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Next Step Home Baseline Estimation Study

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Next Step Home Baseline Estimation Study

A Report to the Northwest Energy
Efficiency Alliance

Prepared by Evergreen Economics with
CIC Research and John Stevenson

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1 Executive Summary

NEEA engaged the Evergreen team (Evergreen Economics, along with John Stevenson and CIC Research) in March 2014 to establish the baseline for the Next Step Home (NSH) Initiative. The primary objectives of the study include:

- **Conducting a Market Characterization** – This included documenting the current market size for newly constructed homes (energy efficient and not), forecasted market growth, and barriers to energy efficient construction and purchases among homebuilders and homebuyers.
- **Establishing the Baseline** – This required estimating the percentage of new homes in the Northwest (Idaho, Montana, Oregon and Washington) that currently meet and are likely to meet the Next Step Home specification with no assistance from NEEA or its partner utilities.

Next Step Homes are expected to deliver annual energy savings that are about double what a Northwest ENERGY STAR home would deliver. The Northwest ENERGY STAR specification is designed to deliver approximately 15% energy savings relative to state codes, and thus a Next Step Home delivers roughly 30% savings. For purposes of this baseline study, Next Step Homes are required to meet a prescriptive specification that includes the following features:

1. Advanced wall efficiency (insulation and windows) with a u-value of 0.035 or lower in Heating Zone 1, and 0.030 or lower in Heating Zones 2&3;
2. An ultra-tight shell (2.0 ACH₅₀) and heat recovery ventilation (HRV);
3. Ducts inside the building shell (if applicable);
4. Efficient heating strategies, such as
 - a. Gas Furnace – 94% AFUE
 - b. Heat Pump – 9.0 HSPF, 12.0/11.5 EER
 - c. Ductless Heat Pump – 3.0 COP
 - d. Radiant floor heating
5. A heat pump water heater, or natural gas water heater with 0.81 efficiency; and
6. U.25 windows

Homes that include these features may also achieve other home certifications, such as Passive House, LEED for Homes, Earth Advantage Gold or Platinum, and Built Green, although this is not a requirement.

Some of these energy efficient home features may be adopted into different state building codes at different times in the future; however, it was not within the scope of this study to estimate if and when these code changes may occur. This is because NEEA tries to influence future residential energy code changes (and claim savings) after baseline market penetration has been estimated. In this context, studies like this focus on purely “natural” adoption by builders for baseline estimations.

Some of the key findings from this study include:

- 1) Potential buyers of energy efficient homes face a wide range of financial, informational and technical barriers. In particular, homebuyers and financial institutions often do not recognize and monetize long-term energy savings, and are not willing to finance more expensive energy efficient homes. Moreover, many homebuyers are unable to identify energy efficient homes or features and believe that existing codes guarantee efficiency. Lastly, homebuyers sometimes perceive that heat pump water heaters, ductless heat pumps and tankless water heaters have general performance problems.
- 2) Some energy efficient homes programs obtained moderate market shares in 2013. The Northwest ENERGY STAR Homes Program obtained over 14% market share in Idaho and Oregon, while Built Green obtained 12% market share in King County, Washington. Other programs such as LEED (Idaho) and Passive House only achieved market shares of less than 2%.
- 3) None of the homebuilders surveyed for this research had built a home that met all of the Next Step Home requirements in 2013.

Based on these and other research findings, we propose the following recommendations:

- 1) For the current baseline, NEEA should assume that approximately 0% of single-family home construction in all states is fully meeting the Next Step Home requirements without assistance from NEEA.
- 2) For the 20-year baseline, NEEA should utilize the following state-level market share estimates derived from the builders phone survey. These estimates are also generally consistent with estimates provided by efficient home program managers, when the potential impacts of increasing building codes are not factored in.
 - Idaho = 20%
 - Montana = 15%
 - Oregon = 20%
 - Washington = 12%
- 3) If NEEA chooses to adopt data-grounded, 10-year baselines, NEEA should utilize the following state-level market share estimates derived from the builders phone survey. These estimates are also generally consistent with estimates provided by efficient home program managers, when the potential impacts of increasing building codes are not factored in.
 - Idaho = 10%
 - Montana = 10%
 - Oregon = 15%
 - Washington = 10%

2 Introduction

2.1 Study Purpose

The Northwest Energy Efficiency Alliance (NEEA) is supported by and works in collaboration with the Bonneville Power Administration, the Energy Trust of Oregon and more than 100 Northwest utilities on behalf of more than 13 million energy consumers. NEEA uses the market power of the region to accelerate the innovation and adoption of energy-efficient products, services and practices. Additional information on NEEA and its work is available on NEEA's website at <http://www.neea.org/>.

NEEA engaged the Evergreen team (Evergreen Economics, along with John Stevenson and CIC Research) in March 2014 to establish the baseline for the Next Step Home (NSH) Initiative. The primary objectives of the study include:

- **Conducting a Market Characterization** – This included documenting the current market size for newly constructed homes (regardless of energy efficient performance), forecasted market growth, and barriers to energy efficient construction and purchases among homebuilders and homebuyers.
- **Establishing the Baseline** – This required estimating the percentage of new homes in the Northwest (Idaho, Montana, Oregon and Washington) that currently meet and are likely to meet the Next Step Home specification, with no assistance from NEEA or its partner utilities.

Establishing credible baseline market shares before the start of the Initiative is of critical importance so that NEEA can reliably claim credit for its strategic market interventions. Moreover, this baseline-related research provides useful market intelligence that NEEA can use to shape its Initiative planning to gain rapid traction.

2.2 Next Step Home Description

Next Step Homes are expected to deliver annual energy savings that are about double what a Northwest ENERGY STAR home would deliver. The Northwest ENERGY STAR specification is designed to deliver approximately 15% energy savings relative to state codes, and thus a Next Step Home delivers roughly 30% savings. For purposes of this baseline study, Next Step Homes are required to meet a prescriptive specification that includes the following features:

1. Advanced wall efficiency (insulation and windows) with a u-value of 0.035 or lower in Heating Zone 1, and 0.030 or lower in Heating Zones 2&3;
2. An ultra-tight shell (2.0 ACH₅₀) and heat recovery ventilation (HRV);
3. Ducts inside the building shell (if applicable);

4. Efficient heating strategies, such as
 - a. Gas Furnace – 94% AFUE
 - b. Heat Pump – 9.0 HSPF, 12.0/11.5 EER
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5. A heat pump water heater, or natural gas water heater with 0.81 efficiency; and
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Homes that include these features may also achieve other home certifications, such as Passive House, LEED for Homes, Earth Advantage Gold or Platinum, and Built Green, although this is not a requirement.

Notably, some of these energy efficient home features may be adopted into different state building codes at different times in the future; however, it was not within the scope of this study to estimate if and when these code changes may occur. This is because NEEA tries to influence future residential energy code changes (and claim savings) after baseline market penetration has been estimated. In this context, studies like this focus on purely “natural” adoption by builders for baseline estimations.

3 Research Tasks

3.1 Market Characterization

One of the main research tasks was to characterize the new home construction market in the region. In particular, the objectives included:

- Summarizing new single-family homes construction volumes in the Northwest;
- Tabulating the number of active homebuilders; and
- Presenting current single-family construction forecasts to inform the short-term market potential for Next Step Homes.

To address these tasks, we utilized secondary data sources such as the building industry publication *Construction Monitor* for information on the number of homebuilders in the region, and *McGraw Hill Construction*, which develops and publishes single-family construction forecasts.

3.2 Document Barriers to Purchases of Energy Efficient Homes

One of the topics NEEA specifically requested information on is homebuyer barriers to purchases of energy efficient homes. For this task, we conducted a secondary literature review of recent, readily available Northwest and nationally-focused studies documenting homebuyer perceptions of and barriers to purchasing energy efficient homes.

3.3 In-depth Interviews with Efficient Homes Program Managers

For this task, we conducted interviews with staff that manage and/or design other efficient homes programs in the Northwest and the US. The primary objectives of these interviews were to understand current and projected trends in single-family new construction (including the specific measures planned for the Next Step Homes specification), current and expected builder adoption of the specification and projected future barriers. The interviews also solicited programs market share data, where available.

3.4 Northwest Homebuilders Phone Survey

Much of this research focused on obtaining construction practices information via a quantitative telephone survey of regional homebuilders. Some of the key goals of the survey were: documenting the extent to which builders are currently building Next Step Homes; soliciting estimates of 10 and 20-year market share for Next Step Homes; and identifying specification measures most and least likely to be adopted by builders. Evergreen Economics, John Stevenson and CIC Research developed the survey instrument and CIC fielded the survey. The final survey instrument is included in Appendix B, and Appendix E shows the disposition of the survey recruitment.

4 Market Characterization

This section presents information on recent (i.e., 2013) single-family homes construction activity, including the number of homes built in the states covered by NEEA, and the number of builders that constructed these homes. This section also includes five-year housing construction forecasts available from secondary sources.

4.1 Northwest Single-Family Home Construction Overview

In order to document recent single-family home construction in the Northwest, we obtained and tabulated permit data from the US Department of Housing and Urban Development (HUD).¹ Specifically, we utilized the number of single-family residential unit building permits per county issued by HUD between July 1, 2012 and June 30, 2013. Under the assumption that permits are obtained six months prior to home completion (on average), this time interval provides us with an estimate of the number of single-family homes completed in 2013.² Urban and rural designations were determined for each county using the 2013 Rural-Urban Continuum Codes (RUCC), and heating zones were also assigned using the county-level designations developed by the Regional Technical Forum (RTF; See <http://rtf.nwcouncil.org/> for more information on the RTF).³

HUD releases preliminary building permit data on a monthly basis, which are updated throughout the year until final data are released in May of the following year. Since the permit data of interest spans 2012-2013, we obtained final counts for 2012 and preliminary counts for 2013. We do not expect the final 2013 counts to vary significantly from the preliminary counts used in this tabulation.

¹ HUD State of the Cities Data Systems: <http://socds.huduser.org/permits/>

² For information on home construction approvals and construction durations, see: <https://www.census.gov/construction/nrc/lengthoftime.html>. In the West region 55% of single-family homes built in 2013 were completed 4 to 6 months after starting, and 37% of homes were started 1 to 2 months after authorization (permitting). From these data we use 6 months as an average time from authorization to completion.

³ NEEA distinguishes urban from rural counties using RUCC developed by the United States Department of Agriculture (USDA). As noted on the USDA website, the RUCC forms “a classification scheme that distinguishes metropolitan counties by size and nonmetropolitan counties by degree of urbanization and proximity to metro areas.” These codes are available for download at: <http://www.ers.usda.gov/data-products/rural-urban-continuum-codes.aspx#.VD1qCkizc-M>.

Table 1 provides the total single-family home building permits disaggregated by state, urban/rural location, and heating zone. Over half (54%) of all permits in the Northwest states were issued in Washington State. The vast majority of permits issued were for urban counties (27,148) as opposed to rural (3,293). In Idaho, Oregon and Washington, most permits were for counties in heating zone 1 and the least were in heating zone 3, while most permits in Montana were in heating zone 3.

Table 1: 2013 Single-Family Home Construction by State, Urban/Rural Location, and Heating Zone

State	Location	Total	Subtotals By Heating Zone		
			1	2	3
ID	Rural	740	24	483	233
	Urban	4,778	3,428	878	472
	Total	5,518	3,452	1,361	705
MT	Rural	944	0	37	907
	Urban	751	0	505	246
	Total	1,695	0	542	1,153
OR	Rural	564	414	143	7
	Urban	6,372	5,353	1,019	0
	Total	6,936	5,767	1,162	7
WA	Rural	1,045	706	339	0
	Urban	15,247	14,323	924	0
	Total	16,292	15,029	1,263	0
Total	Rural	3,293	1,144	1,002	1,147
	Urban	27,148	23,104	3,326	718
	Total	30,441	24,248	4,328	1,865

Source: Evergreen Economics analysis of US HUD permits data accessed on March 21, 2014.

4.2 Northwest Homebuilders

In order to estimate the number of active Northwest homebuilders, we obtained and tabulated 2012 and 2013 Northwest builder permit data from *Construction Monitor*. Specifically, the data includes all single-family homes permitted in the Northwest during 2012 and 2013, tabulated by state and number of units per builder. Additionally, we filtered the *Construction Monitor* data to include only builders with approved permits between July 1, 2012 and June 30, 2013 to account for the assumption that, on average, permits are requested six months prior to home completion. As described above, this filter allows us to estimate the number of builders that completed projects in 2013.

Table 2 provides a breakdown of the number of builders in each state for 2013, categorized by the number of units each builder constructed during this time. As shown below, over 72% of the estimated 7,785 total builders built only one home during 2013. The majority of all builders were located in Washington (40%), while Idaho accounted for only 13% of all builders. Montana had the second most builders in the Northwest (1,973), however both Oregon and Idaho had more builders in every category besides single-home builders, especially in the large builder categories of 25 to 99 units and 100 units or more.

Table 2: Single-Family Builders by State and Volume: 2013

State	Number of Units Built						Total	Percentage of Grand Total
	1	2-4	5-9	10-24	25-99	100+		
Washington	2,183	531	182	115	98	19	3,128	40.2%
Montana	1,692	183	52	38	8	0	1,973	25.3%
Oregon	1,075	336	121	81	29	4	1,646	21.1%
Idaho	677	202	76	48	29	6	1,038	13.3%
Total	5,627	1,252	431	282	164	29	7,785	100.0%
Percentage of Grand Total	72.3%	16.1%	5.5%	3.6%	2.1%	0.4%	100.0%	

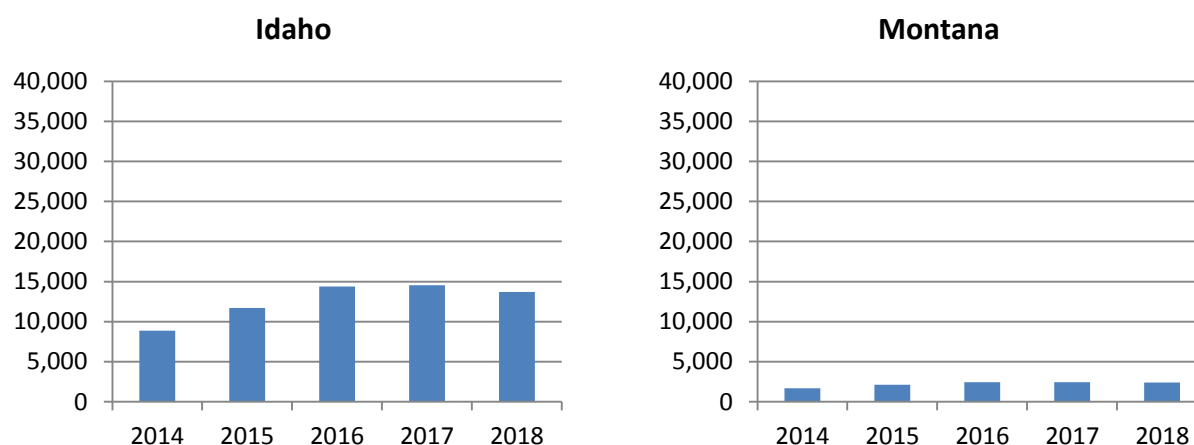
Source: Evergreen Economics analysis of *Construction Monitor* builders data obtained on March 27, 2014.

4.3 Single-Family Construction Forecast

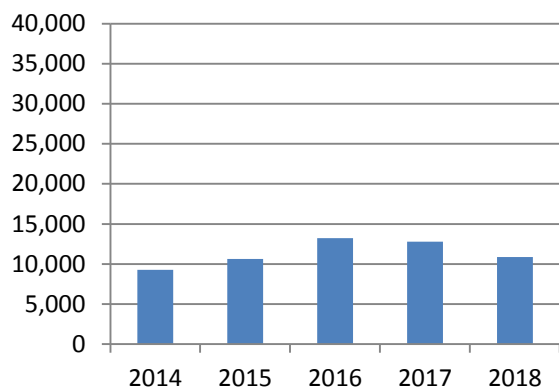
NEEA obtained annual forecasts of single-family home construction from *McGraw Hill Construction* presented below in **Figure 1**. For all five years forecasted, Washington has the largest number of homes to be constructed and Montana has the lowest. Over the entire period, Idaho and Montana should experience the most growth (54% and 45%), while Washington and Oregon should experience the least (33% and 17%).

All four states appear to exhibit the same basic trends. There is an expected growth period from 2014-2016 and very little change from 2016-2017, followed by a period of decline from 2017-2018. Specifically, from 2014-2016 Idaho construction should increase by 62% while the other three states should increase between 43-55%. Then from 2016-2018, Oregon and Washington should decrease by 22% and 16%, while Idaho should decrease by 5% and Montana experiences almost no change (<1% decrease).

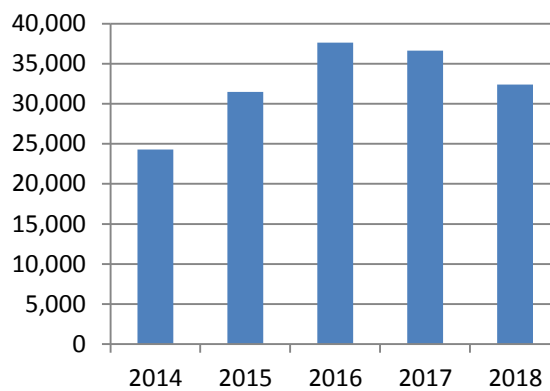
Figure 1: Annual Forecast of Single-Family Home Construction by State



Oregon



Washington



Source: Q2 2014 *McGraw Hill Construction* – Residential Units Forecast

5 Homebuyers' Barriers to Efficient Home Purchases

As part of the market characterization for the Next Step Home baseline establishment study, Evergreen Economics reviewed existing literature and other secondary information sources documenting homebuyer practices and preferences to identify barriers to energy efficient home purchases. This effort involved reviewing program evaluation reports, market research reports and other industry publications. **Table 3** below lists the organizations we researched to acquire the literature for this review.

Table 3: List of Resources Accessed to Acquire Literature

Demand Side Management and Evaluation Industry	Green Building Industry
American Council for an Energy Efficient Economy (ACEEE)	American Institute of Architects (AIA)
California Measurement Advisory Council (CALMAC)	U.S. Department of Energy Building America
Lawrence Berkeley National Laboratory (LBNL)	National Association of Home Builders (NAHB)
Northwest Energy Efficiency Alliance (NEEA)	United States Green Building Council (USGBC)
National Renewable Energy Laboratory (NREL)	Earth Advantage

Following are the secondary sources Evergreen reviewed:

- *Understanding the Importance of Energy Efficiency in the Home Purchase Process* (Shelton Group for NEEA, November 25, 2013)
<http://neea.org/docs/default-source/reports/understanding-the-importance-of-energy-efficiency-in-the-home-purchase-process.pdf?sfvrsn=9>
- *Home Buyers Focus Groups Market Research Report* (Curtis Research Associates for NEEA, January 2009)
<http://neea.org/docs/reports/homebuyersfocusgroupsmarketresearchreport.pdf>
- *Challenges and Opportunities To Achieve 50% Energy Savings in Homes: National Laboratory White Papers* (US Department of Energy, July 2011)
http://energy.gov/sites/prod/files/2013/11/f5/ba_tech_roadmap_0.pdf
- *New and Remodeled Green Homes: Transforming the Residential Marketplace* (McGraw Hill Construction Smart Market Report, 2012)
<http://www3.cec.org/islandora-gb/en/islandora/object/greenbuilding%3A52>
- *The Value of Energy Performance and Green Attributes in Buildings: A Review of Existing Literature and Recommendations for Future Research* (Lawrence Berkeley National Laboratories, September 7, 2011)
<http://emp.lbl.gov/sites/all/files/POLICY%20BRIEF%20Energy%20Performance.pdf>

- *Market Research on Builder's Selling Practices and Strategies for Energy Efficient Homes* (Navigant Consulting for Southern California Edison, May 3, 2013)
http://www.calmac.org/%5C/publications/MARKET_RESEARCH_ON_BUILDERS_SELLING_PRACTICES_AND_STRATEGIES_FOR_ENERGY_EFFICIENT_HOMES_SCE033501.pdf
- *Is Energy Efficiency Capitalized into Home Prices? Evidence from Three US Cities* (Resources For the Future, July 2013)
<http://www.rff.org/RFF/Documents/RFF-DP-13-18.pdf>
- *Northwest Energy Star Homes Program: Eighth Market Progress Evaluation Report* (Evergreen Economics for NEEA, February 14, 2012)
<http://neea.org/docs/reports/northwestenergystarhomesprogram.pdf>
- *Northwest Heat Pump Water Heater Market Test Assessment* (Evergreen Economics for NEEA, December 9, 2013)
<http://neea.org/docs/default-source/reports/northwest-heat-pump-water-heater-market-test-assessment.pdf?sfvrsn=6>
- *Northwest Ductless Heat Pump Initiative Market Progress Evaluation Report #3* (Evergreen Economics for NEEA, March 19, 2014)
<http://neea.org/docs/default-source/reports/northwest-ductless-heat-pump-initiative--market-progress-evaluation-report-3.pdf?sfvrsn=4>

Table 4 below summarizes the primary homebuyer barriers to energy efficient new home purchases and measure adoption.

Table 4: Summary of Homebuyer Barriers to Energy Efficient Home Purchase and Measure Adoption from Secondary Research Review

Home Buyer Barriers	
<i>Financial Barriers</i>	<ul style="list-style-type: none"> • High first costs • Economic benefits not recognized by key market actors • Economic benefits not recognized by financial markets • Unwillingness to pay for energy efficiency among homebuyers • Undervaluing of unseen energy efficiency measures by homebuyers
<i>Educational Barriers</i>	<ul style="list-style-type: none"> • Low cost of energy • Lack of awareness of energy efficient home benefits • Lack of awareness of energy efficient homes availability • Skepticism about energy efficiency • Perception that existing codes lead to highly efficient homes • Inability to identify efficiency
Measure Adoption Barriers	
<i>Heat Pump Water Heaters (HPWH)</i>	<ul style="list-style-type: none"> • High first costs (less relevant for new home purchases) • Perceived poor performance issues • Inability to meet hot water demand in large homes • Need for larger installation rooms
<i>Efficient Water Heaters</i>	<ul style="list-style-type: none"> • High first costs (less relevant for new home purchases) • Potential delays in providing hot water for tankless water heaters • Low natural gas prices
<i>Ductless Heat Pumps (DHP)</i>	<ul style="list-style-type: none"> • Perceived problems with capability and functionality • Aesthetics

The remainder of this section presents detailed findings of Evergreen’s secondary literature research related to demand for energy efficient homes, drivers for energy efficient home purchases and barriers to energy efficient home purchases.

5.1 Demand for Energy Efficient New Homes and Drivers

Recent studies in the Northwest indicate that while demand among potential homebuyers for certified energy efficient homes, both new and existing, is fairly low, latent demand for energy efficient homes may actually be significantly higher. A recent survey conducted by the Shelton Group (2013) that interviewed 304 potential home buyers across the four Northwest states found that 37% of potential homebuyers were looking for a certified green/energy efficient home. Interestingly, however, when the survey informed respondents that the Northwest

ENERGY STAR program designed homes to be 15% more efficient than code and educated them about the associated cost savings, the number of interested homebuyers rose to 60%. A separate market research study conducted by Curtis Research Associates (2009) found a similar pattern, concluding that “interest in green homes increases when homebuyers begin to learn about the benefits of green homes” - particularly reduced utility bills and increased comfort. This indicates the existence of latent demand for energy efficient homes that can be tapped by, among other messages, emphasizing the financial benefits of energy efficient homes, particularly decreased operating costs, and non-financial benefits, particularly increased home comfort.

While energy efficiency may not be a primary driver in the home purchase decision for many people, it is a strong secondary driver. Studies repeatedly find that homebuyers are primarily driven by issues such as home size, floor plan, affordability, quality of construction and neighborhood in their purchase decision, but increasing interest in energy efficiency is a highly cited consideration. The Shelton Group (2013) found that 73% of potential homebuyers considered energy efficiency to be “important,” although energy efficiency ranked seventh after home size, affordability, quality of construction, quality of neighborhood, heating and cooling costs and comfort. Sixty-six percent of potential homebuyers indicated they would pay an “optimal” (i.e., preferred) premium of 5% for an energy efficient home. These results are supported by Evergreen Economics’ (2012) evaluation of the Northwest ENERGY STAR program in which 201 recent new construction homebuyers were interviewed. Homebuyers were asked to rate the importance of energy efficiency on a 10-point scale with 10 being extremely important. The average score was 7.6 with 26% stating that energy efficiency was extremely important.

Key drivers for interest in energy efficient homes among homebuyers typically relate to reducing home operating costs, saving money and increasing personal comfort. Factors related to “environmental responsibility” are typically less important, and homebuyers rarely mention increased home resale value as a purchase motivation. Study findings include:

- Among potential homebuyers interviewed by the Shelton Group (2013), the most important reasons to purchase an energy efficient home were to save money (25%), lower home operating costs (22%), protect the environment (11%), and obtain higher resale values (3%).
- McGraw Hill (2012) found similar results with 63% of builders stating their clients request green homes to save money, 24% to protect the environment, and 23% because they perceive the homes to be a better investment.⁴
- The Curtis Group (2009) found that energy efficiency was a secondary consideration to reduce bills and/or increase comfort but focus group participants typically did not

⁴ While the McGraw Hill study does not elaborate on why customers perceive energy efficient homes to be a better investment, other studies note that customers sometimes equate energy efficient homes with higher quality construction and higher resale value.

equate energy efficiency homes with green or eco-friendly themes.

5.2 Barriers to Energy Efficient New Home Purchases

The literature review consistently revealed a number of barriers to energy efficient home purchases that can be grouped into financial barriers and educational barriers. The following sections describe each of these barriers in detail.

Financial Barriers

High First Costs

The available literature commonly cites high first costs, or the high initial cost of an energy efficient home, as an important barrier to energy efficient home purchases. McGraw Hill's Construction Smart Market Report (2012) survey of homebuilders and remodelers notes that high first costs ranks among the most commonly mentioned barriers with 66% of builders and 59% of remodelers noting this barrier. Evergreen Economics' (2012) evaluation of the Northwest ENERGY STAR program cites cost as the most common reason recent homebuyers opt to not purchase an ENERGY STAR home (22%), noting that while homebuyers are often willing to pay somewhat more for energy efficiency, they can quickly be priced out of the market. Two further barriers exacerbate the problem of high first costs: that economic benefits of energy efficiency are not recognized by key market actors and financial markets, and that many homebuyers are unwilling to pay for energy efficiency.

Economic Benefits Not Recognized by Key Market Actors and Financial Markets

Another theme across the green homes literature is the failure of market actors to capitalize energy efficient measures in valuation of energy efficient new homes. Appraisers are often not trained to value energy efficiency improvements or benefits when making their valuations (Evergreen Economics 2012, 2014; US DOE 2011; McGraw Hill 2012). In addition, real estate professionals often do not sell the energy efficiency aspects of a new home (US DOE 2011). Lastly, despite the emergence of energy efficient mortgage (EEM) programs, mortgage lenders generally do not distinguish between efficient and inefficient homes when assessing mortgage qualification criteria or when developing mortgage products that reflect lower risk of default from homes that are more efficient and have lower energy costs (Evergreen Economics 2012, 2014). The result is that potential homebuyers who desire an energy efficient home may not have access to sufficient capital to purchase the home they want, effectively pricing them out of the efficient home market.

Unwillingness to Pay for Energy Efficiency Among Homebuyers

A concurrent and widely mentioned barrier that parallels those mentioned above is homebuyer or homeowner unwillingness to pay for energy efficiency. McGraw Hill (2012) found that 80% of interviewed builders believed that unwillingness to pay for energy efficiency is the greatest barrier. Builders stated that consumer expectations of lower priced

homes due in part to downward pricing trends related to the housing market crash reinforced unwillingness to pay a premium for energy efficient homes. Evergreen Economics (2012) found that 55% of interviewed homeowner's who recently purchased a home claimed they would pay nothing extra for an ENERGY STAR home.

One component of unwillingness to pay that is frequently identified is that homebuyers undervalue unseen energy efficiency measures (US DOE 2011, Walls et al 2013). Duct work, insulation, envelope improvements, and to some extent, heating and cooling equipment efficiencies are often difficult for homebuyers to see or understand. As a result, homebuyers do not realize the full value of an energy efficient home.

Notably, a body of qualitative and quantitative literature examining the effect of green or energy efficient certification on home values indicates that some of these barriers may be breaking down. Some significant findings from these studies include:

- The Shelton Group (2013) found homebuyers would consider paying 5% to 10% more for a certified energy efficient home, with 5% being optimal.
- Green Grid Analytics (2010) found that people who look for green homes believe green certified homes cost 6% to 10% more and are willing to pay this premium because they believe these homes are 6% to 10% cheaper to operate annually on average.
- An LBNL (2011) literature review lists five recent studies across the commercial and residential sectors that found a price premium associated with energy efficient certification ranging from 3% to 35%.
- A Resources for the Future (2013) study used a hedonic regression model based on Multiple Listing Service (MLS) data identifying homes with ENERGY STAR and local certifications from three US cities including Portland, Oregon. The study finds homebuyers pay a significant premium for certified homes, particularly for local certification programs (e.g., Earth Advantage). However, they also note that homes of a more recent vintage may lack a significant sales premium, potentially due to more stringent building codes that narrow the difference between certified and uncertified homes.

Low Cost of Energy

The low cost of energy in the United States as a whole and particularly in the Northwest can be a barrier to energy efficiency uptake. Energy prices in the Northwest are typically among the least expensive in the nation in part due to the prevalence of hydroelectric generation, which has very low operating costs. Because the return on investment of energy efficient measures is directly linked to a home's energy bills, low cost of energy can reduce return-on-investment (ROI) and lengthen the payback period of energy efficiency, making it a less appealing prospect for potential home buyers (US DOE 2011).

Educational Barriers

Lack of Awareness of Benefits and Availability of Energy Efficient Homes

A large proportion of homebuyers continue to be unaware of the benefits of energy efficient new homes. McGraw Hill (2012) finds that 63% of builders list lack of homebuyer education as a key barrier to energy efficient home sales. Evergreen Economics (2012) notes that homebuyers, as well as builders and other market actors, are often unaware of the potential value of energy savings and the non energy benefits such as improved indoor air quality associated with improved construction practices.

Many homebuyers are also unaware of the availability of energy efficient homes. In 2012, Evergreen Economics found that less than 50% of potential homebuyers across the four Northwest states were aware of five energy efficient certification programs, ENERGY STAR, Earth Advantage, Built Green, LEED and NAHB Green. The most recognized program was ENERGY STAR with 44% of homebuyers aware of the program. The least recognized programs were LEED and NAHB Green with 16% recognition for each. In some cases, even people who live in an energy efficient home are unaware of the benefits of energy efficient home ownership. The Shelton Group (2013) found that four out of ten ENERGY STAR homeowners do not know they own an ENERGY STAR home. Evergreen Economics (2012) found that 36% of homeowners who lived in a green or energy efficient certified home were not aware that their home was certified.

Skepticism about Energy Efficiency

There remains some skepticism about energy efficiency among homebuyers. This skepticism appears to come from two sources. The first source is a perception that one's personal home does not have a carbon footprint, leading homebuyers to feel that green home certifications are a "marketing ploy" rather than a legitimate source of value (Curtis Research 2009). The second source of skepticism arises from consumer difficulty in differentiating between accurate and false efficiency claims (Evergreen Economics 2012).

Perception that Existing Codes Lead to Highly Efficient Homes

Finally, a potential barrier to homeowner purchase of efficient new homes that may grow over time is a perception that existing residential building codes ensure that all new homes are adequately energy efficient. Curtis Research (2009) quotes one potential homebuyer as saying

"It's been a lot of years since there have been codes to build houses. There have to be insulated windows and the proper amount of thickness or R-rated insulation in the walls. So you're talking about a pretty old house that wouldn't be energy-efficient in terms of windows and insulation."

Evergreen Economics (2012) found that 20% of recent homebuyers believe that new homes

are already efficient, rendering energy efficient labeling unnecessary.

5.3 Barriers to Next Step Home Measures

In addition to barriers to new home purchases, there are also barriers to adoption of specific energy efficient measures that may be in high performance homes. Below, we outline specific barriers for heat pump water heaters, efficient water heaters and ductless heat pumps that are mentioned in the available literature.

Heat Pump Water Heaters (HPWH)

In a 2013 market progress evaluation report, Evergreen Economics identified the following barriers to HPWH adoption:

- **High first costs and low awareness.** These are barriers for any emerging technology such as HPWHs; however, this may not be as much of an issue for new homes.
- HPWHs still retain a **stigma of poor performance** that remains from the original release of the technology in the 1980s. Earlier iterations of HPWHs had performance issues due to poor engineering, improper installation and variable climate dependent performance. Surveyed HPWH owners mentioned concerns about performance, reliability, noise and quality when considering purchasing a HPWH, although HPWHs met the expectations of an overwhelming 95% of purchasers.
- **Hot water demand** can present a challenge for HPWHs that may be unable to provide enough hot water to serve different family sizes.
- The **need for larger install rooms** to accommodate HPWHs is a potential barrier to adoption for many homeowners.

Efficient Water Heaters

The NSH specifications for efficient water heaters call for a HPWH, or natural gas water heater with 0.81 efficiency, which, given current technology is typically a tankless water heater. Evergreen identified the following barriers to adoption of efficient water heaters in two reports. The first report was a 2012 ACEEE report documenting the market transformation progress of water heating technology, including HPWHs and 0.80 to 0.82 EF tankless natural gas water heaters as well as other conventional and emerging water heating technologies. The second report was a 2012 Verinnovation Inc. market update report prepared for NEEA, which focused primarily on HPWHs and tankless gas water heaters.

- **High first costs**, although this may not be as much of an issue for new homes.
- For tankless hot water heaters, the potential for **long delays in producing hot water** is a potential barrier. While tankless water heaters are often marketed as providing “endless hot water,” customers often confuse this to mean *instant* hot water.
- **Skepticism** about claims of utility bill savings.

- **Education gaps.** Consumers indicate that they lack information to judge the benefits of high efficiency water heaters.
- **Low natural gas prices** can make the economic case for high efficiency gas water heaters “a tough sell.”

Ductless Heat Pumps (DHP)

In a 2014 market progress evaluation report, Evergreen Economics identified the following barriers to DHP adoption:

- **Capability and functionality** of DHPs is a concern for some homeowners, with 21% of surveyed homeowners concerned about general functionality and 11% concerned about functionality in cold weather. Households that actually installed DHPs, however, reported high satisfaction on multiple DHP features – e.g., heating and cooling comfort, noise levels, appearance, and electricity bill savings.
- **Aesthetic concerns** are also raised by a portion of homeowners, with 11% concerned about the appearance of DHP units both inside and outside the home.

6 Baseline Estimation - Homes Programs Interviews

This section presents the results of in-depth interviews conducted with senior program staff from energy efficient new home construction programs (the programs) active in the Northwest. Evergreen Economics conducted these interviews in support of the Next Step Homes (NSH) Baseline Assessment Study.

During April and May 2014, Evergreen Economics completed seven interviews with senior program staff from the following energy efficient new homes construction programs.⁵

- Northwest ENERGY STAR (CLEAResult)
- Earth Advantage
- Built Green – King County, Washington
- United States Green Building Council (LEED)
- Passive House
- US Environmental Protection Agency (EPA)
- Residential Energy Services Network (RESNET)

The primary objectives of the interviews were to:

- Solicit perceptions of the volume of current construction that meets the NSH specifications;
- Solicit perceptions of the likely trajectory of NSH construction in 10 years and 20 years;
- Identify current and expected barriers to builder adoption of the NSH specification;
- Obtain data on each programs' 2013 market share to help characterize the market;
- Solicit program data to identify NSHs constructed in 2013; and
- Identify recent studies on homebuyer barriers to energy efficient home purchases.

Prior to each interview, Evergreen staff provided the participants with a copy of the interview questions and the following information regarding the Next Step Homes specifications so they would be fully informed at the time of the interview:

“Next Step Homes, which we’ll refer to as “high performance homes,” are expected to deliver annual energy savings that are about double what a Northwest ENERGY STAR home would deliver. The Northwest ENERGY STAR specification is designed to deliver approximately 15% energy savings relative to state codes, and thus a high performance home delivers roughly 30% savings. High performance homes must meet a prescriptive specification that includes the following features:

⁵ The entities listed gave permission to be named as participants in this study and to report the market data they provided. However, all qualitative interview responses and forecasts from the in-depth interviews are anonymized and not attributable to any one interviewee.

1. *Advanced wall efficiency (insulation and windows) with a u-value of 0.035 or lower in Heating Zone 1, and 0.030 or lower in Heating Zones 2&3;*
2. *An ultra-tight shell (2.0 ACH₅₀) and heat recovery ventilation (HRV);*
3. *Ducts inside the building shell (if applicable);*
4. *Efficient heating strategies, such as*
 - a. *Gas Furnace – 94% AFUE*
 - b. *Heat Pump – 9.0 HSPF, 12.0/11.5 EER*
 - c. *Ductless Heat Pump – 3.0 COP*
 - d. *Radiant floor heating*
5. *A heat pump water heater, or natural gas water heater with 0.81 efficiency; and*
6. *U.25 windows*

Homes that include these features may also achieve other home certifications, such as Passive House, LEED for Homes, Earth Advantage Gold or Platinum, and Built Green, although this is not a requirement.”

The remainder of this section presents the results of the in-depth interviews.

6.1 Estimated 2013 Baseline Next Step Homes

The first battery of questions aimed to determine if the programs collected sufficient data on their homes to identify homes that meet the Next Step Homes specification. If this information were available, we would then use it to provide an estimate of the market share of “high performance homes” in 2013 that can serve as a minimum baseline. If sufficiently detailed data were not available, we asked the program staff to provide an informed estimate of the number of Next Step Homes that may have been constructed in the Northwest states or the estimated market share of these homes in 2013. **Table 5** presents the estimated number of program homes that meet or approximate the NSH specifications.

Table 5: Estimates of Program Homes Approximating or Meeting NSH Specifications¹

Program	State(s) Where NSHs Identified	Data Available	Estimate	# Program Homes	Notes
ENERGY STAR	WA	Y	N	5	2 homes are Built Green; 1 Passive House
	OR	Y	N	9	1 NEEA NSH Pilot received assistance
Passive House	ID	Y	N	1	
	MT	Y	N	1	
	OR	Y	N	19	
	WA	Y	N	12	
Earth Advantage ²	OR	N	Y	15	All homes are ENERGY STAR
USGBC/LEED (Idaho) ³	ID	N	Y	38	
Built Green ⁴	WA	N	Y	43	All homes receive some incentives

¹ There is possibility of overlap between program homes as it is not possible to crosscheck addresses with the limited data provided.

² The Earth Advantage home count includes homes in Oregon and South West Washington. We include all of these homes in the Oregon Count. Earth Advantage does not track some specification data, namely, specific wall or window u-values. The homes reflected in the EA number meet all other NSH specifications.

³ USGBC (LEED) do not track specific measure information for certified homes, rather they are tracked on a point scale. We use the number of LEED Platinum single-family homes as a proxy for NSH- equivalent homes.

⁴ The Built Green value is the number of homes built in King and Snohomish counties only. Built Green does not track specific measure information sufficient to identify NSHs. We use the number of Built Green 5 Star homes that typically are 40% to 50% above code as a proxy for NSH-equivalent homes.

In **Table 6**, we aggregate the data above, accounting for known overlap between programs, to develop an estimate of energy efficient new home program homes meeting or approximating the NSH specification by state. We compare these numbers to the total number of homes constructed in 2013 to approximate the market share of these homes.

Table 6: Count of Program Homes Approximating or Meeting NSH Specifications in 2013

State	Program Homes Meeting NSH Specification	Total Homes Constructed (2013)¹	Approximate Market Share
ID	38	5,518	0.69%
MT	1	1,695	0.06%
OR	42	6,936	0.61%
WA	57	16,292	0.35%
Total	132	30,441	0.43%

¹ Total homes constructed is drawn from Evergreen Economics analysis of US HUD permits data accessed on March 21, 2014, presented in Table 1 in the Market Characterization section of this report.

There are limitations to these estimates, including:

- Lack of information on NSHs in Montana;
- Potential for other homes that meet NSH specifications but which are not accounted for by the programs we surveyed;
- Some homes included in the counts above may not actually meet all of the NSH specifications; and
- Possibility of overlap between program homes, as it is not possible to crosscheck all addresses with the limited program data provided.

Given these limitations, it is reasonable to assume that the current market share for homes meeting the NSH specifications is less than 1%.

6.2 Expected Next Step Home Trajectory

To help forecast a baseline for NSHs, Evergreen asked program staff to give their perspective on where the market for homes meeting NSH specifications may be heading in the future absent of promotion by NEEA and the Northwest utilities (including Bonneville Power Administration and Energy Trust of Oregon). Specifically, we asked what changes they anticipate in the market share of homes built to NEEA’s specification, if NEEA and the Northwest utilities do not provide technical, marketing or financial assistance to builders, in 10 years and in 20 years. **Table 7** below presents the results.

Table 7: Estimated Market Shares: 10 years and 20 years

Time Period	Market Share – Low	Market Share – High	Market Share - Average	Market Share - Median
2024	1%	40%	12%	6%
2034	5%	80%	30%	13%

Source: Interviewed homes program managers.

As **Table 7** shows, the seven interviewees ranged widely in their estimates of market share for NSHs. One reason for the range of estimates was differing opinions between interviewees on whether the NSH specifications would be adopted as code over the next two decades or not. Interviewees that tended to give lower market share estimates were less optimistic about measures being adopted into code, whereas those at the higher end forecast expect more rapid code adoption of NSH specifications. All interviewees stated that their estimates are highly speculative given the dynamic nature of the energy efficient new homes market.

Interviewees provided the following reasons for downward pressure on market share over the next two decades:

- Lack of consumer demand. Several interviewees explained that knowledge of energy efficiency in housing is still low among the general public and lower for high performance homes. This could result in lack of consumer demand without which builders will not build to the NSH specification.
- High first costs of NSHs and the associated technologies will be a challenge for many builders. While some will build NSHs to differentiate their product, the high cost will price some builders out of this sub-market. High costs also have the potential to price customers out of the new homes market, depressing demand.
- Lack of knowledge of emerging technologies among builders. For example, builders are often not aware of HRV differences and are not skilled in optimizing these systems.
- The rebounding housing market may cause some builders to be less inclined to build efficient homes to differentiate themselves, leading to an overall decrease in market share of efficient homes.
- The emerging trend of consolidation in the building industry. One interviewee noted that in Washington national building companies have acquired many local builders over the past five years. These national companies are less “in tune” with local demand

for efficiency. This could result in fewer builders of efficient homes overall.

- Equipment and technology is changing quickly, so these types of measures could become outdated and no longer considered “high performance” by some builders.
- Low demand in rural areas because the “appetite for sustainability” is not there.
- The trend toward performance-based codes (2015 IECC codes) could increase market share of NSHs; however, if the program does not allow equipment tradeoffs, many homes may be built to other specifications to achieve high efficiency.

Program staff gave the following reasons for increasing market share of NSHs over the next two decades:

- Most measures will be available soon. HPWHs are growing and heavily incented in Washington. (In contrast, HRVs are growing slower and are the biggest hurdle per NSH Pilot builder feedback.)
- Improving education targeted at consumers and builders should increase demand for energy efficient homes.
- In some areas of the Northwest, migration from California may bring consumers who are more aware of energy efficiency.
- Perception that codes are going to increase quickly, especially among interviewees who run national level programs who were referencing codes on a national level rather than codes specific to the Northwest.
- Increasing demand for energy efficiency in urban areas.
- Rising costs of energy.

6.3 Perceived Barriers to Next Step Homes

We then asked program staff to expound on the current and potential barriers that may face the NSH Initiative. In addition to the issues noted above, interviewees identified the following barriers facing the NSH program:

- Perceived problems with new technologies. Some builders and consumers believe that there can be problems with air quality in very tight homes and performance issues with heat pump technologies.
- Lack of knowledge and understanding of highly efficient homes among realtors and appraisers, resulting in low appraisal values and inadequate marketing.
- Consumer preferences for aesthetic details such as finishes and countertops over energy efficiency.
- Low cost of energy in the Northwest, meaning longer payback periods for energy efficient measures.
- Manufacturers may not be designing new technology with measures integration in mind.
- Lack of financing options for energy efficient homes and stringent construction loans.
- Significant pushback from builders and building associations in some areas against

further regulation and code changes. If these efforts are successful, they could significantly impact market transformation.

- One interviewee noted that the market for energy efficient homes is “becoming crowded,” which can lead to confusion among builders and consumers. This interviewee also noted that prescriptive programs are often difficult for consumers to comprehend versus performance-based programs.

6.4 2013 Market Shares of New Homes Programs

As part of our research, we also characterize the market for energy efficient homes in general, in the Northwest states. To this end, we asked program staff to provide us with estimates or data describing the 2013 market share of their programs.

Table 8 below presents the estimated market share of each program we contacted.

Table 8: Energy Efficient Home Programs Market Shares

Program	State	# Program Homes Built	Total Homes Built in Region	Estimated Market Share
ENERGY STAR	ID	793	5,518	14.37%
	MT	101	1,695	5.96%
	OR	1,030	6,936	14.85%
	WA	1,111	16,292	6.82%
Passive House	ID	1	5,518	0.02%
	MT	1	1,695	0.06%
	OR	19	6,936	0.27%
	WA	12	16,292	0.07%
Earth Advantage	OR	477	6,936	6.88%
USGBC/LEED (Idaho)	ID	83	5,518	1.50%
Built Green ¹	WA	533	4,359	12.23%

¹ Figures for Built Green are for King County only.

² Total homes constructed is drawn from Evergreen Economics analysis of US HUD permits data accessed on March 21, 2014, presented in Table 1 in the Market Characterization section of this report. Estimated market share may differ from program values.

7 Baseline Estimation - Northwest Homebuilders Phone Survey

CIC Research conducted a phone survey of 185 single-family homebuilders in May and June of 2014 to obtain information about builders' current and projected building practices, and estimates of future Next Step Home construction levels. Appendix B includes the detailed survey instrument, and Appendix C includes additional survey results to those presented in this report chapter.

Table 9 below shows the distribution of completed surveys by state and builder size (number of 2013 completed homes). Originally, 32 strata were developed to account for state, builder size, and urban vs. rural locations. However, due to the low response rates among rural builders and the largest builders (25+ homes), the 32 strata were collapsed into 13 unique strata by state, with three distinct builder sizes instead of the original four, and no urban versus rural distinction. Washington is the only exception, with four size categories, because of the relatively larger response rate among large builders. See Appendix E for a more detailed overview of the response rates for specific strata.

Table 9: Number of Completed Surveys

State	Subtotal By Builder Size – 2013 Homes Built			Total
	2-4	5-9	10+	
ID	26	5	7	38
MT	21	9	6	36
OR	28	14	4	46
WA	36	14	15*	65
Total	111	42	32	185

*Because of the larger sample size, Washington builders were further disaggregated into 10-24 and 25+ homes strata with unique weights. For the other states, response rates were low for the largest categories, and thus were collapsed into a single size category of 10+ homes.

As shown in the table, 60% of the surveyed builders were small builders, 23% were medium volume builders, and 17% were large builders. Additionally, 21% of builders were from Idaho, 19% from Montana, 25% from Oregon, and 35% from Washington. The disparities across state and builder size are reflective of the differences in the number of total builders in each stratum within the overall regional sample frame.

Current Construction of Next Step Homes

During the survey, builders were asked to estimate the number of their 2013 completed homes that included energy efficient elements that are in the Next Step Home specification. These elements included advanced walls, ultra tight shell with HRV, 94% efficiency gas

furnace, high efficiency heat pumps, ductless heat pumps, radiant floor heating, ducts in conditioned spaces, heat pump water heater, 0.81 EF gas water heater, and U.25 windows. **Table 10** below summarizes the weighted average percentages of 2013 homes per state that included efficient measures based on the homebuilder survey results. It was not within the study scope to verify the installation of these measures, particularly since most homes completed in 2013 are currently occupied.

Table 10: Percentage of 2013 Homes with Next Step Home Efficiency Measures⁶

Measure	State				Average
	ID (n=38)	MT (n=36)	OR (n=46)	WA (n=65)	
94% gas furnace	64%	63%	92%	81%	75%
Ducts in conditioned spaces	35%	91%	34%	56%	54%
0.81 EF gas water heater	15%	26%	92%	41%	44%
Advanced walls	46%	66%	49%	13%	44%
U.25 windows	33%	54%	31%	43%	40%
Ultra tight shell with HRV	6%	18%	26%	12%	16%
High efficiency heat pump	7%	6%	13%	16%	11%
Radiant floor heating	9%	5%	6%	3%	6%
Ductless heat pumps	1%	0%	3%	2%	2%
Heat pump water heater	1%	1%	0%	2%	1%

As shown above, there was a high variation in the inclusion of the efficiency measures. The most common efficiency measure was the efficient gas furnace, included in 75% of Northwest homes. The only other measure found in over 50% of homes was ducts in conditioned spaces, found in 54% of 2013 homes, including 91% of homes in Montana. On the other end of the spectrum, radiant floor heating (6%), ductless heat pumps (2%), and heat pump water heaters (1%) were the least common measures built into Northwest homes in 2013. While there was general consistency among the states, certain measures were much more likely to be included in some states versus others. For example, efficient gas water heaters were in 92% of Oregon homes but only 26% of Montana homes and 15% of Idaho homes.

Additionally, builders were asked how many of their completed 2013 homes included *all* of these measures. While several builders indicated they had included at least some of the measures in their homes, none reported that they had completed a home with all of the measures in 2013.

⁶ Percentages in tables were calculated using two weighting strategies. Weight_1 was used to estimate the builder universe while Weight_2 was used to estimate the number homes in respective 'universe'. For more details, please see Appendix D.

Builder Estimates of Future Next Step Home Construction

Another key component of the builder survey was to obtain open-ended 20-year and 10-year estimates for the adoption of Next Step Homes across the different states. Builders were asked to provide an estimate of the market share for Next Step Homes under the assumption that NEEA and Northwest utilities will not provide financial incentives or technical assistance to builders, and state codes will not change significantly. **Table 11** below shows the estimated market shares of Next Step homes in 20 years by state and builder size, while

Table 12 displays the estimates for 10 years.

Table 11: Estimated Market Share of Next Step Homes - 20 Years (Median Values)

State	Subtotal By Builder Size				Overall
	2-4	5-9	10+ (10-24 for WA)	25+ (WA Only)	
ID (n=38)	14%	40%	12%	N/A	20%
MT (n=36)	15%	16%	15%	N/A	15%
OR (n=46)	17%	22%	20%	N/A	20%
WA (n=65)	19%	10%	10%	7%	12%
Overall					15%

Table 12: Estimated Market Share of Next Step Homes - 10 Years (Median Values)

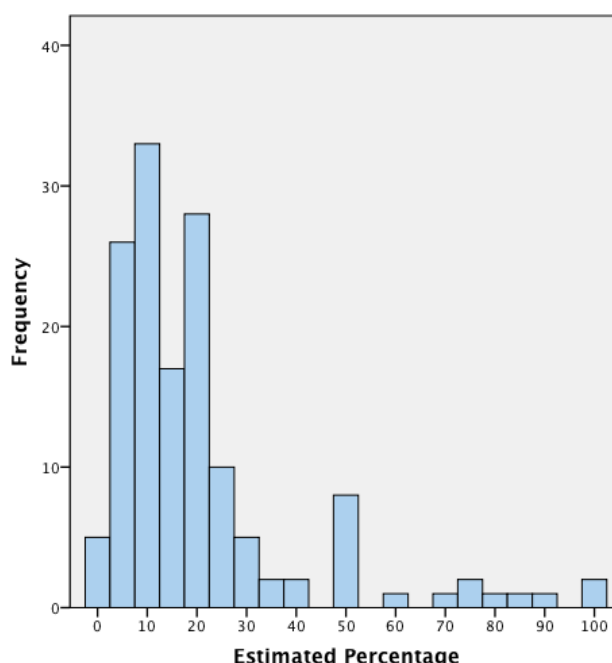
State	Subtotal By Builder Size				Overall
	2-4	5-9	10+ (10-24 for WA)	25+ (WA Only)	
ID (n=38)	10%	28%	10%	N/A	10%
MT (n=36)	10%	10%	10%	N/A	10%
OR (n=46)	10%	16%	20%	N/A	15%
WA (n=65)	10%	6%	10%	6%	10%
Overall					10%

For the 20-year estimates, Idaho and Oregon builders provided the highest statewide market share estimates at 20%, followed by Montana at 15% and Washington at 12%. Idaho builders in the 5 to 9 home range were particularly inclined to project relatively high market shares, as were Oregon builders with 10 or more homes in 2013.

For the 10-year estimates, only Oregon builders estimated a market share higher than 10%, driven largely by builders in the 10+ homes group. Overall, the weighted median value estimate across all states and builder sizes was 10% in 10 years, compared to a weighted median value of 15% in 20 years.

Figure 2 shows the distribution of responses by builders to the 20-year NSH market share question. While the most builders believe the market share will be below 25 percent, a small minority of builders believes that the market share for Next Step Homes will be over 50% of all new homes in 20 years. To reduce the impact of these “outlier” responses, we elected to report median values in the preceding tables as opposed to mean (average) values. As we found in our interviews with some program managers, we believe that some of these builders may have based their high estimates on expectations of rapidly increasing codes. That said, the fact that some builders gave estimated market shares over 50% suggests that some builders are particularly optimistic about the prospects for Next Step Homes, or highly efficient homes in general.

Figure 2: Distribution of Estimated Market Share of Next Step Homes - 20 Years



Bootstrap Method for Computing Standard Errors and Confidence Intervals

Due to the complexity of the sample design for the builder survey and the weights developed to compute the results, confidence intervals computed using standard methods are not correct. Instead, we approximate the confidence intervals using an empirical resampling technique known as the *bias-corrected and accelerated (BCa)* bootstrap method.⁷ The bias-

⁷ Like percentile-based methods, the BCa bootstrap is based on resampling from an empirical distribution of values and then selecting the $\alpha/2$ and $(1-\alpha/2)$ values as the lower and upper values of the $1-\alpha$ confidence interval, where Alpha represents the level of significance and $1-\alpha$ represent the level of confidence. For example, a 90 percent confidence interval is associated with an alpha of 0.10. For the standard percentile-based confidence interval, the lower bound of the 90 percent confidence interval is the $0.10/2 = 5$ th percentile value; the upper bound of the 90 percent confidence interval is the $(1.0 - 0.1)/2 = 95$ th percentile value. See Efron, B., & Tibshirani, J. (1993). *An Introduction to the Bootstrap*. Boca Raton, FL: Chapman & Hall.

corrected and accelerated (BCa) bootstrap, by Efron (1987), adjusts for both bias and skewness in the bootstrap distribution. The BCa approach is applicable in a wide variety of analyses, in particular for those analyses where the measure of interest is bounded at one or more specific values, such as the current analysis where zero and 100 percent bound the survey responses. **Table 13** and **Table 13** indicate how the bootstrap confidence intervals for the 20- and 10-year market share for each state.

Table 13: Confidence Intervals for Market Share of Next Step Homes – 20 Years

State	Market Share (Median)	90% Confidence Interval	
		Lower	Upper
ID (n=38)	20%	15.0%	26.1%
MT (n=36)	15%	11.9%	18.5%
OR (n=46)	20%	15.4%	24.7%
WA (n=65)	12%	8.9%	15.4%
Overall	15%	13%	17.1%

Table 14: Confidence Intervals for Market Share of Next Step Homes – 10 Years

State	Market Share (Median)	90% Confidence Interval	
		Lower	Upper
ID (n=38)	10%	7.4%	12.8%
MT (n=36)	10%	7.7%	13.0%
OR (n=46)	15%	12.4%	18.0%
WA (n=65)	10%	7.5%	13.3%
Overall	10%	8.8%	11.4%

Analysis of Next Step Home Measures

Builders were also asked about the likelihood of including the specific Next Step Home measures in their homes over the next 10 years using a scale of 1 to 10, where 1 is “not at all likely” and 10 is “extremely likely.”

Table 15 below displays the results for each of the ten measures by state, along with an average of all the Northwest states.

Table 15: Likelihood of Installing Next Step Home Measures in Future Homes

Measure	State				Average
	ID (n=38)	MT (n=36)	OR (n=46)	WA (n=65)	
94% gas furnace	8.68	8.99	8.12	7.70	8.15
U.25 windows	7.84	6.82	7.13	6.27	6.85
Ducts in conditioned spaces	6.68	8.29	6.50	6.50	6.76
0.81 EF gas water heater	6.77	5.93	7.31	5.58	6.31
High efficiency heat pump	5.64	4.02	6.59	6.49	6.05
Advanced walls	5.54	5.44	6.79	4.58	5.46
Ultra tight shell with HRV	5.76	5.29	6.53	4.65	5.44
Ductless heat pumps	3.93	2.95	5.46	4.63	4.51
Heat pump water heater	3.62	3.37	4.34	4.36	4.10
Radiant floor heating	3.72	5.08	3.88	3.63	3.90

The measures that builders said they were most likely to include in their future homes included high efficiency gas furnaces, U.25 windows, and ducts in conditioned spaces. The highest individual likelihood responses for measures included an 8.99 for efficient gas furnaces in Oregon, 8.68 for efficient gas furnaces in Idaho, and 8.29 for ducts in conditioned spaces in Oregon. On the other end, scores for ductless heat pumps, radiant floor heating, and heat pump water heaters all averaged below a 5. These low scores suggest that these measures will take a significantly longer time to be adapted by builders in the Northwest.

Main Challenges for Next Step Home Construction

Builders were also asked to describe the main challenges for Next Step Home construction going forward. By far the most commonly reported challenge for homebuilders was the (expected) premium costs associated with these homes. Specifically, many homebuilders stated that few buyers will be able and willing to pay the higher up front costs of high efficiency homes despite the long-term energy savings the homes may yield. Other challenges that homebuilders identified included:

- Lack of consumer education about high efficiency measures;
- Difficulty integrating multiple efficiency systems;
- Expected low and stable electricity costs, which will reduce demand for energy efficiency;
- Challenges procuring U.25 windows, with added expense (unless window sizes or counts are reduced);

- Concerns about “too tight” homes with inadequate ventilation (i.e., mold and health issues); and
- Increasing manufacturer costs for mechanical systems.

Suggestions to Encourage High Performance Home Construction

In a closing question, builders were asked to provide suggestions on how to encourage more building of Next Step Homes. The most common suggestions included:

- Increase homeowner education about highly efficient homes;
- Increase financial incentives to buyers and builders;
- Develop promotional marketing material; and
- Promote changes to building codes to accommodate Next Step Homes.

In addition, several builders did not provide specific suggestions but indicated the best way to encourage an increase in high performance home construction would be to promote any methods that would decrease the high initial capital investments.

8 Key Findings and Recommendations

In this section, we present some of the key findings from the research activities, and recommendations regarding NEEA's baseline estimates for the Next Step Home Initiative.

Key Market Characterization Findings:

- 1) In 2013, approximately 7,800 builders (including builders of single, private residence homes) constructed about 30,000 single-family homes in the Northwest states.** Fifty-three percent of regional homes were constructed in Washington, which has historically led the region's home construction. Eighty-nine percent of homes were constructed in urban (versus rural) counties.
- 2) Construction forecasts through 2018 show that Idaho and Montana should experience the most growth (54% and 45%), while Washington and Oregon should experience the least (33% and 17%).** For all four states, there is a forecast growth period from 2014-2016 and very little change from 2016-2017, followed by a period of declining construction from 2017-2018. Growth forecasts were not available for urban versus rural areas.
- 3) Potential buyers of energy efficient homes face a wide range of financial, informational and technical barriers.** In particular, homebuyers and financial institutions often do not recognize and monetize long-term energy savings, and are not willing to finance more expensive energy efficient homes. Moreover, many homebuyers are unable to identify energy efficient homes or features and believe that existing codes guarantee efficiency. Lastly, homebuyers sometimes perceive that heat pump water heaters, ductless heat pumps and tankless water heaters have general performance problems.
- 4) Some energy efficient homes programs obtained moderate market shares in 2013.** The Northwest ENERGY STAR Homes Program obtained over 14% market share in Idaho and Oregon, while Built Green obtained 12% market share in King County, Washington. Other programs such as LEED (Idaho) and Passive House only achieved market shares of less than 2%.

Key Baseline Estimation Findings:

- 1) For all four states, less than one percent of homes constructed in 2013 likely met the Next Step Home specifications, according to data provided by managers of Northwest energy efficient homes programs.**
- 2) None of the surveyed homebuilders had built a home that met all of the Next Step Home requirements in 2013.** Currently, the most commonly installed NSH measures in

new homes are 94% gas furnaces (in 75% of survey respondent homes) and ducts inside conditioned spaces (in 54% of homes).

- 3) **The surveyed builders estimated 20-year regional market share for Next Step Homes, without assistance from NEEA or the Northwest utilities, at 15%.** The median value estimates ranged from a high of 20% in Idaho and Oregon to a low of 12% in Washington.
- 4) **Northwest homes program managers believed that regional, 20-year market share for Next Step Homes would range from 5% to 80%, with a median value of 13%.** One reason for the wide range of estimates was differing opinions on whether or not the NSH specifications would be adopted as code over the next two decades. Interviewees that gave lower market share estimates were less optimistic about measures being adopted into code, whereas those at the higher end of the forecast range expected more rapid code adoption of NSH specifications. (The surveyed builders were instructed to not consider potential code changes.)
- 5) **The surveyed builders estimated 10-year regional market share for Next Step Homes, without assistance from NEEA or the Northwest utilities, at 10%.** Only Oregon builders estimated a higher market share (15%).
- 6) **Northwest homes program managers believed that regional, 10-year market share for Next Step Homes would range from 1% to 40%, with a median value of 6%.** Again, interviewees that gave lower market share estimates were less optimistic about measures being adopted into code, whereas those at the higher end of the forecast range expected more rapid code adoption of NSH specifications.
- 7) **Going forward, builders said they were most likely to include high efficiency gas furnaces, U.25 windows, and ducts in conditioned spaces in their future homes. Builders are least likely to install ductless heat pumps, radiant floor heating, and heat pump water heaters.**
- 8) **Surveyed builders and interviewed homes program managers described the following expected challenges for future Next Step Home construction:**
 - High first costs
 - Poor understanding and marketing by realtors
 - Potential air quality problems in very tight homes
 - Continuing low energy costs in the Northwest, that will reduce demand
 - Technical difficulty integrating required measures
 - Builder resistance to future code and programs changes

Recommendations:

Based on the research findings, we make the following recommendations:

- 1) For the current baseline, NEEA should assume that approximately 0% of single-family home construction in all states is fully meeting the Next Step Home requirements without assistance from NEEA.**
- 2) For the 20-year baseline, NEEA should utilize the following state-level market share estimates derived from the builders phone survey. These estimates are also generally consistent with estimates provided by efficient home program managers, when the potential impacts of increasing building codes are not factored in.**
 - **Idaho = 20%**
 - **Montana = 15%**
 - **Oregon = 20%**
 - **Washington = 12%**
- 3) If NEEA chooses to adopt data-grounded, 10-year baselines (rather than fit an S-shaped curve to the 20-year baselines), NEEA should utilize the following state-level market share estimates derived from the builders phone survey. These estimates are also generally consistent with estimates provided by efficient home program managers, when the potential impacts of increasing building codes are not factored in.**
 - **Idaho = 10%**
 - **Montana = 10%**
 - **Oregon = 15%**
 - **Washington = 10%**

These 10-year baselines suggest that Next Step Homes may realize relatively rapid growth in the next ten years, as some builders strive to build above increasing state codes to differentiate themselves in the market. After 10 years, builders' construction of Next Step Homes may decrease somewhat if the majority of prospective builders have already joined this submarket.

Appendix A: Other Programs Staff In-Depth Interview Guide

Next Step Home

Other Programs Staff In-depth Interview Guide

Objectives:

- Solicit perceptions on the volume of current NSH construction
- Identify current and expected future barriers to builder adoption of NSH specification
- Solicit program data to identify NSHs constructed in 2013 or earlier
- Identify recent studies on homebuyer barriers to energy efficient home purchases
- Obtain data on programs' 2013 market share

Target Audience:

- Representatives from organizations that promote energy efficient homes in the Northwest, including:
 - Northwest ENERGY STAR
 - Earth Advantage
 - Built Green
 - LEED
 - National Association of Homebuilders
 - EPA
 - DOE
 - RESNET

Introduction:

Hi, this is _____ with Evergreen Economics, an energy program evaluation firm in Portland, Oregon. NEEA, the Northwest Energy Efficiency Alliance, has contracted us to assess the baseline market share of a new type of highly energy efficient home in the Northwest – homes that go above and beyond ENERGY STAR – and asked us to contact you in order to obtain some information important to our research.

Is now a good time?

IF NEEDED: Our discussion should take about 20 minutes. (SCHEDULE IF NECESSARY)

Before we start, here is NEEA's current specification for these highly energy efficient homes (*Note: we will also email this definition in advance of the call*):

These homes, which we'll refer to as "high performance homes," are expected to deliver annual energy savings that are about double what a Northwest ENERGY STAR home would deliver. The Northwest ENERGY STAR specification is designed to deliver approximately 15% energy savings relative to state codes, and thus a high performance home delivers roughly 30% savings. High performance homes must meet a prescriptive specification that includes the following features:

1. Advanced wall efficiency (insulation and windows) with a u-value of 0.035 or lower in Heating Zone 1, and 0.030 or lower in Heating Zones 2&3;
2. An ultra-tight shell (2.0 ACH₅₀) and heat recovery ventilation (HRV);
3. Ducts inside the building shell (if applicable);
4. Efficient heating strategies, such as
 - a. Gas Furnace – 94% AFUE
 - b. Heat Pump – 9.0 HSPF, 12.0/11.5 EER
 - c. Ductless Heat Pump – 3.0 COP
 - d. Radiant floor heating
5. A heat pump water heater, or natural gas water heater with 0.81 efficiency; and
6. U.25 windows

Homes that include these features may also achieve other home certifications, such as Passive House, LEED for Homes, Earth Advantage Gold or Platinum, and Built Green, although this is not a requirement.

In the past year, NEEA has partnered with a few Northwest builders to build some homes to the specification, which was called the Next Step Home during this Pilot phase.

Current Baseline and Database Questions:

First, let's discuss the extent to which High Performance Homes may already be constructed in the Northwest – specifically in Idaho, Montana, Oregon and Washington.

- 1) Do you believe that there are any homes in databases that you maintain that meet NEEA's High Performance Home specification?
- 2) [If 1 = NO] Could you or someone else at your organization give an informed estimate of the number of High Performance Homes that may have been constructed in the Northwest states in 2013? Or do you have a sense of what the market share of these homes might have been in 2013? [PROBE to see if market share varies by state/region]

Record	State/Region	2013
Quantity		
Market Share		

- 3) [If 1 = YES] Do you believe that your database contains sufficient information that someone could use it to identify High Performance Homes?

- 4) [If 3 = YES] What data fields would you use?

- 5) [If 3 = YES] How can these fields be used to determine whether a home met the specification? [Probe to see if homes can be identified by year built and state/region]

- 6) [If 3 = YES] Who could we work with to obtain a copy of your database, and work with to identify HPHs? (GET NAME AND CONTACT INFO, AND FIND OUT IF ANY NON-DISCLOSURES REQUIRED)

- 7) [IF ANY HIGH PERFORMANCE HOMES ESTIMATED OR IN DATABASE] Do you know if any of the High Performance Homes we have been discussing received assistance or incentives from NEEA or a Northwest utility? To the extent possible, we are trying to identify “naturally occurring” baseline homes for our research. (GET DETAILS ON SPECIFIC BUILDERS IF THEY KNOW THAT.)

Perceptions of the Next Step Home

Now we would like to get your perspective on where the market for High Performance Homes may be heading.

- 8) What changes do you anticipate in the market share of homes built to NEEA's specification in the next 10 years, if NEEA and the Northwest utilities do not provide technical, marketing or financial assistance to builders? (GET DETAILS ON EXPECTED CHANGES OR NOT, MAGNITUDE, IN WHICH STATES)
 - a) Why do you say that? (PROBE on builder attitudes, equipment availability and costs, changing codes, other emerging equipment/practices, skills availability, consumer demand, housing trends]
- 9) And how about 20 years from now?
 - a) Why do you say that? (PROBE on builder attitudes, equipment availability and costs, changing codes, skills availability, consumer demand, housing trends]
- 10) What do you think will be the biggest challenges – present and in the future – to increasing market share for High Performance Homes?

Closing Questions

As part of our research we also want to characterize the market for energy efficient homes in general, in the Northwest states.

- 11) For the energy efficient homes program(s) you work with, do you have any information on 2013 program market share or number of constructed homes you can share with us?

IF NEEDED: Our research is focused on newly constructed, detached single-family homes in the Northwest states.

- 12) Lastly, we also want to conduct a literature review of recent studies on homebuyer attitudes towards highly energy efficient homes, and barriers that programs need to overcome.

Are you aware of any studies like this that we should review? (GET DETAILS ON AUTHOR, YEAR, WEBSITE, TITLE, ETC.)

Those are all the questions I have for you now. Thank you for your time and good information. If I have any follow-up questions, may I contact you again?

Appendix B: Northwest Homebuilders Phone Survey Instrument

Next Step Home Baseline Estimation Builder Phone Survey

FINAL May 27, 2014

Objectives:

- Document builder practices regarding home types, price ranges, and target markets
- Document extent to which builders are currently building homes meeting the Next Step Home specification
- Solicit estimates of 10 and 20-year market share for Next Step Homes, by state
- Identify specification measures most and least likely to be adopted by builders

Target Audience: About 200 Northwest home building companies that completed 2 or more single-family homes in 2013.

INTRODUCTION

Hi, this is _____ calling from CIC Research for a survey on new home construction in the Pacific Northwest. First, I want to assure you that this is not a sales call – we are only trying to gather information about the new homes market.

IF BUILDER NAME IN SAMPLE: Could I please speak to [BUILDER NAME]?

ELSE: Could I speak to a person in your company who is most aware of the construction and design specifications affecting the energy use of the homes you build?

[WHEN CORRECT PERSON IS ON-LINE:]

Hi, this is _____ calling from CIC Research for a survey on new home construction in the Pacific Northwest. First, I want to assure you that this is not a sales call. We are only trying to better understand the market for a new type of highly energy efficient home in the Northwest – homes that go above and beyond traditional code.

IF PERSON OTHER THAN [BUILDER NAME] REACHED: Can I confirm that you're someone in your company who is aware of the construction and design specifications affecting the energy use of the homes you build?

Yes	[CONTINUE]
No/DK	[ASK TO SPEAK WITH CORRECT PERSON, OR TERMINATE]
Refused	[TERMINATE]



[IF NECESSARY] We are doing this research for the Northwest Energy Efficiency Alliance, or NEEA (KNEE_AH). NEEA is an alliance of more than 140 Northwest utilities and energy efficiency organizations working to accelerate the innovation and adoption of energy-efficient products, services and practices in the Northwest. This survey will help NEEA make its home construction programs as useful as possible to builders like you.

[IF NEEDED] Our survey will take about 15 minutes.

READ TO ALL: Please know that all your answers will be confidential. We never link any information to a particular person or company.

Is now a good time?

- | | |
|------------|-------------------|
| Yes | [CONTINUE] |
| No | [SET UP CALLBACK] |
| DK/refused | [TERMINATE] |

BACKGROUND/FIRMOGRAPHIC INFORMATION

Q 1. First, about how many total years have you personally been involved in the business of building single-family homes? Please think about your current company and any previous companies you've worked for.

- 1) Record BusYears _____,
- 88) Don't Know
- 99) Refused

NOTE: IF BusYears < 2 TERMINATE:

Thanks for your time, but we are only speaking with builders that have been constructing new homes for at least 2 years.

Q 2. I'd like to get an estimate of the number of homes your company built in the Pacific Northwest in 2013. If your company has multiple branches or offices, please only consider the homes you built from the office we have reached you at. Could you please estimate how many detached, single-family homes you completed in each of the following states in 2013? Your best guess is fine. READ:

- 1) Idaho - Record ID#built_____, Don't Know or Refused
- 2) Oregon - Record OR#built_____, Don't Know or Refused
- 3) Montana - Record MT#built_____, Don't Know or Refused
- 4) Washington - Record WA#built_____, Don't Know or Refused

NOTE: IF < 2 TOTAL HOMES BUILT, OR THEY SAY DON'T KNOW OR REFUSED FOR ALL STATES, TERMINATE:

Thanks for your time, for the purposes of this study we need to speak with builders that completed 2 or more new single-family homes across the Northwest in 2013.

ELSE: For the remainder of this call, when we talk about homes you build, we are referring to the new 2013 detached, single-family homes in those Northwest states we just discussed.

NOTE: SET [HIGHSTATE#] TO MAXIMUM OF CONSTRUCTION VOLUMES ABOVE, AND CODE MATCHING [HIGHSTATE] = ID, OR, WA OR MT. IF TIES, RANDOMLY SELECT ONE STATE.

Q 3. We'd like to know what percentage of these 2013 homes you built in the Northwest is spec built and what percentage are custom built. What percent are "spec" built - that is, they have been completely or almost completely built without the customer's direct involvement - and what percent is custom built?

Record PctSpec _____

Record PctCustom _____

88) Don't know

99) Refused

NOTE:

IF Q 3 IS NOT DON'T KNOW OR REFUSED, AND [PctSpec] + [PctCustom] IS NOT 100%, ASK:

Can we adjust these figures so they total to 100 percent? What percent of your homes are spec and what percent are custom?

ADJUST PctSpec and PctCustom

Q 4. [IF PctSpec > 0%] Thinking again about the spec homes from 2013. What was the average price of your spec homes? Would you say it was:

- 1) Less than \$300,000
- 2) Between \$300,001 and \$400,000
- 3) Between \$400,001 and \$500,000
- 4) Between \$500,001 and \$600,000
- 5) More than \$600,000
- 88) Don't know
- 99) Refused

Q 5. [IF PctSpec > 0%] Which of the following groups make up the market for your spec homes? Do you target (READ ALL, ALLOW MULTIPLES):

- 1) First-time homebuyers
- 2) Experienced or "move-up" buyers
- 3) Working, "empty nesters"
- 4) Retirees
- 5) Any other groups; SPECIFY _____

- 88) Don't know
- 99) Refused

Q 6. [IF PctSpec > 0%] How important is it to your company to design energy efficiency into your spec homes? Is it: (READ CHOICES)

- 5) Extremely important
- 4) Very important
- 3) Somewhat important
- 2) Not very important
- 1) Not at all important
- 88) Don't know
- 99) Refused

Q 7. [IF PctCustom > 0%] Now think about those custom homes that you built in the Northwest in 2013. What was the average price of your custom homes? Would you say it was:

- 1) Less than \$300,000
- 2) Between \$300,001 and \$400,000
- 3) Between \$400,001 and \$500,000
- 4) Between \$500,001 and \$600,000
- 5) More than \$600,000
- 88) Don't know
- 99) Refused

Q 8. [IF PctCustom > 0%] And which of the following groups make up the market for your custom homes? Do you target (READ ALL, ALLOW MULTIPLES):

- 1) First-time homebuyers
- 2) Experienced or "move-up" buyers
- 3) Working, "empty nesters"
- 4) Lower income households
- 5) Higher income households
- 6) Retirees
- 7) Any other groups; SPECIFY _____
- 88) Don't know
- 99) Refused

Q 9. [IF PctCustom > 0%] How important is it to your company to design energy efficiency into your custom homes? Is it: (READ CHOICES)

- 5) Extremely important
- 4) Very important
- 3) Somewhat important
- 2) Not very important
- 1) Not at all important
- 88) Don't know
- 99) Refused

Q 10. NOT USED

Q 11. NOT USED

Q 12. NOT USED

In the past year NEEA partnered with a few Northwest builders to build some very energy efficient homes in a pilot study, which was called the Next Step Home pilot.

Q 13. Did your company participate in NEEA's Next Step Home demonstration pilot?

- 1) Yes
- 2) No
- 88) Don't know
- 99) Refused

Q 14. NOT USED

Q 15. NOT USED

Q 16. NOT USED

BASELINE ESTIMATIONS

Now let's discuss the specifications for a new type of highly energy efficient home. We'll call these "high performance homes," and they are expected to be at least 30% more energy efficient than state codes.

[IF Q 13 = YES] These homes are equivalent to the Next Step Home we just discussed.

Q 17. Thinking about the [HighState#] homes you completed in [HighState] in 2013, how many homes included the following elements (READ LIST AND RECORD RESPONSE AFTER EACH ELEMENT)?

[IF Q 13 = YES] Please only consider your Next Step Homes that did not receive any assistance from NEEA.

- 1. Advanced walls with a maximum u-value of 0.035 in Heating Zone 1, and 0.030 in**

Heating Zones 2&3. Some builders do this with strap-wall or double stud construction to minimize thermal bridging and add exterior insulation;

Record #, Don't Know or Refused

- 2. An ultra-tight shell with only 2 air changes per hour, and a heat recovery ventilation system (HRV);**

Record #, Don't Know or Refused

- 3. Efficient heating equipment, such as**

- a. A 94% efficiency gas furnace**

Record #, Don't Know or Refused

- b. A heat pump with 9.0 HSPF and 12.0 or 11.5 EER**

Record #, Don't Know or Refused

- c. Ductless heat pumps**

Record #, Don't Know or Refused

- d. Radiant floor heating**

Record #, Don't Know or Refused

- 4. Ducts inside the home shell, for ducted systems**

Record #, Don't Know or Refused

- 5. Efficient water heating equipment, such as**

- a. A heat pump water heater**

Record #, Don't Know or Refused

- b. A natural gas water heater with a 0.81 efficiency factor**

Record #, Don't Know or Refused

- 6. U.25 windows**

Record #, Don't Know or Refused

Q 18. [IF ALL ELEMENTS 1,2, 6 and (3a,b,c, or d) and (4, if 3a or b) and (5a or 5b)] ABOVE AT LEAST 1] How many of your [HighState] homes in 2013 included ALL of the measures we just discussed, and thus could be considered a high performance home?

- 1) Record [2013HPHs]
- 88) Don't know
- 99) Refused

Now let's talk about the future market potential of high-performance homes. Again, these would be homes that would be 30% more efficient than state codes.

NOTE TO CATI:

If HighState = ID, set [20Start] to a randomly drawn uniformly distributed integer between 10% and 20%. Set [20Inc] to 5%.

If HighState = OR, set [20Start] to a randomly drawn uniformly distributed integer between 10% and 20%. Set [20Inc] to 5%.

If HighState = MT, set [20Start] to a randomly drawn uniformly distributed integer between 10% and 20%. Set [20Inc] to 5%.

If HighState = WA, set [20Start] to a randomly drawn uniformly distributed integer between 10% and 20%. Set [20Inc] to 5%.

Q 19. Thinking about the single-family market in [HighState], if NEEA, BPA (if HighState = OR: Energy Trust) and the Northwest utilities do not provide financial incentives or technical assistance to builders, and state codes do not change significantly, do you think the market share for these homes will be greater than [20Start] 20 years from now?

- 1) Yes
- 2) No
- 88) Don't know – READ: **We know future building trends can be hard to predict, but please use your best judgment – your information will be combined with many other responses just to develop a reasonable estimate.**
- 99) Refused

Q 20. [IF Q 19 = YES] Do you think the market share for these homes will be greater than [20Start + 20Inc] 20 years from now?

- 1) Yes
- 2) No
- 88) Don't know
- 99) Refused

Q 21. [IF Q 19 = NO] Do you think the market share for these homes will be greater than [20Start - 20Inc] 20 years from now?

- 1) Yes
- 2) No
- 88) Don't know
- 99) Refused

Now, I have two questions regarding the future market potential of high-performance homes. Again, we are just looking for your best guess.

Q 22. If NEEA and the Northwest utilities do not provide financial incentives or technical assistance to builders, and state codes do not change significantly, what do you think the market share for these homes will be in 20 years?

Record [20YrEst] (IF ZERO/NONE, SKIP TO Q 24)

- 88) Don't know
- 99) Refused

Q 23. And what do you think the market share for these homes will be in 10 years?

Record [10YrEst]

- 88) Don't know
- 99) Refused

CLOSING QUESTIONS

I just have a few more questions and then we'll be done.

Q 24. I'll read a list of the 10 measures that go into high performance homes and I'd like you to tell me how likely you are to include each measure in your own new homes in the next 10 years. We'll use a scale of 1 to 10, where 1 is not likely at all, and 10 is extremely likely. (READ ALL)

- 1) Advanced walls
- 2) Ultra tight shell with HRV
- 3) 94% gas furnace
- 4) High efficiency heat pump
- 5) Ductless heat pumps
- 6) Radiant floor heating
- 7) Ducts in conditioned spaces
- 8) Heat pump water heater
- 9) 0.81 EF gas water heater
- 10) U.25 windows

- 88) Don't know
- 99) Refused

Q 25. What do you think will be the main challenges for high performance home construction going forward?

Record open-end; try to post code:

- 88) Don't know
- 99) Refused

Q 26. Do you have any suggestions on how we could encourage more building of these homes?

Record open-end; try to post code:

- 88) Don't know
- 99) Refused

Q 27. Last question. May I please get your age?

- 1) Record AGE _____
- 99) Refused

Those are all the questions we have for you today. Thank you very much for sharing your time and good information!

Appendix C: Additional Builder Survey Results

Table 16: Percent of Builders That Built 75% or More: Spec vs. Custom

State	Type of Home	
	Spec	Custom
ID (n=38)	16%	55%
MT (n=36)	36%	36%
OR (n=46)	43%	39%
WA (n=65)	31%	32%
Average	32%	39%

Table 17: Average Price of 2013 Spec Homes

Price	State				Total
	ID	MT	OR	WA	
Less than \$300,000	100%	74%	49%	33%	51%
Between \$300,001 and \$400,000	0%	19%	30%	31%	25%
Between \$400,001 and \$500,000	0%	7%	16%	11%	10%
Between \$500,001 and \$600,000	0%	0%	0%	10%	5%
More than \$600,000	0%	0%	5%	15%	9%
Total					100%

Table 18: Target Market for 2013 Spec Homes

Group	State				Total
	ID	MT	OR	WA	
First-time homebuyers	58%	64%	50%	52%	53%
Experienced or move-up buyers	23%	12%	5%	28%	20%
Retirees	1%	3%	24%	16%	15%
Don't know	1%	3%	21%	1%	7%
Working, empty nesters	17%	1%	1%	1%	4%
Don't target	0%	14%	0%	0%	1%
Military	0%	0%	0%	1%	0%
Small families	0%	0%	0%	0%	0%
Experienced move-down buyers from CA & FL	0%	3%	0%	0%	0%
Total					100%

Table 19: Importance of Designing Energy Efficiency Into Spec Homes

State	Level of Importance				
	Extremely Important	Very Important	Somewhat Important	Not Very Important	Not at All Important
ID	8%	77%	16%	0%	0%
MT	15%	42%	29%	14%	0%
OR	28%	39%	29%	5%	0%
WA	12%	41%	30%	16%	2%
Total	16%	49%	26%	9%	0%

Table 20: Average Price of 2013 Custom Homes

Price	State				Total
	ID	MT	OR	WA	
Less than \$300,000	44%	38%	21%	13%	25%
Between \$300,001 and \$400,000	34%	25%	20%	42%	33%
Between \$400,001 and \$500,000	5%	15%	35%	27%	23%
Between \$500,001 and \$600,000	5%	15%	16%	3%	8%
More than \$600,000	13%	7%	8%	14%	12%
Total					100%

Table 21: Target Markets for 2013 Custom Homes

Group	State				Total
	ID	MT	OR	WA	
Experienced or 'move-up' buyers	41%	29%	31%	43%	37%
Retirees	18%	18%	20%	21%	19%
Higher income households	14%	19%	12%	15%	15%
First-time homebuyers	9%	17%	18%	5%	11%
Working, 'empty nesters'	11%	5%	8%	14%	11%
Lower Income households	4%	6%	0%	3%	3%
Don't know	2%	0%	9%	0%	3%
Don't target	0%	6%	0%	0%	1%
Moderate-priced homebuyers	2%	0%	0%	0%	0%
Investors	0%	0%	2%	0%	0%
Total					100%

Table 22: Importance of Designing Energy Efficiency Into Custom Homes

State	Level of Importance				
	Extremely Important	Very Important	Somewhat Important	Not very Important	Not at all Important
ID	34%	51%	15%	0%	0
MT	25%	52%	23%	0%	0
OR	30%	53%	17%	0%	0
WA	15%	42%	30%	9%	4%
Total	26%	50%	21%	2%	1%

Appendix D: Builder Survey Weighting

Weight_1 was created to account for the number of builders in each strata used in the analysis. Weight_2 was created to account for the number of homes built in each strata. Weight_1 was used for a majority of the analysis, while Weight_2 was used only when the questions directly referred to the number of homes built by the survey participants.

Table 23: Weighting Methods

Strata	Weight_1	Weight_2
ID1	7.653846154	20.28269231
ID2	15.2	101.384
ID3	12	653.52
MT1	7.666666667	20.16333333
MT2	5.555555556	38.11111111
MT3	8.333333333	174.5
OR1	11.32142857	28.75642857
OR2	8.571428571	55.97142857
OR3	28.25	1355.1525
WA1	13.44444444	35.35888889
WA2	10.85714286	71.33142857
WA3	11.4	177.384
WA4	20.8	1739.088

Appendix E: Builder Survey Disposition Tables

NEEA Next Step 06/25/14 FINAL CALL TALLY	TOTAL Quota = 217		ID Rural 2-4 Quota = 16		ID Urban 2-4 Quota = 7		ID Rural 5-9 Quota = 5		ID Urban 5-9 Quota = 8		ID Rural 10-24 Quota = 1		ID Urban 10-24 Quota = 8		ID Rural 25+ Quota = 1		ID Urban 25+ Quota = 8	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
LIVES	24	6.7%	2	4.4%	10	6.5%	0	0.0%	0	5.3%	0	0.0%	6	13.6%	0	0.0%	3	8.6%
No answer	121	33.7%	19	42.2%	46	29.9%	6	31.6%	23	40.4%	0	0.0%	17	36.6%	2	66.7%	8	22.9%
Answering machine	7	1.9%	0	0.0%	3	1.9%	0	0.0%	2	3.5%	0	0.0%	2	4.5%	0	0.0%	0	0.0%
Busy number	11	3.1%	3	6.7%	0	0.0%	0	0.0%	1	1.8%	0	0.0%	1	2.3%	0	0.0%	6	17.1%
Callback	163	45.4%	24	53.3%	59	38.3%	6	31.6%	29	50.9%	0	0.0%	26	59.1%	2	66.7%	17	48.6%
TOTAL LIVES																		
DEADS	22	6.1%	2	4.4%	14	9.1%	1	5.3%	2	3.5%	1	50.0%	2	4.5%	0	0.0%	0	0.0%
Number not in service	3	0.8%	1	2.2%	1	0.6%	1	5.3%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Fax/Modem	103	28.7%	9	20.0%	44	28.8%	11	57.9%	17	29.8%	0	0.0%	10	22.7%	0	0.0%	12	34.3%
Refused	6	1.7%	1	2.2%	5	3.2%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Wrong number	3	0.8%	0	0.0%	1	0.6%	0	0.0%	1	1.8%	0	0.0%	0	0.0%	0	0.0%	1	2.9%
Company Policy Against Surveys	4	1.1%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	2.3%	0	0.0%	2	5.7%
Mid-term terminate (incomplete)	6	1.7%	1	2.2%	3	1.9%	0	0.0%	1	1.8%	0	0.0%	1	2.3%	0	0.0%	0	0.0%
Wrong Company Type	1	0.3%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	2.3%	0	0.0%	0	0.0%
Referred to Corporate	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Referred to Other	2	0.6%	0	0.0%	2	1.3%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
T1: OT = DK or REF	7	1.9%	1	2.2%	4	2.6%	0	0.0%	1	1.8%	0	0.0%	0	0.0%	0	0.0%	1	2.9%
Respondent Never Available	1	0.3%	0	0.0%	1	0.6%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Spanish or Other Language	158	44.0%	15	33.3%	75	48.7%	13	68.4%	23	40.4%	1	50.0%	15	34.1%	0	0.0%	16	45.7%
TOTAL DEADS																		
COMPLETED INTERVIEWS	38	10.6%	6	13.3%	20	13.0%	0	0.0%	5	8.8%	1	50.0%	3	6.8%	1	33.3%	2	5.7%
TOTAL SAMPLE	359		45		154		19		57		2		44		3		35	

NEEA Next Step 06/25/14 FINAL CALL TALLY	MT Rural 2-4 Quota = 15		MT Urban 2-4 Quota = 15		MT Rural 5-9 Quota = 7		MT Urban 5-9 Quota = 5		MT Rural 10-24 Quota = 5		MT Urban 10-24 Quota = 4		MT Rural 25+ Quota = 2		MT Urban 25+ Quota = 2	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
LIVES	45	42.9%	23	41.8%	13	41.9%	10	52.6%	8	44.4%	8	50.0%	2	25.0%	2	25.0%
No answer	7	6.7%	3	5.5%	2	6.5%	1	5.3%	0	0.0%	1	6.3%	1	12.5%	0	0.0%
Answering machine	31	29.5%	20	36.4%	9	29.0%	9	47.4%	7	38.9%	6	37.5%	0	0.0%	1	12.5%
Busy number	1	1.0%	0	0.0%	2	6.5%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Callback	6	5.7%	0	0.0%	0	0.0%	0	0.0%	1	5.6%	1	6.3%	1	12.5%	1	12.5%
TOTAL LIVES																
DEADS	8	7.6%	9	16.4%	3	9.7%	0	0.0%	1	5.6%	1	6.3%	0	0.0%	0	0.0%
Number not in service	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Fax/Modem	25	23.8%	14	25.5%	6	19.4%	4	21.1%	7	38.9%	4	25.0%	2	25.0%	3	37.5%
Refused	3	2.9%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Wrong number	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Company Policy Against Surveys	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Mid-term terminate (incomplete)	4	3.8%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Wrong Company Type	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Referred to Corporate	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Referred to Other	0	0.0%	0	0.0%	1	3.2%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
T1: OT = DK or REF	3	2.9%	1	1.8%	1	3.2%	0	0.0%	0	0.0%	1	6.3%	0	0.0%	1	12.5%
T2: Less than 2 homes built in 2013	4	3.8%	0	0.0%	2	6.5%	1	5.3%	0	0.0%	0	0.0%	2	25.0%	0	0.0%
Respondent Never Available	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Spanish or Other Language	47	44.8%	24	43.6%	13	41.9%	5	26.3%	8	44.4%	7	43.8%	4	50.0%	5	62.5%
TOTAL DEADS																
COMPLETED INTERVIEWS	13	12.4%	8	14.5%	5	16.1%	4	21.1%	2	11.1%	1	6.3%	2	25.0%	1	12.5%
TOTAL SAMPLE	105		55		31		19		18		16		8		8	

NEEA Next Step 06/25/14 FINAL CALL TALLY	OR Rural 2-4 Quota = 17		OR Urban 2-4 Quota = 9		OR Rural 5-9 Quota = 1		OR Urban 5-9 Quota = 8		OR Rural 10-24 Quota = 1		OR Urban 10-24 Quota = 8		OR Rural 25+ Quota = 2		OR Urban 25+ Quota = 8	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
LIVES	2	5.7%	17	6.0%	0	0.0%	9	7.8%	0	0.0%	2	3.2%	0	0.0%	5	12.2%
No answer	17	48.6%	99	35.2%	3	60.0%	44	38.3%	0	0.0%	26	41.9%	2	28.6%	15	36.6%
Answering machine	0	0.0%	1	0.4%	0	0.0%	1	0.9%	0	0.0%	2	3.2%	0	0.0%	0	0.0%
Busy number	0	0.0%	14	5.0%	1	20.0%	3	2.6%	0	0.0%	5	8.1%	0	0.0%	3	7.3%
Callback	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
TOTAL LIVES	19	54.3%	131	46.6%	4	80.0%	57	49.6%	0	0.0%	35	56.5%	2	28.6%	23	56.1%
DEADS																
Number not in service	3	8.6%	14	5.0%	0	0.0%	7	6.1%	1	33.3%	4	6.5%	0	0.0%	1	2.4%
Fax/Modem	0	0.0%	1	0.4%	1	20.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Refused	5	14.3%	76	27.0%	0	0.0%	30	26.1%	2	66.7%	17	27.4%	3	42.9%	7	17.1%
Wrong number	0	0.0%	8	2.8%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	2	4.9%
Company Policy Against Surveys	0	0.0%	0	0.0%	0	0.0%	2	1.7%	0	0.0%	1	1.6%	0	0.0%	1	2.4%
Mid-term terminate (Incompletes)	0	0.0%	1	0.4%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Wrong Company Type	4	11.4%	10	3.6%	0	0.0%	2	1.7%	0	0.0%	1	1.6%	1	14.3%	2	4.9%
Referred to Corporate	0	0.0%	1	0.4%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	2.4%
T1: Q1 = DK or REF	0	0.0%	2	0.7%	0	0.0%	1	0.9%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
T2: Less than 2 homes built in 2013	1	2.9%	10	3.6%	0	0.0%	1	0.9%	0	0.0%	2	3.2%	0	0.0%	2	4.9%
Respondent Never Available	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Spanish or Other Language	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
TOTAL DEADS	14	40.0%	124	44.1%	1	20.0%	44	38.3%	3	100.0%	25	40.3%	5	71.4%	16	39.0%
COMPLETED INTERVIEWS	2	5.7%	26	9.3%	0	0.0%	14	12.2%	0	0.0%	2	3.2%	0	0.0%	2	4.9%
TOTAL SAMPLE	35		281		5		115		3		62		7		41	

NEEA Next Step 06/25/14 FINAL CALL TALLY	WA Rural 2-4 Quota = 17		WA Urban 2-4 Quota = 7		WA Rural 5-9 Quota = 1		WA Urban 5-9 Quota = 9		WA Rural 10-24 Quota = 1		WA Urban 10-24 Quota = 9		WA Rural 25+ Quota = 1		WA Urban 25+ Quota = 9	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
LIVES	4	12.9%	34	7.5%	0	0.0%	8	5.4%	0	0.0%	0	0.0%	3	2.7%	0	0.0%
No answer	12	38.7%	131	29.0%	1	20.0%	44	29.9%	0	0.0%	37	33.3%	2	40.0%	40	40.4%
Answering machine	2	6.5%	17	3.8%	0	0.0%	4	2.7%	0	0.0%	2	1.8%	0	0.0%	2	2.0%
Busy number	2	6.5%	17	3.8%	0	0.0%	6	4.1%	0	0.0%	4	3.6%	0	0.0%	6	6.1%
Callback	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
TOTAL LIVES	20	64.5%	199	44.0%	1	20.0%	62	42.2%	0	0.0%	52	46.8%	2	40.0%	58	58.6%
DEADS																
Number not in service	1	3.2%	38	8.4%	0	0.0%	9	6.1%	0	0.0%	3	2.7%	0	0.0%	6	6.1%
Fax/Modem	0	0.0%	5	1.1%	0	0.0%	0	0.0%	0	0.0%	1	0.9%	0	0.0%	0	0.0%
Refused	6	19.4%	114	25.2%	0	0.0%	49	33.3%	1	33.3%	33	29.7%	1	20.0%	20	20.2%
Wrong number	0	0.0%	15	3.3%	0	0.0%	3	2.0%	0	0.0%	5	4.5%	0	0.0%	2	2.0%
Company Policy Against Surveys	0	0.0%	2	0.4%	0	0.0%	1	0.7%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Mid-term terminate (Incompletes)	0	0.0%	0	0.0%	1	20.0%	1	0.7%	0	0.0%	1	0.9%	0	0.0%	0	0.0%
Wrong Company Type	2	6.5%	22	4.9%	0	0.0%	7	4.8%	0	0.0%	1	0.9%	0	0.0%	1	1.0%
Referred to Corporate	0	0.0%	0	0.0%	0	0.0%	1	0.7%	1	33.3%	0	0.0%	2	40.0%	3	3.0%
T1: Q1 = DK or REF	0	0.0%	2	0.4%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
T2: Less than 2 homes built in 2013	0	0.0%	7	1.5%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Respondent Never Available	0	0.0%	12	2.7%	1	20.0%	2	1.4%	0	0.0%	5	4.5%	0	0.0%	4	4.0%
Spanish or Other Language	0	0.0%	2	0.4%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
TOTAL DEADS	9	29.0%	219	48.5%	2	40.0%	73	49.7%	2	66.7%	50	45.0%	3	60.0%	36	36.4%
COMPLETED INTERVIEWS	2	6.5%	34	7.5%	2	40.0%	12	8.2%	1	33.3%	9	8.1%	0	0.0%	5	5.1%
TOTAL SAMPLE	31		452		5		147		3		111		5		99	