

## Defining Label Components

A building energy labeling program can create a new, custom label unique to a jurisdiction, or can adopt usage of existing labels offered by national home energy labeling programs. Custom labels can help highlight the jurisdiction's program/policy goals by measuring impacts on local energy use, emissions reduced, jobs created, or dollars saved. Stakeholders should consider what information will be most valuable to homeowners and real estate professionals, and best reflect the program/policy goals. States that have designed a custom label found that designing a label that is agreed upon by all stakeholders can be a valuable, but challenging experience (see [Sample Labels](#)).

Designing a custom label has associated benefits beyond simply producing a market-facing product. A custom label specific to a locality can engender a feeling of ownership amongst all stakeholders, from the label designers to the end use consumer. The design process can engage important actors and create a buzz of anticipation and excitement. And once launched, the label will have a certain amount of consensus that will bring it an air of legitimacy.

However, the process of creating a custom label and deciding which metrics to include can take significant time and resources. For this reason, creating a timeline and schedule for developing the label is essential. A decision must be made early on whether the final product needs to be a consensus decision or can be decided by a majority vote. Stakeholders must commit to the timeline up front. The timeline should include firm dates for choosing which metrics to include, and for subsequent drafts. Minimizing the resources spent on label design will free up resources for other aspects of the program. For this reason, recommendations from the EMPRESS team on how to best "harmonize" metrics and measurements generated by Home Energy Score and the Home Energy Rating System (HERS) index software follow. At a minimum, the EMPRESS team believes consistent label elements should be established to ensure comparability between labels, even if multiple implementers are able to deliver labels that display the information differently.

### Background

The EMPRESS team undertook the task of "harmonizing" Home Energy Score and the Home Energy Rating System (HERS) index due to the potential for market confusion caused by the difficulty of comparing information generated by Home Energy Score and HERS. The lack of comparability stems from four sources: 1.) Different scoring systems and scales (Home Energy Score 1-10, HERS 0-100+)<sup>1</sup>, 2.) energy performance measurements, such as MBtu/year or utility costs/year, are different when calculated by Home Energy Score and HERS software, 3.) the assumptions and inputs used in different modeling tools vary, and 4.) non-standard building energy labels presenting different sets of information further hinders the comparisons of homes.

The EMPRESS team's goal was to provide information to facilitate standardizing building energy labeling. For this reason, the Team analyzed various metrics in terms of their ability to support different policy objectives, as well as other factors like durability, granularity, ease of understanding for consumers, cost, and financial industry recognition. No recommendations were created on *how* to display metrics on a label, but by providing information on the strengths and weaknesses of various metrics and their

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<sup>1</sup> Home Energy Score is a 1 -10 score based on absolute source energy consumption where 1 is high energy use and 10 is low energy use

HERS is a 0-100+ score based on relative site energy consumption compared to a reference home where 0 is low energy use and 100+ is higher energy use

ability to support different policy objectives, we hope to help states and other jurisdictions develop labeling programs and labels that facilitate home energy comparisons and encourage home energy improvements. Furthermore, we aim to help Multiple Listing Services (MLSs) and other home service providers to better design, build, and accurately populate their databases. The long-term goal is information consistency to assist real estate market actors (including consumers, lenders, property inspectors, appraisers, jurisdictions and others) by providing data that is easier to compare, understand and interpret. The recommendations and information that follow were developed by the EMPRESS team through internal discussions **and vetted through a large stakeholder engagement process**. The EMPRESS team includes energy office staff from Arkansas, Massachusetts, Missouri, Oregon, and Rhode Island along with other energy labeling experts.

### Introduction to the Label Component Matrix

A variety of energy-related metrics and measurements can be generated by both Home Energy Score and Home Energy Rating System (HERS) software platforms. Examples of these metrics and measurements include estimated annual energy costs, site MBtu per year, and annual greenhouse gas (GHG) emissions. Each draws attention to different aspects of a building’s energy use. For instance, greenhouse gas emissions may motivate environmentally conscious homeowners to improve their home’s energy efficiency while helping the public to connect a jurisdiction’s GHG reduction goal to building energy use. Similarly, an annual energy cost metric may motivate a financially conscious homeowner while simultaneously aligning with an energy cost reduction policy objective.

| <b>Definitions</b>                                                                                                                                                                                       |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>Measure:</b> single unit with single point in time, unit-specific, usually a quantifiable attribute. For example, annual gallons of oil used.</p>                                                  |
| <p><b>Metric:</b> a derivative of one or more measurements, provides broader context by abstracting measurements to be more understandable. For example, a Home Energy Score or a HERS index rating.</p> |

The following matrix describes the effectiveness of currently available metrics and measurements from Home Energy Score and HERS in supporting common building-related energy policy objectives. It also describes metric and measurement characteristics that should be considered when creating a labeling program or policy. States and local governments can use the matrix to help them select those metrics and measurements to be displayed on building energy labels in their jurisdictions.

### How to Use the Matrix

Begin by following the instructions on the left-hand side of the matrix (in the orange cells). First, select one or more primary metrics to include on a label. Descriptions of each suggested primary metric are located in the narrative after the matrix and summarized within the matrix cells. Second, select one or both cost metrics with supporting fuel use and price information. Every building energy label should include a cost metric with a specified timeframe, fuel use and fuel unit price assumptions. Every label should also include all supporting information described in the matrix (i.e. date of issue, tool version, and verification body). Lastly, the supplemental information summarized in the matrix should be considered for inclusion on building energy labels.

The graphic design of a label should be used to highlight the items that are the highest priority for a jurisdiction. The EMPRESS team recommends standardizing a minimum set of information to be included on all labels within a jurisdiction. For example, the state of Oregon created administrative rules

which define minimum requirements and options for home energy labels (see [Case Study 6: Oregon](#) for more information)<sup>2</sup>. States and local governments may choose to highlight and prominently display metrics or information that most strongly support their current policy priorities. In making decisions regarding which metrics to include on a label, we advise that jurisdictions do not preclude or prevent other metrics from being on a label. In other words, a minimum set of requirements is recommended, but limiting what other content can be on a label is not advised.

The common policy objectives and program design considerations included in the matrix were put forward by EMPRESS team members and participating stakeholders. Descriptions of these policy objectives and program design considerations are located below. Descriptions of each metric and other recommended information are also located below the table. Most, but not all, metrics and measurements shown within the matrix currently can be generated by either Home Energy Score or HERS scoring systems.

### Labeling Component Summary

To start designing a label, it is strongly recommended that readers follow the instructions on the left-hand side of the matrix and read all of the corresponding sections in the supporting narrative. The matrix, on its own, does not fully summarize the many details that should be considered when designing a label.

However, the matrix and narrative, when used in combination, are meant to serve as a starting point for jurisdictions as they begin the design process. Working through the matrix and narrative, will not only clarify the recommendations on which metrics and measurements should be included on every label, but it will help raise important questions regarding the pros and cons of other common metrics. The detail provided in the matrix and narrative should lead jurisdictions to seek out other needed information and assistance.

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<sup>2</sup> Oregon administrative rules:  
[https://secure.sos.state.or.us/oard/viewSingleRule.action;JSESSIONID\\_OARD=mqczJC1ntNKIbdDUaeC4L5GckJh2S6id0iVuR7AQa5QgsKpVGBzi!79857996?ruleVrsnRsn=48132](https://secure.sos.state.or.us/oard/viewSingleRule.action;JSESSIONID_OARD=mqczJC1ntNKIbdDUaeC4L5GckJh2S6id0iVuR7AQa5QgsKpVGBzi!79857996?ruleVrsnRsn=48132)

|                                                                       |                                                                                                                                                                                                                                                                                                                                                           | A. Policy Objective                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                              | B. Metric Characteristics                                                                                                 |                                                                                                      |                                                                        |                                                                                       |                                                               |                                                 |  |
|-----------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------|-------------------------------------------------|--|
|                                                                       |                                                                                                                                                                                                                                                                                                                                                           | Greenhouse Gas (GHG) Reductions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Energy Use Reductions & Cost Savings                                                                                         | Use case(s)                                                                                                               | Durable                                                                                              | Granular (Impact on the home to change the score)*                     | Readily Understood by Consumers**                                                     | Cost of Delivery                                              | Finance Industry Recognition                    |  |
| Choose one or more primary metrics                                    | <b>1. Primary Metrics***</b>                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                              |                                                                                                                           |                                                                                                      |                                                                        |                                                                                       |                                                               |                                                 |  |
|                                                                       | <i>Home Energy Rating System (HERS) Index</i>                                                                                                                                                                                                                                                                                                             | Usually Yes--improvement in HERS/HES is generally correlated with GHG reductions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Yes - Directly compares the home's energy & cost to the reference code IECC 2006                                             | Primarily used for new home marketing, programs (e.g., ENERGY STAR) & code compliance; can also be used on existing homes | Somewhat - Index will change when reference code baseline is updated and/or when software is updated | Yes                                                                    | The Index generally requires some explanation by the Rater                            | Generally \$400-1000                                          | Available, but not often used                   |  |
|                                                                       | <i>Home Energy Score</i>                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Yes - Directly compares source energy & cost to the national averages (derived from 2009 Energy Information Agency data)     | Primarily used for existing home retrofit initiatives; can also be used for new homes                                     | Somewhat - Scores will change when underlying score bins are updated and/or software is updated      | Somewhat - generally large improvements are needed to impact the score | The score, while simple in scale, generally requires some explanation by the Assessor | Generally \$200-400                                           | Available, not often used but use is increasing |  |
|                                                                       | <i>Greenhouse gas (GHG) impact</i>                                                                                                                                                                                                                                                                                                                        | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Yes Indirectly-reduction in GHG emissions may be correlated with a reduction in energy use and/or cost depending on fuel mix | New or existing homes                                                                                                     | Generally yes- Subject to changes in fuel and generation mix                                         | Yes - Depends on scale precision                                       | Units new to consumers                                                                | Can be extracted from existing tools, so similar cost to HES. | Not currently                                   |  |
|                                                                       | <i>Site energy use in millions of British Thermal Units per year (MBtu/year)</i>                                                                                                                                                                                                                                                                          | Usually Yes--reduction in MBtu or kWh-equivalent is generally correlated with GHG reductions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Yes - lower Mbtu and kWh-e metrics directly indicate lower energy use and/or cost.                                           |                                                                                                                           | Yes                                                                                                  | Yes                                                                    |                                                                                       |                                                               |                                                 |  |
| <i>Site kilowatt hour equivalent per year (kWh-equivalent/year)</i>   |                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                              |                                                                                                                           |                                                                                                      |                                                                        |                                                                                       |                                                               |                                                 |  |
| Pick a Cost Metric & A Timeframe                                      | <b>2. Cost Metrics</b>                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                              |                                                                                                                           |                                                                                                      |                                                                        |                                                                                       |                                                               |                                                 |  |
|                                                                       | <i>Total Energy Cost (\$/timeframe)</i>                                                                                                                                                                                                                                                                                                                   | Derived from estimated asset-based energy use, not operational (billing) data. This is usually the total annual energy cost for the home. Some programs might choose to display monthly energy costs if they are messaging monthly mortgage and related costs. Programs that want to message longer term energy costs (e.g., costs over the average timeframe for home ownership) may choose to display 10 year energy costs.                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                              |                                                                                                                           |                                                                                                      |                                                                        |                                                                                       |                                                               |                                                 |  |
|                                                                       | <i>Energy Savings (\$/timeframe)</i>                                                                                                                                                                                                                                                                                                                      | Usually annual savings from recommended measures. For example, HES recommends only measures with a 10 year payback or better. Not all systems generate recommendations or savings. New homes scores may not display recommended upgrades. New homes programs can display savings above a standard code home (this home built to code)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                              |                                                                                                                           |                                                                                                      |                                                                        |                                                                                       |                                                               |                                                 |  |
| Support with Fuel Use & Unit Prices                                   | <b>3. Fuel Use and Price</b>                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                              |                                                                                                                           |                                                                                                      |                                                                        |                                                                                       |                                                               |                                                 |  |
|                                                                       | <i>Native Fuel Use by Fuel Type</i>                                                                                                                                                                                                                                                                                                                       | Estimated fuel use in the units a customer would see on their bill. Native units means therms or ccf or decatherms for natural gas, kilowatt-hours for electricity and gallons for oil or propane.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                              |                                                                                                                           |                                                                                                      |                                                                        |                                                                                       |                                                               |                                                 |  |
|                                                                       | <i>Unit Price by Fuel Type</i>                                                                                                                                                                                                                                                                                                                            | Price per fuel in native units, for example \$1.00 per therm, \$0.10 per kWh, or \$2.00/gallon.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                              |                                                                                                                           |                                                                                                      |                                                                        |                                                                                       |                                                               |                                                 |  |
|                                                                       | <i>Annual Cost by Fuel Type</i>                                                                                                                                                                                                                                                                                                                           | Cost of all fuel use in the home, discrete by fuel. Allows homeowners to see what each fuel represents in their energy budget.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                              |                                                                                                                           |                                                                                                      |                                                                        |                                                                                       |                                                               |                                                 |  |
| Include on All Labels                                                 | <b>4. Supporting Information</b>                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                              |                                                                                                                           |                                                                                                      |                                                                        |                                                                                       |                                                               |                                                 |  |
|                                                                       | <i>Date of Issue</i>                                                                                                                                                                                                                                                                                                                                      | Include date of issue as reference point for fuel costs and tool version.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                              |                                                                                                                           |                                                                                                      |                                                                        |                                                                                       |                                                               |                                                 |  |
|                                                                       | <i>Tool Version</i>                                                                                                                                                                                                                                                                                                                                       | Include tool version number for reference.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                              |                                                                                                                           |                                                                                                      |                                                                        |                                                                                       |                                                               |                                                 |  |
|                                                                       | <i>Verification Body</i>                                                                                                                                                                                                                                                                                                                                  | Include body responsible for issuing label, such as local provider or verifier with QC oversight responsibilities (reference RESO).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                              |                                                                                                                           |                                                                                                      |                                                                        |                                                                                       |                                                               |                                                 |  |
| Other Information to Include to Help Explain and Substantiate Metrics | <b>5. Supplemental Information</b>                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                              |                                                                                                                           |                                                                                                      |                                                                        |                                                                                       |                                                               |                                                 |  |
|                                                                       | <i>Reference Case</i>                                                                                                                                                                                                                                                                                                                                     | Including reference case(s) as indicators can help consumers to better compare homes. For example, including references such as a zero-net energy home or an average home within the specified jurisdiction, can help consumers understand a home's relative performance. In other words, the consumer may not understand what a MBtu/year metric means, but with reference case(s), the consumer could know if a home was better or worse in relative terms.                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                              |                                                                                                                           |                                                                                                      |                                                                        |                                                                                       |                                                               |                                                 |  |
|                                                                       | <i>Recommendations</i>                                                                                                                                                                                                                                                                                                                                    | Provide any home performance, energy saving, health and safety, building durability and other recommendations to provide guidance and suggestions to home owners/buyers to make improvements.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                              |                                                                                                                           |                                                                                                      |                                                                        |                                                                                       |                                                               |                                                 |  |
|                                                                       | <i>Conditioned Floor Area</i>                                                                                                                                                                                                                                                                                                                             | Information on the conditioned floor area of a home allows for better, more accurate, comparisons with other homes by providing a basis for normalization.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                              |                                                                                                                           |                                                                                                      |                                                                        |                                                                                       |                                                               |                                                 |  |
|                                                                       | <i>Year Built</i>                                                                                                                                                                                                                                                                                                                                         | Year built can help predict the performance of a home because it dictates the building code standards used during the home's construction.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                              |                                                                                                                           |                                                                                                      |                                                                        |                                                                                       |                                                               |                                                 |  |
|                                                                       | <i>Home Features</i>                                                                                                                                                                                                                                                                                                                                      | Listing key features such as energy efficiency HVAC systems or extra insulation can help consumers to connect the estimated energy performance of a home to the home's physical assets. Such knowledge can encourage consumers to appreciate and maintain their most important energy-saving features. For energy professionals, this information can provide insight into some of the assumptions used for calculated metrics such as estimated MBtu/year. This information can also support local energy efficiency programs by providing both home energy auditors and home owners with knowledge about existing assets.                                                                                                                                                                                                                                                         |                                                                                                                              |                                                                                                                           |                                                                                                      |                                                                        |                                                                                       |                                                               |                                                 |  |
|                                                                       | <i>Site vs. Source Energy Use</i>                                                                                                                                                                                                                                                                                                                         | The metrics described above use site information in their calculations. However, there are several efforts by DOE, Home Energy Score, California and others that aim to reduce greenhouse gas emissions and costs system-wide. Tracking system-wide reductions in emissions and costs requires metrics to be based on source calculations. However, this adds complexity and can cause confusion for the general public. In addition, it may act to disengage homeowners since reducing source emissions or costs, in contrast to reducing site emissions or costs, is often out of a homeowner's control. Therefore, it is not recommended that metrics indicating source emissions or costs be primary or secondary metrics. The inclusion of this type of information on a label would primarily be for the benefit of state or federal-level program/initiative administrators. |                                                                                                                              |                                                                                                                           |                                                                                                      |                                                                        |                                                                                       |                                                               |                                                 |  |
|                                                                       | <i>New Future Asset &amp; Operational Metric</i>                                                                                                                                                                                                                                                                                                          | In the future, a metric may be established that considers both asset and operational information for a home. All metrics currently listed in this table are based on asset information only. If a combination asset and operation metric is established, consumers would benefit from understanding both what systems are within a home and how they are currently operating.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                              |                                                                                                                           |                                                                                                      |                                                                        |                                                                                       |                                                               |                                                 |  |
|                                                                       | <i>Other Certifications</i>                                                                                                                                                                                                                                                                                                                               | Include any energy efficiency and green building program certification information, including but not limited to local program certifications, ENERGY STAR, LEED, National Green Building Standard, etc.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                              |                                                                                                                           |                                                                                                      |                                                                        |                                                                                       |                                                               |                                                 |  |
| <i>Translations from other score</i>                                  | Any metric can be translated into a "grade" or other simplified "binned metric" such as A-F or 1-10. The A-F approach is currently used in Europe and in some real estate portals; HES uses the 1-10 scale. Often kBtu/sq. ft. is used as the basis for an A-F grade. It is important that the basis of the grade or binned metric be noted on the label. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                              |                                                                                                                           |                                                                                                      |                                                                        |                                                                                       |                                                               |                                                 |  |

\*How sensitive the score is to retrofits - i.e. will small changes impact the score?

\*\*This Metric Characteristic also includes the level of recognition by an average consumer.

\*\*\*Assumes a common calculation engine is used for all metrics.

## Column Headers:

### A. Policy Objectives

Policy objectives refer to the desired outcomes of a home energy labeling policy. While the two objectives considered, “greenhouse gas reductions” and “energy use reduction and cost savings” have similarities in terms of outcome, there are differences in steps that may be taken to achieve each. A greenhouse gas (GHG) reduction goal may have a greater focus on “beneficial electrification” or the shift from fuels such as natural gas, propane or heating oil to electricity or increasing the number of net zero energy homes, while a goal focused on energy use reduction and cost savings may target fuel switching from heating oil to natural gas or increasing insulation.

**Greenhouse Gas Reductions:** For states and localities with the goal of specifically reducing GHG emissions through improved building design, efficiency, and installed renewable energy systems, a greenhouse gas impact metric directly addresses this policy objective. Site MBtu/year, kWh-equivalent/year, HERS and Home Energy Score can be correlated with greenhouse gas emissions, but are a step removed.

**Energy Use Reductions & Cost Savings:** For states and localities with the goal of reducing energy use or costs for consumers, energy cost reductions can be achieved by increased building energy efficiency, fuel switching and, in some cases, renewable energy installations. A lower site MBtu/year, kWh-equivalent/year, HERS index rating or Home Energy Score directly indicates lower energy use and/or cost. A lower GHG impact metric can indirectly signify reduced energy use and/or cost, but the relationship depends heavily on changes to the fuel mix.

### B. Metric Characteristics

This section describes various characteristics that should be considered when choosing a metric(s). Specifically, this section explains what is meant by the following characteristics: use case(s), durability of the metric, granularity of the metric, how readily understood the metric is by consumers, the cost of delivering the metric, and whether the metric is recognized by the financial industry. The matrix includes information about each metric in terms of these characteristics, and this information should be considered, together with the overall program design, when choosing a metric(s).

**Use Case(s):** the types of homes – either new or existing single family residential – that usually receive the metric and/or can receive the metric, along with information on common delivery programs.

**Durability:** the ability of the metric to facilitate “apples-to-apples” comparisons between buildings over time, assuming no building asset changes are made during that time — i.e., the metric can be used to compare homes regardless of when the metric is generated as long as no asset upgrades or changes are made. If an energy upgrade is completed, it is assumed that a new building energy label would need to be generated. Metrics that would change depending on when they are generated (either because the metric itself relies on making a comparison or because it relies on underlying information that changes over time (like energy prices) are generally less durable.

**Granularity:** the ability of the metric to reflect small differences in energy usage – i.e. will small changes in energy use impact the metric value upward or downward. This can be an important consideration for retrofit programs and is largely affected by the scale<sup>3</sup> used to display a metric on a label.

**Readily Understood by Consumers:** the ability of the metric to be easily understood by consumers without additional education/explanation. Note that most, if not all, metrics, can be made more understandable by providing a point of comparison (such as an average home) on the label. The comments included under this category also address customer recognition levels.

**Cost of Delivery:** the cost of delivering a metric to a consumer for a single home. The values are approximate, shown in 2017 U.S. dollars, and assume that the home assessment needed to generate the metric is completed separately from construction. In some cases, a builder or contractor may bundle multiple home assessments together to reduce costs below what is shown in the matrix.

**Finance Industry Recognition:** the availability of financing products that specifically consider the indicated metric in their underwriting. HERS has been available to Energy Efficient Mortgages products for many years, but lack of promotion and cost of HERS ratings has been a barrier to market uptake. The HomeStyle Energy mortgage loan helps lenders offer affordable financing to borrower improving efficiency in their homes. It is available to all Fannie Mae lenders. For home purchases, FHA Energy Efficient Homes Policy was enacted in 2016 to include the Home Energy Score. Homes with an HES of 6 or better can stretch their debt-to-income ratio two percent, allowing them more buying power toward an energy efficient home. Historically, HERS has been recognized by both federal agencies and local lenders. Home Energy Score has also been recognized by federal financing agencies. Recognition of particular metrics and rating systems will continue to evolve over time and should be considered locally depending on which lenders and programs are interested in offering beneficial financing products.

#### Rows:

##### 1. Primary Metrics

Primary metrics can help drive the building market toward net zero homes, strategic electrification, solar installations, and increased energy efficiency. The five primary metrics identified in this effort are the Home Energy Rating System (HERS) index, the Home Energy Score, greenhouse gas impact, site energy use in millions of British Thermal Units per year (MBtu/year) and site kilowatt hour equivalent per year (kWh-equivalent/year). These primary metrics have been selected because they are strong indicators of both a building's annual greenhouse gas emissions, and of a building's energy use.

The matrix includes an evaluation of the primary metrics based on the following metric characteristics: durability, granularity, ease of understanding by consumers, cost of delivery, and financial industry recognition. Common use cases are also summarized. Please see the Further Discussion of Primary Metrics section for more information

The two energy scores, HERS and Home Energy Score have been included because they provide a relatively simple way to compare homes. HERS ratings are mostly applicable for new home and/or code compliance programs which can reduce energy costs through improved energy efficiency. In contrast,

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<sup>3</sup> In this case, scale refers to the precision of the unit used to display a metric on a label. For example, a greenhouse gas impact metric can be displayed in units of metric tons, tens of metric tons, hundreds of metric tons, the number of cars taken off the road per year (which according to the EPA is about 4.7 metric tons of carbon dioxide per year), or some other unit. Some units or scales will show smaller changes in greenhouse gas emissions than others.

Home Energy Scores are primarily used for existing homes and are therefore most effective in improving the energy efficiency of home retrofit projects. The remaining three primary metrics – greenhouse gas impact, site MBtu/year and site kWh-equivalent/year – are calculated directly from total energy use values without normalizing for home size. For this reason, they are indirect indicators of energy efficiency and costs, and there is no guarantee that decreases in these metric values equate to dollar savings.

## 2. Cost Metric & Timeframe

It is recommended that all labels include a cost metric with a specific timeframe. Cost values are easily understood by consumers without additional explanation and can therefore be a useful piece of information for consumers to help with home comparisons. In general, costs are calculated based on current energy rates and may be derived from either asset or operational data. Modeling tools that produce a HERS rating or Home Energy Score score produce this metric from asset-based data. A cost metric, whether energy savings or total annual energy cost, does not normalize for factors such as home size. Because these values will change as energy prices fluctuate, it is important for this metric to be tied to a label's date of issuance. Fuel use and fuel price information should also be included on the label to allow for this metric to be updated with current energy prices (see next section). The timeframe (e.g., per month, per year, per 10 years, etc.) for the metric should also be clearly indicated. In some cases, a monthly timeframe may be preferable, especially if a program is relating costs to monthly mortgage or other types of expenses. In other situations, yearly or even ten-year timeframes (to represent the average length of time that people stay in their homes) may be more appropriate to use given that most people live in homes for about this period of time.

**Asset:** Data based on design and physical characteristics, reveals intrinsic energy performance not how its operated.

**Operational:** Data based on actual energy use, normalized for building size and type, and weather.

## 3. Fuel Use and Price

Information describing fuel use in native fuel units (e.g. gallons of propane or heating oil) and fuel price assumptions are critical to include on all labels. This information can help explain how total energy use and total energy costs were estimated. This information also provides greater transparency regarding calculated metrics. It is recommended that the timeframe used to show fuel use in native fuel units and fuel price be the same as the timeframe selected for the cost metric(s) described above.

Total annual estimated costs by fuel type should also be included on labels to allow homeowners to see what each fuel represents in their annual energy budget. When annual cost by fuel type is presented on an energy label, the homeowner is able to determine which fuels are driving their annual energy costs. Moreover, the cost impacts caused by variable fuel prices and energy use over time can become clearer.





## Further Discussion of Primary Metrics

The primary metrics are: the Home Energy Rating System (HERS) Index, the Home Energy Score, Greenhouse Gas Impact, site energy use in millions of British Thermal Units per year (MBtu/year), and site kilowatt hour equivalents per year (kWh-equivalent/year).

1. **Home Energy Rating System (HERS) Index:** This metric or score conveys a home's energy efficiency relative to the 2006 International Energy Conservation code and can be used for indicating code compliance. HERS uses an asset-based energy model that compares the home as designed (the "rated home") against the same home built to 2006 IECC standards, considered the "reference home", which would score 100. The rated home then either gains or loses 1 point for every 1% difference from the reference home. So, a home that uses 50% more energy than the reference home would score 150 and a home using 50% less energy would score 50. A zero-energy home that uses no energy (through efficiency and renewables) and saves 100% of the reference home's energy would score a 0. Lower is better<sup>4</sup>. The score is most often used by builders complying with building energy code through the Energy Rating Index (ERI) pathway in the International Energy Conservation Code (IECC), the ENERGY STAR program, or by contractors who are competing based on energy efficiency in new construction. Some lenders may also recognize HERS ratings and provide favorable financing. RESNET and the U.S. Department of Energy determined that a typical resale home scores 130 on the HERS Index.<sup>5</sup>

**Policy Objectives:** In general, a HERS Index score is quite applicable for new home programs and code compliance verification given its level of detailed inputs and favorable characteristics for program design consideration. Therefore, it can be quite effective for code compliance or to drive new homes towards energy efficiency levels that exceed base code. It is also the only approach available at time of writing for compliance with the Energy Rating Index pathway for performance-based energy code compliance under the 2015 and 2018 International Energy Conservation Code (IECC).<sup>6</sup> Using the HERS Index score can have a positive influence on greenhouse gas emissions, although the connection is indirect. HERS tools also generate greenhouse gas emission values as a tool output which, if included on a label, can support a greenhouse gas reduction policy objective.

### **Metric Characteristics:**

*Use Case(s):* HERS Index scores are often used by programs marketing high-performance new homes (e.g. ENERGY STAR), and to support code compliance. They can also be used on existing homes, although it is more common to use HERS Index scores for residential new construction.

*Durability:* HERS Index scores are based on the 2006 IECC. As long as the 2006 IECC reference home marker is not changed in the future, HERS ratings should remain relatively durable over

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<sup>4</sup> RESNET. Understanding the HERS Index. <http://www.hersindex.com/understanding>. Accessed November 30, 2017.

<sup>5</sup> RESNET. A Lower HERS Index Score Means a More Energy Efficient Home. <https://www.resnet.us/hers-index-large-scale>. Accessed November 30, 2017.

<sup>6</sup> RESNET. Energy Rating Index Performance Path. Frequently Asked Questions. [http://www.resnet.us/uploads/documents/RESNET\\_Energy\\_Rating\\_Index\\_FAQ\\_Factsheet.pdf](http://www.resnet.us/uploads/documents/RESNET_Energy_Rating_Index_FAQ_Factsheet.pdf). Accessed November 30, 2017.

time. However, HERS ratings standards have regularly been modified over the years, resulting in shifting methodologies and home scores. Even as recently as 2017, new standards have gone into effect that have a marked impact of the durability of HERS ratings when house-size factors were applied to the standards.

*Granularity:* In terms of granularity, HERS Index scores can show relatively small changes in energy usage, but these small changes may not necessarily equate to noticeable energy cost savings. For example, lighting and appliance upgrades often do not affect a home's HERS Index score. Therefore, it is recommended that consumers also have an energy cost metric to accompany a HERS Index score, especially when retrofit projects are being implemented.

*Readily Understood by Consumers:* In general, consumers do not understand a HERS Index score without additional information or education. The fact that the scale is based on an energy code baseline and lower values equate to better building energy efficiency usually needs to be explained. However, the score is widely recognized by the building industry and code officials throughout the U.S.

*Cost of Delivery:* The cost of a HERS Index score can vary widely depending on the situation. The cost, in 2017 U.S. dollars, often ranges between \$400-\$1000 for single ratings. Since HERS scores are often applied to new construction, it is common for the cost of the rating to be bundled into the overall construction costs, thereby minimizing its perceived cost. In addition, the rating cost can usually be reduced if multiple homes are rated at the same time ("batch ratings").

*Finance Industry Recognition:* There are several financing products currently available that recognize energy savings from HERS Index scores in their underwriting considerations. RESNET, the HERS Index oversight body, lists the following on their website<sup>7</sup>: Federal Housing Administration, Veterans Administration, Fannie Mae and Freddie Mac. There may also be some local lenders that recognize HERS ratings and provide special financing. However, these products are not well known nor are they widely utilized.

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<sup>7</sup> <https://www.resnet.us/energy-mortgage>

Sample labels that included HERS:



**System and score:**  
HES = 8 (or HERS = 65)

Figure 2: Scorecard used with Missouri's Home Energy Certification program that includes a HERS Index Score and a Home Energy Score  
Image Source: <https://energy.mo.gov/energy/mhec> Accessed on 2/22/2018

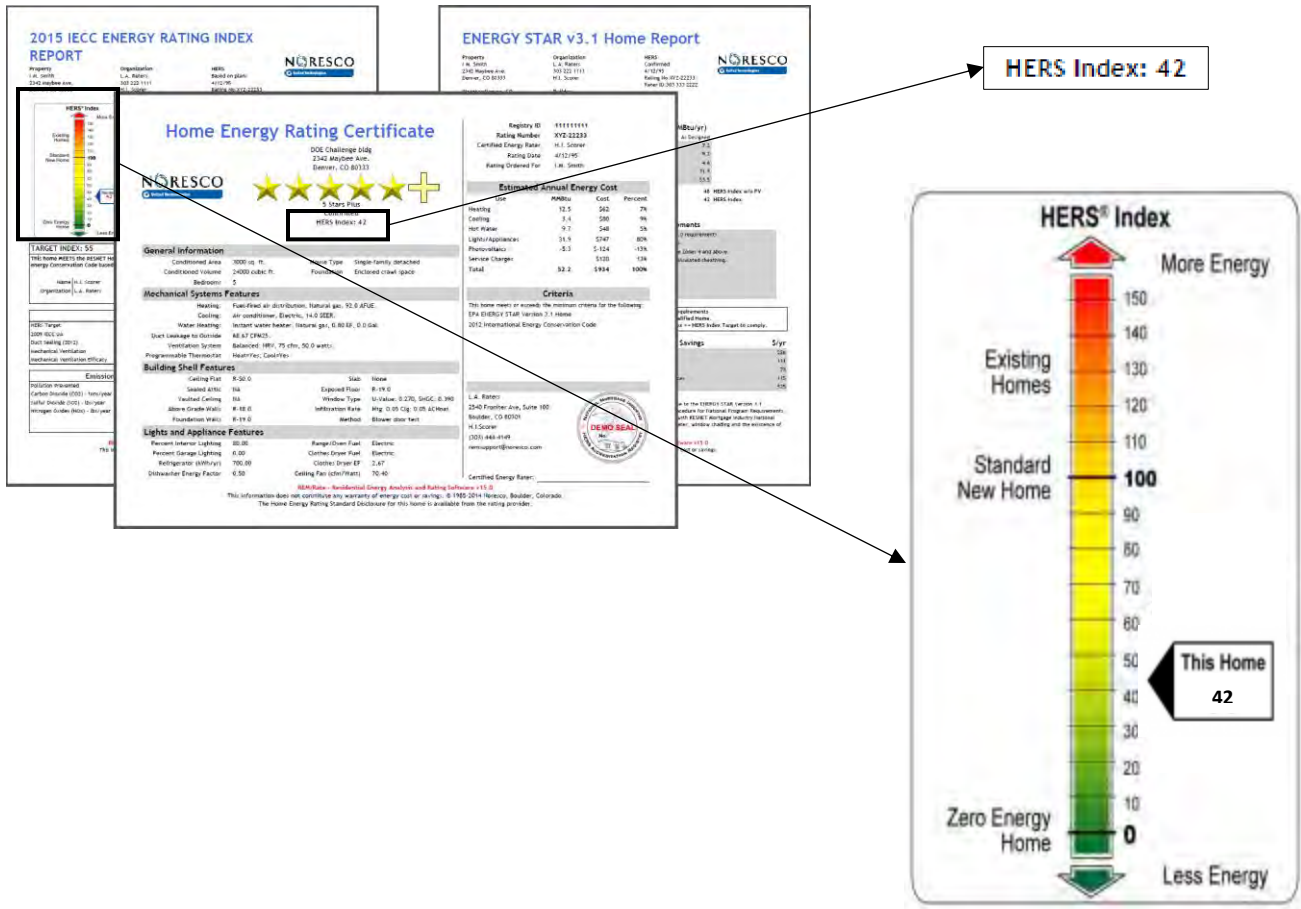


Figure 3: Sample Home Energy Rating Certificate from REM/Rate that clearly highlights the HERS Index score  
 Image Source: <http://www.remrate.com/> Accessed 2/2/2018

- Home Energy Score:** This metric or score conveys a home’s efficiency through a 1 to 10 scale. The model used to generate the score is an asset-based energy model abstracted to “bins” (a band of energy use, similar to how the letter grade A represents a score of 90-100) or deciles based on source energy calculations. A score considers heating, cooling and hot water end uses and normalizes for weather and home occupancy. This score is most often provided for existing homes (versus new construction) and is provided as part of DOE’s Home Energy Score program, which provides consumer-facing materials about energy efficiency. Scores are generated from asset-based absolute energy use. The score is also recognized by the U.S. Department of Housing and Urban Development (HUD) Federal Housing Administration’s (FHA) [Energy Efficient Home \(EEH\) Policy](#).

**Policy Objectives:** Home Energy Score is used primarily for home retrofit initiatives (versus new construction). The score can showcase certain energy efficiency improvements and home retrofits. Therefore, it can theoretically drive existing homes toward energy efficiency improvements and cost savings. This in turn, can have a positive influence on greenhouse gas emissions, although the connection is indirect. The Home Energy Score tool also generates greenhouse gas emission values as a tool output which, if included on a label, can support a greenhouse gas reduction policy objective.

### **Metric Characteristics:**

*Use Case(s):* Home Energy Scores are often used by existing home retrofit initiatives. They can also be used on new homes, but it is more common to see an older, existing home with a Home Energy Score.

*Durability:* The Home Energy Score scale is structured by DOE so that a home with average estimated annual energy use when compared with U.S. housing stock, no matter the climate zone will receive a score of 5. Therefore, as the single family residential building stock's average energy efficiency changes, the "bins" used for the 1-10 scale may be adjusted, which suggests that this metric is not highly durable. Although the future frequency of these changes is unknown, the bins have been modified through updated versions of the scoring methodology three times, most recently in 2016. This may cause long-term comparability problems between homes scored before and after scale adjustments are made. Scores are based on EIA's Residential Energy Consumption Survey (RECS) from 2009. As with HERS, enhancements to the underlying software tool may affect the scores.

*Granularity:* In a similar fashion, Home Energy Score is only considered to be a somewhat granular metric because small changes in energy use are often not reflected in the score. This is a result of having only 10 bins, and that scores only change from improvements that have an impact on a home's overall energy use. For lower to middle bin homes a significant change in energy efficiency is needed to move a home from one bin to another. For example, replacing an exterior door or a few windows often would not affect a score. Additionally, because the tool utilizes a small number of simplified inputs (which reduces the cost of delivery), small improvements such as partial wall insulation may not be reflected in the tool data entry.

*Readily Understood by Consumers:* The 1-10 scale is readily understood by consumers due to its simplicity. Moreover, it is associated with the U.S. Department of Energy, a federal agency that may add credibility to a label. However, it may not be transparent because consumers do not know how "bins" are set, or what it means that the score is based on source energy. Therefore, the energy assessor usually needs to deliver a brief explanation along with the score.

*Cost of Delivery:* In 2017 US dollars, one could expect to pay about \$200-\$400 for a Home Energy Score assessment and report. Generating a Home Energy Score requires less data than generating a HERS rating. Therefore, it can often be less expensive. However, the consumer likely bears Home Energy Score costs, while HERS costs are often bundled into a new construction project's costs. When Home Energy Score is integrated into existing Efficiency Programs and software tools, delivery costs may be significantly reduced. However, initial software integration costs need to be considered.

*Finance Industry Recognition:* Home Energy Scores are recognized by the U.S. Department of Housing and Urban Development (HUD) Federal Housing Administration's (FHA) Energy Efficient Home (EEH) Policy. However, this product is relatively new, and not yet well utilized by consumers. For home purchases, FHA's Energy Efficient Homes Policy allows homes with Home Energy Score of 6 or better to stretch their debt-to-income ratio by two percent.

**Sample label that included a Home Energy Score:**

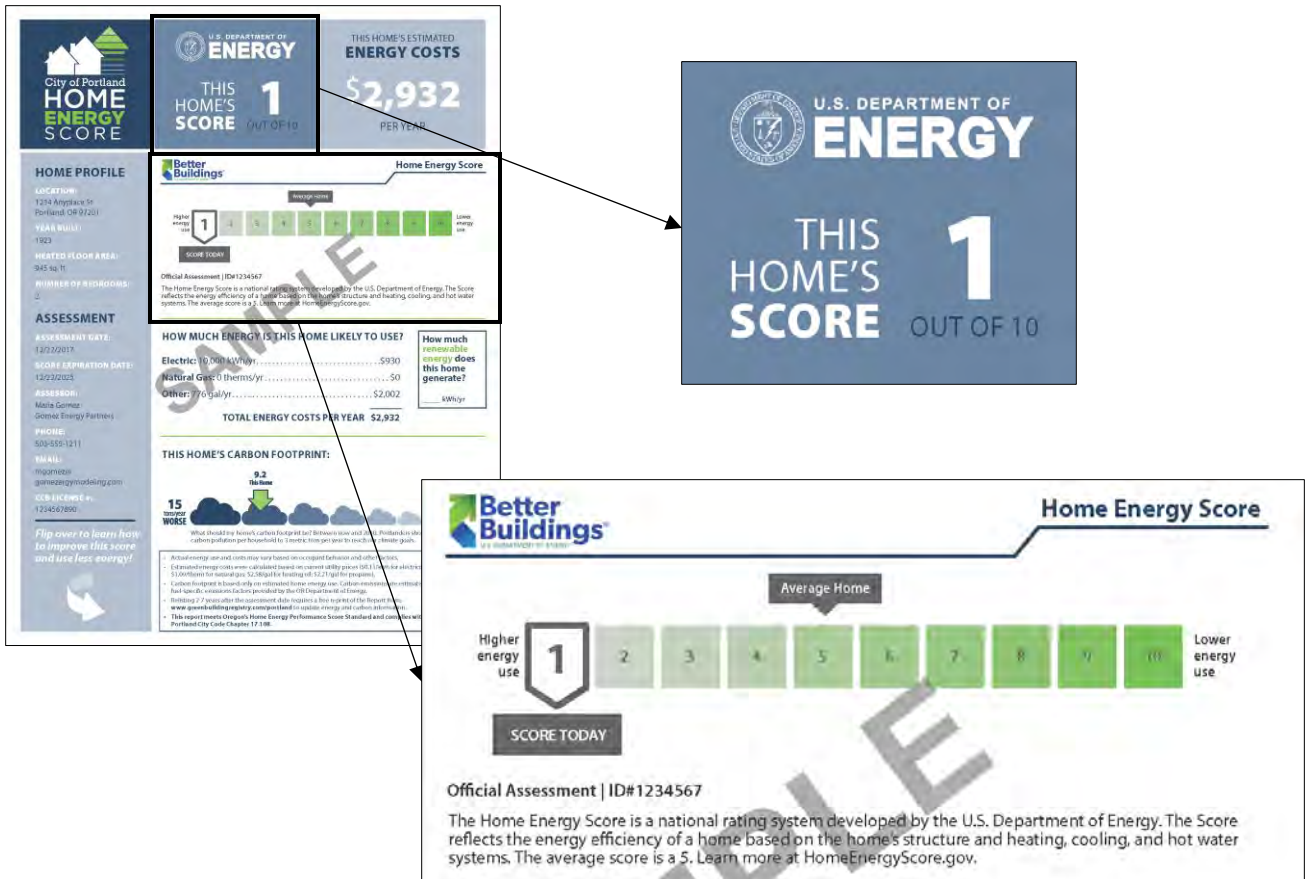


Figure 4: Sample building energy label from the City of Portland that clearly highlights the Home Energy Score  
 Image Source: <https://www.portlandoregon.gov/bps/71421> Accessed 2/22/2018/

- Greenhouse Gas Impact:** This metric shows a home’s total annual site energy use converted into greenhouse gas emission units. The units displayed can be adjusted depending on a jurisdiction’s preference. For example, metric tons of CO2 equivalent is commonly used, and this can be displayed graphically by clouds, number of cars, or another graphic representation. Modeling tools that produce a HERS rating or Home Energy Score can produce asset-based greenhouse gas emission values. This metric does not normalize for factors such as home size.

**Policy Objectives:** This metric supports greenhouse gas reduction policy objectives. It is a metric that can help to raise awareness of greenhouse gas emissions associated with residential buildings. Both the Home Energy Score and HERS tools can generate greenhouse gas emission values as a tool output. A greenhouse gas impact metric can also help drive energy use reductions and cost savings, although the connection is not direct.

**Metric Characteristics:**

**Use Case(s):** This metric can be generated by both Home Energy Score and HERS software. Therefore, it is commonly applied to both new and existing residential homes.

**Durability:** Greenhouse gas emissions are affected by how a home’s heating and water heating fuel mix and a location’s electricity supply changes over time. Assuming that heating and water heating fuels don’t change, then a changing electricity generation mix would be the primary factor that could change greenhouse gas emissions over time. If the fuel mix and renewability of electricity generation changes for the region, then the greenhouse gas emission estimate will no longer be accurate for a home.

**Granularity:** A greenhouse gas impact metric is dependent on the scale<sup>8</sup> used on the building energy label.

**Readily Understood by Consumers:** Consumers may not understand a greenhouse gas emission metric if it is not presented in an intuitive, simple manner. Common methods include number of cars taken off the road or trees planted.

**Cost of Delivery:** Both Home Energy Score and HERS scoring tools can generate greenhouse gas emission values. No additional costs are incurred by including a greenhouse gas impact metric if either a Home Energy Score or HERS rating is already being generated.

**Finance Industry Recognition:** At this time, the EMPRESS team does not know of any financial products that utilize a greenhouse gas impact metric. This could change if carbon pricing is ever implemented at a large-scale.

**Sample label that included greenhouse gas impacts:**

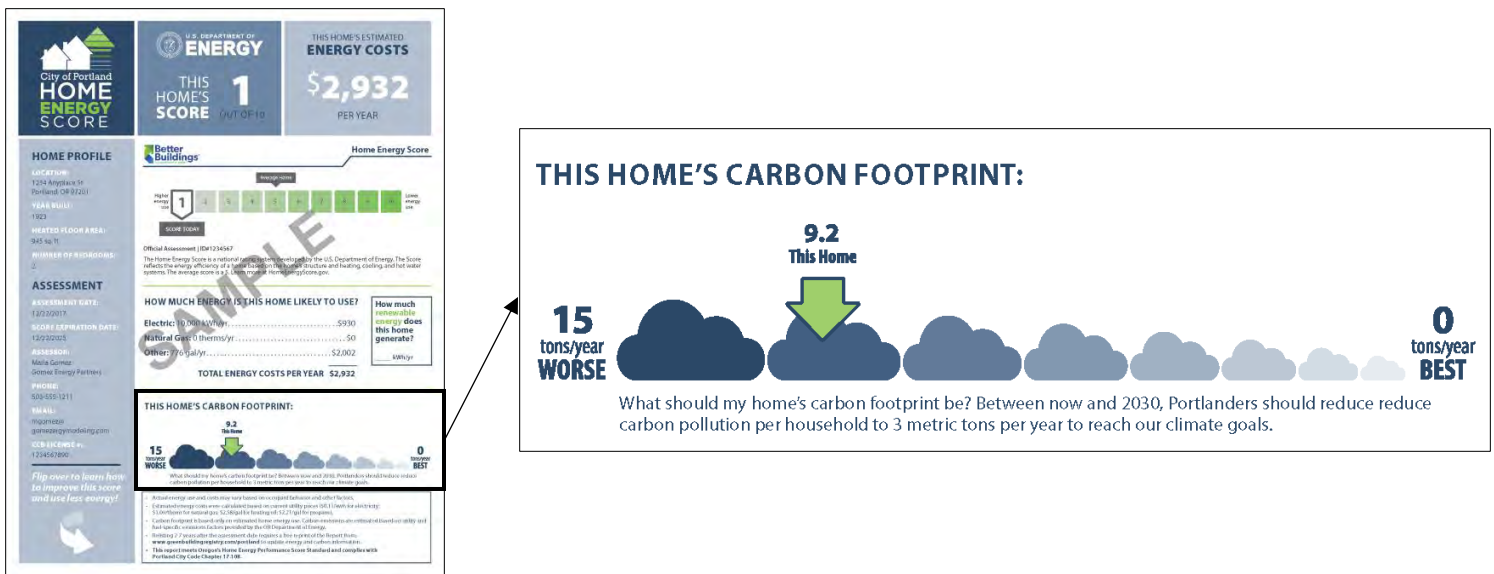


Figure 5: Sample label from Massachusetts’s 2012-2014 Residential Energy Rating Initiative that highlights GHG impacts  
Image Source: <https://www.mass.gov/service-details/home-mpg-energy-performance-scores> Accessed 2/22/2018

<sup>8</sup> In this case, scale refers to the precision of the unit used to display a metric on a label. For example, a greenhouse gas impact metric can be displayed in units of metric tons, tens of metric tons, hundreds of metric tons, the number of cars taken off the road per year (which according to the EPA is about 4.7 metric tons of carbon dioxide per year), or some other unit. Some units or scales will show smaller changes in greenhouse gas emissions than others.

4. **Site Million of British Thermal Units/Year (MBtu/year):** This metric shows a home's total annual site energy use converted into MBtu units. This metric may be derived from asset or operational data. Modeling tools that produce a HERS rating or Home Energy Score produce asset-based MBtu/year values. This metric does not normalize for factors such as home size.

**Policy Objectives:** Both Home Energy Score and HERS tools generate MBtu/year metrics as direct outputs. This metric is correlated with greenhouse gas emissions and energy costs, but is not a direct representation of either. It can drive some homes toward renewable installations and net zero energy construction.

**Metric Characteristics:**

*Use Case(s):* This metric can be generated by both Home Energy Score and HERS software. Therefore, it is commonly applied to both new and existing residential homes.

*Durability:* Site MBtu projections for a home will not change over time unless the house characteristics change, which makes this metric quite durable.

*Granularity:* In general, this metric is highly granular and will reflect even small changes caused by home improvements. It provides an absolute scale by which to compare the energy use of homes.

*Readily Understood by Consumers:* The average consumer does not understand what a Btu represents. However, understanding can be increased by providing a point of comparison, such as the site MBtu/year used by an average home or a home built to the energy code in the area and indicating that less is better.

*Cost of Delivery:* Both Home Energy Score and HERS scoring tools generate site MBtu/year values. No additional costs are incurred by including a site MBtu/year metric if either a Home Energy Score or HERS rating is already being generated.

*Finance Industry Recognition:* The EMPRESS team is unaware of any current financial offerings that currently use or reference a MBtu/year metric as part of the financing decision-making process.



Sample label that included MBtu/year:

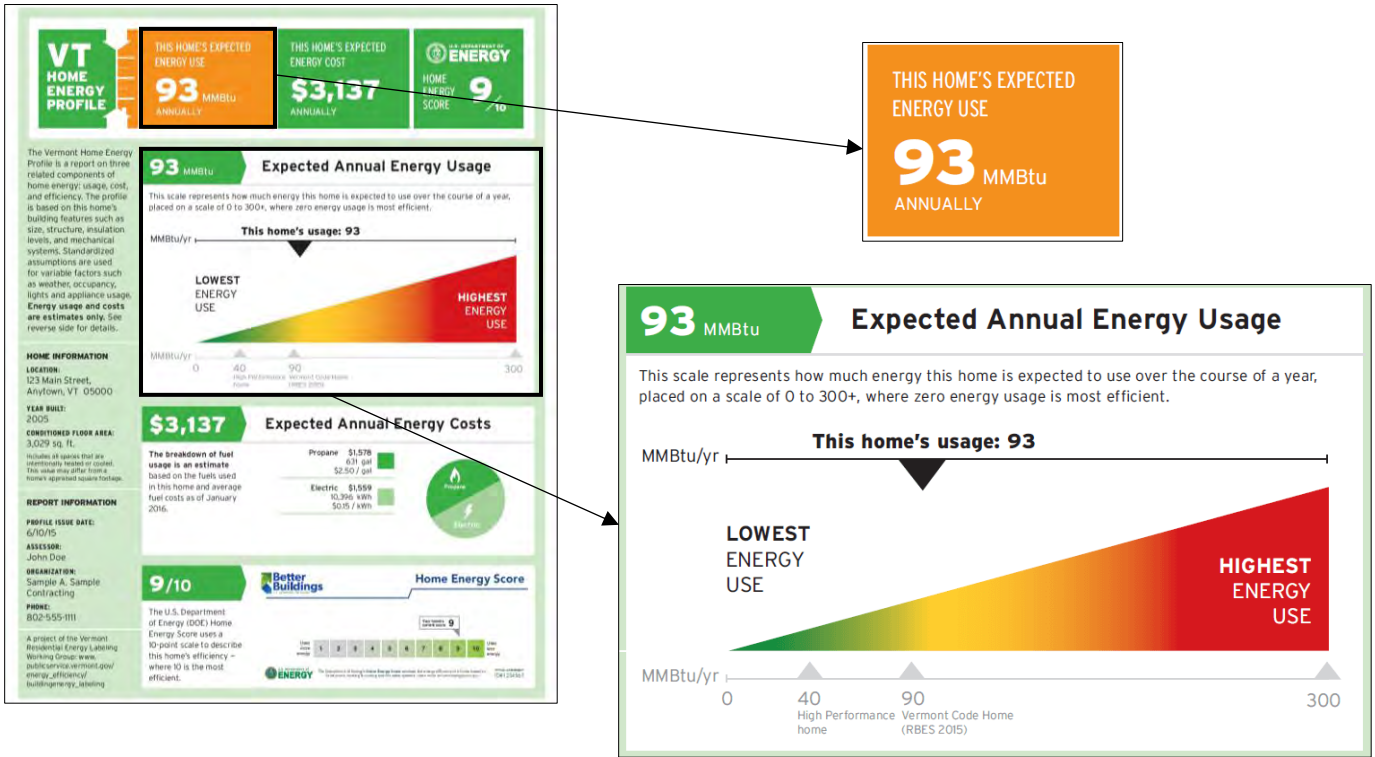


Figure 6: Sample label from Efficiency Vermont that clearly highlights a MBtu/year metric.

Image Source: <https://www.encyvermont.com/news-blog/blog/the-vermont-home-energy-score-a-label-that-matters> Accessed 2/22/2018.

- 5. Site Kilowatt Hour-Equivalent/Year (kWh-equivalent/year):** This metric shows a home’s total annual site energy use converted into kWh-equivalent units. This metric may be derived from asset or operational data. However, Home Energy Score and HERS tools do not currently output this metric, although it can easily be calculated from fuel use per year values which are generated by Home Energy Score and HERS tools. This is also a primary metric in some European countries. This metric does not normalize for factors such as home size.

**Policy Objectives:** In a similar fashion to site MBtu/year, this metric is related to, but is not a direct measurement of greenhouse gas emissions and energy costs. It is a particularly relevant metric for jurisdictions interested in driving the market toward beneficial electrification such as fuel switching from oil heat to high efficiency air-source heat pumps. In some areas, electrification is desirable for greenhouse gas emission reductions with an increasingly or existing renewable-powered grid. In addition, this metric may help to encourage zero net energy construction.

**Metric Characteristics:**

*Use Case(s):* This metric can be generated by both Home Energy Score and HERS software. Therefore, it is commonly applied to both new and existing residential homes.

*Durability:* Similar to site MBtu/year, a site kWh-equivalent/year is a relatively stable metric that should not change unless the characteristics or equipment in the house changes. Therefore, site kWh-equivalent/year should remain a pretty stable metric.

*Granularity:* A site kWh-equivalent/year metric is dependent on the scale<sup>9</sup> used on the building energy label.

*Readily Understood by Consumers:* The average consumer is also unlikely to understand what is meant by site kWh-equivalent although kWh is a familiar unit to any homeowner who pays electricity bills. The average consumer will not understand how other fuels (gas, oil, propane) can be converted into kWh units, but not consumed as kWh. Therefore, further education may be required. However, it is expected that lower values will be understood as better than higher values. In addition, including a reference point, such as the site kWh-equivalent/year of an average home in the area would help consumers to better understand the value presented.

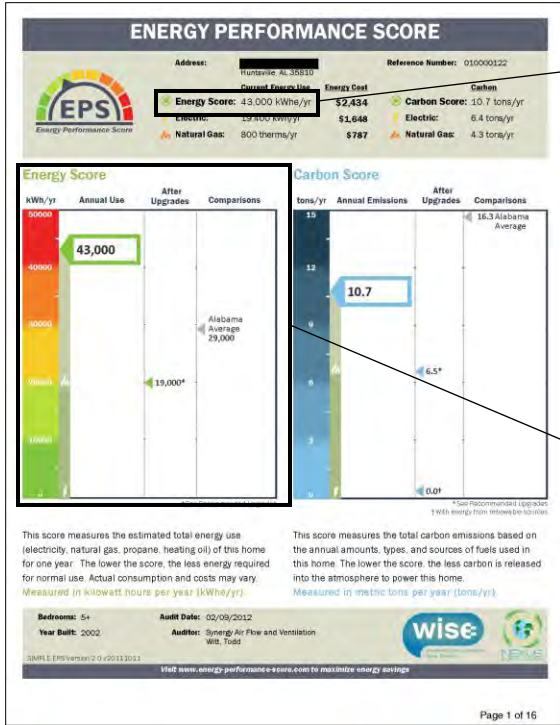
*Cost of Delivery:* Both Home Energy Score and HERS scoring tools generate the data needed to calculate a site kWh-equivalent/year value. Therefore, little to no additional costs are incurred by including a site kWh-equivalent/year metric if either a Home Energy Score or HERS rating is already being generated.

*Finance Industry Recognition:* The EMPRESS team is unaware of any financial offerings that currently use or reference a kWh-equivalent/year metric as part of the financing decision-making process.

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<sup>9</sup> In this case, scale refers to the precision of the unit used to display a metric on a label. For example, an average home uses about 100 MBtu/year which equals 34,120 kWh-equivalent/year. This could be presented in actual kWh-equivalents or per 100 kWh-equivalents, both are somewhat granular. However, if presented per 1,000 kWh-equivalents, it starts to become less granular. Therefore, the granularity of site kWh-equivalent/year is dependent upon the precision used.

Sample label that included kWh-Equivalent/year:



Energy Score: 43,000 kWh/yr

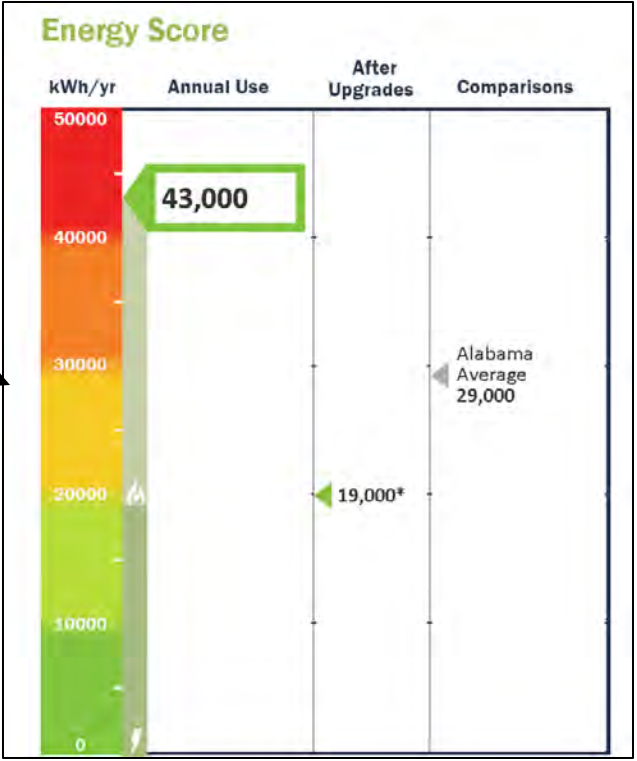


Figure 7: Sample Energy Performance Score (EPS) report label that used kWh-equivalent/year as a primary metric  
Image source: [https://energy.gov/sites/prod/files/2014/01/f6/eps\\_report\\_sample.pdf](https://energy.gov/sites/prod/files/2014/01/f6/eps_report_sample.pdf) Accessed on 2/22/2018