A New Model for Disclosing the Energy Performance of Residential Buildings

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Housing markets in the U.S. lack consistent access to information on the energy performance of homes available for sale or lease, and, as a result, buyers and sellers are unable to value energy efficiency in residential markets. In the past two years, a small number of U.S. states and cities have implemented programs requiring rating building energy use and the disclosure of these ratings. The European Union has also implemented labeling requirements for its member states. Such rating and disclosure programs can introduce transparency into the market and help break down several common barriers to pursuing efficiency. Yet existing approaches to disclosure are fraught with numerous issues, including a lack of connection to the retrofit process, poor visibility of ratings, and a lack of balance between transparency for stakeholders and homeowner privacy. These problems limit the benefits of labeling for the delivery of energy efficiency. Current research in the field advocates for increased transparency and improved rating processes, but few papers examine the problems with the disclosure process itself. Focusing on the disclosure of building energy ratings, this paper examines the needs that residential labeling should address and proposes a new model of disclosing residential energy performance for states to adopt. The model, centered around web-enabled data analysis, aggregation, and access, has the potential to provide clear, consistent, and visible ratings to key market actors and, in turn, provide more complete information to residential markets on building efficiency.[a]

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Introduction

Cities, states, utilities, and federal agencies in the U.S. have been extensively funding energy efficiency programs in recent years in order to support and catalyze investments in efficiency and building performance. In 2010 alone, these entities allotted a total of $5.5 billion for various programming, including outreach, rebates, and subsidies (ACEEE 2011). Despite all these efforts, only 200,000 homes per year are retrofitted for energy improvements in the U.S. (Snugg 2012). Furthermore, the focus of these investments remains on the individual repair and retrofit of homes and apartment buildings, instead of on the creation of an active marketplace for home upgrades.

This current state of efficiency programming fails to achieve the economies of scale that would be possible through widespread residential upgrades. In addition, it will be important for efficiency programs to move away from a reliance on state and federal efficiency incentives as these budgets become constrained. Finally, the delivery of energy efficiency may benefit from not relying solely on utilities to create and operate home efficiency programs.

Instead, the residential market should be able to inherently place value on energy efficiency in homes, by having more complete information on the energy performance of buildings. Such transparency, if provided with careful consideration of all stakeholder needs, can create demand for home energy efficiency, in turn spurring investments in home energy performance and working to enable a self-sustaining energy efficiency industry.

Objective

The residential market needs to value the energy performance of homes in order to support investments in efficiency. Information barriers in the current housing market, however, obstruct consumers from doing so, preventing them from weighing energy performance in their decision-making. Namely, prospective tenants, buyers, and building owners generally lack access to any information to determine how well a home performs in terms of energy use. Even the many buyers and renters who wish to seek out energy efficient homes have little information on how much energy they can expect their potential next home to consume. (Indeed, the few existing standards, such as LEED and Energy Star Homes, are mostly limited to a relatively small number of new homes.) This information barrier prevents these market actors from valuing energy efficiency and the long-term costs of energy use. A customer's inability to identify efficient homes also represents a gap in the value chain of delivering energy efficiency: many customers

Figure 1: A Danish building energy label, which includes a letter grade from A-G, key energy use metrics, and the assessor name.
Source: BuildingRating.org 2011.

want efficiency and cost savings, but there is a major information barrier between this demand and the number of retrofits being done by building owners.

To introduce more market transparency, states can enable the provision of more complete information on the energy performance to potential buyers and tenants. Under a building labeling policy, owners of buildings (both old and new) are required to assess the energy performance of their properties. This assessment generates a rating, which indicates performance on a scale such as A through F, or 0-100. The assessment also generates a a larger label, which, depending on the specific approach, provides the rating and information on expected energy bills, the retrofit needs of the building, and comparisons to the average local home. This label is mandatorily disclosed to prospective tenants or buyers at time of lease or sale, respectively; in some cases, labeling policies go one step further and require the rating to be publicly listed and accessible to all. The European Union has required all member states to implement building labeling programs since 2009 (see Figure 1 for an example). In the U.S, mandatory building rating and disclosure policies have been adopted in the past two years by a limited number of jurisdictions: the states of California and Washington, and the cities of Austin, Washington DC, and New York.

The policy of building labeling offers numerous beneficial impacts on the delivery of energy efficiency. On the consumer-facing side, providing transparency through labeling enables homebuyers and apartment hunters to seek out efficient buildings; for example, a prospective homebuyer can compare the energy performance of two homes of interest and pick between an A-rated home and a D-rated home. Building owners thus have a market-driven incentive to improve their properties and advertise positive ratings (IEA 2010). Indeed, studies of building labeling in the Netherlands observe higher property valuations for homes and offices with green ratings, when compared to lower-rated but otherwise similar buildings (Jennen and Kok 2011, Brounen and Kok 2010). Allowing prospective residents to access energy performance information, previously only available to the building owner, thus reduces the information imbalances inherent in the housing market. Furthermore, on the owner-facing side, building owners can identify inefficiency in their properties, perhaps targeting the lowest-rated buildings in their portfolio for upgrade.

Additionally, building labeling can create a new data resource for states, cities, and utilities as they work to identify efficiency needs. Under the current conditions, states, cities, and utilities have access to a few data streams: property assessor reports (covering home size, age, etc.), home energy bills, infrared imagery (being piloted), and advanced metering data (where applicable). Building labels, especially if generated through on-site home assessments, can provide a new data stream to cities, states, and utilities that captures the housing stock's ratings, shape of building systems, and retrofit needs. Using this rich dataset in conjunction with the existing data enables these stakeholders to better identify residential efficiency potential, create more powerful building models, and develop targeted incentives for home upgrades.

As a result of these impacts, labeling helps break down some of the most common barriers that stand in the way of pursuing building energy efficiency.

- Labeling ameliorates the **landlord-tenant split incentive**, as landlords of inefficient apartments must disclose energy performance, and, in turn, are incentivized to invest in improvements to the property that will cut costs for future tenants (Dunsky et al. 2010).
- Labeling similarly addresses the **builder-buyer split incentive**: home builders, required to disclose the rating of a new home, have an incentive to build efficient properties and a disincentive to avoid constructing buildings that will be rated poorly (IEA 2010).
- Additionally, proactive homeowners and landlords that do invest in energy efficiency upgrades currently face the **risk** of not being able to recover their investment at the time of sale or through rent, respectively. Labeling helps mitigate this risk by recognizing the resulting efficiency and creating a market where the owner can recover initial investments through higher sales price or rent (Dunsky et al. 2010).
- Finally, a disclosed rating can create pressure from tenants that overcomes the **inertia** for owners to conduct a building retrofit (Burr et al. 2010)

Stakeholder Needs

There are several key stakeholders that stand to share in the benefits and costs of such a program, and their needs must be considered when a state develops labeling policies. Clearly, this includes homeowners, prospective buyers, and prospective tenants. In addition, utilities, state agencies, and city governments stand to play a vital role in building labeling. Finally, a bill currently introduced in committee in the U.S. Senate, the SAVE Act (S. 1737), would enable mortgage underwriters to take into consideration a home's energy performance, based on a site assessment, in addition to the usual cost factors of property tax and home insurance (IMT 2011). This bill would make banks and other mortgage underwriters key stakeholders as well. Table 1 below describes the stakes of each of these key stakeholders, examining the needs that should be taken into consideration for good labeling policy.

Table 1: The stakes of the stakeholders in building labeling.

Building owner	▪ Can use information to understand retrofit needs of the building ▪ Have an incentive to market a more efficient building for sale or lease ▪ Want reasonable privacy of how their properties perform ▪ Costs of getting a building rated must not be burdensome
Homebuyers and prospective tenants	▪ Want to know the energy performance and comfort of prospective next home ▪ Need any energy labels to be trustworthy and easy to understand ▪ Need easy access to energy labels ▪ Building ratings should be easily comparable between two properties ▪ For buyers: want an accurate energy rating if the SAVE Act is passed, for more favorable lending terms
Utilities	▪ May be working to capture low-cost energy efficiency ▪ Has billing data which could be used to help in building rating ▪ Must maintain privacy of energy bills for ratepayers
State and city governments	▪ Need to lower emissions to meet sustainability goals ▪ Need to identify retrofit needs of residential building stock ▪ Need to identify energy use 'gushers' ▪ Need to develop targeted incentives for energy efficiency
Banks	▪ Under SAVE Act, would seek accurate information on energy performance when writing mortgages ▪ Want to lend money to homeowners at reasonable interest rate with little risk of borrower default

In summary, a labeling policy that addresses the needs of the multiple stakeholders is a powerful tool for improving the delivery of energy efficiency in the residential sector. By providing transparency about the energy performance of housing stock, building labeling policies can break down information barriers, provide extensive insight into specific retrofit needs, and tackle some of the key barriers to effective efficiency delivery.

Existing Literature

Several whitepapers lay out well-thought out arguments for how labeling should be implemented: mandatory or voluntary, assessment-based or not, focus on commercial vs. residential, etc. Some of these papers are the work of state governments that have carefully identified the best path forward for their state; this includes Massachusetts DOER (2010) and Maine PUC (2010). Others are published by thinktanks, such as ACEEE and NEEP, and examine existing approaches and their applicability to the national or regional level. These papers also lay out the case, in general, for transparency in real estate markets.

As the Europe Union has implemented building labeling policies in 2009, there is also extensive literature on their policy development and observations on early adoption. Several papers, such as ECEEE (2009) and BPIE (2010) identify case studies and best practices in labeling in Europe, examining successes to date. Some of these papers seek to identify a way forward from the E.U.'s current implementation. Finally, a number of works attempt to quantify the results the European labeling program is having on the real estate market, but, by and large, most papers note that it is too early for this kind of analysis.

Few papers from the U.S. or E.U., however, examine how the process of rating and disclosure itself could be improved, especially in the residential sector. Indeed, there is significantly less research on the problems of the current disclosure mechanisms; few papers examine how residential building ratings could be more effectively disclosed. Thus, this paper will focus on the mechanisms for disclosing building energy ratings in the residential sector, identifying problems with existing disclosure mechanisms and proposing a new model for disclosure.

New York's Local Law 84

As of February 2011, New York City requires all buildings sized over 50,000 square feet to conduct building benchmarking and disclosure. The City is doing the same with its own buildings larger than 10,000 square feet.

Each year, building owners must collect data on energy and water used. They then enter it into EPA's ENERGY STAR Portfolio Manager, as well as data on building occupancy. Portfolio Manager then provides an estimate of the building's energy use intensity and GHG emissions. For commercial and institutional buildings, it also compares the result to a national sample of buildings, providing a percentile score from 0-100. Building owners then submit the report to the City. Residential building reports will be visible to the public in 2013.

The City provides numerous options for the use of default values when actual data might not be available. It has also held numerous trainings to get building owners ready for benchmarking.

In addition to Local Law 84, the City's Local Law 87 requires these same large buildings to conduct an energy audit and retro-commissioning every 10 years.

Source: City of New York 2012a and 2012b, EPA 2012, BMVBS 2010.

Problems with Current Approaches to Disclosing Building Energy Performance

Despite the potential of building labeling to catalyze residential energy efficiency, labeling policies have been implemented on a very limited scale in the U.S. Furthermore, the approaches that are in use have significant flaws, failing to encompass key attributes that are essential to effective rating and disclosure. A new approach to labeling is needed, moving away from these flawed implementations and fully addressing all the aspects that can make for effective rating and disclosure on a broad scale.

Limited Implementation in the U.S.

Comprehensive labeling only exists in five jurisdictions. Starting in 2010, New York City and Washington, DC require all buildings over 50,000 ft^2 (commercial and multifamily) to be benchmarked using ENERGY STAR's Portfolio Manager tool, and to disclose the results on a city-run website (see sidebar on p. 5). Washington state and California require buildings over 10,000 and 5,000 ft^2, respectively, to use Portfolio Manager. However, these two states only require that the results be disclosed to buyers, lenders, and lessees.[b] Finally, Austin requires an evaluation for all residential buildings – from single-family homes on up – with disclosure at time of sale, and hence is the only jurisdiction in the U.S.[c] to require energy performance assessments for all of its residential buildings (BuildingRating 2011, Austin Energy 2012).

Notably, a few states have adopted voluntary home rating and disclosure methods, with the Home Energy Rating System (HERS), developed by the Residential Energy Services Network, being one of the most publicized. HERS uses on-site home assessments to determine energy retrofit needs (similar to Austin) and provides a score for the home's performance on a scale of 0 to 250. HERS can be used for all single-family homes and multifamily buildings under three stories. The resulting certificate lists the home's energy attributes, compares the home to a net zero energy home, and estimates the annual energy costs (CEC 2011).

In contrast to the U.S., building labeling in the E.U. has been launched at a broad scale. The 2002 European Energy Performance of Buildings Directive requires all member states to implement building rating and disclosure. Specifically, all buildings are required to have an Energy Performance Certificate at the time of sale or lease, in effect since 2009; as a result, programs in Europe are still very much in early implementation and refinement. Beyond this, there is extensive variation from country to country in calculation methods, enforcement, administration, and overall implementation (BPIE 2010).

[b] Seattle has expanded this to residential buildings over 5 units.

[c] There are several other jurisdictions with some form of energy disclosure, but all of them fall short of comprehensive rating and disclosure in these five jurisdictions. Several cities and states require disclosing utility bills when selling a home, or require assessments for new homes only. Beyond the five discussed here, no other jurisdiction requires an actual rating or assessment for old and new buildings alike.

Numerous Shortcomings in Current Approaches to Labeling

The current approaches to labeling (or voluntary labeling like HERS) fail to encompass important aspects of effective rating and disclosure. As a result, they fail to maximize the potential benefits of rating policies. The key shortcomings include the following:

- *Lack of comparability.* The programs do not produce labels that can be easily compared across all types of residential properties; specifically, current approaches produce an assessment, with no score, for multifamily buildings, and a different type of rating, or none at all, for single family homes. Instead, the rating system should be analogous and comparable between building types.
- *Use of only one type of available data.* The labeling programs use either utility billing history (as part of using Portfolio Manager) or home assessment. This fails to capture the benefits that could result if both types of data were used together, including improved clarity about home energy performance, coverage of more types of buildings, and better identification of retrofit needs.
- *Lack of accuracy and reliability.* Without accurate and reliable ratings, a labeling policy will come to be seen as a useless bureaucracy (BPIE 2010) and lack the trust of stakeholders. As it stands, Portfolio Manager leaves it up to the building owner to either get submetered data from each tenant, or just estimate, leaving significant room for error or self-interested manipulation. Additionally, not all jurisdictions actively audit the reports that Portfolio Manager generates. The use of auditing and measures to improve accuracy could foster increased stakeholder trust in the resulting labels.
- *Lack of refined disclosure policy.* The set of existing disclosure requirements does not strike the best balance between privacy and providing information to the right stakeholders. New York and the District of Columbia require that all benchmarked buildings disclose their reports online, available to the city, interested tenants, and everyone else. But this approach is not likely to be readily accepted for single-family homes, where residents expect confidentiality about their energy use (Barr et al. 2010). Meanwhile, in Austin, the disclosure strategy lies at the other end of the spectrum, where rating is required only when selling and the rating is disclosed only to the buyer – and that only at the time of closing or lease signing. This system fails to provide information to the city and state on the current retrofit needs of the housing stock, and it does not provide information to apartment hunters and buyers when they are actually comparing properties. Instead, a better approach would be to hybridize these two opposing options into a disclosure strategy that maximizes the benefits of both.
- *Need to connect ratings to retrofits.* The rating and disclosure programs don't always connect homeowners to retrofits. While Austin's home energy assessments provide the type of on-site examination that can identify retrofit needs, building labeling programs need to plug homeowners into using retrofit programs, finding retrofit contractors, and simply understanding their building performance.
- *Lack of visibility.* The ratings are not always visible. While Austin requires multifamily buildings to post their rating in a common area, most jurisdictions do not feature highly visible ratings, instead placing the duty upon tenants and buyers to go online and look up ratings for a prospective new home online.

The E.U.'s labeling programs have nearly as many flaws as the U.S.'s early implementation. Rating in the E.U. is largely dependent on home assessment alone, with no utilization of past billing data (BPIE 2010). Most countries do not collect the ratings into an official database, leaving local and national officials unclear as to the collective state of the building stock. Additionally, many E.U. countries lack mechanisms to register, audit, and enforce building ratings. As a result, user uptake of ratings remains a concern (BPIE 2010).

Given these significant drawbacks in both U.S. and E.U. labeling, a new model is needed for disclosing the energy performance of residential buildings, one that can be more effective in catalyzing energy efficiency through transparency. With the shortcomings of existing approaches in mind, this new approach must address the needs below.

The Needs that Rating and Disclosure Should Address

An effective building rating and disclosure policy needs to encompass several key attributes in order for it drive housing markets to value energy efficiency and catalyze building improvements.

The Labeling Policy Should Encompass All Residential Buildings

A residential labeling program must be able to provide a rating for all types of homes; segments of the housing market cannot be left out, as this risks undermining the trust and usefulness of the labeling program. First, the labeling policies of California, Washington state, New York City, and Washington, DC only generate assessments of larger multifamily buildings. Furthermore, the ENERGY STAR Portfolio Manager only be used for over 5,000 ft^2, and residential buildings that do meet this size can still only use the tool to generate a benchmark but not an actual score. As a result, Portfolio Manager cannot be used as a rating system for smaller residential buildings or for generating comparable scores (EPA 2012). In contrast, Austin requires ratings for all residences, and uses audit protocols that encompass all residential buildings.

Buyers, sellers, and renters interact with and conduct transactions with residential buildings of all sizes; e.g., an apartment hunter may look at units in duplexes and high-rises. To provide ratings for only a certain size of building fails to introduce useful transparency to the entire residential market. An ideal labeling policy should provide ratings for all residential buildings, with ratings that can be directly compared between different types of buildings.

Labels Should Include Both Asset and Operational Ratings

Home rating can consist of two methods: asset-based and operationally based. Asset-based ratings involve a visit to the home by a qualified assessor, who measures home characteristics of the building envelope, HVAC, hot water, and fixed lighting (NES 2009). This data is then used to calculate the home's potential energy use under standard operating conditions and calculate a corresponding score, and the assessment is used to provide specific recommendations for retrofit. Operationally based ratings use the historical energy use data of a building – typically the bills over the past year – in conjunction with basic size and occupancy characteristics of the building to calculate its energy use intensity and a corresponding score. Portfolio Manager is an operationally based tool.

Both approaches present their own benefits. A strong rating policy should draw on the advantages of both, as summarized below.

Asset ratings:

- enable comparisons between buildings irrespective of current tenant behavior;
- clearly identify the retrofit needs for the building owner, which are generally possible only through on-site assessment (IEA 2010);
- allow new buildings to be rated, whereas operational ratings require energy use histories of at least a year (IEA 2010, BMVBS 2010); and
- allow comparisons against city building codes for new buildings. Codes are typically defined in the U.S. in terms of envelope and systems characteristics.

Operational ratings:

- allow a building owner to track energy performance over the years;
- allow owners to measure or confirm the performance of new green buildings or newly renovated buildings; and
- enable retrocommissioning in new buildings that may be falling short of their designed potential (Cohen 2010).

Providing both operational and asset information is the best approach to provide clarity to prospective homeowners and renters (NES 2009), as this enables them to understand both the building's potential and how much energy previous residents have actually used. Combining both may also be the best option for buildings with multiple dwelling units: the building could receive an asset rating, complemented by operational data for each unit to capture variation between units.

As a result, a combination of asset and operational data in labeling captures the benefits of both approaches, and it is widely recognized as the best strategy for energy efficiency delivery (by Jensen et al. 2007, BMVBS 2010, and Massachusetts DOER 2010). Indeed, Jensen et al. 2007 identifies a spectrum of options for home energy assessment in Denmark: at one end, the lowest quality option is to simply add up meter data; the highest quality option, at the other end, is a computation based on both site assessment and meter reading.

The Labeling Program Should Work to Reduce the Costs Associated with Asset Rating

States that want to implement building labeling must consider the cost burdens, which have been borne by building owners so far. In the E.U., asset-based ratings of single-family homes cost from under €100 up to €500, based on the country (EPBD 2010). For apartments, the range is €100-200 per unit. In Austin, the cost of the assessment of a single-family home is generally $200 to $300 (Austin Energy 2012).

Bringing costs down is identified as a need for future labeling policy in the E.U. (Maes and Vekemans 2007) and in the U.S. (NEEP 2009). Jensen et al. 2007 also notes that doing asset-based assessment would deliver higher quality in rating Danish buildings but drive up the cost of the process.

Generally, asset ratings become prohibitively expensive for larger multifamily buildings, as they are much more complex to assess (Jensen et al. 2007). As a result, both the E.U. and the early adopters in

the U.S. identify operational ratings as the only practical, affordable option for large buildings (IEA 2010). Thus, labeling policy should require that ratings for smaller residential properties be as cost-effective as possible, and allow operational ratings for larger buildings.

The Approach to Disclosure Should Maintain Privacy

In addition to costs, states that seek to implement building labeling should work to protect the privacy of residents (whether owners or renters) in regards to their energy use and, similarly, ensure that utilities can continue to protect the confidentiality of their customers (Barr et al. 2010). For homeowners that want to maintain the confidentiality of their energy use, the worst case would be that building ratings make the energy use of every residential building visible to the public. To protect the privacy of those who want to keep their energy billing confidential, labeling needs to avoid any unnecessary disclosure of private information.

Ratings Should Be Accessible to the Right Stakeholders at the Right Time

In order for labels to actually drive market valuation of energy efficiency, the labeling policy must provide access to appropriate stakeholders at the right time in their decision making processes. Specifically, ratings must be accessible to prospective homebuyers and prospective tenants at the same time that they view the property or read other information about it. Indeed, disclosure at the time of final transaction (i.e., lease signing or closing) has been observed to have little impact on decision-making (BPIE 2010).

Separately, states, cities, and utilities need to have access to the dataset of building ratings in order to identify local retrofit needs and potential. Indeed, in New York and the District of Columbia, the city manages the database of ratings. In general, collecting the label data in a central database is crucial to running state-wide or city-wide assessments of building stock (BPIE 2010).

Finally, under a future SAVE Act, mortgage underwriters would require disclosure of the building rating at the time that mortgage terms are calculated.

Ratings Need to Be Made Visible

Providing access to prospective homebuyers and tenants is good but not sufficient. In order to spur the housing market into actually valuing energy efficiency, energy performance ratings needs to be visible, well-known, and likely to be read by a potential homebuyer or tenant when considering a dwelling. Simply providing access to an online database of ratings, for example, would result in few people taking the initiative to look up a rating, and, in turn, a much weaker market valuation of efficiency. This is especially true in high-demand 'seller's markets' (Brounen and Kok 2010).

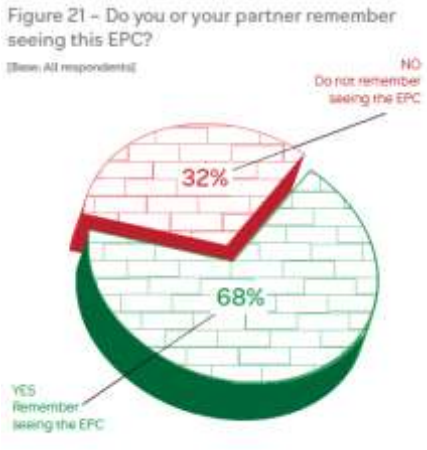


Figure 2: Recent homebuyers in England and Wales, on seeing the energy performance certificate (EPC) during home purchasing. Source: NES 2009

Indeed, in Germany, the seller of a building is only required to share the label upon request; perhaps as a result, only 35% of recent homebuyers reported in a survey that they read it

(Amecke 2011). Similarly, in England and Wales, a survey of homebuyers in 2008 and 2009 found that only 68% recalled seeing the energy performance label (NES 2009), as seen in Figure 2. In general, promoting the certificates is a key priority for improvement of building rating in the E.U. (BPIE 2010), and building labeling policy should make the rating as visible as possible to consumers.

The Labeling Program Needs to Include Measures to Maintain Stakeholder Trust

The disclosure of energy ratings can have an impact on residential markets only if the stakeholders trust the information being presented – true for prospective buyers and renters, mortgage writers, cities and states, owners, and current residents. In order to foster trust in a labeling system, the following criteria should be met:

- **Unbiased by resident behavior**. The rating cannot be biased by the energy use habits of an existing resident. As a result, an asset-based rating should be part of the disclosure.
- **Reproducible and Consistent**. A building should receive the same rating regardless of the assessor that conducts the visit, regardless of the time of year. Indeed, a story of a building receiving an 'A' from one assessor and a 'B' from another would be enough news to undermine trust in the system (BPIE 2010). In order to ensure reproducibility, a standardized calculation tool should be developed by a central authority for use by assessors.
- **Thorough**. The assessment needs to examine all relevant aspects of the house, such that major home systems aren't skipped for the sake of cutting assessment prices. Indeed, reducing the cost of the assessment could go too far, as a cheap rating could be seen as untrustworthy (BPIE 2010). One can imagine that a home label produced for $15 wouldn't be taken seriously by homebuyers.
- **Transparency**. In the spirit of making the market transparent, it is crucial that the process is clear to all stakeholders. Assessment protocols, calculation methodologies, and all default values should be made available online, so that residents can understand what goes into a rating.
- **Regularly audited.** The state agency overseeing building labeling must be able to easily and regularly audit a sample of building labels to ensure their accuracy.

These criteria need to be met for building labels to be trusted. Otherwise, there is a major risk that the building rating program comes to be seen as a useless bureaucracy and unnecessary intrusion of privacy.

The Labeling Program Should Actively Connect Owners with Retrofits

Building labeling should, in the end, facilitate energy improvements to homes and apartments. Thus, beyond providing transparency, the label should connect owners with taking action on retrofitting, especially if they have a very inefficient house. Indeed, this is especially important when the price signal of labeling alone is not enough to shift the market towards efficiency.

States that are implementing labeling programs should require the use of asset-based ratings that generate a detailed list of home retrofits. Operational ratings provide little insight into the improvements a building might need. The assessor conducting the asset rating should provide a detailed list of actionable steps that are clear and easy to understand for the homeowner. Furthermore, in states with home retrofit programs and rebates, the label should provide a direct link for each of its action

items – for example, a phone number to call for the state insulation programs, or the website for rebates on CFLs.

The rating tool could perhaps provide a rough estimate of what the resulting label would be (BPIE 2010), by plugging the 'improved asset' description into the calculation methodology. For example, a label could read "if all of the recommended actions are implemented, this house will go from a B to an estimated A minus." The homeowner should be able to also easily track the operational results of improvements conducted.

Identifying specific retrofit actions is also beneficial to the state, city, and local utility. Assessing the most prevalent retrofit needs allow efficiency program administrators to respond with appropriate incentives and better model retrofit scenarios (Jensen et al. 2007).

The Rating and Disclosure Process Should Be Simple

Finally, the process of obtaining a building label should not be burdensome in terms of time, effort, or complexity. This is especially true for single-family homes or small multifamily buildings that do not have administrative staff. As a result, the rating process – including site assessments – should be completed in one visit. Updates involving operational data should be easy to conduct as well; for example, an easy-to-navigate web form.

This also extends to the disclosure process. The step of providing access to ratings should be as simple as possible. After all, making disclosure as easy as possible makes it more likely that building owners will comply.

A New Model for Building Rating and Disclosure

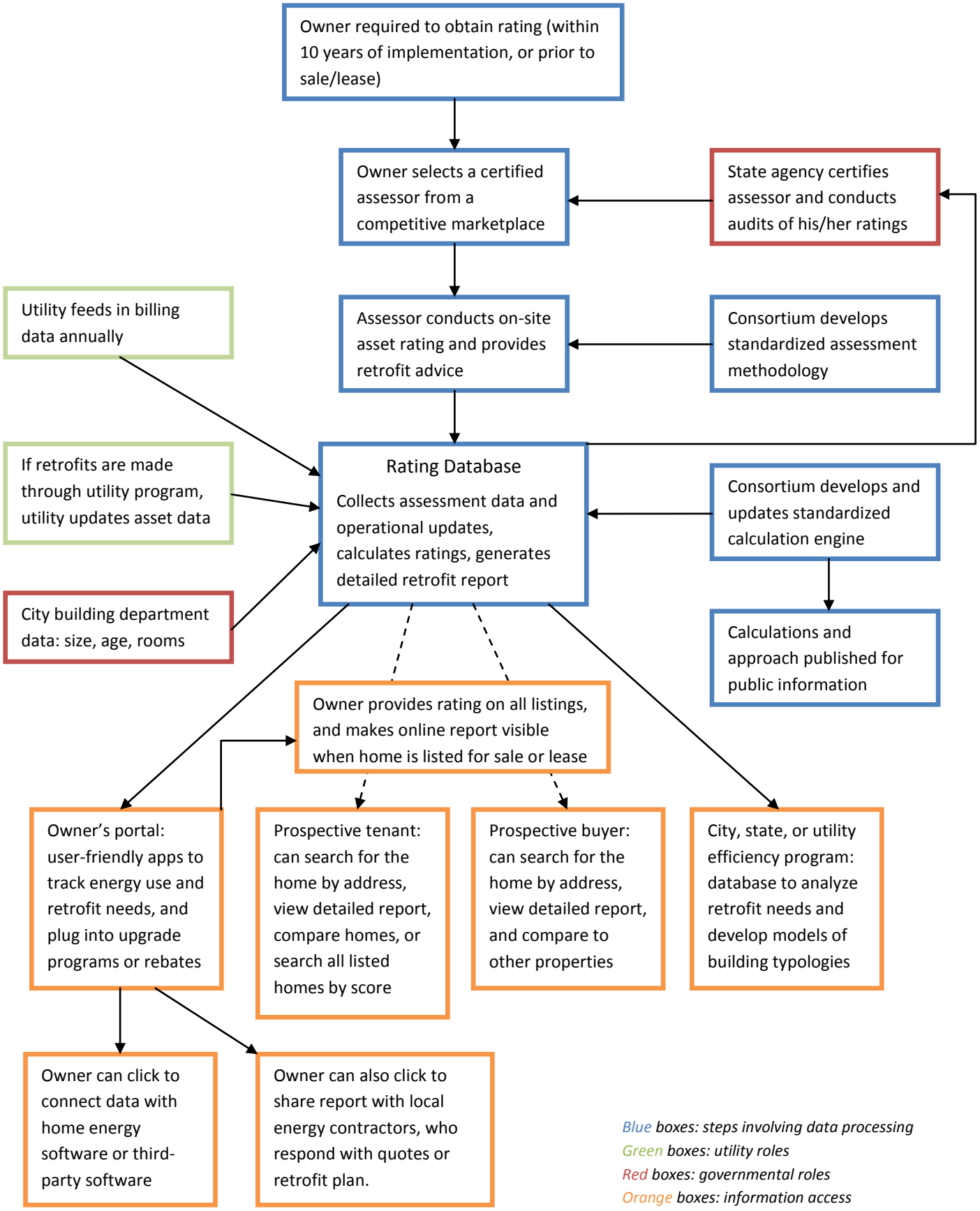
A successful approach to disclosing the energy performance of buildings must meet many needs and address the concerns of several stakeholder groups. A new model is needed for building energy rating and the disclosure of these ratings.

Specifically, states that seek to introduce residential rating and disclosure should adopt an innovative model comprised of four key elements.

1. **A Web-based engine for streamlined data collection, rating calculation, and information access.** A web-based database and analysis engine would collect home assessment data and operational data, then calculate and store the ratings. The platform would have an interface to provide owners access to their own building's performance. Owners could connect this data with third-party home energy software, or share with third parties of their choice, such as energy contractors.
2. **Required asset ratings enhanced by annual operational updates.** A requirement for homeowners to conduct an asset-based home assessment within 10 years, or prior to the first time the unit is available for sale or rental. Home energy assessors would plug the collected data into the online engine. Utility data would be plugged into the engine to provide complementary operational ratings annually. Larger multifamily buildings would conduct operational labeling only.

3. **Confidentiality of ratings, with Web-enabled disclosure to all relevant stakeholders.** Building owners would have continuous access to their home's ratings online. At the time when the unit is listed for sale or lease, owners would be required to disclose a building's ratings (asset and operational, as applicable) on all marketing materials. Owners would also be required to share access to the more in-depth label report collected online. This disclosure would be enabled by the owner's online portal, through which the rating would be made public at time of listing.
4. **Choice and competition in ratings.** A competitive marketplace for conducting ratings, complemented with state certification of assessors, periodic audits of assessors using the aggregated labels, and a standardized assessment and calculation methodology.

The resulting process is illustrated in the diagram below. The diagram shows the process for single-family home and small multifamily rating and disclosure; large multifamily buildings will omit the asset-based process.


Owner required to obtain rating (within 10 years of implementation, or prior to sale/lease)
Owner selects a certified assessor from a competitive marketplace
State agency certifies assessor and conducts audits of his/her ratings
Utility feeds in billing data annually
Assessor conducts on-site asset rating and provides retrofit advice
Consortium develops standardized assessment methodology
If retrofits are made through utility program, utility updates asset data
Rating Database
Collects assessment data and operational updates, calculates ratings, generates detailed retrofit report
Consortium develops and updates standardized calculation engine
City building department data: size, age, rooms
Calculations and approach published for public information
Owner provides rating on all listings, and makes online report visible when home is listed for sale or lease
Owner's portal: user-friendly apps to track energy use and retrofit needs, and plug into upgrade programs or rebates
Prospective tenant: can search for the home by address, view detailed report, compare homes, or search all listed homes by score
Prospective buyer: can search for the home by address, view detailed report, and compare to other properties
City, state, or utility efficiency program: database to analyze retrofit needs and develop models of building typologies
Owner can click to connect data with home energy software or third-party software
Owner can also click to share report with local energy contractors, who respond with quotes or retrofit plan.
Blue boxes: steps involving data processing
Green boxes: utility roles
Red boxes: governmental roles
Orange boxes: information access

Following implementation of a state labeling law, all residential building owners would be required to complete a home energy rating within 10 years. A window of this length would provide more than enough time for owners to prepare, in addition to spreading out the number of assessments to be performed by a finite number of local energy assessors. Large buildings would be required to complete operationally based ratings, while smaller buildings would be required to complete an asset-based onsite assessment.

As the first step, the homeowner consults a directory of certified home energy assessors, provided online by the state. The owner picks one to come and do an assessment, likely seeking out the lowest cost provider.

The assessor collects data on the building's envelope, fixed lighting, HVAC, hot water, and orientation – as specified by a standardized protocol. This could be the HERS protocol, or another similar measurement standard. The assessor also collects data from the homeowner on occupancy. (For large buildings, the assessor's task is to take the building owner through the operational rating process). The assessor also provides the homeowner the option to make their rating public – perhaps if the owner wants to showcase their green building, or does not want to have to think about disclosure later on.

The standardized protocol also provides default values for a select few home components based on building typology, instead of requiring on-site measurement. In the E.U., the data acquisition phase of the rating process has introduced errors in the rating of up to ±20%. Using a small number of default values can reduce this measurement error, and in turn limit deviation in the final rating to ±5% (BPIE 2010). Accordingly, the protocol in this model of building rating uses default values for a limited number of house parameters, where actual measurement would be prone to error.

The assessor inputs the data into a central database, operated by a state agency. The database's rating engine uses a standardized calculation procedure to develop an asset-based rating. Ideally, this calculation method, as well as the data collection protocol, is developed and updated by a consortium of building technology experts, state agencies, and energy assessors. This is the practice used in Denmark, where a consortium also operates the database (Jensen et al. 2007), and it represents a way to involve multiple stakeholders with the rating program.

This database also receives address-specific information from utility billing data and the city's building assessment office. This portability of individual utility data to external software has already been pioneered by the Green Button initiative in which utility data is plugged into third-party software upon the customer's request (Fehrenbacher, 2012). These data sources allow the engine to calculate an operational rating each year, one that can be compared to the asset rating in place for single family homes and small multifamilies. For example, a home might have the potential to be a B in energy use, but it could have been operated in the past year at a C+. These two ratings must be disclosed to stakeholders.

The aggregated data of a state's building ratings now provide a resource for the state, cities, and utilities to analyze. By running regressions against building characteristics, analysts develop precise models of building typologies and work to identify specific retrofit needs. In addition, the state uses the ratings to

conduct audits of certified assessors. Stage agencies can also use this data to identify homeowners who want to showcase their green homes, to support proactive building owners.

Meanwhile, the building owner is provided access to view his rating online, using a user-friendly portal. This portal helps each owner understand the ratings, describes the home's improvement needs, and compares the building to the local average. Action steps accompany each retrofit need, providing information, for example, on what program to call for insulation rebates or the link to utility retrofit programs. To improve owner uptake, the database can also provide a one-time or periodic mailing (or e-mailing) of all this information.

In addition, the homeowner can choose to provide access to the rating to third parties of his or her choice. For example, the owner can click to connect this data with third-party energy use software, such as that developed by OPower. Additionally, he or she can use the portal to share the report with local contractors, who may then respond with plans or cost estimates for addressing retrofit needs. As a final example, the homeowner could also disclose his rating to a community group or neighborhood association that is holding an efficiency competition.

When the home is ready to be rented or sold, the owner is required to list the rating (i.e., just the letter grades or numerical scores) in all online ads, home listing flyers, and other marketing materials. Additionally, the owner goes online and makes the full assessment profile public for as long as the listing is active.

WalkScore's Apartment Search by Score

WalkScore is a website providing users an understanding of how walkable their neighborhood is. The site uses public data on the locations of key amenities, such as grocery stores and public transit and analyzes proximities to generate a rating for any given address. The rating is on a scale of 0 to 100, where 100 is a highly mixed-use, walkable location. WalkScore then overlays these ratings with current apartment listings, allowing apartment hunters to search for homes that exceed a certain score. Users can also refine based on some of the attributes that constitute the score, such as proximity to transit. The interface uses Google Maps to visually present apartments meeting an apartment hunter's score and amenity criteria.

Source: WalkScore 2012.

The apartment hunters and homebuyers are thus presented with the asset and operational ratings on all listings. They can also go online, search for the specific house, and understand its energy performance and specific retrofit needs, the latter being especially important for buyers. This public portal allows users to compare buildings of interest side-by-side. Moreover, a customer in the market for a new apartment or house can go to this portal and search for all currently-listed units that meet their energy performance needs; this could be all apartments that score over a B, or could be all houses that have highly insulated walls. WalkScore uses a similar method to provide an apartment search for people looking to live in a compact, walkable neighborhood (see sidebar).

This market of interested buyers and renters acts to keep disclosure enforced. If a building owner has not made his online energy rating accessible when it is listed, prospective tenants and buyers can report the violation to a state agency. The agency is able to use the database history to examine if in fact disclosure was not provided. Furthermore, failure to make the rating public also keeps it from being

viewed by all the interested buyers and renters who are using this portal to search for properties.

The Advantages

This model for disclosing the energy performance residential buildings works to address the key issues of labeling identified previously and may provide a more effective approach to labeling than current ones.

- **Ratings provided for all residential buildings, in a comparable format**. In this model, a rating methodology is provided for residential buildings of all sizes, and the same disclosure requirements apply to all residential properties. Unlike current U.S. labeling practices, asset-based ratings for smaller buildings and operational ratings for large multifamilies will be comparable, using analogous rating scales and reports. As a result, prospective home owners and renters can examine energy ratings for all of the homes they may be considering, allowing for fair comparisons during decision-making.
- **Includes asset and operational information**. Both an asset rating and complementary operational ratings are part of the label, except for large multifamily buildings which have only an operational component. As a result, the rating provides the benefits of both methodologies identified earlier, in contrast to the labeling programs in U.S. jurisdictions.
- **Works to bring down costs**. First, a competitive marketplace for assessors means that, over time, rating services will begin to offer competitive prices and discounts. In fact, companies like Retroficiency have begun to offer 'no-touch' energy assessments of commercial buildings by analyzing energy use interval data (Retroficiency 2012, Czarnecka 2012); the application of this technology to homes could drive down costs further. Second, the streamlining of update processes into a central data engine drives down costs: utility data and building assessor data is fed directly into this database, eliminating the need for manual updates. Third, requiring only operational ratings for large multifamily buildings avoids the need for what would be very expensive on-site assessments.
- **Maintains privacy when public disclosure is not needed**. Owners and residents can be assured that the ratings and utility billing data is maintained in a secure database, accessible only to efficiency program administrators. At the time of sale or lease, the ratings are published in all listing materials, and the online detailed report is shared only while the home is listed.
- **Combines the benefits of time-of-sale rating and fully public disclosure, by providing access to the right stakeholders at the right time,** During the site visit, the assessor provides the building owner with the option to make her listing public from the start; this enables owners of green buildings to publicize their buildings. Cities, states, and utilities can meanwhile analyze data pulled from the centralized database and can work to develop retrofit programs that target the observed needs. Finally, people seeking to rent or buy view the rating at the time they see other information about the property, and can go online to see complete information on the property's label. Under a future SAVE Act, the rating report generated by the database could be directly shared with mortgage underwriters as well. In short, this hybrid model provides the benefits of periodic, public ratings (like in New York) by ensuring that all homes are rated and that these ratings are available to cities, states, and building owners themselves. At the same

time, it provides the benefits of time-of-sale rating (like in Austin) by maintaining the confidentiality of resident energy use until it is disclosed by the owner for purposes of sale or lease.

- **Ratings are highly visible**. The asset and operational ratings can't be missed by apartment hunters and house hunters: these letter grades or numerical scores are required to be listed on Craigslist ads, apartment information sheets, and home listing sheets.
- **The program is designed to be much more trustworthy**. This model encompasses measures to foster trust in energy labels. The use of asset ratings means that the label is unbiased by the behavior of the previous tenant, and instead represents the house's potential. A highly standardized protocol for data collection and a standardized, central calculation engine for ratings work to help ensure reproducibility in ratings. The disclosure of these methodologies to the public provides transparency into the process as a whole. Finally, the collection of ratings in a central database, tagged with the name of the assessment company, allows for state officials to run automated, periodic audits on an assessment company's work.
- **Labels connect owner directly to retrofit options.** Both the existing homeowner and buyer need to be aware of any retrofit needs and the actions they can take. In this model, the on-site assessor provides retrofit recommendations during the visit, and a full list of recommendations and easy-to-follow steps for implementation are available once the report is generated online. Homeowners can use the site to share the report with contractors, to take action on these steps. This streamlines the process of upgrading homes as much as possible, increasing uptake of home retrofit programming. Providing homeowners with the option to estimate what their rating could be post-improvements, and the ability to track operational ratings after retrofits, also encourage owners to be proactive once their properties have been rated.
- **Getting and sharing a rating is simple for building owners.** Providing a directory of assessors eases the process of getting a rating, and the on-site nature can allow assessors to walk homeowners through the remaining steps: accessing the web portal to view or share ratings, and disclosing the ratings on any listing materials. The portal itself is designed to be as user-friendly as possible. Specifically, disclosing ratings in this model does not require homeowners to print out copies of reports, or type up complex energy use statistics. Instead, they simply disclose the basic asset and operational ratings when they list the home, and use one-click sharing on their web portal to make the detailed rating report public during this time.

Costs and Funding

This new model of building rating and disclosure works to reduce costs, as described above. Nonetheless, the costs of assessing millions of homes in a state and processing them through a complex rating engine and database are likely to be significant.

Prospective tenants and homebuyers are likely to benefit the most from a mandatory disclosure policy: they would have access to more complete information on a home that can help with decision-making. Yet charging them for this benefit may be out of the question. Since the goal is to make ratings as visible as possible, and viewings of energy certificates remains a challenge in countries like England and Germany, charging users to access rating reports is not recommended. It would diminish the number of

people that actually view and consider the ratings, perhaps to the point that there is negligible impact on the market.

Instead, utility ratepayer-funded retrofit programs may be in a position to contribute. An analysis of energy certificates in England and Wales finds that certificates would increase the demand for efficiency programs and cut the amount of marketing they need by £40 million annually (Olloqui 2009). As a result, the funding saved in the marketing of efficiency programming could be plowed directly back into running the rating program.

There are also management costs to be funded. In the UK, the central registry of ratings is a private company that is funded by a fee on all submitted certificates (BMVBS 2010). Needless to say, these costs would only be passed on by the assessor to the building owner.

As a result, the costs of building rating may be largely borne by building owners, while the costs of the program and database management will need to be funded by a mix of utility ratepayer funds and state agency funding. For owners, however, the burden costs should not be overstated: conducting a one-time site assessment at $200-300, prior to selling or leasing, is a tiny fraction of typical home sale values or annual rental income.

Potential Impacts of this Disclosure Model

Of course, implementation of such a rating and disclosure program would be a complex undertaking for a state. In a state like Massachusetts, implementation would require coordination with multiple utilities and numerous towns and cities. Funding sources would need to be identified to develop rating methodologies and calculation tools. State agencies would have to develop assessor training and certification programs, and the Commonwealth would need to work closely with all stakeholders. With 2.8 million housing units statewide (U.S. Census 2010), the assessment costs for building owners could total $56 million annually, if assessments are distributed over the 10 years of the compliance window.

Nonetheless, such an approach to disclosure, supplemented with other well-planned elements of a labeling strategy, could have significant impacts on the housing market. Rating programs in the E.U. and U.S. are in the early stages of implementation, of course, and, as a result, few evaluations of program results have been published. Nonetheless, preliminary studies indicate that labeling seems to have an impact on the valuation of efficient buildings. In the Netherlands, office buildings that received greener labels than average earned a higher amount of rent per square meter than non-green labeled buildings; this is a statistically significant correlation that held other major building characteristics constant (Jennen and Kok 2011). A review of home sales in the Netherlands from 2008 to 2009 revealed another statistically significant correlation: homes that received a label of A, B, or C had, on average, 2.7% higher valuations than D-or-lower rated homes that were otherwise identical (Brounen and Kok 2010). As a result, early indicators are that labeling programs are creating value for assessed energy efficiency, providing an incentive for building owners as a result.

If labeling is to be implemented, then the model proposed in this paper presents a new, improved way to implement disclosure. By considering many key stakeholder concerns, it offers the possibility of

disclosure in a way that addresses the myriad needs of privacy, transparency, macro-level analysis, clarity, trust, and ease of use.

As a result, the access to more complete information provided by such a model can transform the way stakeholders seek residential energy efficiency. Building owners are provided with clear information on their building's performance, through a platform that enables them to understand retrofit needs, more easily connect to retrofit opportunities, and share information with third-party organizations and applications. This information enables them to tap into market demand for efficient buildings, by working to earn a higher rating and marketing the resulting label.

For prospective tenants and homeowners, this model provides more complete information to the housing market, made highly visible and clear. This transparency enables apartment hunters and home buyers alike to make more informed decisions, and to easily make energy performance a decision factor when searching for a new home. As a result, tenants and homebuyers collectively can create a market signal for more efficient homes.

Cities, states, and utilities all benefit from this approach, with up-to-date, detailed information available on the performance and needs of housing stock. Access to this detailed data, in turn, provides a foundation for targeted efficiency programming.

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