ACEEE Policy Brief
American Council for an Energy-Efficient Economy

Home Energy Efficiency Policies: Ratings, Assessments, Labels, and Disclosure

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A small but growing number of local governments are adopting policies requiring residential energy ratings, assessments, or energy-use disclosure.[1] These closely related options share a common objective: making home energy use, costs, and efficiencies visible to consumers and valued in residential real estate markets to guide home purchases and improve decision making. In this policy brief, we use *home energy efficiency policies* as an umbrella term for these various types of policies.[2] Our theory of change is that if we correct the market's information gap about home energy use, people will value efficient homes more highly than less-efficient homes, which will drive purchase decisions as well as home improvements aimed at greater energy efficiency.

Home energy ratings are numerical scores based on an assessment of the home's physical properties that affect energy use. As with vehicle fuel-economy ratings and Energyguide labels for US appliances, home energy ratings let buyers compare the energy efficiency and performance of various homes.[3] Some home energy assessments provide home energy reports, rather than ratings, and offer findings and recommended energy efficiency improvements. Energy-use disclosure makes utility data on home energy consumption publicly available, typically as part of the real estate sales process; this sometimes involves a label, either on the home or in real estate listings.

Requiring home energy efficiency policies in real estate markets is an option for cities interested in reducing residential energy use and increasing the energy efficiency of the housing stock. Although interest in them is growing, such policies are not yet as common in the United States as they are in Europe (Cluett and Aman 2013; ACEEE 2014; Mudgal et al. 2013).

Home energy assessments vary in their depth of analysis and reporting format. Typically, they require an onsite inspection by a certified assessor to gather data on the building envelope, mechanical systems (space heating and cooling, ventilation, and water heating), and onsite renewables. Some assessments and reports may be very detailed and yield highly granular results (e.g., energy use by principal end uses). They establish energy-use baselines, identify energy efficiency opportunities, estimate implementation costs and energy savings, and prioritize measures based on these estimates; other assessments are less detailed. While all home energy ratings require an energy assessment, not all such assessments are used to develop and report an

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[1] The terminology for home energy efficiency policies varies. Home energy ratings can be used to create *home energy labels*. The terms *home energy assessment* and *home energy audit* both refer to collecting data on home energy use, developing recommendations for improving energy efficiency, and possibly yielding a performance score. There are no universally accepted definitions for these terms, however, and the terms are used somewhat interchangeably by some, while others make clear distinctions between the terms based on the depth of data collection and analysis.

[2] For additional details and examples of home energy efficiency policies see ACEEE 2014, Cluett and Amann 2013, Earth Advantage 2014, and EMPRESS 2018.

[3] Appendix A gives an example of the home energy report provided to consumers in Portland, Oregon.

overall score or rating. While less common, requiring only assessments—without home energy scores—has the same objectives and can be effective, as we show later in the Austin, Texas, example.

Energy-use disclosure for residential properties is much less common than home energy ratings because such data are considered confidential in many jurisdictions; as our examples below show, however, this is starting to change (see Chicago for a prominent example).

Policy Goals and Benefits

Home energy efficiency policies can help consumers by increasing transparency about the costs associated with operating a home. These policies also can inform future policy and program efforts to reduce building energy consumption. Further, such policies can help cities track progress toward community-wide climate and energy targets, assuming they establish a baseline and some type of reporting system for improvements and energy use.

Residential energy efficiency policies involve many parties engaged in residential real estate markets. Table 1 summarizes possible benefits that residential energy ratings, assessments, labels, and disclosures can offer these key stakeholders. Although some cities that have policies in place may not have achieved these benefits yet, they are the expected outcomes given sufficient time.

Table 1. Possible stakeholder benefits from home energy efficiency policies

Stakeholder	Benefits of policy
Homeowners	Identify energy- and cost-saving priorities for home energy improvements and receive a better valuation of existing energy efficiency features and improvements in the real estate market.[a] Implementing recommendations can also improve thermal comfort.
Prospective home buyers	Gain more information about the energy costs of owning the houses and receive a better valuation of existing energy efficiency features and improvements. Gain upfront information on recommended improvements that could be financed directly through the buyer's mortgage.
Home sellers	Gain a possible price premium for energy-efficient homes through better valuation of existing energy efficiency features and improvements compared to less-efficient, lower-rated homes.[b] Providing otherwise missing information on expected energy use can reduce the time homes spend on the market, even for those with lower ratings.[c]
Policymakers	Improve local housing stock. Get more access to data on the energy use and/or ratings of the existing building stock, both to inform future policy development and track progress toward local climate and energy reduction goals for buildings. Enables administrators to target poor-performing homes for improvements and identify high-frequency, high-value measures. Increases the number of efficient homes in housing markets.

Stakeholder	Benefits of policy
Realtors	Gain more information on the energy efficiency of homes, which enables them to market energy efficiency features more accurately and confidently; also, efficient homes can sell at a price premium and may sell faster. Increase the ability to respond to customers' interests in home energy efficiency and expected energy costs. The realty industry's own research shows that realtors view such information as important to their customers.[d]
Builders and contractors	Gain new customers and opportunities as homeowners implement recommended energy efficiency measures, especially if financial incentives are available to customers. Can gain recognition as a green builder, distinguish themselves in the market, and attract customers.
Utilities/energy efficiency program managers	Increase program participation from homeowners. Provide market and home performance data to guide program design, including incentives and available services. Increased program participation helps utilities achieve savings targets.
Appraisers	Given a clear documentation of energy efficiency features and performance, appraisers can more easily and accurately value those attributes—enabling them to access and incorporate energy data as another "comparable" attribute used in valuing properties.

[a] Mugdal et al. (2013) found that the effects of a one-letter or equivalent improvement in home rating across European property markets shows a strong correlation between higher-rated houses and an increase in market value of up to 11%. [b] Fuerst et al. (2013) found that in the UK market, houses with higher home energy ratings sold at a statistically significant price premium. [c] Philbrick, Scheu, and Blaser (2016) found that homes that disclosed energy costs sold faster than those that did not disclose costs on multiple listing services. [d] NAR Research Group 2018.

Policy Design and Adoption

Creating policies that require home energy ratings, assessments, or disclosure typically involves four steps:

- Confirm the scope of local authority and assess available resources
- Cultivate support from local stakeholders
- Develop policies, rules, and infrastructure
- Implement policy and track results

Confirm Local Authority and Assess Available Resources

A fundamental step in creating home energy efficiency policies is to confirm the local (city) government's authority to enact and enforce such policies. In the United States, such local authority varies widely and is subject to state and local statutes and regulations.

Successful policies requiring home energy ratings or assessments depend on a variety of resources, analytical tools, technical expertise, and communications. Home energy ratings do not require utility energy data. However these data may be desirable and useful as they can provide a home's baseline energy use and be used to benchmark efficiency.

Home energy assessment or rating policies require a base of trained, certified practitioners who can assess homes, make recommendations for improvements, and carry out the necessary work. To create this base of experts, cities can use existing training and certification programs or they can create them together with the passage of home energy rating or assessment requirements.[4]

Energy disclosure policies, such as those in Chicago, require utilities to publicly report household energy-use data. Making household energy use public can be a barrier, however, due to regulations governing the confidentiality of utility customer data, which have historically been the norm. To address this, policies can require that home energy ratings be disclosed only when properties are placed on the market. Additionally, cities can work with utilities and regulators to change existing policies to allow such public disclosure of customer energy data. Chicago administrators use a software platform that directly transfers utility data to real estate listings of properties for sale; doing so streamlines the process and reduces administrative costs. Other jurisdictions that also require disclosure of these data at the time of sale include Montgomery County, Maryland; New York State; Alaska; and Hawaii.

Well-designed and successful home energy efficiency policies depend on the existing infrastructure involved in home construction, sales, and performance analysis. In the United States, local real estate databases known as multiple listing services report data on real estate for sale and can include energy-use data, home energy ratings, and information on the listed homes' energy efficiency characteristics. Potential home buyers—especially those interested in low energy costs and other benefits of energy-efficient homes—can use these data to inform their purchase decisions as they compare different properties of interest.

In some jurisdictions, existing code inspection processes can be modified to incorporate home energy rating requirements for new construction. In this way, compliance with home energy ratings can be consistently assessed and become routine.

Home energy assessments and ratings typically rely on and use existing analytical tools—that is, software developed and tested specifically for determining the expected energy efficiency and performance of homes. Such software generally relies on engineering and statistical analysis and building energy modeling. Inputs may include the structure's physical properties, mechanical and electrical systems data, and utility records. Such assessment and rating tools expedite policy development. They also offer consistency and add instant credibility to the resulting reports or ratings. One existing home energy assessment software tool is the Home Energy Score™ (HES) software developed by and available from the US Department of Energy (DOE).[5]

CULTIVATE SUPPORT FROM LOCAL STAKEHOLDERS

Residential real estate markets are complex and involve many stakeholders. Gaining support from these parties is important for developing and implementing home energy efficiency policies. This

[4] Analytical tools are emerging that automate home energy scoring using remote data collection and modeling; such tools could greatly reduce the costs for home energy ratings, enabling more rapid and broad applications for home energy efficiency policies (Hopkins and Corvidae 2018).

[5] For information on the Home Energy Score™, see www.energy.gov/eere/buildings/downloads/home-energy-score.

process typically begins with city officials and advocates fostering a dialog among community policymakers and stakeholders. Addressing the specific concerns of realtors and housing contractors is especially important; their input and cooperation is important to develop community acceptance, reduce compliance costs, and improve compliance rates, all of which are keys to successful policies.

Our case studies demonstrate the importance of securing local stakeholder support and cooperation. In each case study, city officials led the policy development and facilitated a stakeholder engagement process. Without strong city leadership, it is unlikely that such policies would be developed and implemented because some stakeholders would likely oppose them from the start. For example, realtors often oppose proposed home energy rating and disclosure requirements because they believe these policies will add complexity, costs, and time to the home-buying process. Ideally, city officials will engage with realtors when developing policies and will respond positively to their concerns. While gaining such support for policy development may not happen, once such policies are enacted, getting cooperation from realtors is critical for the implementation to succeed.

DEVELOP POLICY, RULES, AND INFRASTRUCTURE

The process of developing a policy for home energy efficiency is typically distinct from developing the rules that govern it. Policies set the framework, approach, and objectives, while the rules and guidelines provide the details necessary to implement the policies.

Determining the exact policy design for home energy efficiency begins by choosing the type of policy best suited for a given local application. As table 2 summarizes, there are three principal policy types: home energy ratings and home energy assessments, which vary in their required data inputs, analysis types, and forms of reporting; and utility bill disclosures, which may require changes in utility regulation and the creation of databases.

Table 2. Types of home energy efficiency policies

Policy type	Details	Benefits of policy	Where has this been done?
Home energy assessment*	Requires an energy assessment before a home is listed on the market, and results of the assessment are made available to interested home buyers	Provides an evaluation of the structure and equipment of the home for new and existing homes. For existing homes, assessments provide homeowners with options for physical improvement of the home to reduce energy use through improved energy efficiency.	Austin, Texas
Home energy rating	Requires existing and new homes on the market to receive a numerical score on the home's overall energy efficiency. For new homes, this is required before a certificate of occupancy is granted.	Provides a simple rating to compare the energy efficiency of homes and typically recommends ways to improve energy efficiency	Established in Berkeley, California; Portland, Oregon; Santa Fe, New Mexico (new construction); and Boulder, Colorado (new construction); with a pilot in Denver, Colorado, and a proposal in Minneapolis, Minnesota

Policy type	Details	Benefits of policy	Where has this been done?
Utility bill disclosure	Provides historic data on energy use and costs to prospective home buyers or renters	Informs current homeowner and prospective buyer of the home's energy consumption and costs	Chicago, Illinois; Montgomery County, Maryland; Alaska; Hawaii; and New York State

*** A variation here is policies that require only disclosure of energy efficiency characteristics and technologies to prospective home buyers, rather than requiring a full home energy assessment. Kansas, Maine, and South Dakota use this type of policy.**

Each policy has pluses. Home energy ratings have emerged as a preferred policy option for many cities because they offer several advantages:

- The rating gives the homeowner a simple, easily understood metric for the home's overall energy efficiency.
- Ratings and the associated assessments can be valuable to homeowners by motivating them to identify, prioritize, and implement recommended improvements to increase energy efficiency.
- Home buyers can easily compare the energy efficiency of different homes under consideration, which can be one of many factors that go into a purchase decision.
- Homeowners and realtors can use home energy ratings to highlight and market homes with high energy efficiency ratings. There is a proven and growing market for green, energy-efficient homes.

Regardless of the type of policy, city governments must address several fundamental questions when creating home energy efficiency policies:

- When must the rating, assessment, or disclosure occur?
- What is the policy's effective date or the date that homes must be in compliance?
- Who are the recipients of the mandated disclosure or rating?
- Who is the party responsible for compliance?

Table 3 shows various time options for disclosure. Best practice is to link these requirements with transaction times in the home-ownership cycle in order to improve rates of compliance and leverage existing transaction times to include enforcement. Disclosing energy use or energy rating at the earliest possible stage in a transaction process enables home buyers to incorporate energy-use and efficiency information into their decisions and negotiations, as well as to guide follow-up improvements after purchasing a home. Surveys show that homeowners are more likely to make such improvements within the first few years of purchasing a home (JCHS 2015). Berkeley, California, has enacted a different approach: It provides an option to complete energy assessments within a year of closing. We describe and discuss this approach later in the Berkeley case study.

Table 3. Time and recipients of energy-use and/or efficiency disclosure

Event in home ownership life cycle	Specific timing options	Recommended recipients of disclosure or rating
Sale	• Time of listing • During contract period • Closing date • Specified period post-closing	Prospective home buyers and tenants, local government
Rental	• Time of rental listing (optimal timing) • Lease signing	Prospective renters, local government
Construction	• Before certificate of occupancy is issued for new construction • Time of significant renovation to existing building	Local government, public-at-large, prospective home buyers
Scheduled (not life-cycle related)	• On a regularly timed basis • Disclosure(s) before future date	Local government, public at large

Establishing a compliance timeline is another key step for home energy rating and disclosure requirements. The compliance timeline must account for various factors, including requirement stringency and stakeholders' capacity to comply. If asset ratings are required and property owners are unfamiliar with them, a stepwise approach to full implementation may be optimal. This allows time for stakeholders to become familiar with the requirements and to establish the necessary infrastructure.

Stakeholders also need to know who will receive the home energy rating or energy-use disclosure. If informing the home-buying process is the primary goal, home buyers may be the only recipients; if the goal includes community energy planning, local government officials also may be recipients.

Implement Policy and Track Results

Once in place, enforcement is an administrative function assigned to the relevant arm of city government—typically a department tasked with tracking and recording real estate transactions, enforcing building codes, or implementing energy/sustainability plans. Implementation and performance tracking plans should be required. Such data are important for evaluating policy outcomes, including compliance, market changes, and progress toward policy objectives, such as total energy savings and reduced greenhouse gas (GHG) emissions. Program data should be publicly available.

Tracking the number of homes complying with policy requirements is important for enforcing an ordinance, as well as for assessing and modifying the requirements based on implementation experience. Because these policies create additional duties and responsibilities for tracking and enforcement, city governments also must establish funding mechanisms to support these functions. Typically, such funding may come from fees established in conjunction with the home energy rating requirements and paid as part of filing requirements for real estate transactions. Tracking

program data can take different forms depending on data requirements, availability, and policy objectives. It may require creating databases and tracking systems.

Case Studies

In the following sections, we highlight home energy efficiency policies in Portland, Oregon; Berkeley, California; and Austin, Texas.[6] Each city's policy is unique and reflects the need to innovate and experiment with various approaches, as policy experiences to date are limited.

PORTLAND, OREGON: HOME ENERGY RATING

Policy

Portland established a Home Energy Score Ordinance in 2016 that went into effect on January 1, 2018.[7] It requires sellers of single-family homes to disclose a home energy report and score when they list a property for sale. The primary driver of this ordinance is the city's 2015 Climate Action Plan (CAP), although earlier CAP iterations included proposals for mandatory residential energy performance disclosure. Also, for a decade prior to the passage of Portland's ordinance, the state of Oregon had explored various voluntary scoring programs and protocols.

The ordinance includes several goals:

- Make energy performance in residential buildings transparent
- Enable more knowledgeable decisions about the full costs of operating a home
- Motivate energy efficiency investments in homes that lower utility bills
- Reduce carbon emissions
- Increase comfort, safety, and health for homeowners

Portland's Bureau of Planning and Sustainability (BPS) led the policy development process throughout 2016. The policy drew on best practices from many US cities and other countries, as well as input from experts on home energy assessments and disclosure policies. BPS also engaged and cultivated the support of local stakeholders, including

- Representatives from the real estate, energy efficiency, and home performance industries
- Energy efficiency advocates
- Climate protection advocates
- Equity organizations representing low-income homeowners, communities of color, and tenants, as well as advocates for homeownership and affordable housing
- The general public

Portland employed a research, evaluation, and facilitation expert to help develop and execute the public engagement strategy during policy development. The approach for public engagement included professionally run consumer focus groups, facilitated discussions with industry stakeholders, and a forum on equity issues. BPS staff also consulted with an informal technical

[6] While these three cities are comparable in several ways, they have substantially different population sizes. One-year estimates from the American Community Survey administered by the US Census Bureau (2018) shows the 2017 population for each city as follows: Portland, 648,121; Berkeley, 122,334; and Austin, 950,714.

[7] The ordinance can be found here: www.portlandoregon.gov/bps/article/620857.

advisory group to assist in developing strategies to introduce the HES policy to the real estate market.

A key BPS policy decision was choosing the exact type of home energy rating. Portland chose the US DOE's HES because of its simplicity, its connections to mortgage products, and its potential to link regional markets to a national standard. HES is an asset rating that examines a home's structural and fixed characteristics. HES uses a 1–10 scale (with 10 being most efficient) and provides upgrade recommendations based on a set of standard measures. BPS wanted an asset rating that examines the structural and fixed characteristics because it translates results to an easily understood and readily comparable score. The average cost of an HES assessment and analysis is $150–250.

Portland and the state of Oregon had several years' experience with voluntary energy scoring programs that had not been well accepted or used within real estate markets. After considering the policy options, BPS chose to use and require HES because it better met the city's goals than the prior voluntary scoring programs.

Results

The policy became effective on January 1, 2018. Although it is too early to assess its impacts, BPS plans to evaluate the market impact and energy savings in approximately two years. Portland is currently focused on education and compliance, as increasing awareness among the public and key stakeholders is important at this early stage of implementation. While tracking energy savings and GHG reductions are fundamental goals of the ordinance, the data and experience are not yet sufficient to estimate the impacts. Table 4 shows key policy data that Portland is tracking.

Table 4. Partial preliminary first-year data for Portland's home energy score policy (through September 2018)

Element	Value
Number of unique homes scored	7,000
Average base score	4.5 on a 10-point scale
Average upgrade score	7.2
Average predicted upgrade electricity savings per year per home	1,600 kWh
Average predicted upgrade natural gas savings per home per year	111 therms
Average predicted home energy score change after retrofit	3 points
Average predicted energy cost savings per home per year after retrofit	$303
Number of authorized home energy assessors	121

As table 4 shows, the early results are promising for the newly established policy's success. Many homes have received scores, and these scores reveal significant potential for improvement. If homeowners undertake the recommended improvements, most can achieve an average increase of 3 points on the 10-point HES scale and enjoy annual energy cost savings of more than $300. Various state and local programs are available to assist homeowners and provide financial incentives for certain upgrades and improvements.

Portland's HES policy is part of its portfolio of policies to reduce GHG emissions. The combined impacts of the city's policies and actions to date have successfully reduced GHG emissions. In 2014, residential energy use accounted for 19% of GHG emissions in Multnomah County (the county in which Portland is located); these emissions are 23% lower than 1990 levels, despite a population increase of 33%.

Lessons

Portland's experience offers several lessons (Roy et al. 2018). First, using the US DOE's HES overcomes the market barriers of cost and complexity that are associated with more in-depth, granular energy rating systems. HES—which is an asset rating approach—is simpler, and thus more readily understood and comparable for home buyers and sellers than more complex rating systems. This greatly increases the policy's acceptance and use within targeted real estate markets.

While BPS staff members worked to engage and gain the support of the real estate community (realtors), they realized early in the process that this was unlikely. They therefore focused on research and analysis to respond to the realtors' concerns—mainly, that HES requirements would create impediments and slow down real estate transactions, while offering minimal benefits to home buyers and sellers. BPS communicated these responses to city council members, who found the consumer protection benefits of the proposed policy to be particularly compelling. Ultimately. BPS gained council members' support and they unanimously passed the ordinance despite the opposition from realtors. After swift passage of the ordinance, Portland worked with realtors and other stakeholders to develop details of the policy and address the realtors' concerns.

Requiring HES when listing a property for sale instead of at closing is more acceptable to some realtors and other stakeholders involved in property transactions (such as title companies and mortgage providers), because it does not complicate the process of closing the sale. This also should be more effective in achieving the desired impact of transforming the residential real estate market to incorporate energy efficiency and performance as key factors in purchase decisions.

Berkeley, California: Home Energy Rating

Policy

Berkeley has a long record of working to improve the energy efficiency of residential properties. In the 1980s, Berkeley established the Residential Energy Conservation Ordinance (RECO), which required that a minimum set of simple efficiency measures be installed at time of sale. In 2009, Berkeley passed a CAP that established goals for GHG reductions. Subsequent analysis by city staff showed that achieving its GHG reduction goals would require the city to greatly improve the energy efficiency of its homes. RECO was missing opportunities for deep energy savings because it did not take a whole-building approach; it also did not align well with existing utility incentive programs. These deficiencies led to the development and passage of the Building Energy Saving Ordinance (BESO) in 2015, which replaced RECO.[8] The goal of BESO is to reduce building energy use and GHG emissions as part of the CAP.

[8] The full ordinance can be found here: www.cityofberkeley.info/uploadedFiles/Planning_and_Development/Level_3_-_Energy_and_Sustainable_Development/BESOordinanceUpdated_20170329.pdf.

BESO applies to homes and commercial and multifamily buildings. It requires registered energy assessors to perform energy assessments of homes at the time of sale. Typically, the home seller arranges and pays for the assessment. However a unique feature of BESO is that the home seller can receive a deferment that transfers the assessment requirement to the home buyer, who must fulfill this requirement within 12 months after the sale and bears the assessment cost. In addition to listing energy savings opportunities, the assessments link homeowners to incentive programs for energy efficiency improvements offered by utilities, such as Energy Upgrade California. The assessment uses software developed by the US DOE and yields an HES. Improvements are voluntary. Utility efficiency programs also support a home upgrade advisor service for the entire Bay Area; that service contacts any homes that receive an HES of 6 or less and provides individualized support for financing and program participation.

Berkeley's Office of Energy and Sustainable Development administers BESO. Home energy scores are compiled and available on the city's website. This information must be provided to prospective buyers and tenants unless a deferral is obtained. Noncompliance results in a citation fee.

BESO's guiding principles are that the ordinance should be easy, affordable, and valuable. The ordinance's goal is to increase the transparency of home energy use and efficiency in housing markets. Home buyers can use this information as a factor in their purchase decisions; homeowners can use it to identify the best opportunities for improving the energy efficiency of their homes.

Results

BESO is a relatively new policy. The Office of Energy and Sustainable Development plans to complete an evaluation of BESO and report results to the city officials in the near future. In its first year (2016), 921 homes complied with BESO, which represented 4% of the total building stock of single-family homes (not just those on the housing market). Initial surveys show that 62% of residents find HES easy to understand and 35% find HES to be motivational.

It is difficult to measure and track energy efficiency improvements that have resulted from home energy assessments. The reason for this is because not all such improvements will occur and be tracked as part of utility incentive programs (such as Energy Upgrade California) and data privacy issues pose a barrier to collecting specific program participation information.

Berkeley's CAP is successfully reducing energy use and associated GHG emissions. In 2015, residential energy use accounted for only 18% of total community GHG emissions (residential natural gas was 13% and residential electricity was 5%). From 2000 to 2015, the city witnessed a 19% decrease in residential electricity usage and 31% decrease in residential natural gas usage. The contribution of BESO toward this reduction is not available.

Lessons

A key lesson is that it was critical that BESO use an existing home energy rating tool. In Berkeley's case, this tool was the US DOE's HES software. BESO would not have worked if the city had had to develop its own tool.

A key provision of BESO that differs from other home energy rating policies is that BESO requires the rating at the time of sale, not the time of listing. As noted above, the option to defer and transfer the HES requirement to home buyers is another key difference between BESO and other home

energy rating policies. This option was politically important to gain the support of realtors, who otherwise would have viewed BESO requirements as a possible barrier or delay to completing a sale. In practice, the city has found that this deferral benefits many home buyers. Engaging directly with the home energy assessor can provide valuable guidance to new homeowners for home improvements undertaken after purchasing a property. They can include recommended energy efficiency upgrades with other planned home remodeling. Home buyers also can rely on the established building energy professional who performed their assessments to guide them on the next steps for making recommended upgrades.

To ensure home energy assessment accuracy and quality—as well as to adapt the tool as needed—the city relies on a local HES partner for administration and technical support. The HES partner reviews every submitted report and accompanies home assessors on 5% of their home visits. A challenge has been integrating home energy data with other city data platforms and associated reports such as MLS. Including HES information in MLS is important since such listings are primary resources used by home buyers in shopping for properties. Prospective buyers should be able to compare energy performance information along with the many other characteristics and features of properties listed. This inclusion of HES information in MLS is not yet in place in Berkeley, but the city is working to implement it in the near term.

Berkeley's experience offers a lesson in the timing of home energy efficiency information (Roy et al. 2018). This approach differs from policies enacted by other cities that provide home energy efficiency information at the time of listing, suggesting that either approach can be successful.

AUSTIN, TEXAS: HOME ENERGY ASSESSMENT

Policy

The Energy Conservation Audit and Disclosure (ECAD) ordinance requires energy audits (assessments) and disclosures for all homes and buildings that are served by Austin Energy (the city-owned and -operated utility) and located within Austin city limits. ECAD is part of the Austin City Code[9] and promotes energy efficiency by identifying potential energy savings in homes, businesses, and multifamily properties. The benefits include

- Improving comfort
- Increasing the value and marketability of homes
- Improving indoor air quality
- Saving money and energy

ECAD helps meet some of the goals established in the Austin Climate Protection Plan, such as

[9] ECAD can be found here: austinenergy.com/ae/energy-efficiency/ecad-ordinance/energy-conservation-audit-and-disclosure-ordinance/. Residential provisions of ECAD can be found here: austinenergy.com/ae/energy-efficiency/ecad-ordinance/ecad-for-residential-customers.

- Offsetting 900 megawatts of peak energy demand by 2025 to reduce Austin's carbon footprint
- Reducing the city's carbon dioxide emissions by more than 365,000 metric tons by 2020

The Austin Climate Protection Plan was instrumental in enacting ECAD, which was passed in 2008. The policy's energy savings goals are important components of the energy savings required to meet Austin's overall climate goals; residential energy use accounted for 22% of GHG emissions in Travis County (the county in which Austin is located) in 2013. Austin Energy spearheaded a robust stakeholder process in developing ECAD to gain support and address technical issues such as prioritizing different types of energy efficiency measures given Austin's climate.

ECAD requires home energy audits at the time of listing a property for sale if a house is 10 or more years old. It also requires that audit reports be presented to prospective home buyers before the end of the option period (the period when potential buyers can cancel their purchase contracts). The home seller bears the cost of the audit, which typically ranges from $150 to $275, depending on the property's size and the types and complexity of the home appliances, equipment, and systems. Austin Energy has implemented the program and is responsible for its ongoing management. The City of Austin Compliance Office is responsible for enforcing ECAD; noncompliance with it is a misdemeanor with fines from $500 to $2,000 (the higher range is for commercial buildings).

Results

Between 2009 and 2012, a total of 36,423 homes were sold in Austin, and an average of 64% were in compliance with the residential energy audit requirement. The Austin City Council set a goal that 25% of houses be retrofit based on a high percentage (94%) of audited homes receiving some type of energy efficiency recommendations.

According to the Austin Energy staff members we interviewed, ECAD has raised housing stock performance. Household energy data support this claim: Households in Austin use much less energy than households served by other utilities in Texas. However it should be noted that not all of this difference can be attributed to ECAD, as Austin Energy offers customers a broad portfolio of energy efficiency programs.

Lessons

To pass the ordinance, engaging with and gaining the support of key stakeholder groups was crucial. Austin Energy sought input from stakeholder groups so that it could understand their concerns and develop responses to address them. Initially, Austin Energy proposed requiring certain upgrades identified from home energy assessments but, given opposition from realtors, it settled on requiring only the audits and the resulting home energy reports. Austin Energy continues to facilitate and offer training sessions for realtors on ECAD to ensure that realtors not only understand requirements, but also understand the value that home energy audits create in real estate markets.

Having a qualified pool of home energy auditors is vital for ECAD to function effectively. Austin Energy grew the initial auditor pool through training when the ordinance was first enacted. The utility further expanded this pool with federal funding that became available in 2009 as part of the American Recession Recovery Act.

The timing of the disclosure of energy assessment data was important to allow homeowners enough time to incorporate energy-use information into their decision making. Initially, the ordinance required that audit results be provided before the time of sale. While this information may have been useful to new homeowners in prioritizing what types of improvements to make, the disclosure time did not leave any room for price negotiation based on the audit results. ECAD was subsequently changed to require audit reports to be available at the time of listing.

Conclusion

Homes are the single largest purchase consumers make. Although home energy use and costs vary widely, the numbers are largely invisible to home buyers. Home energy ratings, assessments, and disclosure make energy use and costs visible, letting prospective buyers inform their purchase decisions by comparing the efficiency and performance of various homes. Such transparency can increase consumer demand for energy-efficient homes. The result can be an overall increase in home energy performance in a given market when homes are upgraded to achieve higher energy efficiency.

The energy savings that result from home efficiency upgrades not only save money for homeowners, but also reduce carbon emissions from fossil fuel use. Cities seeking to reduce these emissions as part of their sustainability or CAP can establish policies to require home energy ratings to help meet carbon reduction goals. Experience with home energy efficiency policies is somewhat limited in the United States, but results from the cities that have enacted such policies are promising. These encouraging US results mirror results in Europe, where such policies are more common. As they proliferate, home energy efficiency policies do appear to drive residential real estate markets to higher levels of energy efficiency and reduce a city's carbon footprint.

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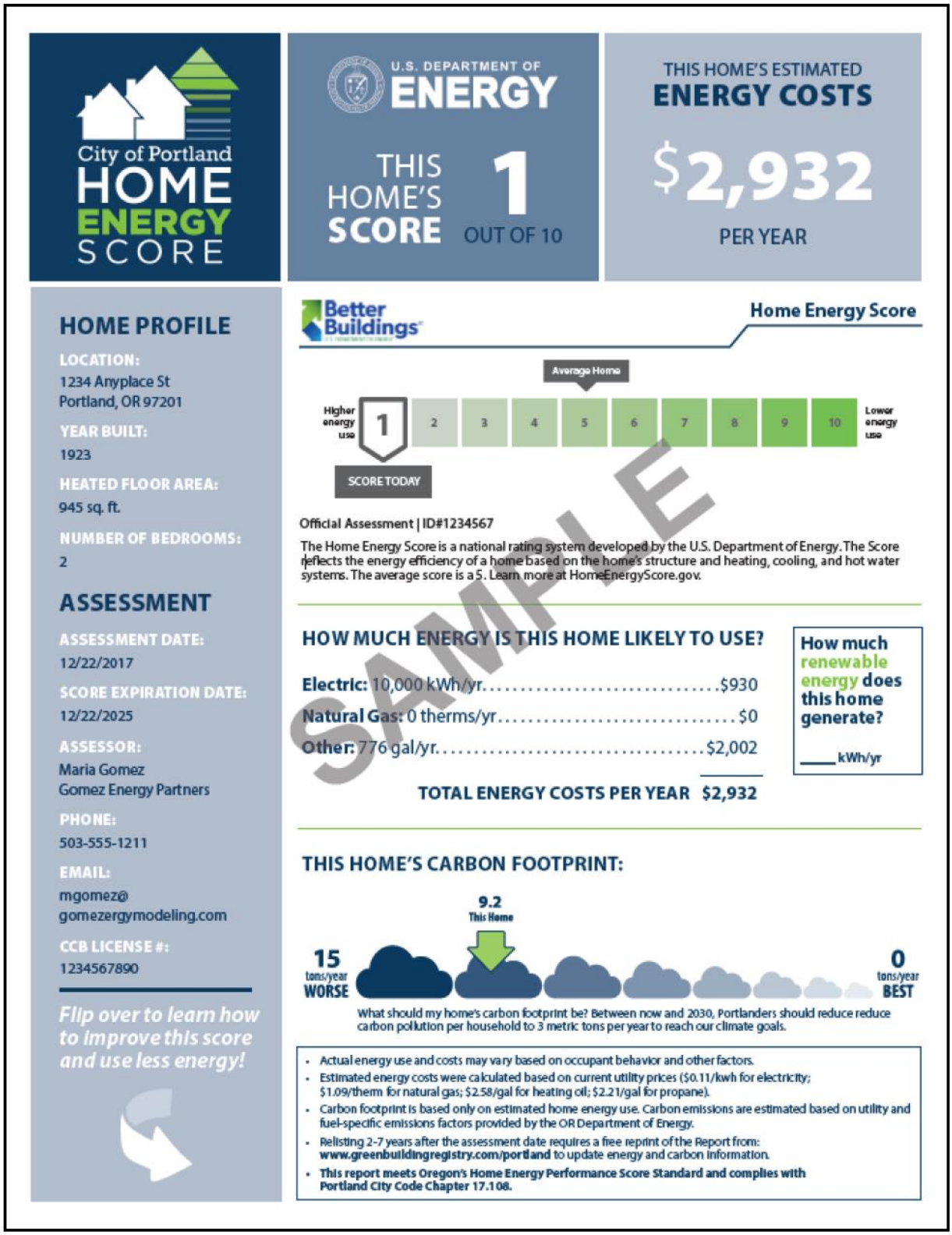
Appendix A. Sample Home Energy Rating from Portland, Oregon



City of Portland HOME ENERGY SCORE

U.S. DEPARTMENT OF ENERGY

THIS HOME'S SCORE 1 OUT OF 10

THIS HOME'S ESTIMATED ENERGY COSTS

$2,932 PER YEAR

HOME PROFILE

LOCATION:
1234 Anyplace St
Portland, OR 97201

YEAR BUILT:
1923

HEATED FLOOR AREA:
945 sq. ft.

NUMBER OF BEDROOMS:
2

ASSESSMENT

ASSESSMENT DATE:
12/22/2017

SCORE EXPIRATION DATE:
12/22/2025

ASSESSOR:
Maria Gomez
Gomez Energy Partners

PHONE:
503-555-1211

EMAIL:
mgomez@
gomezergymodeling.com

CCB LICENSE #:
1234567890

Flip over to learn how to improve this score and use less energy!

Better Buildings

Home Energy Score

Average Home

Higher energy use 1 2 3 4 5 6 7 8 9 10 Lower energy use

SCORE TODAY

Official Assessment | ID#1234567

The Home Energy Score is a national rating system developed by the U.S. Department of Energy. The Score reflects the energy efficiency of a home based on the home's structure and heating, cooling, and hot water systems. The average score is a 5. Learn more at HomeEnergyScore.gov.

SAMPLE

HOW MUCH ENERGY IS THIS HOME LIKELY TO USE?

Electric: 10,000 kWh/yr	$930
Natural Gas: 0 therms/yr	$0
Other: 776 gal/yr	$2,002
TOTAL ENERGY COSTS PER YEAR	**$2,932**

How much renewable energy does this home generate?

____ kWh/yr

THIS HOME'S CARBON FOOTPRINT:

9.2 This Home

15 tons/year WORSE — 0 tons/year BEST

What should my home's carbon footprint be? Between now and 2030, Portlanders should reduce reduce carbon pollution per household to 3 metric tons per year to reach our climate goals.

- Actual energy use and costs may vary based on occupant behavior and other factors.
- Estimated energy costs were calculated based on current utility prices ($0.11/kwh for electricity; $1.09/therm for natural gas; $2.58/gal for heating oil; $2.21/gal for propane).
- Carbon footprint is based only on estimated home energy use. Carbon emissions are estimated based on utility and fuel-specific emissions factors provided by the OR Department of Energy.
- Relisting 2-7 years after the assessment date requires a free reprint of the Report from: **www.greenbuildingregistry.com/portland** to update energy and carbon information.
- **This report meets Oregon's Home Energy Performance Score Standard and complies with Portland City Code Chapter 17.108.**

Score today:	Score with improvements:*	Estimated energy savings with improvements:	Estimated carbon reduction with improvements:
1	9	$1,672 PER YEAR	57% PER YEAR

TACKLE ENERGY WASTE TODAY!

Enjoy the rewards of a comfortable, energy efficient home that saves you money.

- [x] Get your home energy assessment. Done!
- [ ] Choose energy improvements from the list of recommendations below.

  Need help deciding what to do first? Non-profit Enhabit offers free 15-minute phone consults with expert home advisors. Call 855-870-0049.
- [ ] Select a contractor (or two, for comparison) and obtain bids.

  Checkout **www.energytrust.org/findacontractor** or call toll free **1-866-368-7878**.
- [ ] Explore financing options at **www.enhabit.org** or **www.energytrust.org**.

* PRACTICAL ENERGY IMPROVEMENTS | COMPLETE NOW OR LATER

To achieve the "score with improvements," all recommended improvements listed below must be completed. Improvements all have a simple payback of ten years or less and may be eligible for mortgage financing. For a more detailed explanation of costs and payback, please get a bid from a contractor.

FEATURE	TODAY'S CONDITION	RECOMMENDED IMPROVEMENTS
Attic insulation	Ceiling insulated to R-0	Insulate to R-38 or R-49 if code requires it
Attic insulation	Ceiling insulated to R-19	Insulate to R-38 or R-49 if code requires it
Duct insulation	Un-insulated	Insulate to R-8
Duct sealing	Un-sealed	Reduce leakage to a maximum of 10% of total airflow
Envelope/Air Sealing	Not professionally air sealed	Professionally air seal
Heating Equipment	Oil furnace 60% AFUE	Upgrade to ENERGY STAR
Heating Equipment	Natural Gas/Propane Furnace	Upgrade to ENERGY STAR
Wall insulation	Insulated to R-0	Fully insulate wall cavities
Water Heater	Standard electric tank	Upgrade to ENERGY STAR, minimum 2.76 EF (Energy Factor)
Windows	Multiple types	Upgrade to ENERGY STAR
Air Conditioner	None	
Basement wall insulation	None	
Floor insulation	Insulated to R-0	
Foundation wall insulation	None	
Skylights	None	
Cathedral ceiling	None	
Solar PV	None	Visit www.energytrust.org/solar to learn more

YOU CAN DO IT YOURSELF!

Looking for low-cost ways to cut energy waste, boost your comfort and lower your energy bills? Visit the resources below to learn about easy changes you can make today:

www.energytrust.org/tips and **www.communityenergyproject.org/services**