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# **Home Energy Audit and Retrofit Including Home Energy Scoring**

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Report to the Legislature  
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## Executive Summary

During the 2009 session the Washington State Legislature directed the Department of Commerce to “develop and recommend to the legislature a methodology to determine an energy performance score for residential buildings and an implementation strategy to use such information to improve the energy efficiency of the state's existing housing supply”<sup>1</sup>. To meet this request, Commerce has developed a set of recommendations and supporting background.

A home energy score is intended to provide a common metric for home energy use that allows consumers to easily compare the energy efficiency features or expected total energy use of one home compared to another. The label that presents the home energy score is frequently compared to the miles per gallon or MPG sticker required on new cars.

Two home energy scoring programs show market potential. This includes the Energy Performance Score (EPS) developed by Earth Advantage and the Home Energy Score (HES) developed by the U.S. Department of Energy. Both are being tested in large market pilot programs aimed at improving the existing housing market. These scoring methods will likely become the general scoring methods for home energy. Commerce is not recommending adoption of a home energy score at this time to allow further development of these new products.

An effective home energy scoring and labeling method is only one element needed to improve energy efficiency in existing homes. Commerce recommendations for improving the adoption rate of home energy improvements recognize the need to provide consumers with a trusted system for energy auditing, recommendations for improvements, and contractor quality assurance program that includes third party review. Commerce recommends that the state take a coordinating role to promote standardization of these processes throughout the state. As a basis for this program Commerce recommends adopting the program outline developed by U. S. Environmental Protection Agency, “Home Performance with Energy Star.”

This document provides a thorough background on a number of recent developments in home energy scoring methods and home energy retrofit programs. This includes recent federal policy and program design, and existing home energy scoring in Washington. This is followed by a detailed description of several home energy scoring methods. A description of large home energy retrofit programs is also included to support the Commerce recommendation for a coordinated home energy retrofit program.

There is some discussion of cost for both home energy scoring and home energy retrofit program development. An individual home energy score costs approximately \$500 per home.

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<sup>1</sup> ENGROSSED SECOND SUBSTITUTE SENATE BILL 5854 Chapter 423, Laws of 2009, Section 7.

## Introduction

During the 2009 session the Washington State Legislature directed the Department of Commerce to “develop and recommend to the legislature a methodology to determine an energy performance score for residential buildings and an implementation strategy to use such information to improve the energy efficiency of the state's existing housing supply”<sup>2</sup>. This is now codified in RCW 19.27a.180. To meet this request, Commerce has developed a set of recommendations and supporting background.

The majority of this report was produced in 2009. It has been modified with new information reflecting developments that occurred in 2010, including the introduction of new home energy scoring methods and the development of community weatherization programs.

The legislature directed Commerce to seek input from interested parties. During the development of this document Commerce made contact with many interested parties including utility staff, software developers, energy auditors, housing organizations and realtors and conservation groups. In January 2010 Commerce published a review draft and circulated among 63 individuals and organizations that showed interest in this project or held a leadership role in the energy efficiency industry. Responses to the review draft were used in the development of this final report.

In the January 2010 review draft Commerce did not make specific recommendations for the adoption of home energy scoring method. In 2009 and 2010 home scoring methods and supporting software were undergoing a great deal of development with new scoring methods being released as late as November 2010. In the review draft Commerce recommended waiting for these developments to determine if a specific home energy scoring method would be ready for endorsement by the State of Washington.

Since that time two new home energy scoring programs have come to the fore as the best candidates for use in Washington State: the Energy Performance Score developed by Earth Advantage and the Home Energy Score (HES) developed by the U.S. Department of Energy. Both are being tested in large market pilot programs aimed at improving the existing housing market. These scoring methods will likely replace existing scoring methods, such as the Home Energy Rating System. Commerce recommends waiting for further market development and evaluation of these products before selecting a specific home energy score for Washington.

Advancing implementation of home energy improvements need not wait for final selection of a scoring device. Commerce has made recommendations for coordination of existing weatherization program standards. In this report Commerce presents a method for doing this based on the U.S. EPA Home Performance with Energy Star program.

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<sup>2</sup> ENGROSSED SECOND SUBSTITUTE SENATE BILL 5854 Chapter 423, Laws of 2009, Section 7.

## Commerce Recommendations

### Recommendations Regarding Adoption of a Home Energy Scoring Method

- Do not adopt a state specified home energy scoring method in 2011
- Monitor early implementation of two promising new home energy scoring methods. This includes the Energy Performance Score developed by Earth Advantage and the Department of Energy Home Energy Score. Continue implementation of home energy scoring in voluntary energy efficiency programs.

House Bill 5854 Section 7 asks Commerce to determine an energy performance score for residential buildings and an implementation strategy to use such information to improve the energy efficiency of the state's existing housing supply.

A home energy score is intended to provide a common metric for home energy use that allows consumers to easily compare the energy efficiency features or expected total energy use of one home compared to another. The label that presents the home energy score is frequently compared to the miles per gallon or MPG sticker required on new cars.

Home energy scoring and labeling methods have been in existence in the United States for 20 years or more. The older established scoring methods have not gained broad market adoption. Critics of existing scoring methods cite three primary reasons existing energy labeling programs are not broadly utilized. They include:

- Cost. It is thought that the older home energy auditing and scoring methods are overly detailed resulting in long home energy audit time and higher than needed cost
- The score does not convey a message the consumer can understand or act on. As a result, it has not provided valued information
- The home energy score does not accurately reflect the actual energy use of the home so consumers do not trust the information

To revitalize the home energy scoring concept proponents have been active addressing these issues. Beginning in 2009, there was a renewed interest in home energy scoring. This resulted in the creation of revised home energy audit protocols, new analysis software and new home energy labels. This was a development year.

The Energy Performance Score (EPS) developed by Earth Advantage and the Home Energy Score (HES) developed by the U.S. Department of Energy show market potential and will likely become the most widely adopted scoring methods for home energy. Other labels such as the older Home Energy Rating System (HERS) may be phased out.

The Energy Performance Score (EPS) has been in development since 2008 and has been used by Earth Advantage for several years. In 2010 EPS was developed to a stage where it could be implemented by large external programs. It has been selected as a scoring tool for several community retrofit programs in Washington including the City of Seattle's "Community Power Works", Bellingham's "Community

Energy Challenge” and Washington State’s participation in “Catalyzing the National Home Energy Retrofit Market”. EPS is also being used in Oregon for new and existing homes.

Also in 2009, The U.S. Department of Energy was developing a new home energy score as envisioned by the White House white paper, *Recovery through Retrofit*. In November of 2010 the U.S. Department of Energy launched their new Home Energy Score (HES). This scoring method will be used in pilot demonstrations in 10 locations in the U.S., Portland being the only test site in the Northwest. This represents another large pilot program that can be used to evaluate home energy rating as a supporting delivery mechanism for energy efficiency upgrades.

Commerce recognizes that these two programs are the likely candidates for a home energy rating system. At this juncture Commerce recommends allowing early adopters’ experiences with EPS and HES to play out before selecting a reference home performance rating method for Washington State. There are technical differences between the EPS and HES rating systems. Both present good methods for conducting the rating.

Commerce recommends that the primary criterion for selection of a home energy rating be market outcome. This may be evaluated with a range of questions.

- Do consumers implement additional energy efficiency measures as a result of having their homes rated?
- Do appraisers or lending organizations adopt and utilize one rating method?
- Which rating method will be best connected to other energy efficiency support elements such as utility rebates or federal grant and lending programs?
- Can these programs be implemented at a reasonable cost?

It should be noted Commerce is not currently recommending home performance scoring as a mandatory disclosure requirement at time of sale or lease. Our current understanding of rating cost is that it is too high for a broad mandatory program. The cost is in the range of \$450 to \$700 per home. This can be revisited once cost for the two new scoring methods is established in the market.

### **Recommendations for Supporting Home Energy Retrofit Progress in Washington**

- Develop standards, infrastructure and marketing to improve consumer confidence in energy efficiency retrofits.
- Designate a lead coordinating agency for the implementation of a State Home Energy Audit and Improvement program. Washington State University Extension Energy program is the most likely candidate to be designated the program coordinator.

An effective home energy labeling method is only one element needed to improve energy efficiency in existing homes. Commerce recommendations for improving the adoption rate of home energy improvements include providing consumers with a trusted system for energy auditing and recommending for improvements, and designing a contractor quality assurance program supported with third party oversight.

Washington State has many different home energy efficiency programs. They each operate under their own program guidelines and should be respected. But the state could serve to provide a unifying marketing and quality assurance program that increases consumer confidence in these programs. This will benefit the consumer, existing efficiency programs and participating contractors. To support this, Commerce makes the following recommendation.

**Designate a lead coordination agency for the implementation of a State Home Energy Audit and Improvement Strategy.**

This agency shall coordinate:

- standards for the implementation of home energy retrofits
- a certification and referral program for home energy auditors and contractors
- third party quality assurance standards for home energy retrofits
- standard recommendation for energy efficiency features in existing homes
- uniform contractor bid form
- uniform marketing materials to be used by certified auditors and contractors
- standards for reporting and evaluation
- information on available tax incentives, rebates and loans.

Regardless of the home energy score method used, implementation of a program will require infrastructure that supports the consumer. In many cases home energy audit programs fail to deliver efficiency upgrades because the consumer does not connect with all people needed to successfully complete the job, including a certified auditor, contractors and referral to funding sources. The consumer may also need reasonable assurances that the work will be completed in a professional manner. To eliminate these concerns, a third party quality assurance program is recommended.<sup>3</sup>

The U.S. Environmental Protection Agency has developed a program strategy for improving the energy efficiency of existing homes called Home Performance with Energy Star (HPwES). HPwES relies on local sponsors for implementation, such as a utility, local government, or the state energy office. The outline of the activities recommended above is largely based on the strategy outlined in the Home Performance with Energy Star Sponsor Guide<sup>4</sup>. It should be noted that the guide only provides a strategy for program development. Much work must be completed at the local level to fully develop an implementation strategy.

Commerce does not endorse the implementation of HPwES independent of existing home energy efficiency programs in the state. Every effort should be made to create a state program that is inclusive

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<sup>3</sup> "...for many households, the cost of retrofitting continues to present a substantial barrier to increasing home energy efficiency, as does perceived lack of easily available information about payback times, qualified contractors, instructions for do-it-yourselfers." Survey of homeowners: Nevious, Monica J., Consortium for Energy Efficiency, [Why Don't People Save More Energy? Lessons in Motivation from the 1999 Residential Characterization Study of Wisconsin Households.](#)

<sup>4</sup> U.S. EPA, [Home Performance with Energy Star Sponsor Guide](http://www.energystar.gov/ia/home_improvement/HPwES_Sponsor_Guide.pdf), 2008

of existing efficiency programs, auditors and qualified contractors. This state program administrator should use a “big tent” approach.

The coordinating agency should provide leadership and perform all functions that are enhanced through centralization. The program should also be designed so the administrator can assign program duties to qualified organizations including utilities, local government, education institutions and non-profit community weatherization organizations.

To implement a program, funding will need to be identified. An example of a first year program development and pilot program budget developed by EPA is \$418,000 (Table 1). Ongoing implementation costs are higher. Commerce believes this is a reasonable estimate. Commerce assumes some of this funding will be made available through future federal grants.<sup>5</sup> It is also advisable that the program Commerce and the program coordinator seek to build partnerships with utilities or other funded efficiency projects to move this concept forward.

Research has shown that people are most likely to take action to upgrade their home’s energy efficiency based on their motives to save money and increase comfort. Services marketed to consumers and promotional efforts should center on these motives.<sup>6</sup>

## **Background**

### **Federal Policy and Program Development**

Recent federal energy policy has emphasized improving the efficiency of existing housing stock. The national discussion and new federal funding opportunities have influenced regional and state activities in this area. For context this description of federal policy and program initiatives has been included.

There are a number of federal policy initiatives that were recently developed aimed at increasing residential energy retrofit activity. These were developed to reduce energy use and carbon emissions while providing jobs and stimulating the economy. The two notable activities are American Recovery and Reinvestment Act of 2009 (Recovery Act) and a policy initiative developed by the White House, “Recovery through Retrofit.” Both contain elements that are relevant to the subject of home energy scoring and improving the market for home energy retrofits.

Recovery Act funding has allowed for the development and implementation of pilot programs aimed at increasing the penetration rate for home energy retrofits. Many states, including Washington, have implemented community weatherization programs, developed energy efficiency loan loss reserve funds and developed workforce training for home energy auditors. Throughout the nation numerous

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<sup>5</sup> A Department of Energy grant to Commerce, *Multistate Model for Catalyzing the National Home Energy Retrofit Market*, WSU Energy Program and others proposes to implement many of the strategies outlined below in Kitsap County.

<sup>6</sup> “The message seems clear: saving money on energy bills is the primary reason that people engage in activities to save energy, except when it comes to actions that people take to improve the thermal performance of their homes, where comfort considerations take on equal weight.” Pg 34 Pigg, S., & Nevius M., (2000). *Energy and Housing in Wisconsin, A Study of Single-Family Owner-Occupied Homes*, Volume 1: Report and Appendices, November 2000; <http://www.ecw.org/ecwresults/199-1.pdf>

implementation strategies will be tested and evaluated. These programs will provide valuable input for future program designs including demonstration and evaluation of home energy scoring as well as other consumer communications.

Key guidance for the development of federal home energy policies have been articulated in the White House policy document “Recovery through Retrofit”<sup>7</sup>. This document was developed by the Office of the Vice President with input from the Middle Class Task Force Council on Environmental Quality. Released in 2009, the document provided the following set of recommendations for improving energy efficiency retrofit penetration rates. Key recommendations include:

- Develop an energy performance label for homes
- Develop a national home performance measure
- Support municipal energy financing
- Improve energy efficient mortgages
- Expand state revolving loan funds
- Establish national workforce certification and training standards

With respect to home performance scoring, *Recovery through Retrofit* recognizes the need to develop a uniform “nationally recognized home performance measure” for existing homes. This is needed to support the labeling program as well as the financial instruments.

In November of 2009 the Department of Energy and the Environmental Protection Agency initiated a process to define a national energy rating program for commercial buildings and homes. The program outline as published by DOE is as follows:<sup>8</sup>

The National Building Rating program will provide guidance for building energy retrofits based on state-of-the-art cost and performance data and a national, comprehensive energy efficiency rating system for both residential and commercial buildings.

The program outcomes include development of free web based applications for performing the National Building Rating. The tools will be capable of delivering recommendations for specific actionable retrofit measures that meet programs requirements for labeling.

The outline from DOE includes all the possible variations in a rating system and numerous support systems. This includes:

- Asset measurement is a description and analysis of a building’s energy efficiency features such as insulation and heating equipment—systems and structures that use or save energy.

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<sup>7</sup> Office of the Vice President, Middle Class Task Force Council on Environmental Quality, *Recovery through Retrofit*, October 2009. [http://www.whitehouse.gov/assets/.../Recovery\\_Through\\_Retrofit\\_Final\\_Report.pdf](http://www.whitehouse.gov/assets/.../Recovery_Through_Retrofit_Final_Report.pdf)

<sup>8</sup> Memorandum of Understanding on Improving the Energy Efficiency of Products and Buildings Between the U.S. Environmental Protection Agency and the U.S. Department of Energy, September 2009.

- Operational measurement of end-use energy quantification or review of energy consumption. This is typically based on assessment of utility bills. In some scoring schemes the data are normalized for the floor area of the building, number of occupants, etc.
- Benchmarking is a peer to peer comparison based on an operational rating. One building is compared to another building with similar characteristics.

DOE has made progress on the development of a number of these projects. The following elements have been developed and are currently being applied in select pilot projects:

- Developed a home energy performance label
  - DOE has released the Home Energy Score
- Developed a home performance measure
  - Improvement recommendations include in the Home Energy Score
- Supported national retrofit standards
  - DOE released an extensive set of standards, “Workforce Guidelines for Home Energy Upgrades”
- Improve energy efficient mortgages
  - HUD has sponsored a loan loss insurance fund for energy efficiency upgrades called “Power Saver”

Finally, we would like to make note of a federal initiative that has not yet found success. The HomeStar or Retrofit for Energy and Environmental Performance or (REEP) program promoted by the White House has not yet received funding. REEP is the primary federal program proposed for improvement of residential buildings. This language was incorporated into the climate legislation moving through congress, including HR 2454 passed by the U.S. House of Representatives in June of 2009 as well as similar language in the primary U.S. Senate climate change bill.

### **Existing Home Energy Scoring in the State of Washington**

Home energy scoring has been in use in the United State since the mid 1990’s. The programs were originally developed to support qualification for energy efficient mortgages. In more recent years home energy scoring has been used to qualify new homes for the Energy Star label and the energy efficient home federal tax credits for builders. Washington State University Extension Energy Program (WSU) currently supports all these functions by acting as a program administrator for the Residential Energy Services Network (RESNET) Mortgage Industry National Home Rating Standards (HERS). Currently there are 7 certified raters listed by WSU. They complete about 150 home energy ratings a year.

The small number of ratings provided through the WSU program provides evidence that the value of home performance scoring has not been recognized by the general Washington marketplace. The WSU program has not attempted to develop this service for widespread adoption of home energy scoring. Instead this program has used to implement new home efficiency programs. This includes Energy Star and analysis to certify new home tax credits for builders. This is further limited by the strong desire by WSU to implement new home efficiency programs using prescriptive requirements rather than individual building analysis or scoring method. Energy Star for example is almost exclusively

implemented through a checklist approach in Washington. The remaining program functions, energy efficient mortgage qualification, has been provided primarily as a public service.

The WSU RESNET HERS program is a fee based service. The WSU program charges home energy auditors \$200 for administrative overview, required third party quality assurance and software fees. Raters add these fees to what they charge customers for their service. The total cost to the customer is \$500 or more depending on the required reporting details.

In recent months a new home energy scoring method has been introduced in Washington to support the retrofit markets. The Energy Performance Score developed by Earth Advantage and Oregon Energy Trust has been adopted for use by several community based weatherization programs. These programs are just beginning to implement the use of the program. Comments on market acceptance and cost would be premature at this time.

## **Home Energy Score Methodology**

There are two primary methods used to develop building energy scores. One is to base a score on the existing building energy end use or utility bill. The other is to create an estimate of the buildings energy use by auditing the buildings energy efficiency features. The following provides brief descriptions of both.

### **Operational score based on utility bills normalized for building size and occupancy**

Using the existing building energy use to determine a score is a simple but limited method for arriving an energy score. This is called an operational rating. For homes, Energy Star Home Energy Yardstick is a good example of this method. The consumer enters:

- one year of energy use and cost data from utility bills or fuel deliveries
- floor area of the home
- how many occupants reside in the home
- the location of the home using the zip code

A score is generated ranking the home compared to other homes of similar size, occupancy and location. Energy Star Home Energy Yardstick creates this score using broad statistical information on home energy use collected by the U.S. Energy Information Administration. The Home Energy Yardstick method uses a source<sup>9</sup> energy use calculation which has a negative scoring attribute for homes with electric space and water heating.

The primary advantage of this method is that it can be employed at little or no cost. The disadvantage is that energy use and the resulting bills are highly dependent on occupant behavior and do not provide well directed instruction on home energy improvements. Because of this, a home owner with a poor score is directed to seek a more detailed evaluation form a home energy improvement professional.

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<sup>9</sup> Site energy use is the energy measured by the utility meter at the site. Source energy includes energy used to generate and transport energy that is measured on site. For example, the HES scoring method multiplies the site energy by 2.89 to arrive at source energy. Natural gas is multiplied by 1.09.

It is worth noting, Washington State requires the use of a utility billing method for commercial buildings in this state. A commercial building rating tool, Energy Star Portfolio Manager provides a benchmark score based on utility bills and normalization factors common to specific commercial building types. RCW 19.27A.170 requires the disclosure of Energy Star Portfolio Manager Benchmark scores as part of sale, lease or lending documentation. RCW 19.27A.190 requires public agencies to create an energy benchmark for each reporting public facility using Portfolio Manager. For public buildings, if the building has a poor score it triggers additional auditing and improvement.

It is not likely that the adoption of an operational rating will meet the intent for state adoption of a home energy performance score. The score is too dependent on occupant behavior and does not provide good information on the property. It may be adopted as a first step in a tiered approach that would direct home with a high operational score to seek more detailed energy audit and score.

### **Asset Rating: Score based on a detailed inspection of home energy efficiency features**

To implement this method an energy auditing professional completes a detailed energy audit of the home. The information collected during this audit is entered into energy simulation software that creates an estimate of the homes energy use. The energy use estimate is then converted to a score.

This type of scoring method is described as an asset rating. The energy end use simulation holds constant home energy end use that is not related to energy efficiency features of the building. This creates a score based on a limited range of variables including; building insulation levels, window efficiency characteristics, building air leakage, heating, cooling and hot water equipment efficiency.

The most common variable to hold constant are operational attributes, including thermostat set points, hot water use and miscellaneous plug loads. Appliance efficiency is included in some ratings, but left constant in others. Lighting energy may or may not be adjusted for the size of the home.

One normalization factor that varies from one scoring method to another is the size of home. Most methods provide a score based on the home energy use per square foot of floor area. This focuses the score on the efficiency features of the building, not the size of the building. One new scoring method does not adjust the score based on building floor area. The score is per home and will be most closely related to the energy bill for the home.

The advantage of an asset rating or score is that it closely related to the energy efficiency features in the building. Occupant behavior has been eliminated from the scoring criteria. Appliances that may be moved when occupants move are eliminated in some scoring regimes.

Based on the audit conducted for the score, a list of improvement can also be provided by the auditor. This provides consumers with information they can act on to improve the energy efficiency of their home and as a result, the score.

Detailed energy audit and scoring methods come at a cost of approximately \$500. Recent redevelopment efforts for asset ratings have focused on simplifying the audit to reduce cost.

### **Three Asset Ratings Described**

This section describes three home energy scoring products. First, this paper describes the Residential Energy Services Network (RESNET) home energy rating (HERS). The HERS rating has been included because it has the longest history and because it is currently being used in Washington State. Two new home energy scoring products have been included because they are the most likely candidates for a Washington home energy scoring method. This includes the “Energy Performance Score” (EPS) created by Earth Advantage and the U.S. Department of Energy “Home Energy Score” (HES).

#### **RESNET HERS score**

The RESNET HERS score is the most used in the United States. It originated in the early 1990’s and was developed among others as a tool to qualify homes for energy efficient mortgages. The RESNET HERS score became the dominant tool primarily due to the fact that it was selected and used as the official scoring tool for several federal programs, FHA Energy Efficient Mortgage, Energy Star Homes and a federal energy tax credit for new homes.

HERS is a score of the energy efficiency assets of the home. The auditor collects a comprehensive list of energy efficiency details including; building insulation, tested air sealing, heating and cooling equipment, major appliances, and lighting. It includes energy consumption data for small electronics or other miscellaneous plug loads, but these are not considered part of the score. It will provide credit for on-site renewable energy systems. The score is based on the predicted utility energy use for the home under a set of standard operating conditions. Occupant variables such as thermostat set point are intentionally removed from the calculation.

The RESNET HERS score ranges from 0-150 or higher. A score of 100 represents the same home if it had been built to the new home requirements of the 2004 International Energy Conservation Code and appliances that meet federal minimum appliance efficiency standards. Each point change represents a one percentage change in energy use compared to the score of 100. Zero means the home uses no more energy than it generates on site with renewable systems such as residential solar panels or wind turbines. It should be noted that this score is based on source energy use rather than site energy use. This will tend to provide very low scores to homes with electric resistance space and water heating.

There are a number of software providers for this scoring system. All the programs must be calibrated to pass what is called a BESTEST comparison. HERS BESTEST is a verification procedure developed by the National Renewable Energy Laboratory (NREL) in the 1990’s to determine the accuracy and effectiveness of the energy load prediction capability of software tools. The list of software products that can provide the RESNET HERS rating or a federal energy tax credit evaluation includes: EnergyGauge USA, EnergyInsights, REM/Rate, Energy Pro, MICROPAS7.

RESNET HERS programs are available in many States through third party organizations. These organizations have been recognized by the national RESNET organization to provide the local management function.

To qualify as a Residential Energy Services Network (RESNET) HERS auditor, the participant must complete a number of trainings and pass both written and field tests.

The national RESNET HERS program is funded by a combination of member fees and federal grants. Local HERS programs operate as fee based services. Both national and local organizations collect fees for training, certification and for program administration.

Energy efficiency audits conducted to create a HERS rating of an existing home may be used to prepare additional reporting. Computer programs that prepare the HERS score also create list of recommended improvements and may provide cost and cost effectiveness criteria. These are required components of a number of HERS rating programs, most specifically the Mortgage Industry National Home Energy Rating Systems Standards.

### **Energy Performance Score (EPS)**

The EPS has been developed by Earth Advantage with the Oregon Energy Trust. EPS is used to provide scores for new homes as well as existing homes. The EPS was developed and tested in the last few years and is now being selected for broader program implementation. EPS has been selected as a scoring tool for several community retrofit programs in Washington including the City of Seattle's "Community Power Works", Bellingham's "Community Energy Challenge" and Washington participation in the four-state project "Catalyzing the National Home Energy Retrofit Market".

The EPS score is based on site energy use per home. All of the homes fuels are converted to equivalent kWh to provide an energy reporting metric. Carbon emissions from each fuel are also summed and presented on the label. Several comparisons are included on the label. This includes the average energy use of homes in the state and a target home energy use set by carbon reduction policies. An additional comparison is included that represents estimated energy use after recommended efficiency upgrades have been implemented.

An important distinction for this product is that it does not normalize the score based on building size. The EPS score is energy use per home, rather than energy use per square foot of floor area. This is a more direct reflection of the energy bill, but a less direct depiction of the energy efficiency features of the home.

For existing homes, the developer has adopted the use of "Simple", a simplified spreadsheet-based modeling program. Simple has only 32 required data inputs compared to the HERS method which requires approximately 100 data entry points. Simple has been chosen by the developers to reduce audit time while maintaining or improving accuracy of energy end use estimates.<sup>10</sup> This is expected to reduce audit time and cost.

The EPS developers have not specified audit standards for their product. But it is expected programs adopting this method will also adopt nationally recognized auditing standards. Building Performance

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<sup>10</sup> Oregon Energy Trust, Energy Performance Score Findings & Recommendations Report, 2008 Pilot, August 2009, Portland Or.

Institute (BPI) or by a Residential Energy Services Network (RESNET) qualifications are likely to be used as qualifying criteria.

Recommendations for home energy improvements are developed by the auditor and included in a simple report. Recommendations for improvements are reported and prioritized. The auditor describes current building elements as “poor”, “average” or “good” and prioritizes potential for energy savings as “low” or “high”. The cost of efficiency measures are noted as “low” or “high”. Auditors base their comments on experience and recommendation checklists developed by utilities.

Earth Advantage is also developing some supporting infrastructure. This includes a web database to maintain records of EPS scores and a contractor referral web portal.

### **The U.S. Department of Energy’s Home Energy Score (HES)**

HES was introduced in November of 2010. The score was developed in response to the plan outlined in the White House policy paper, “Recovery through Retrofit”. In this policy brief one of the key elements is the development of a “National Building Energy Rating program”. The Home Energy Score was developed to simplify home energy ratings and provide recommendations for home upgrades. The HES is currently being used in pilot programs in ten locations. Modifications may be made in response to pilot results. It is expected to be made more broadly available late in 2011.

The HES is a variation of the web based energy simulation tool Home Energy Saver. This tool has been available on the web for more than 10 years. There is also a more detailed model under development called Home Energy Saver Pro. These tools are developed by Lawrence Berkeley National Laboratory.

Like the EPS, the HES has been developed to provide an accurate assessment of home energy use with fewer auditor inputs than the older programs. The auditor must conduct a brief walk-through of the home and collect about 45 data points. The EPS has limited inputs to key building components, heating, cooling and hot water equipment. Other factors are held constant.

The HES reflects the home's condition as an asset. Based on an audit of primary building features, the software creates an estimate of home energy use. The HES provides a score on a 1-10 scale. The computer simulation estimates the home's site energy use then converts it to source energy use prior to scoring. The home is scored in comparison to other homes of the same size. The 1-10 scale was developed using statistical analysis of existing home energy use. The best score of 10 will require the home to perform better than many new homes. But it does not include the range offered by other products that provide ratings as low as zero net energy use.

The HES also creates a set of improvement recommendations. The improvement report supplies an estimate of measure cost and energy savings. The improvement report is limited to measures with a 10 year or less payback. HES also categorize improvement measures into two categories. Insulation for example can be installed any time. This is compared to the furnace that can be upgraded at time of replacement. The development of cost and savings are fully automated. Cost data from large data sets

makes this possible. This provides the advantage of speed and consistency, but limits judgment calls from the auditors.

To qualify to use the HES, auditors must be certified by the Building Performance Institute (BPI) or by a Residential Energy Services Network (RESNET) and receive a passing grade on DOE's Home Energy Scoring Tool test.

The HES is has been developed with funding from the U.S. Department of Energy. They are expected to continue to support this product into the future. No fees for the use of this product are expected.

## Labels

Figure 1. Energy Star Home Energy Yardstick

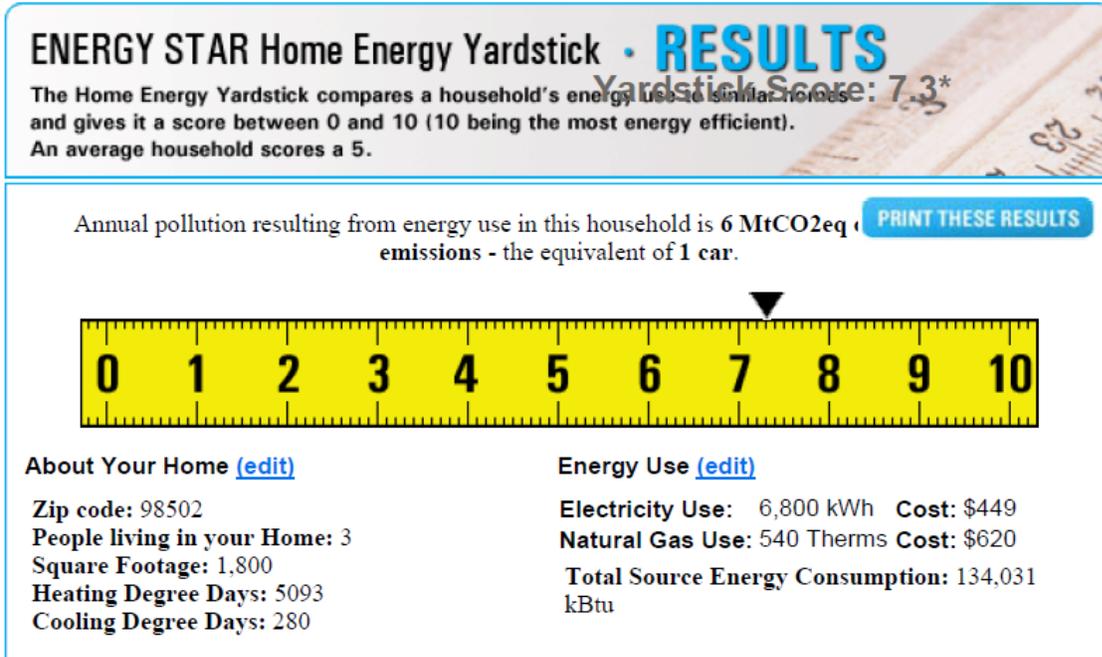


Figure 2. RESNET Home Energy Rating Index

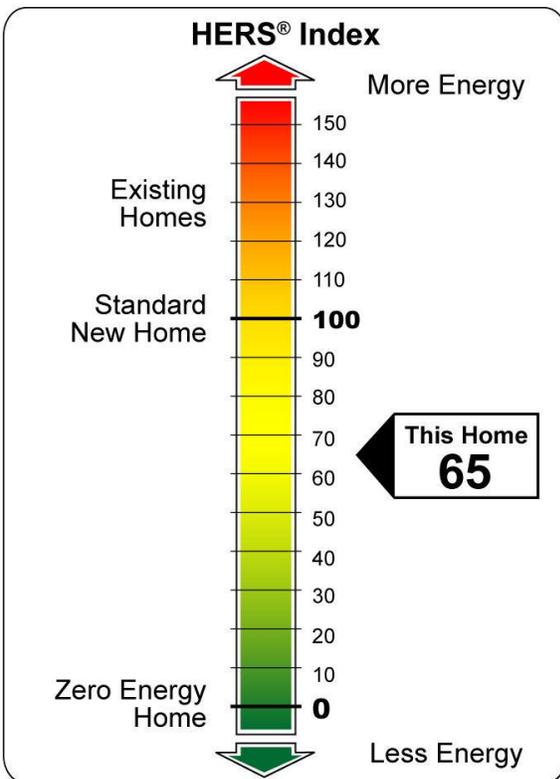
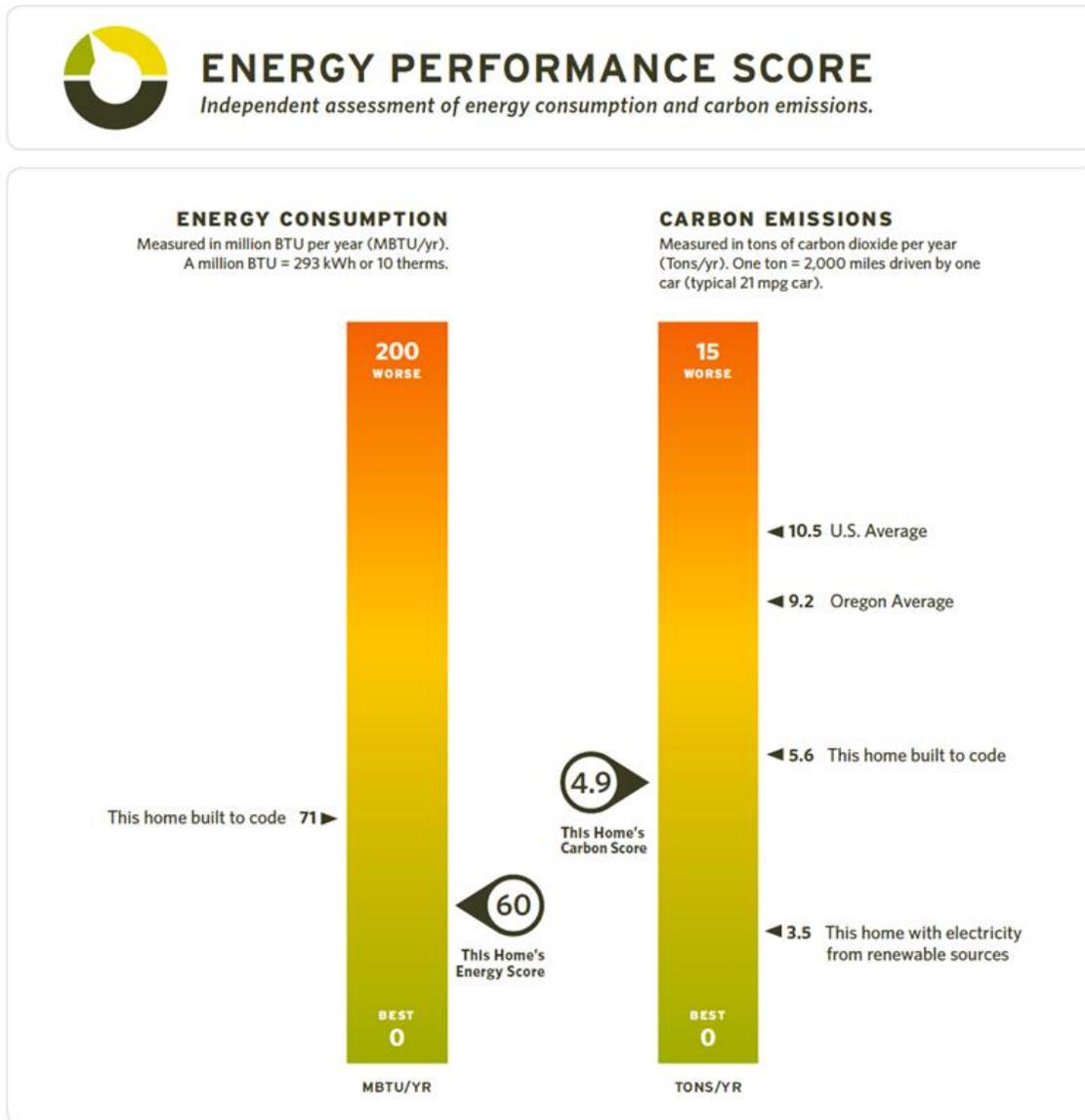


Figure 3. Energy Performance Score

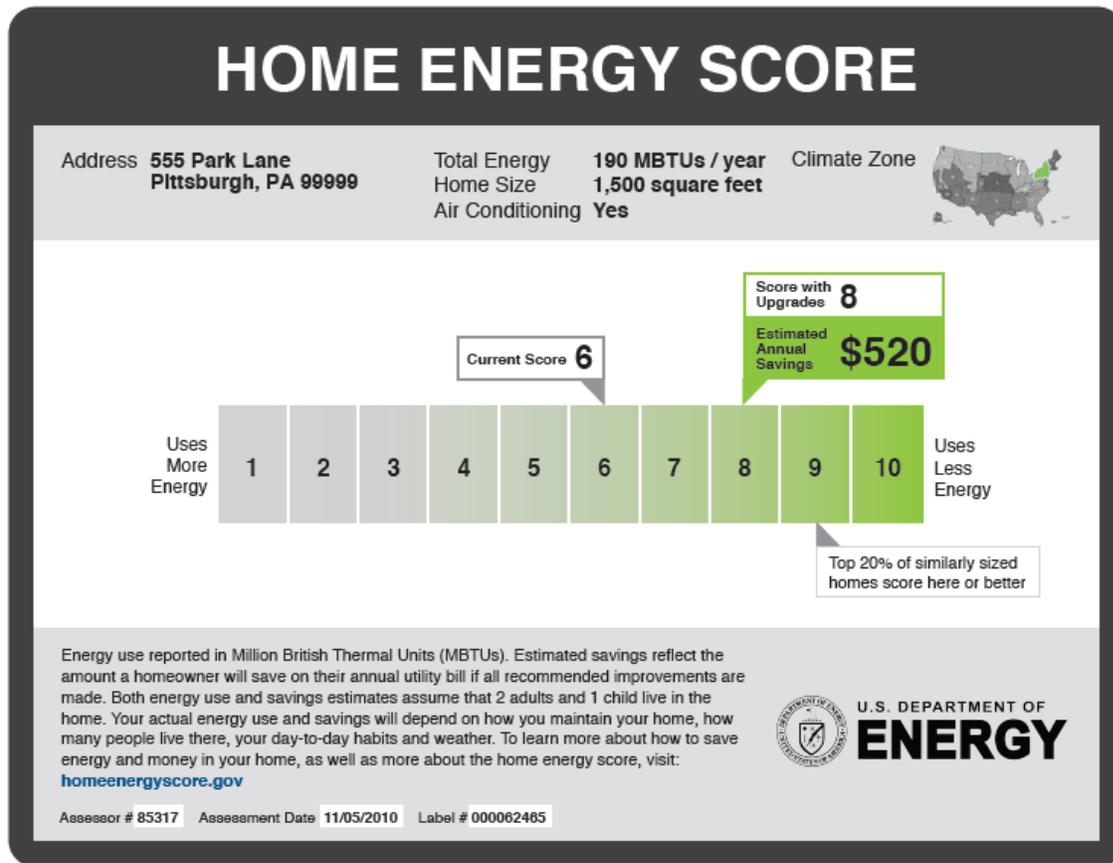


REPORT FOR: This is a sample, not an actual EPS.

<b>ISSUE DATE:</b> 04-06-2009  <b>CONDITIONED FLOOR AREA (SQUARE FEET):</b> 2,000	<b>ESTIMATED ANNUAL ENERGY USAGE:</b> Electric (kWh): 6,834 Natural gas (Therms): 480	<b>IDENTIFICATION #:</b> 9009  <b>TYPE:</b> Single Family	<b>ESTIMATED AVERAGE ANNUAL ENERGY COSTS*:</b> <b>\$1,370</b> monthly average: \$114 <small>* Actual energy costs may vary.</small>
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The EPS is brought to you by Energy Trust of Oregon. Energy Trust makes it easy for homes to identify ways to use energy more efficiently. We provide cash incentives for everything from energy-saving products to insulation to solar energy systems.

Figure 4. U.S. Department of Energy Home Energy Score



### Will scoring change home value in the marketplace?

A home energy score will rank the energy efficiency of one home compared another. This is intended to represent the value to a potential home buyer at time of sale or to a potential renter. It is anticipated that the market value of the more efficient home will be greater than the comparable less efficient home. Only two studies identified by Commerce provided comment on this subject.

There is some evidence that home energy scoring can impact the value to home, but, this finding is limited to one report from Australia. The Australia program has been in place since 1999 and requires a home energy score be available at time of sale. Scores must be posted with advertising. Good enforcement of this standard and the length of time it has been in service lead to widespread implementation. A detailed statistical study that eliminated many other variables was able to establish that there is a very good correlation between the energy efficiency score and the sale price of the home.<sup>11</sup>

Another European study, based on the Danish program, indicated that only 50 to 60 percent of the homes eligible for scoring in their time of sale mandatory program were being scored. Their program

<sup>11</sup> Australian Bureau of Statistics (ABS), Energy Efficiency Rating and House Price in the Act, 2008

has no enforcement and marketplace value was not established in the report. However, it is worth noting that less than half of the program's participants were aware that there was a score connected with their home. And, among those who were aware of scores connected to their homes, their actions to improve the energy efficiency of their homes occurred at the same rate as those who were not aware of their scores.<sup>12</sup>

### **Discussion of energy auditing information other than the score**

A report released by the Department of Energy in 2010, *Motivating Home Energy Improvements* provided consumer feedback on the value of information included as part of home energy audit and scoring reports. The consulting group developing the report used consumer focus groups in six cities to develop the results.

The results were somewhat different for home owners than home buyers. But for both groups the participants were most interested in the list of recommendations to improve energy efficiency, estimated cost savings, and estimated cost of the energy efficiency improvements. The actual energy use of the home and home energy score were of less interest to the participants.

The results of this study are also noted a report by Dunsky Energy Consulting. Owners of existing homes value other energy efficiency information more than they value the home energy score. The energy audit outcomes of most value to consumers is the list of possible improvement measures, cost to install the measures, and an estimate of the energy or money they will save if they implement the energy improvement measure. It has been well established that the absence of these resources pose significant market barriers to consumers when interested in upgrading the efficiency of their homes.<sup>13</sup> This information is provided by many different methods.

For existing homes, it is possible to make a basic set of recommendations that are cost effective for building owners. The major building components in most homes have been extensively analyzed by the U.S. Department of Energy, the Northwest Power and Conservation Council, Bonneville Power Administration and many of the State's utilities. Cost effectiveness has been verified for a large population of homes. For the most part, the resulting recommendations for insulation are determined by the space available in the building assembly. Air leakage control and high efficiency equipment have been analyzed and can be confidently recommended on a wide scale. Figure 5, U.S. Department of Energy Insulation Fact Sheet illustrates the uniform nature of insulation recommendations. There is little variation to the recommendations for the nation, and even less variation when the scope is narrowed to the northern climate zones. Using these established methods, useful and reliable information on both, the recommended measures and energy savings may be presented to the consumer.

A more detailed evaluation of cost effectiveness of individual efficiency measures for each individual home could be conducted using a computerized home energy analysis, like those used by home energy

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<sup>12</sup> Does Energy Labeling on Residential Housing Cause Energy Savings?, Vibeke Hansen Kjaerbye, Danish Institute of Governmental Research, Copenhagen, Denmark, 2008

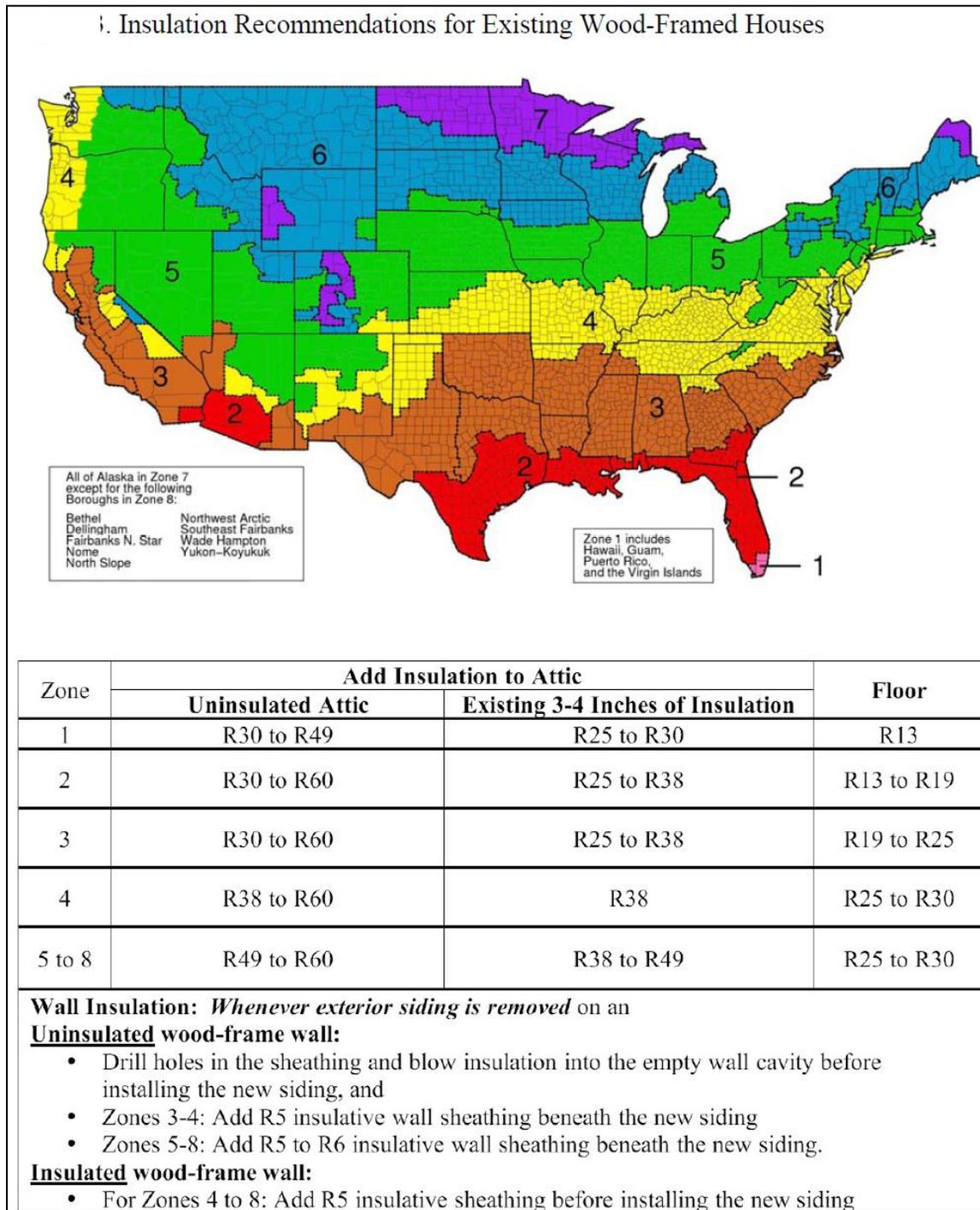
<sup>13</sup> Valuing Building Energy Efficiency through Disclosure and Upgrade Policies, A Roadmap of the Northeast U.S. Dunsky Energy Consulting, November 2009.

scoring systems. However, this method would rarely change the resulting recommendations for minimum features.

The cost of efficiency upgrades are well known in general terms. An auditor can make a reasonable estimate and prepare cost analysis for the consumer, but to move the process along, the consumer will need to obtain actual bids from a contractor.

The one objection Commerce has noted to implementation of this simple method is that it may not satisfy the lending industry for two reasons. The lending industry typically needs to assess energy savings unique to a particular structure and they generally rely upon computer simulations to obtain a life cycle cost analysis. This could be addressed by working with the lending industry to establish acceptable prescriptive lending criteria.

Figure 5. U.S. Department of Energy, Insulation Fact Sheet, Oak Ridge National Laboratory



## **Cost of Home Energy Audit and Scoring**

The cost of a home energy audit and scoring is approximately \$500 per home. This includes the audit, reporting and any administrative fees the home energy auditor pays to the administrative agency.

The Residential Energy Services Network recently published a survey of the cost of home energy scoring. The survey included response from auditors from 16 states. The findings are as follows:

The national average of the cost for inspection and testing and producing an energy performance rating of a home was \$492.00. The costs ranged from a high of \$1,000 to a low of \$165. The range of one standard deviation was \$700 to \$300.<sup>14</sup>

A conversation with Andrew Gordon, the RESNT HERS program administrator at Washington State University Extension Energy Program pegged the cost as something over \$500. This includes the administrative fees WSU charges to run the program. Fees include providing software licenses and third party quality control. WSU charges \$200 per rating for the administration. Mr. Gordon commented that the administrative cost could come down if the program were implanted on a large scale. The RESNET study referenced above estimated a nearly 1/3 reduction in rating charges if the number of scores they performed were to double.

Puget Sound Energy and Seattle City light will be testing the Home Performance Scoring method as part of the City of Seattle's 5000 home audit program. Their program plan documents a cost of \$600 per audit. Participating consumers will be asked to pay \$95 of the cost.<sup>15</sup> The actual cost and outcomes of this program implantation model will be informative to any state program development.

Time studies of auditing and scoring methods demonstrate that some methods can be developed to shorten the audit and analysis time. The Oregon Energy Trust sponsored a pilot study that compared several home energy audit and scoring methods. There were good indications that the auditing and scoring time can be cut substantially. Depending on the audit and scoring protocol, the time spent on this process ranged from a little over one hour to more than 3 hours. However, there is also recognition that these time studies only record a portion of the activities that influence the time an auditor spends on a specific job.<sup>16</sup>

## **Mandatory Disclosure of Home Energy Scores**

Commerce has examined the implementation of home energy scores as a mandatory requirement. We did not conclude that this method should be implemented in the next few years. The main reasons we have not pursued this avenue is cost. We also recommend waiting for Federal policy direction and infrastructure development.

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<sup>14</sup> National Average Cost of Home Energy Ratings, Residential Energy Services Network, Inc. February 27, 2009

<sup>15</sup> City of Seattle, Office of the Mayor, Office of Sustainability & Environment, Department of Planning & Development Seattle Green Building Capital Initiative, April 2009.

<sup>16</sup> Oregon Energy Trust, Energy Performance Score Findings & Recommendations Report, 2008 Pilot, August, 2009.

As stated earlier, a home energy score is a disclosure report that provides a single metric representing the value of a home's energy efficiency features to the consumer. For this to occur in the marketplace there needs to be wide implementation.

Home energy scoring methods have been implanted in Australia and the European Union as mandatory requirements for all housing. In most cases this means mandatory disclosure at time of sale or lease. In many cases this is based on a home energy score.

In 2003, the European Union adopted legislation requiring all Member States to design and implement national, mandatory energy labeling and disclosure laws. Early implementation began in 2006, with all member states beginning compliance by 2009. Commerce did not perform a detailed review of these standards but acknowledge them as possible future references.<sup>17</sup>

The Australia program has been in place since 1999 and requires a home energy score be available at time of sale. Scores must be posted with advertising.

There is evidence that home energy scoring can impact the value to home. This is limited to one report from Australia. Good enforcement of this standard and the length of time it has been in service lead to widespread implementation. A detailed statistical study that eliminated many other variables was able to establish that there is a very good correlation between the energy efficiency score and the sale price of the home.<sup>18</sup> Other programs have not been as successful because of poor enforcement. Denmark has required home energy scoring for as long as Australia, but enforcement was not as rigorous. As a result this program did not create the housing market differentiation based on the home energy score.<sup>19</sup>

The cost of home energy scoring is a major impediment to mandatory adoption of home energy scoring. Once again, to be effective, home energy scoring would have to be implemented at a large scale. The most common approach is to require home energy audits to be conducted at time of sale. In 2007, there were 120,760 home sales recorded in Washington State. At \$500 per audit, the cost to implement this mandatory home energy scoring method would be more than \$60 million per year. Of course there are other methods to more selectively implement a home energy scoring standard. But these would not meet the requirement for success that the programs be nearly universal. For this method to be practical, the cost of the home energy scoring will need to come down.

Infrastructure is not available at a scale that would reasonable service a mandatory home energy scoring method. To implement on the scale suggested, if an auditor were to provide 200 audits per year, Washington would need 600 auditors just to cover time of sale disclosure.

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<sup>17</sup> [Implementation of the Energy Performance of Buildings Directive, Country reports 2008](#), European Commission, Directorate-General for Energy and Transportation, Brussels, 2008. The Directive on the energy performance of buildings (EPBD) is the [Directive 2002/91/EC \(EPBD, 2003\)](#) of the European Parliament and Council on energy efficiency of buildings. The Directive came into force on 4 January 2003 and had to be implemented by the [EU](#) Member States at the latest on 4 January 2006- or by the end of the grace period, 2009.

<sup>18</sup> Australian Bureau of Statistics (ABS), [Energy Efficiency Rating and House Price in the Act, 2008](#)

<sup>19</sup> [Dunsky Energy Consulting, Valuing Building Energy Efficiency Through Disclosure and Upgrade Policies, A Roadmap for the Northeast U.S.](#), A report for Northeast Energy Efficiency Partnerships, November 2009

A very good review of mandatory disclosure of home energy performance was developed for the Northwest Energy Efficiency Partnership report. Individuals interested in a contemporary review of mandatory home energy scoring are advised to read this report.

## **Supporting Home Energy Retrofit Progress in Washington**

A home energy rating or scoring program will not by itself increase penetration rates for home energy improvements. A concentrated effort is required to build confidence in consumers that result in action. This will require a coordinated effort to adopt standard procedures, contractor qualifications, a system of third party review all supported by a marketing campaign. An approach to this has been developed U.S. EPA called Home Performance with Energy Star (HPwES).

In addition, most consider revised approaches to home energy retrofits funding critical to increasing market adoption rates for home energy improvements. This subject is introduced at the end of this section.

Commerce recognizes that many of the elements described here are in place in Washington. Community and municipal energy efficiency programs and utility programs have all adopted many of the features noted below. For this reason, Commerce believes the appropriate state role is to standardize and coordinate these activates to achieve greater scale throughout the state. This will serve as the implementation plan for home energy scores.

### **Implementation Standards**

A consistent approach to assessing the State's housing stock will require standard implementation guidelines to provide adequate direction and to auditors and installing contractors. For many years, weatherization programs have been active in Washington State. There are numerous implementation standards available for implementation. A state program should develop an accepted standards adoption process so these standards can continue to be used with few, if any, modifications. Washington should also consider a standard recently developed by the Department of Energy. Active standards include:

- Utility specific weatherization manuals
- Bonneville Power Administration, "Energy Efficiency Implementation Manual"
- Department of Commerce, "Weatherization Manual For Managing the Low-Income Weatherization Program"
- "Workforce Guidelines for Home Energy Upgrades" recently released by DOE.

### **Auditor Standards, Training and Certification**

To provide quality home energy inspection services, professional qualifications need to be part of any program. Commerce does not endorse any single system, but recognizes that there are a number of good training and certification programs.

There are a number of nationally recognized standards for home energy auditing. These standards are provided oversight by local affiliates. This includes Building Performance Institute (BPI) and the

Residential Energy Services Network (RESNET). In the state of Washington, there is a growing group of affiliates that provide training, certification and third party oversight using these standards. We think it is important to add that BPI is the chosen standard for Washington State Low Income Weatherization Programs. It should be noted that these programs may provide a variety of certifications. The affiliate organizations in Washington include:

#### RESNET

- Washington State University Energy Program, Olympia and Spokane

#### BPI

- Building Performance Center, Bellingham
- Environmental Outreach & Stewardship Alliance, Seattle
- South Seattle Community College, Seattle
- Olympic College, Poulsbo
- Washington State University Energy Program, Olympia and Spokane

It is also important to recognize that many training and certification programs have been initiated by others, primarily utilities. These training and certification programs need to be recognized by the proposed program coordinator.

One good example is the Performance Tested Comfort Systems program endorsed by BPA and many of the state's utilities.<sup>20</sup> This program has trained and certified over 600 professionals to test and seal duct work and to provide advanced commissioning of residential heat pump systems. While this group may not be qualified to perform every auditing task, they are experts at this specific work and will need to be recognized. Other programs may include industry certification for installation of insulation, or utility qualifications for participating contractors.

Licensed home inspectors may also be a good asset for the implementation of home energy auditing. Washington State recently initiated a state training and required licensing for home inspectors. While these inspectors have a different skill set than the nationally certified energy auditors, they have other advantages. To date, there are 356 licensed home inspectors in Washington.<sup>21</sup> They cover a wide geographic area. These inspectors are involved in many of the time of home sale transactions in the state. A possible role for home inspectors could be to identify homes that are most in need of a comprehensive audit. For example, if a home inspector identifies that the home has little attic or floor insulation. This could trigger a more comprehensive energy audit.

#### **Standards for Contractors Supported by Third Party Inspection**

Contractors will be relied on for the installation of most energy efficiency measures. They may also be responsible for much of the energy auditing, communications with building owners, and in the end, be closing the deal. Consumers need to trust this group before they will act. By establishing a third party

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<sup>20</sup> Performance Tested Comfort Systems. <http://www.ptcsnw.com/>

<sup>21</sup> Washington State Department of Licensing special query, as of 9/2009.

quality assurance network, consumers will be able to verify the qualifications of the contractors and will have a method for recourse if there is a dispute.

Third party quality assurance programs are a key element in regional energy efficiency programs. This currently includes the regional Northwest Energy Star Homes program and the older “Super Good Cents” program. Utility specific programs play the same role. The community energy efficiency programs currently being implemented using Recovery Act funding also provide this type of assurance.

Contractors can be supported by recognizing them as trusted sources of information and by assuring the customer that they are qualified to do the work. The HPwES program is structured to provide this enhancement. To participate in this program the contractor must meet minimum qualifications. To provide further assurance, the HPwES program sponsor provides consumers with a centralized method of resolving consumer complaints. To assure that the contractors are doing good work, the program incorporates a random third party inspection and evaluation component.

Other standardization features that could help the consumer include uniform inspection and bid forms. This would allow consumers to evaluate the work to be done and compare contractor bids side by side. Many utilities require uniform audit and bid documents as a basic feature of contractor participation in their program.

### **Home Performance with Energy Star: Linking Consumers with Contractors and Incentives**

Commerce is inserting the program description of HPwES as an example of a large program implementation strategy. A program like this will need to be established to support a state home energy auditing and retrofit program. This will be needed with or without the implementation of a home energy scoring method.

The *Home Performance with Energy Star Sponsor Guide* was used by Commerce in the development of our recommendations for an implementation strategy. This guide only provides a strategy for program development. Much work must be completed at the local level to fully develop an implementation strategy.

HPwES is a labeling program for home retrofit auditors or contractors that meet specific program standards. HPwES is a national program from the U.S. EPA and U.S. DOE and offers a comprehensive, whole-house approach to improving energy efficiency and comfort at home. This program is being used in 26 states. The program is implemented by a program sponsor. Most of the program sponsors are utilities or nonprofit organizations supported by utilities. In four cases, state government is the program sponsor.

HPwES is primarily focused on overcoming consumer concerns about working with retrofit contractors. The program emphasizes contractor qualifications and third party review. This is intended to build the consumers’ confidence in the contractor’s performance. The program is also structured to link contractors and consumers with available rebates or loans from utilities, and government. This program design is intended to create a one stop shopping experience for consumers.

HPwES contractors are required to provide comprehensive home inspections that expand beyond energy efficiency. The program includes inspections for potential mechanical equipment, moisture and indoor air quality problems as well as for energy efficiency. As well as a detailed audit, contractors are to include a prequalification interview and a review of the energy bill. At the end of the inspection the consumer is provided with a detailed report that includes an estimate of the energy savings and recommendations for improvements and their cost.

HPwES does not require a home energy score. The guidance from U.S. EPA directs completion of a detailed checklist report. In this case, efficiency measures are determined to be cost effective at the program level rather than at the individual participant level.

It is worth noting that audits conducted under the HPwES program are primarily conducted by the contractors that will eventually deliver the energy efficiency services. In some cases, program sponsors create a separate auditing organization, but this is not the norm.<sup>22</sup>

As noted in the recommendations essential program elements include:

- standards for the implementation of home energy retrofits
- Adopt a certification and referral program for home energy auditors and contractors
- third party quality assurance standards for home energy retrofits
- standard recommendation for energy efficiency features in existing homes
- uniform contractor bid form
- uniform marketing materials to be used by certified auditors and contractors
- standards for reporting and evaluation
- information on available tax incentives, rebates and loans

## **Marketing**

An element of the Commerce recommendation is to centralize marketing messages for home energy audit and retrofit programs in the state. Marketing will play an important role in moving forward a home energy audit and retrofit program. Marketing for energy efficiency products and programs is very diffuse. There are hundreds of providers. For any one of them to gain the attention of a wide audience is difficult. It comes down to trusted sources concentrating their marketing on a few key ideas.

U.S. EPA has played a major role in providing a marketing tool that provides both credibility and wide spread recognition. This is the Energy Star label. The label is now more than 15 years old and has gained positive consumer recognition. The Energy Star label is likely a good tool for marketing in the state of Washington. Key consideration for Washington State will be the rules that apply to the use of this label. Energy Star has had a recent tendency to include program rules that do not add to program outcomes critical for Washington State. The State must engage in this process to ensure that the Energy Star program is a consistent source of value to the State program.

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<sup>22</sup> Conversation with Chandler von Schrader, Home Performance with energy star program lead.

Another trusted source is Washington State utilities. There are many different utilities in the state and in many cases each employs their own marketing and labeling strategies. One project that brought the industry together was the Super Good Cents program for new homes and manufactured homes. Utilities in the region joined together and used a uniform set of standards and a uniform marketing approach. This resulted in broad market recognition. Currently, the WashWise program operating in the Puget Sound area provides this type of centralization for clothes washer standards and rebates.

### **Funding Energy Improvements**

Funding energy efficiency improvements is a complex subject needs more detailed treatment than is considered by this project. Other efforts in Washington State and nationally are working to break free additional funding. This represents only a short overview of these efforts.

The primary funding source for home improvement is the homeowner. Another major contributor will be utilities. Utilities frequently provide grants, rebates and loans. For 2009 - 2011 federal energy tax credits will provide additional incentives. But to complete a comprehensive energy retrofit project, the consumer will still provides the majority of the funding. For major energy retrofit measure such as insulation and air sealing, utility and government incentives only cover part of the cost. Developing methods that allow consumers to capitalize future energy savings is thought to be key to improving the penetration rates of energy efficiency home improvements.

Many utilities encourage conservation by offering homeowners services (such as energy audits or use assessments) and financial assistance (such as rebates, grants and low interest loans). A listing of available incentives statewide is provided on the Database of State Incentives for Renewables and Efficiency<sup>23</sup> funded by the federal Department of Energy. This is a good list, but probably does not include all the programs. There are currently 18 Washington utilities that list different loan programs, 41 utilities provide rebates. We expect the offerings to be significantly enhanced in the next few years as the requirements of the Washington State Energy Efficiency Act – I-937 is implemented. This requires the states large electric utilities to implement all cost effective energy conservation.

Federal energy efficiency tax credits have provided funding for up to one third of the cost of energy efficiency measures, up to \$1500 in 2009 and 2010. For 2011 the cap has been reduced to \$500.

A larger federal proposal that would have provided substantially more funding for energy efficiency measures has failed to progress through congress. The HomeStar program, also called Retrofit for Energy and Environmental Performance was included HR 2454 and passed by the U.S. House of Representatives in June of 2009. This effort did not progress past this first legislative effort and at this time the prospects of added federal funding do not look promising.

Efforts to help consumers to capitalize future energy savings to fund retrofits will need to take the lead. Commerce will be further developing this subject as part of their participation in Department of Energy Grant, Multistate Model for Catalyzing the National Home Energy Retrofit Market. Commerce participation in this grant is focus on developing financing mechanisms designed to increase penetration

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<sup>23</sup> <http://www.dsireusa.org/incentives/homeowner.cfm?State=WA&CurrentPageld=1&RE=1&EE=1>

rates of home energy improvements. This is a three year project, but Commerce expects to make progress on this subject in 2011. This is also a subject identified for additional work in 2011 by the State Energy Strategy.

### The Cost of Program Development and Implementation

Commerce has not developed a detailed budget for implementation of a home energy audit and retrofit program. For reference we have include an example budget from the HPwES Sponsor Guide, Table 1 Example Program Budget.<sup>24</sup> This table provides estimates of startup and ongoing cost at the program level. Please note the pilot year the program cost do not include homeowner incentives, contractor job incentives on infield quality assurance. In each year after the pilot, incentive costs are included. Incentive levels will vary a great deal depending on the actual program incentive structure.

**Table 1. Example Program Budget**

Budget Category	Pilot Phase*	Year1	Year 2	Year 3	Year 4	Year 5
Management	\$156,000	\$160,000	\$225,000	\$242,000	\$259,000	\$276,000
Program Development	\$52,000	\$53,000				
Contractor Recruitment	\$65,000	\$323,000	\$323,000	\$323,000	\$323,000	\$323,000
Training/Certification	\$29,000	\$59,000	\$88,000	\$88,000	\$88,000	\$34,000
Mentoring	\$13,000	\$25,000	\$38,000	\$38,000	\$38,000	\$14,000
Marketing	\$78,000	\$191,000	\$305,000	\$467,000	\$627,000	\$770,000
Contractor Job Incentives		\$39,000	\$117,000	\$234,000	\$351,000	\$468,000
Homeowner Incentives		\$216,000	\$647,000	\$1,295,000	\$1,942,000	\$2,589,000
Infield Inspections (QA)		\$18,000	\$40,000	\$68,000	\$83,000	\$98,000
Evaluation	\$25,000	\$40,000	\$40,000	\$40,000	\$40,000	\$40,000
Total	\$418,000	\$1,124,000	\$1,823,000	\$2,795,000	\$3,751,000	\$4,612,000
Contractor Goal	10	31	63	94	125	136
Job Goal	0	250	750	1500	2250	3000

\*Pilot Phase is typically 6 months to 1 year focused on contractor infrastructure building

<sup>24</sup> Home Performance with ENERGY STAR, Sponsor Guide Version 1.0, September 2008

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## **Appendix A: Short History of Home Energy Rating in the United States**

To provide additional background on the success of home energy scoring in the United States, we have prepared this appendix.

Commerce would like to note, that in order for home performance scoring to be successful, it need to be well aligned with another program objective. In addition the program objective has to add value. In the case of the history that follows, participants did not value the energy efficient mortgage package offered in the early years. In recent years it has been demonstrated that there is some value to connecting home performance scoring to tax credit programs.

Commerce would also like to note that if an alternative to a home energy rating is presented, the participant will take it. In the case of Energy Star Homes, prescriptive compliance has substantially replaced the early role of home energy ratings.

### **1981-2000 Developing a Home Energy Rating System to Support the Energy Efficient Mortgages**

Home energy ratings or scoring have been in place for many years. The original concept dates back to 1981 when a group of mortgage industry leaders set up the National Shelter Industry Energy Advisory Council. This group was formed to develop a rating method that could be used to support the administration of energy efficient mortgages (EEM). The resulting rating system was not systematically used as a basis for mortgage lending and failed to fulfill the objective.<sup>25 26</sup>

In October 1992, Congress passed the Energy Policy Act of 1992 (EPACT), which provided for the establishment of credible voluntary national guidelines for residential energy rating systems and for a pilot test of EEM through federal loan instruments in five states. Alaska, Arkansas, California, Vermont, and Virginia were funded by DOE to lead Home Energy Rating System (HERS) provider organization in each of these states for the pilot period of 1993-1998. Colorado and Mississippi joined the pilot program in 1996. These pilots resulted in 63,000 ratings and 8500 energy efficient mortgages. In the final pilot year, 1998, the programs completed 13,037 home energy ratings at a program cost, of \$4,097,845. Of this, \$1,112,811 was provided by the rating providers or home owner participants. The balance was state, federal or utility funding. (Farhar)

In April 1995, representatives of the national mortgage industry, the National Association of State Energy Officials, and Energy Rated Homes of America founded the Residential Energy Services Network (RESNET) to develop national standards for home energy ratings and to create a market for home energy rating systems and energy mortgages. In 2002 RESNET became incorporated as a 501 (c) (3) non-profit organization and Energy Rated Homes of America merged into the organization. While there were other organizations early in the development to home energy scoring programs, this one has established the central role in the U. S. They play an important role, not only in the development of technical standards, but also as an effective Washington D.C. lobby organization.

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<sup>25</sup> RESNET web site

<sup>26</sup> Farhar, Barbara C., Pilot States Program Report: Home Energy Rating Systems and Energy-Efficient Mortgages, National Renewable Energy Laboratory, April 2000

During the mid to late 1990's Washington State examined the adoption of Home Energy Rating (HERS) and Energy Efficient Mortgage (EEM) program. This included an effort by the Washington State Energy Office to develop an EEM.

In the mid nineties, the Washington State Energy Office worked with relevant stakeholders to consider formation of a uniform Home Energy Rating System (HERS). At that time, HERS was viewed as "a tool in the form of an energy efficiency rating system that could be voluntarily applied to existing homes to enable homeowner, homebuyers and homesellers to make reasonable consideration of a home energy cost in the retrofit, purchase, or sale of a home."<sup>27</sup> One component of the work done at that time was a study of the consumer value of energy efficiency. The study held that consumers did not value home energy efficiency enough to warrant implementation of a rating system. Homeowners and homebuyers did not use energy efficiency information already available ....utility bills or previous home audits; and homesellers were more likely to consider aesthetic improvements over others. Homebuyers ranked energy efficiency more highly when faced with a short list of home features, but as the list grew, energy efficiency fell further down the line. While rising fuel costs, evolving views and the environment, and tough economic likely impact consumer attitudes and behaviors.

### **Energy Efficient Mortgages (EEM)**

Energy Efficient Mortgages (EEM) were the original driver for home energy scoring programs. The EEMs were established to assure that the lower energy bills of an energy efficient home were recognized when considering a home purchasers ability to pay the loans. This would allow the purchaser to qualify for a somewhat more expensive home than the mortgage industry would normally recognize. This method would typically provide up to a two percent increase in the purchasers debt to income ratio. This method was of limited value in the market place. Only people purchasing homes that exceeded the normal debt to income ratio benefit from this formula.

In the late 1990's and through the 2000's many other mortgage products were introduced to the market that were simpler and less expensive to apply for and would provide similar effect. This made it difficult for EEMs to compete with other loan products.

Other incentives have been included as part of some EEM programs. The Alaskan Home Mortgage Corporation offered reduced interest rates on loans by as much as 1.5%, but typically much less. The Vermont Housing Finance Agency provided lower interest loans for the first 4 years of the mortgage. Lower loan processing fees have also been offered as an incentive.

Although EEMs have been available since the early 1990s, the Federal Housing Administration (FHA) has typically issued fewer than 30,000 EEMs annually. (HUD Research Works, U.S. Department of Housing and Urban Development, November 2008.) Compared to the 5.6 million existing homes sales (2006) in the United States, this is not a poor result. (National Association of Realtors, Single-Family Existing-Home Sales and Prices, 2009)

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<sup>27</sup> (Home Energy Rating System Business Plan Feasibility Study In Washington State, 1995)

## **2000 – 2006, Energy Star New Homes Takes Off, Federal Tax Credits Provide Incentives**

Energy Star New Home program and federal income tax credits have sustained the Home Energy Rating industry into this decade. Each has provided markets and financial incentives that support the home energy scoring industry.

The Energy Star Home Program began to take hold in the late 1990's and has become a major efficiency program for new homes during this decade. During the early years of the program the participant was required to use a HERS score to demonstrate that the home meet the Energy Star criteria. As the program progressed, the need to provide a HERS Score for every home was replaced with sampling methods and finally prescriptive requirements for construction. The number of HERS scores took an up-tick in the early years of the Energy Star Program but have largely been replaced by prescriptive options. Since the program began in 1995, just over 1 million U.S. homes have been constructed to this standard.<sup>28</sup>

The Northwest Energy Star Program was developed in 2003 by the region's State Energy Offices and utilities in the region and began operation in 2004. A prescriptive option was developed as the primary method of achieving Energy Star qualification. This was done to reduce the cost of qualification. Today, energy simulations are used only in a few cases. The Northwest has adopted a home grown computer simulation method rather than using the RESNET HERS method. It is similar to a systems analysis approach used for energy code compliance. Market penetration of Energy Star for energy star homes for the region was about 3% of new home construction in 2006. In 2009, the market penetration is better than 8 percent. The market for Energy Star homes has done better than the housing industry as a whole.<sup>29</sup>

In 2005 federal energy tax credits for the construction of energy efficient homes were approved. Builders could take the tax credit if the home was demonstrated to use 50% less energy than a home built to the 2004 International Energy Conservation Code. Heating and cooling energy and cost savings must be calculated using the procedures described in either Residential Energy Services Network (RESNET) HERS or an equivalent procedure. These tax credits were originally available for homes constructed in 2006-2008. This was extended to include homes constructed in 2009. This program benefited RESNET HERS program by creating market for the services.

The WSU Extension Energy Program is one of several program providers for the RESNET HERS program in Washington. WSU has been approving about 150 HERS ratings a year. More than half of these are for federal tax credit home.

### **Other Factors affecting the market for HERS ratings**

In California, the home energy rating industry supports residential energy code compliance. While most energy codes in the nation are primarily met through prescriptive methods, the California energy code

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<sup>28</sup> Energy Star Web Site, [http://www.energystar.gov/index.cfm?fuseaction=mil\\_homes.showSplash](http://www.energystar.gov/index.cfm?fuseaction=mil_homes.showSplash)

<sup>29</sup> Northwest Energy Star Home Program, Market Progress Evaluation Report #6, EconNorthwest for the Northwest Energy Efficiency Alliance

uses a systems analysis approach. Computer simulations are used to approve the designs. In addition, performance testing is required for many compliance options. California energy code regulations have developed the largest network of home performance rating contractors in the nation.

States without energy codes have also provided a marketplace for home performance scores. Until recently, Colorado had not adopted a statewide energy code. Kansas still does not have a statewide energy code. Until recently these two states supported HERS programs as market alternative to codes. This did result in greater home energy rating activity than other states. Both states have transitioned away from HERS ratings. Colorado adopted a state wide energy code. Kansas has developed a prescriptive disclosure form for demonstrating the energy efficiency of the home.

## Appendix B: Opportunities for Home Efficiency Improvement in Washington State

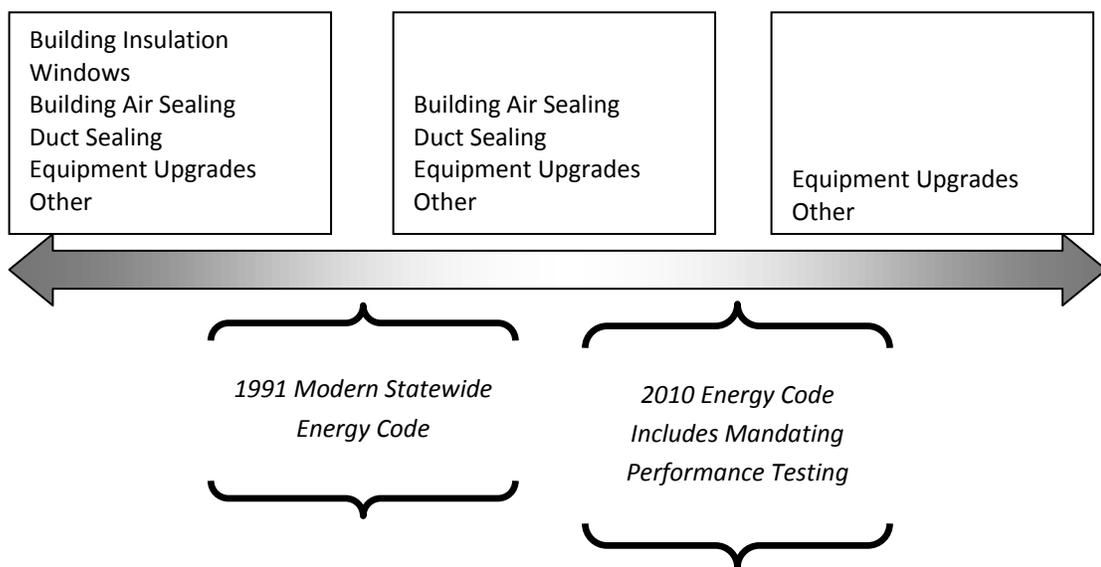
The opportunity to upgrade homes is substantial. While most of this opportunity is in homes built prior to 1990 when modern energy codes were adopted in Washington State. This includes 70 percent of the housing stock. Unfortunately we cannot segregate by age any more accurately than this. Any pre 1990 home may have opportunities. Finding the opportunities will require other means, such as billing analysis or energy audits.

Homes constructed after the energy codes were adopted do not need additional insulation. But many of these homes could benefit from duct sealing and improved heating equipment efficiency. Homes constructed with electric resistance heat in most cases should upgrade to a heat pump. This is a particularly good opportunity for manufactured homes.

An important concept when considering upgrades is timing. Some measures are best implemented when other work is being conducted. When space and water heating equipment fail, it is a prime opportunity to buy the most efficient products. But it is typically unwise to replace equipment until it is nearly worn out. Air sealing and insulation are activities that can be implemented at any time.

### Opportunities for efficiency improvement based on vintage of homes

The opportunity to cost effectively improve the efficiency of homes can be in part targeted by the age of homes. Older homes were not constructed to the same standards as newer homes. Over time the energy efficiency standards and the implementation of those standards have improved. This allows us to make some general distinctions based on age. Older homes have a greater variety of opportunities than newer homes. Many newer homes still have targeted opportunities for improvement.



Homes built prior to the adoption of contemporary energy codes are likely the leading candidates for improvement. While many of these homes have been upgraded since they were constructed, there is

likely the best opportunity to make improvements to many features of the home. This population of homes would benefit most from comprehensive energy audits.

Energy codes were implemented in many parts of the state beginning in the mid 1980's. The first statewide residential energy code was implemented beginning in 1991. For the most part, these homes have good insulation and windows. Targeted audits would be best suited for homes built in 1990's. Efficiency measures would most likely include the following.

A limited number of homes were constructed with metal frame windows. It may be worthwhile to upgrade the worst of these.

Air leakage control was implemented prescriptively. Blower door guided air leakage control could improve the efficiency of many of these homes.

Duct leakage is very high in most homes with forced air heating system. These homes typically have higher duct leakage than older homes. Duct testing will be required by the 2010 Washington State Energy Code as part of furnace replacements.

Space and water heating equipment installed in new 1990's homes could be upgraded and achieve a 12-15% reduction in energy use. These measures should be implemented at time of equipment failure and replacement

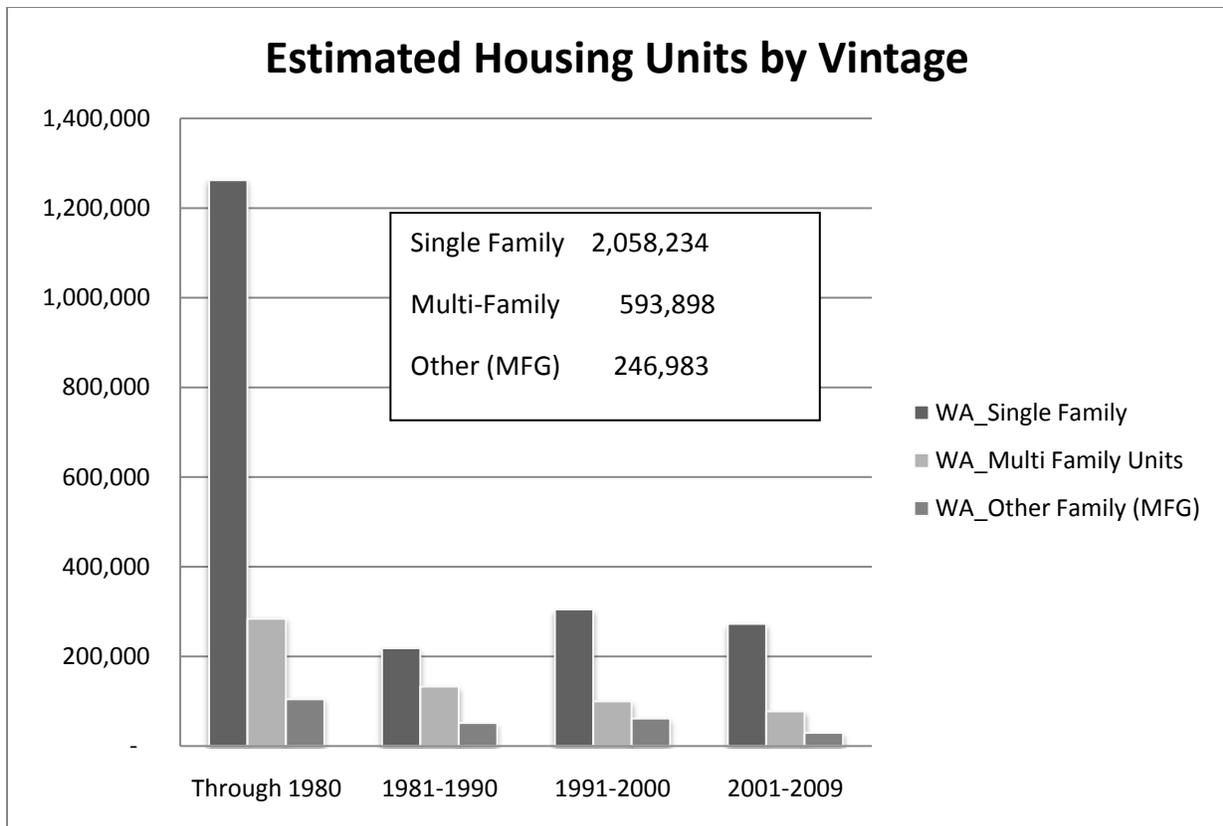
For homes built from 2000 to 2010, the building shell was improved from the 1990's code. The window standards eliminated all but the best metal frame windows. The insulation standards were improved for most homes. Duct leakage control for homes with forced air heat is the most promising measure. Space and Water heating equipment improvements can also improve the efficiency of most new homes constructed in the 1990's. This vintage of home, the opportunity to identify improvements using a comprehensive audit protocol is very limited. A program targeting a few key components would work best.

Beginning in 2010, the Washington State Energy Code will require both air leakage testing and duct leakage testing. This will make all new homes meet minimum standards for these measures. Energy audits for this vintage of homes are not recommended.

For all homes, regardless of age, the introduction of any new appliance or electronic device holds an opportunity for efficiency improvement. Providing advice to consumers about these measures is of great value. But this type of information is not the primary outcome of home energy audits and can be addressed through other types of market transformation efforts. A good example is labeling programs such as Energy Star.

### **Existing Housing Stock Opportunities**

As noted above, the population of homes most in need of improvement are homes built prior to the introduction of modern energy codes. The vast majority of homes were constructed prior to the introduction of the 1991 Washington State Energy Code.



Northwest Power and Conservation Council, 6<sup>th</sup> Power Plan

### Major opportunities for improvement

#### Infiltration and Duct Sealing

**Infiltration:** Estimates that the technical potential to improve energy efficiency through air leakage control exist in 85 percent of homes. For these single family homes, annual space heating energy use could be reduced by 10 percent through this measure<sup>30</sup>.

Infiltration control work should be completed before most insulation projects.

Contemporary air leakage control should be conducted by skilled crews assisted by feedback from blower door testing equipment. Air leakage control needs to include an assessment of ventilation and combustion safety to assure the indoor air quality of the home meets defined minimum standards.

**Duct Leakage:** Estimates that the technical potential to improve energy efficiency air leakage control at 60 percent of the gas home population. For these single family homes, annual natural gas use could be

<sup>30</sup> Cadimus Group, Comprehensive Assessment of Demand-Side Resource Potentials (2010-2029) for Puget Sound Energy, 2009 Least Cost Plan, Appendix C. The data provided is for gas heated single family homes.

reduced by an average of 6 percent through this measure. For many homes the savings could be as high as 20 percent.

Contemporary duct leakage control includes the use of air leakage test equipment. Testing provides some guidance to the retrofit team, but is mostly implemented to quantify savings and for quality assurance.

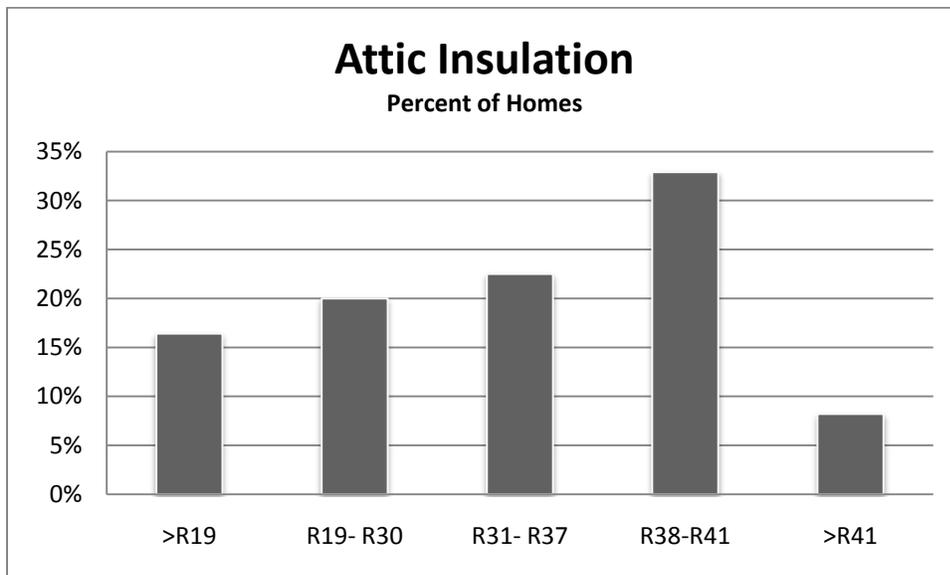
### Building Insulation and Windows

Major categories can be used to describe the opportunity to improve the housing stock. The following describes the opportunity based on a single major survey of existing housing in the Pacific Northwest. This is a limited snapshot of about 500 homes in the region<sup>31</sup>. As a program focuses in on the state or city, the narrower geographic focus would likely provide a different result.

Not all homes with sub-standard insulation can be cost effectively upgraded to a minimum target standard. But the majority can.

### Attic Insulation

Attics with less than R-19 insulation should be improved and are included in most utility rebate programs in the NW region. In many cases attics with less than R-30 offer good opportunity for improvement. About 35 percent of the housing stock fits in one of these two categories. The ability to add attic insulation is limited by the attic space and attic access.



RLW Analytics, Single-Family Residential Existing Construction Stock Assessment, Market Research Report, E07-179, Northwest Energy Efficiency Alliance (10/2007)

<sup>31</sup> RLW Analytics, Single-Family Residential Existing Construction Stock Assessment, Market Research Report, E07-179, Northwest Energy Efficiency Alliance (10/2007)

## Other Ceiling Insulation

Insulation of single rafter vaulted ceilings is limited by the available construction framing. The rafter spaces in earlier homes were only constructed to provide the meet minimum structural requirements. Insulation may be limited to R19 in older homes.

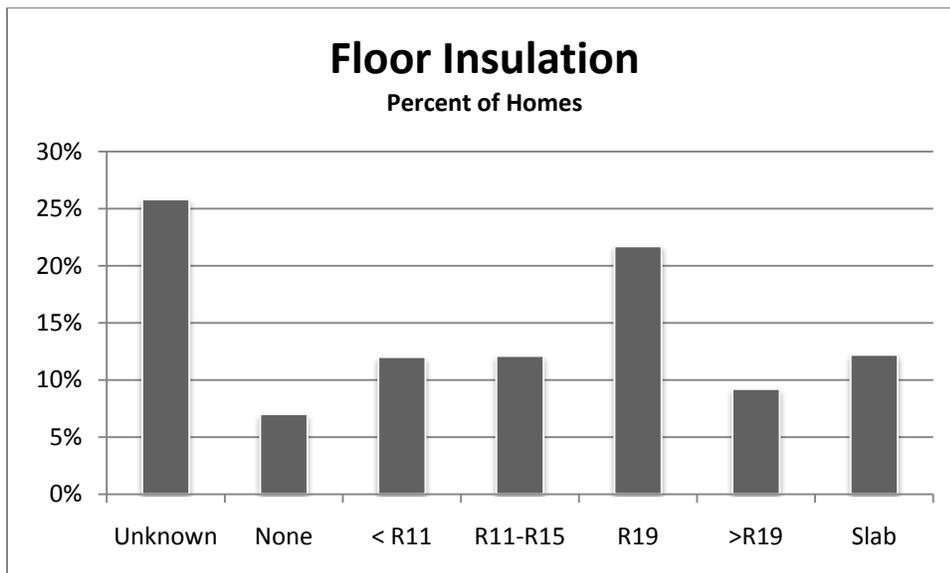
There is an opportunity to provide upgrades by adding cavity insulation + foam insulation above the roof deck. This installation must be completed at the same time the roofing is replaced. Careful consideration of the construction of unvented roof decks requires more expertise than typical vented roof assemblies.

## Floor Insulation

Floors over crawl spaces offer an opportunity for improvement in many homes. Homes with less than R-19 insulation should be upgraded to R-30, or the best value that will fit in the floor system. The graph below indicates that more than 25 percent of all homes could benefit from this measure.

The opportunity to improve homes floor system is limited by access to the under-floor space. The large number of homes in the survey's "unknown" category provide clues to the population of homes that would be difficult to insulate. Also, it would be very difficult to add insulation to an existing slab on grade home.

Some building retrofit contractors advocate for closing the crawlspace venting system and insulating the crawl space walls rather than the floor. There is a danger that this will increased the radon level in the home. As a result, general application of this method is discouraged unless the radon issues can be addressed.

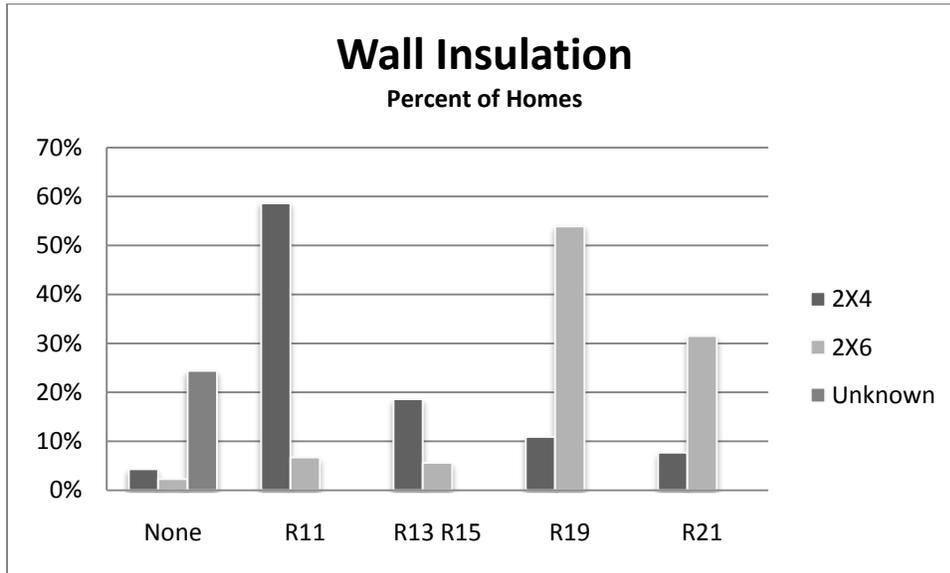


## Wall Insulation

Wall insulation improvements are limited primarily by the space in the wall framing cavity. For all residential construction, the optimum insulation will fill the framing cavity, regardless of the size of the

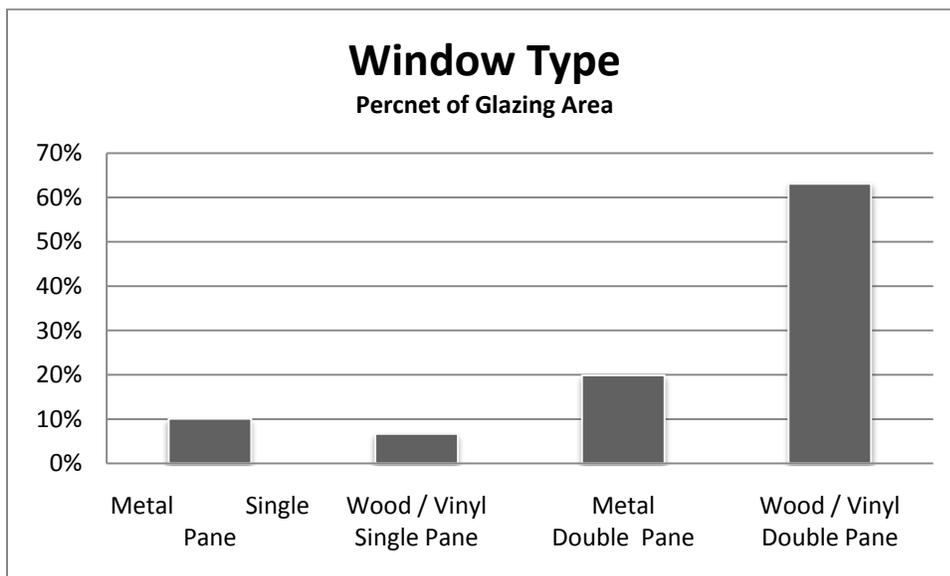
frame. For 2x4 framing this is R-11 to R-15, depending on the type of insulation used. For 2X6 framing, R19 and R21 are common. Cavities that are not filled should be upgraded.

Walls are more difficult to survey for insulation than a crawl space or attic. This probably accounts for the large number of “Unknown” insulation noted on the graph. This is likely an opportunity for improvement as well.



### Windows

Because of the high cost of replacing windows, they are the least cost effective building envelop efficiency measure. Utility incentives frequently support the replacement of all single pane windows and in some cases double pane windows with metal frames. This population of window accounts for about 35 percent of the window area in Pacific Northwest Homes.



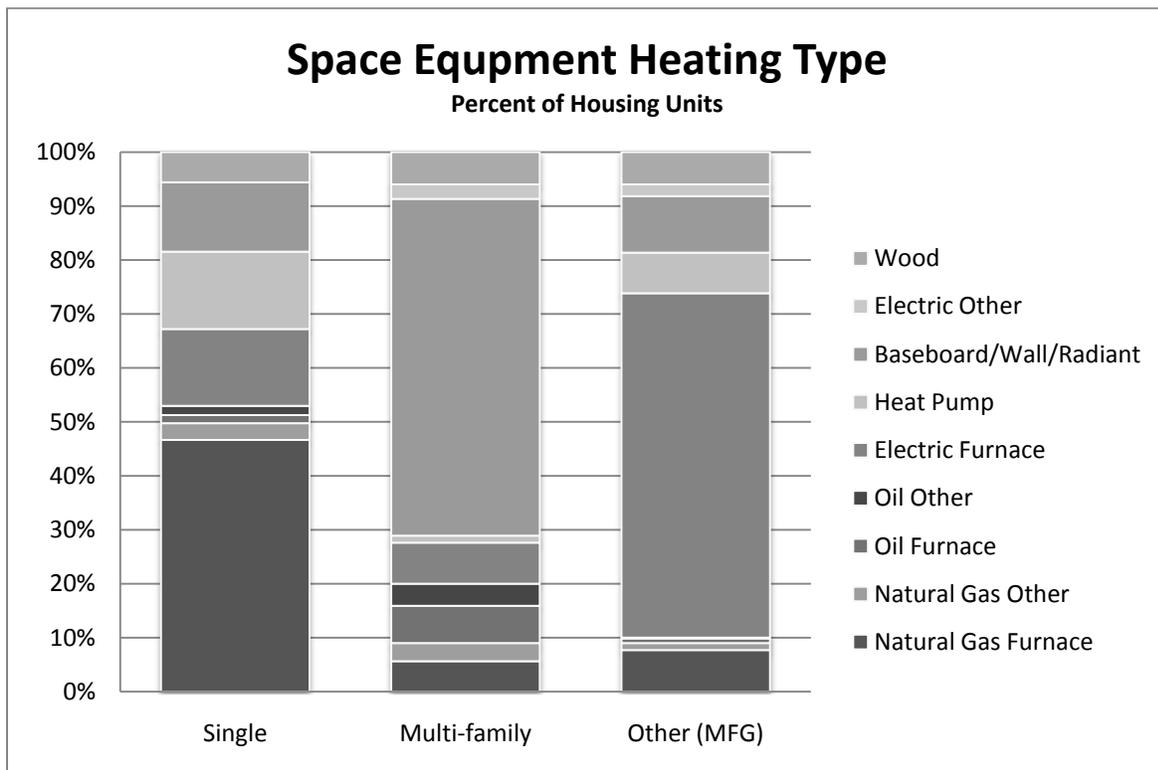
## Space Heating Equipment

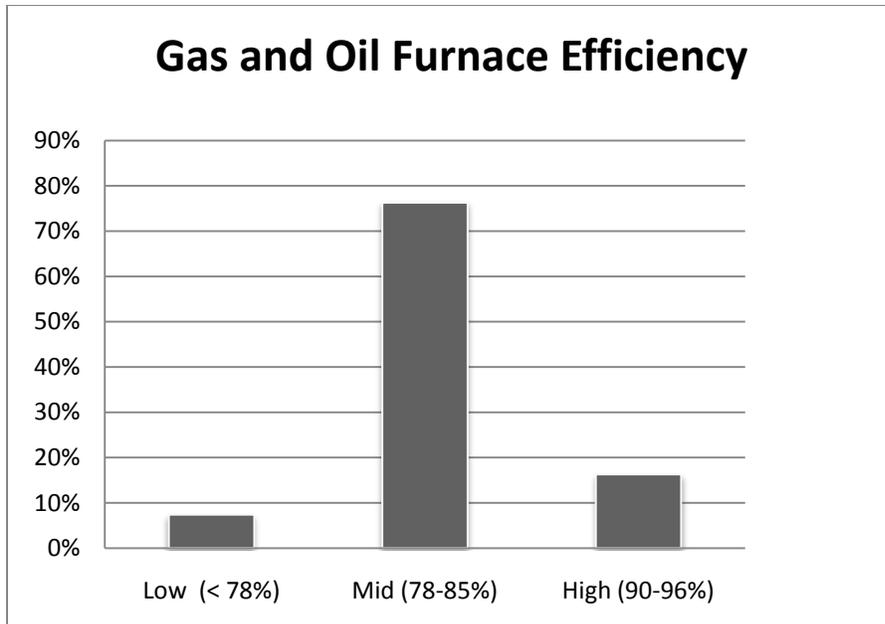
When this survey was conducted in (2004-2006), fifty percent of homes in the survey used natural gas for space heat, while forty one percent used electric heat. Of the gas heated homes, only 16 percent used high efficiency equipment. For the electric heated homes, only 14 percent used a heat pump of any efficiency. The opportunity to improve the efficiency of these homes through the introduction of high efficiency space heating equipment is substantial.

For systems with force air ductwork, the conversion to a high efficiency gas furnace or a heat pump should be cost effective. The recent introduction of ductless heat pumps from Asia to the Northwest market will allow heat pumps to be installed in homes with baseboard electric heat at a lower expense than a traditional heat pump.

Manufactured housing has a large population of electric resistance heating at 62 percent. Most have ductwork, and could be easily converted to a heat pump. This is a major opportunity for efficiency improvement.

For homes with existing combustion furnaces and heat pumps, equipment upgrades should occur when the equipment fails. For homes with electric resistance heating, the opportunity to upgrade is not dependant on the existing equipment.





#### Multi-family Measure Assessment

A similar study has been conducted for multi-family buildings. While not identical to the single family study, the results are similar<sup>32</sup>.

- 5.5 percent of the buildings surveyed had no insulation in the attic. Thirty Five percent of the attics surveyed had less than R-22 insulation
- About five percent of the buildings surveyed had no wall insulation
- 32.8 Percent of multi-family homes had single pane windows. 13.4 percent had double pane metal frame windows
- 62 percent of multi-family homes are heated with electric resistance heat. Many of these housing units could benefit from the implementation of ductless heat pumps.

<sup>32</sup> RLW Analytics, **2004 Multifamily Building Stock Survey, Market Research Report (05-146)**