visible at time of sale. In many markets, the number of high-performing homes in existence greatly exceeds the number that are visible as such when sold, so the challenge is as much to coordinate efforts and ensure buyers are aware of them, as it is to create new high-performing homes.

Second, the larger supply of high-performing homes would help address the challenges faced by real estate agents in developing a business model based on advising buyers and sellers about high-performing homes. Real estate agent/broker and appraiser education provided by the state or a utility would be much more valuable for agents and brokers in the context of a market with many high-performing homes, because the education could actually be used to develop the broker's or agent's business.

And third, marketing could play a crucial role in elevating homeowner awareness by speaking to their needs and interests, thus generating demand for high-performing homes that would benefit all actors in the ecosystem. States, municipalities, and utilities, with their natural public education resources, can play a particularly important role in supporting marketing efforts, but every actor in the ecosystem could contribute to an overall marketing campaign in some way.

For the past three years, Pearl Certification has been working to create ecosystems in several target markets, including Charlottesville, the Grand Rapids area of Michigan, Phoenix, and (to a lesser extent) Boston. Pearl has made serious attempts to build out all of the components of the ecosystem listed above in these areas. These ecosystems are still in relatively early stage: in addition to offering its Pearl Certification, which is specifically designed to communicate to homeowners, Pearl has recruited networks of high-quality real estate agents and contractors and has trained appraisers in these areas. Over the next twelve months, Pearl will be working to bring manufacturers, distributors, and public entities into these ecosystems.

In late 2021 and early 2022, Pearl commissioned a series of appraiser-authored market studies which found that Pearl Certified homes were selling for prices that were, on average, between 3.25% and 5.5% higher than comparable non-certified homes within these ecosystems. (Fincham 2022, see also Adomatis 2018). The premium occurred even in the context of an overheated, appreciating market: The dollar value of these premiums is significant: in Charlottesville, VA, for example, Pearl Certified homes sold for an average premium of more than \$17,000.⁵

⁵ For a detailed discussion of the methodology, which was a standard appraiser “paired-sales” approach, and for more detailed findings, see Fincham 2022.

Several conclusions can be drawn from this study. First, the Pearl Certifications were the vehicle for achieving the premiums, in that Pearl Certification was the differentiating factor, on average, between homes that had a premium and homes that did not.

Second, educated agents also played a crucial role. The studies illustrate their importance in an interesting and convincing way: homes that were certified by Pearl, but were not effectively marketed as such by the real estate agent, as evidenced in the listing and in interviews with the seller, did not command the same premiums.

A significant number of certified homes in each market also appears to have made a difference: although Pearl has not certified 10% of the housing stock in any of these markets, the number of certified homes is significantly getting close in Charlottesville (2,000 Pearl Certified homes in an area with just over 34,000 single-family homes, such that almost 6% of homes in the area are certified), and are significant in the other markets, particularly Phoenix with over 10,000 Pearl Certified homes.

Appraisers have been trained in energy efficiency in two of the four markets (Phoenix and Charlottesville). It was not clear from the study that these appraisers were involved in any of the homes featured in the study. However, Pearl's experience makes clear that work in this area is essential over the long run. Pearl runs a customer service hotline and encourages Pearl Certified homeowners to call for assistance when they sell or refinance. The single most common complaint is appraisers who do not acknowledge the value of energy efficient features.

And a broader conclusion can be drawn from Pearl's experience in these areas. Each of the actors in the ecosystem has an important role to play in ensuring accurate valuation of efficient homes. However, in addition to this role, their interactions together are important. In effect, these actors create conversations about efficient homes and home certifications helps to build overall awareness of their value, driving market transformation. The connections between contractors, builders, and real estate agents in Charlottesville in particular has helped to highlight energy efficient homes. The Pearl study found that a very high proportion of listings in the Charlottesville area, including homes that are *not* Pearl Certified, mention energy efficient features. Not surprisingly, the highest premium came from the Charlottesville area.

The first conclusion that Pearl has drawn from this study, and from its experience in these markets more generally, is that these ecosystems are fundamental to market transformation. Without these constituent pieces, energy efficient homes will never systematically receive price premiums at time of sale: the potential barriers – buyers who can't connect the home features with their interests, agents who don't market the home, appraisers who don't see value in efficient features, or simply a lack of efficient homes at all because they aren't built or renovated – are too significant for premiums to emerge. When ecosystems are in place, by contrast, premiums seem to emerge organically as well.

The second conclusion is that there is a lot of opportunity to expand and strengthen these ecosystems in ways that facilitate the creation of a high-performing home value cycle. Other types of actors – energy auditors, home inspectors, a wider range of contractors, etc. -- can be brought in, and their potential contributions to the ecosystem more effectively leveraged. As part of this process of leveraging and coordinating, more work could be done to address the challenges addressed earlier in the paper.

Ecosystem Platform

Building on the concept of the business ecosystem, this paper proposes a second argument: that the ecosystems just described can be facilitated and strengthened by a technology platform. This thesis, again, is derived from Pearl's experience from its online consumer portal, [Green Door](https://www.greendoor.app/) (<https://www.greendoor.app/>). Green Door is designed to provide homeowners with the resources and tools they need to improve the energy efficiency and other features of their homes, and to sell or refinance it at a fair price. In carrying out these functions, Green Door also anchors and enhances regional ecosystems.

A technology platform by the traditional definition is an online tool that facilitates exchanges between producers and users of value on a digital platform. That is, the platform doesn't create value directly: it connects market actors who create with actors who consume. Airbnb and Lyft are obvious examples of platforms that connect homeowners with home renters and drivers with passengers, respectively. Facebook and YouTube are also considered classic platforms, as they connect creators of content with users of content – with the obvious proviso that on these latter platforms, today's creator may be tomorrow's user, and vice versa.

A platform features one or more “core transactions”: the economic exchanges that generate value (Moazed and Johnson 2016).⁶ The core transaction for Lyft is the ride from one place to another. Pearl's Green Door has two core transactions:

- enabling homeowners to search for qualified contractors who can improve the efficiency of their home, and
- enabling homeowners to search for trained real estate agents who can sell their certified home at an appropriate valuation.

One of the ecosystem challenges is making these connections: as discussed in an earlier section; homeowners face significant challenges finding the right professionals. The platform's search function makes this easy.

The connection is probably the simplest platform function, however one of the authoritative works on the subject describes platforms as having four core functions in addition to the core transaction (Moazed and Johnson 2016):

- Audience building
- Matchmaking
- Providing core tools and services
- Setting rules and standards

For Pearl, of the items on this list, matchmaking is a simple one to explain, in that it is directly related to the core transactions discussed above: Green Door connects homeowners with qualified contractors and real estate agents.

The rule and standard setting function is more complex, and is related to the Pearl's recruitment of high-quality contractors and agents. Given the variability of quality in the contracting field, and the large number of contractors who install standard-efficiency products

⁶ The discussion that follows draws on Moazed and Johnson's 2016 description of the key functions of a platform.

without regard for proper installation procedures, Pearl has set rigorous standards for network admission. The standards are designed to give homeowners the assurance that they are in good hands. This enables the contractor to charge a fair price for the higher efficiency goods and services they provide and the higher quality work. Pearl also sets standards for participation in the real estate network to ensure that member agents can market an efficient home effectively.

The most important thing that Green Door does to enhance the ecosystem is to provide core tools and services. As discussed above, homeowners have relatively limited knowledge of energy efficiency; they like the benefits, but have relatively little understanding of the features. Green Door provides crucial tools that help homeowners overcome this gap. On Green Door they can learn about energy efficiency improvements – including the nature of the equipment and how it would affect their quality of life – and get recommendations designed for their home. Homeowners interested in gameification can select improvements that can help get their home to Pearl’s Silver or Gold levels. They can also search for a contractor to make those improvements. This accelerates increases in the stock of high-performing homes by engaging and educating homeowners, and it increases the demand for contractor services.

Audience building is the fourth and final core platform function. Pearl is developing rebates as an important new tool for encouraging users to use Green Door: several national private sector partners are offering significant rebates for Green Door users to purchase specific high-efficiency products, and Pearl is also exploring opportunities to integrate utility rebates through Green Door. Pearl’s customer service department regularly receives calls from homeowners regarding a range of subjects, from how to make home improvements to how to position their certified home for sale. The combination of services provided by the platform creates multiple reasons for consumers to visit and engage.

In terms of more traditional audience-building Pearl has conducted marketing activities to bring attention to Green Door and plans to ramp up these activities in the near future. It is also planning to raise awareness with public partnerships. These activities will generate general public awareness of Green Door, driving further engagement with the contractor and real estate members of the ecosystem.

The broader significance of each of these functions is that they provide additional ways to coordinate and leverage the potential contributions of ecosystem members to the creation of the high-performing home value chain.

Conclusions

“Business ecosystem” is not a term widely used within the energy efficiency industry. And yet, it may be a key term for professionals seeking strategies to drive demand for energy efficient and high-performing home features in a way that significantly reduces the energy consumption and carbon footprint of residential buildings in the United States (U.S.). A business ecosystem has the potential to harness the latent but disparate energies of a remarkably wide group of stakeholders with an interest in promoting high-performing homes, and to coordinate them in a way that effectively creates a new market dynamic. Technology, in the form of a platform, has the potential to accelerate and strengthen these ecosystems. Preliminary results indicate progress, nascent ecosystems should be carefully monitored, and new ones supported in a range of contexts across the U.S.

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