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Home Builders Market Research Report

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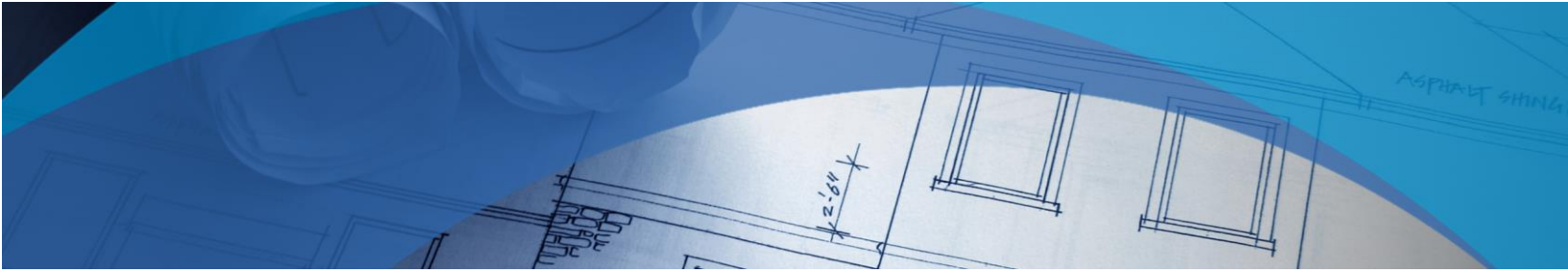


Table of Contents

Executive Summary

The Northwest Energy Efficiency Alliance (NEEA) aims to achieve a Zero Energy Ready (ZER) residential building code by 2030. In working toward this goal, NEEA's Residential New Construction Program, known publicly as BetterBuiltNW, promotes the use of energy-efficient building practices. NEEA contracted with Cadmus to conduct research to provide supply side market insights into above-code practices, provide actionable recommendations that NEEA can use to maximize market outcomes, and identify valuable avenues for future research. Cadmus organized this report into three sections:

EXECUTIVE SUMMARY

- Research Objectives and Approach
- Conclusions and Key Findings
- Recommendations

BUILDER INSIGHTS

- Key Building Practices
- Opportunities for Influence
- Value Propositions
- Product Plan Measures[1]

APPENDICES

- Methodology
- Interview Guide
- Focus Group Guide
- Additional Research Considerations

Research Objectives and Approach

Cadmus structured the research to meet these four objectives:

1. **Understand key building practices and how they differ/are the same between above-code and at-code builders**
2. **Identify opportunities to influence at-code builders to adopt above-code measures**
3. **Test value propositions and identify other values**
4. **Understand challenges and successes associated with installing product plan measures**

Cadmus conducted 35 in-depth interviews with at-code builders and 32 interviews with above-code builders during November and December 2020.[2] Cadmus segmented interviewed builders by state (Idaho, Montana, Oregon, and Washington) and at-code versus above-code (Table 1).

[1] NEEA's Product Plan measures are those that it seeks to include in state residential energy codes. This study focused on the following product plan measures: Air Tightness, Balanced Ventilation with Heat Recovery Ventilators, Super-Efficient Ducts, Super-Efficient Walls, and Super-Efficient Windows.

[2] For the purposes of the research, Cadmus considered above-code builders as those who received out a whole-home program certification (such as ENERGY STAR or LEED) for 25% of the homes they built in 2019 (interviews) or in 2019 and 2020 (focus groups).

Table 1. Completed Builder Interviews by Segment

Builder Type	Above-Code Builder	At-Code Builder	Total
Idaho	9	11	20
Montana	2	4	6
Oregon	10	8	18
Washington	11	12	23
All Builders	32	35	67

Cadmus also conducted four focus groups in early February 2021. Cadmus spoke with 12 at-code and 12 above-code builders. Cadmus segmented the builders by above-code and at-code, and the focus groups contained a mix of builders from the four states. For detailed methodology, see *Appendix A*.

Conclusions and Key Findings

Research Objective 1: Understand key building practices and how they differ/are the same between above-code and at-code builders

CONCLUSIONS	KEY FINDINGS
Conclusion 1. Both builder types exceed code in certain areas, but above-code builders more commonly embrace emerging technologies and building practices.	At-code builders often install above-code features in their homes, even if they do not seek certification. Both builder types most commonly exceed code through with the following measures: • Insulation • Air sealing • High-efficiency HVAC **Above-code builders typically exceed code to a greater extent** and are more likely to install heat pump water heaters and build all-electric homes.
Conclusion 2. Most builders find it easy to meet current residential energy codes.	Most builders think **current codes are easy to meet.** However, **some at-code builders perceive they are at a competitive disadvantage** with builders who do not fully comply with code.
Conclusion 3. At-code builders are most influenced by customer demand and affordability. Above-code builders refuse to compromise on their values.	At-code builders want to **balance home quality with affordability**, and they do not see customer demand for energy efficiency while the booming housing market and rising lumber prices are causing home prices to rise. Above-code builders expressed less concern about costs and said many of their **customers are willing to pay higher prices for sustainable, high-performance homes**.

Research Objective 2: Identify opportunities to influence at-code builders to adopt above-code measures

CONCLUSIONS	KEY FINDINGS
Conclusion 4. Above-code builders see themselves as a source of education for subcontractors, other builders, and homebuyers. Both builder types would benefit from educational materials to provide to home buyers.	Many above-code builders actively try to increase market adoption of above-code practices by **educating their subcontractors and homebuyers about energy efficiency benefits**, and some above-code builders explain methods to subcontractors. These above-code builders serve on boards of national and local green building organizations. Some above-code builders said a lack of informational materials to provide to homebuyers is a barrier.
Conclusion 5. Education about how building science justifies advancing codes may help mitigate concerns around future, tighter codes; however, at-code builders are not fully engaged with current education and training resources.	**Increased Codes:** A subset of above-code builders are true believers of increased codes, but many builders have concerns: • Affordability (both builder types) • Political motivations (at-code only) • Science behind building codes (at-code only) **Education Sources:** Despite NEEA's educational efforts, fewer at-code builders than above-code builders are aware of NEEA's product plan measures or their benefits. At-code builders rely more on their network (of fellow builders, subcontractors, and suppliers) and industry publications for education than on conferences.
Conclusion 6. Subcontractors have a large influence on the decisions made by at-code builders, but the importance of architects should not be overlooked. Low levels of at-code builder interaction with raters limits their influence.	**Subcontractors** are critical influencers on at-code builder decisions, as well as a source of education, but lack of subcontractor capabilities can limit at-code builder decisions. Above-code builders are more likely to educate their subcontractors. Upfront decisions by **architects** and **homebuyers** can limit builder options for equipment and building practices. For example, architects often decide to place ducts in unconditioned spaces for aesthetic purposes. **Raters** have a greater influence on above-code builders than at-code builders. Above-code builders engage with raters throughout the homebuilding process, while at-code builders engage with raters at the end (if at all).

Research Objective 3: Test value propositions and identify other values

VALUE PROPOSITION #1: BUILDER VALUES

"Builders build above-code homes because it reflects their **values** and desire to provide their customers with **really good homes** that are **more comfortable, provide better indoor air quality, last longer**, have **lower energy bills**, and are **good for the planet**."

VALUE PROPOSITION #2: PROFIT/SALABILITY

"Builders build above-code homes because they can **make (more) money** building this way and/or **sell them**."

CONCLUSIONS	KEY FINDINGS
Conclusion 7. Both builder types said above-code practices align with their values, though the two builder types prioritize different elements listed in Value Proposition 1. "Lower maintenance costs" may be a missing value from Value Proposition 1.	 Values, comfort, air quality, and lower bills resonate with most builders. Value rankings vary by builder type: • **Values** and **lower bills** ranked highest with at-code builders • **Values** and **environmental benefits** ranked highest with above-code builders. Some at-code builders thought above-code practices could lead to lower maintenance costs, a value that is missing from NEEA's value proposition.
Conclusion 8. Value Proposition 2 does not reflect builder experience. Builders did not perceive a connection between above-code practices and greater profits or sales.	 Neither profit nor salability resonate with most builders. **Perceived Barriers to Increased Profit** • Appraisal gaps persist • Some builders charge same markup per home regardless of features • Some builders try to keep sale price down **Perceived Barriers to Salability** • At-code homes will sell just as quickly • Many buyers prioritize affordability • Longer build timelines for above-code homes

Research Objective 4: Understand challenges and successes associated with installing product plan measures

CONCLUSIONS	KEY FINDINGS
Conclusion 9. Above-code builders install product plan measures more often than at-code builders. Air tightness and balanced ventilation with heat recovery ventilators (HRVs) have broader market penetration across builder types than other measures.	Common ↕ Uncommon **Air tightness** and **balanced ventilation with HRVs** are common with above-code builders and somewhat common with at-code builders. **Super-efficient ducts** are somewhat common with both builder types, but builders usually install ductless HVAC systems. **Super-efficient walls** are somewhat common with above-code builders but not with at-code builders. **Super-efficient windows** are not common with either builder type.
Conclusion 10. Lack of knowledge and upfront costs are common barriers for most measures. Lack of coordination between builders and subcontractors and between builders and architects are barriers for certain measures.	**Lack of knowledge:** Lack of subcontractor knowledge is a barrier for all product plan measures but super-efficient windows. Some builders lacked knowledge of their homes' air tightness levels and lacked awareness of balanced ventilation with HRVs and super-efficient windows. **Cost:** Cost is a barrier for all measures except super-efficient ducts. **Coordination with subcontractors:** Builders need subcontractors who are willing to take the time required to achieve higher air tightness levels. **Coordination with architects:** Builders need to work with architect's design team upfront to ensure a home's design can accommodate conditioned ducts and HRVs.
Conclusion 11. Visual representation paired with description of how measures work and their key benefits may reduce builder confusion regarding product plan measures.	 In focus groups and interviews, builders did not immediately understand the product plan names, but explaining performance targets reduced confusion.  Focus group respondents thought NEEA's visuals and descriptions accurately represent air tightness, balanced ventilation with HRVs, and super-efficient ducts.

Recommendations

1 **Expand education and training for key market actors about above-code practices and product plan measures by tailoring outreach materials to various points along the market actor journey. Equip market actors with resources to educate home buyers about the benefits of above-code homes and practices.**

Market Actor Journey from At-Code to Above-Code

- Foster awareness through short articles and videos that anyone can view without creating an account on BetterBuiltNW. Link these resources to each best practice listed on BetterBuiltNW's list of "Top 10 Best Practices for Today's Homebuilder."
- Introductory materials should focus on the benefits of above-code building, including terms such as "fresh air," "lower bills," and "increased comfort" in their titles. Do not focus on net-zero homes at this stage, as most at-code builders build dual-fuel homes.
- Help builders, subcontractors, and architects transition to the "consideration" stage by including links in introductory materials to a list of utility rebates, success stories, and more in-depth educational resources such as webinars.
- Continue to engage builders in the "trial" and "commitment" stage by sharing above-code builder tips for success and solutions for overcoming common barriers via webinars or local events. Promote net zero energy practices to committed builders.

Potential Education Topics and Methods

Potential Topics	Builder	Subcontractor	Architect	Appraisers	Potential Method(s)
How to design above-code homes without reducing builder profit	✓		✓		Article, case study, webinar
How to explain the benefits of specific measures or above-code homes to home buyers	✓	✓	✓		Article, buyer-facing printouts, website content
Expected benefits and return on investment (ROI) for product plan measures	✓	✓		✓	Article, case study, webinar
Why raters are important and when to engage with them	✓				Article, webinar, local event
Emerging solutions to help build above-code (e.g., AeroBarrier)	✓	✓			Article, case study, webinar
What to discuss with architect/builder during the design process (e.g., duct placement)	✓		✓		Article, webinar, local event
The science behind the latest code changes and product plan measures	✓	✓	✓		Article, webinar, local event

2 Promote NEEA's existing resources and deploy education about the topics listed above using the following strategies:

- Partner with organizations trusted by at-code builders to distribute education and resources via their newsletters and events. To reach at-code builders, deepen connections with non-green building organizations such as home builder associations, utility energy efficiency programs, and the National Association of Home Builders.
- Prioritize networking events in addition to structured conferences, since fewer at-code builders attend conferences. Invite raters to these events and facilitate interaction between at-code builders and raters, as well as subcontractors to promote learning above-code practices.
- Encourage market leaders (above-code builders, raters) to host webinars and write articles about their experiences and tips.
- Increase the prominence of product plan measures on the websites of BetterBuiltNW and its partners. Add search filters for each product plan measure.

3 Emphasize key wording from Value Proposition 1 (comfort, air quality, and lower bills) in builder communication, and consider adding "lower maintenance costs" to the value statement. For at-code builders, emphasize lower bills. For above-code builders, highlight environmental benefits. Consider de-emphasizing Value Proposition 2.

4 When communicating to builders and subcontractors about product plan measures, use visuals that list performance criteria and key benefits to ensure builders understand the technology being discussed. Include benefits and return on investment estimates on spec sheets.

5 Work with utilities to incorporate rebates for product plan measures into their programs.

- To mitigate affordability concerns, provide higher incentives for affordable housing projects or for homes where the area's median income falls below a certain level.
- Consider ways for utilities to offer incentives to architects and builders to design homes that can accommodate super-efficient ducts and HRVs, such as through energy design assistance programs

6 Consider conducting additional research with key market actors to address the following research objectives (see *Appendix D* for potential research questions and methods):

- Identify successful strategies for building above-code affordably
- Investigate role of subcontractor influence on home building process and how to influence **subcontractors** to promote above-code measures
- Explore ways to influence **architects** to design homes that can accommodate product plan measures

Builder Insights

In this section, Cadmus presents key findings (shown in blue) by research objective, followed by supporting detailed findings. We distinguish between focus groups or in-depth interviews findings where differences exist and between interviewed builders by state. Table 2 presents the segmentation by research approach.

Table 2. Segmentation by Research Approach

	At-Code versus Above-Code [a]	By State
Interviews	✓	✓
Focus Groups	✓	

[a] For the purposes of the research, Cadmus considered above-code builders as those who received a whole-home program certification (such as ENERGY STAR or LEED) for 25% of the homes they built in 2019 (interviews) or in 2019 and 2020 (focus groups).

In collaboration with NEEA, we intentionally designed two questions where the results could be displayed as percentages (Figure 1 and Figure 2 in Research Objective 1). See *Appendix A* for research methodology details, *Appendix B* for the interview guide and *Appendix C* for the focus group discussion guide.

Research Objective 1: Understand key building practices and how they differ/are the same between above-code and at-code builders

Cross-over exists between builder types, with some builders switching between building at-code and above-code.

Though Cadmus formally segmented builders into above-code or at-code categories, three types of builders were identified during the interviews and focus groups:

- Builders who build only above-code
- Builders who build only at-code
- Builders who switch back and forth between at-code and above-code depending on subdivision or municipal requirements or customer demand.[3]

Production, custom, and spec builders were all split between above-code and at-code homes.[4]

[3] Some study builders explained that builders who do not fully comply with code exist in the Northwest market.

[4] Cadmus defined production builders as those who built 40 or more homes in 2019.

Most builders find it easy to meet current building codes, but many expressed concern around future codes.

Most builders find it easy to meet current codes.[5] Above-code builders report they already build far above what code requires. Only Washington at-code builders said their current code is hard to meet. The Washington code changed February 2021 and is the most advanced code of the four states. However, some at-code builders reported that from a cost standpoint, following the current code puts them at a competitive disadvantage compared to builders who do not fully comply with code.

> "It's going to be difficult for most standard builders to meet [the new Washington code]."
> *~Above-Code Builder*
>
> "Unless the code is commonly accepted and enforced, people who voluntarily try to build better will be at a competitive disadvantage. There's always going to be somebody out there who's going to fake the numbers on a blower door test just to get the money."
> *~At-Code Builder*

When asked about their opinions of future, more advanced codes, a subset of above-code builders revealed that they are true believers of increased codes and advanced building practices. Some said they help educate other builders on how to comply once new codes take place. However, despite NEEA's efforts to educate builders about the science behind building code changes—via its BetterBuiltNW website, which publishes articles with titles such as "Resources to Comply with the Updated Washington State Energy Code"— most at-code builders and some above-code builders have deep concerns around increased codes:

- Perception that code increases are politically motivated and not founded on building science or input from the field (at-code builders only).
- Perception that code updates are not done in a way that benefits homeowners (most at-code and some above-code builders).
- Impact on home affordability (both at-code and above-code builders).

> "I would like the code to be founded in science. I'm afraid that it is founded in lobbying right now."
> *~At-Code Builder*
>
> "We should keep improving the code, but we need to do it in a practical way with the interest on the people in the field and what's actually going to work and make sense."
> *~ Above-Code Builder*
>
> "I see a need for [updated codes], but it seems like every time a code changes, our price increases as a builder."
> *~ Above-Code Builder*

Both builder types reported exceeding code in certain areas of their homes, but at-code builders often exceed code to a lesser degree than above-code builders.

Most builders stated that they consider energy efficiency to be very important when selecting measures. Half the at-code focus group builders and almost all the above-code focus group builders reported receiving utility rebates for some aspect of their homes, such as high-efficiency HVAC. When asked what

[5] Cadmus asked only the focus group respondents about their opinion of the current building codes and future codes.

energy-efficient measures they include in their homes, most builders mentioned insulation, air sealing, and HVAC (Table 3). The research showed that above-code builders install these measures more often than at-code builders.

Table 3. Commonly Mentioned Energy-Efficient Building Practices by Builders

Energy-Efficient Building Practice	Summary
Insulation	Most above-code and at-code builders mentioned installing more insulation than required by code.
HVAC	More builders mentioned heat pumps than mentioned efficient furnaces, with no difference between above-code and at-code builders. Of those who mentioned heat pumps, most mentioned ductless heat pumps.
Air Sealing	Except for Idaho, more above-code builders than at-code builders mentioned air sealing.

At-code builders' decisions when selecting a home's measures are more influenced by financial incentives, customer demand, and the ability to provide affordable homes than above-code builders' decisions.

When asked what motivates them to build above-code (or would motivate them), some at-code builders and most above-code builders cited the ability to distinguish themselves from their competitors (Table 4). Most at-code builders were also highly motivated by financial factors, such as the availability of rebates and the ability to lower home energy bills. In contrast, above-code builders more often mentioned non-energy benefits such as increased comfort, durability, longevity, and environmental impacts.

Table 4. Motivations to Build Above-Code Homes

At-Code Builders	Above-Code Builders
• Market differentiation • Lower energy bills • Rebates • Subdivision or city rules	• Market differentiation • Non-energy benefits (comfort, durability, longevity) • Environmental values

Table 5 shows the barriers that builders see to above-code building, with builders widely agreeing that building above-code can increase the upfront cost of the home.

Table 5. Barriers to Above-Code Building

At-Code Builders	Above-Code Builders
• Booming housing market and rising prices (land prices, lumber prices, and median home values are rising) • Increased home cost • Lack of customer demand for energy efficiency • Workforce and product shortages	• ROI determines how far they exceed code • Lack of material/information to explain above-code benefits to homebuyers • Lack of subcontractor training • Sourcing supplies, especially rural areas

Most at-code builders saw higher home costs as a difficult barrier to overcome, since this decreases buyer demand for their homes. Focus group at-code builders explained homes prices are rising rapidly due to the booming housing market, and they are reluctant to further add to the cost of the home for fear of impacting home affordability.

> "[Energy efficiency] is not why customers choose me anymore. And it was. There was a stretch where they valued the fact that it was an ENERGY STAR home. I don't see that now."
> *~At-Code Builder*

> "Some people say that [above-code] costs more, but really it's a better value. And people will pay for value. They just need to be educated."
> *~Above-Code Builder*

Fewer above-code builders saw higher homes costs as a barrier that could be overcome. Many above-code builders said buyers seek them out because they want sustainable, high-performing homes and are willing to pay more. Though some above-code builders said a lack of informational materials to share with buyers about the benefits of above-code homes is a barrier, many above-code builders successfully educate their buyers through a conversation about the value of energy efficiency and how it contributes to sustainability and home performance. Several above-code builders work with higher income buyers, and a few will not work with buyers who are not willing to build a high-performance home. Working with higher income or environmentally-minded buyers allows above-code builders to refuse to compromise their values for a sale.

Lack of homebuyer demand deters many at-code builders from routinely pursuing whole-home certifications.

Half the at-code builders have experience with certifications in the past, but most stopped pursuing them often due to a lack of homebuyer demand for this certification. These builders fall into three categories:

- Those who claim to build homes to the level required without pursuing the certification (**time** and **cost** needed for the certification itself is a barrier)
- Those who exceed code to the extent they feel is required to distinguish themselves from other builders but not enough to achieve a certification (the **time** and **cost** to implement the measures and home specifications required by the certification is a barrier)
- Those who do not exceed code (some think the current code is sufficiently energy efficient).

> "The cost to participate can add to the home's cost, so we only achieve certification if the customer wants it."
> *~At-Code Builder*

> "We just try to build above standard to differentiate a little bit from lower conditions."
> *~At-Code Builder*

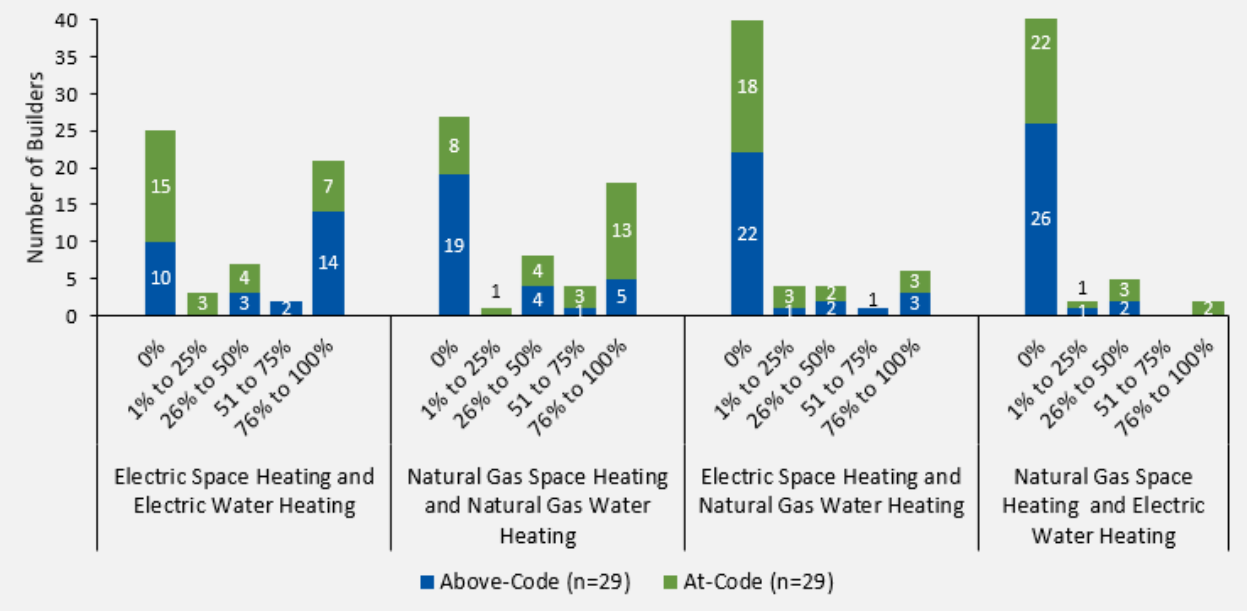
> "Certifications are waste of money. Homes are already efficient via the current energy code, and certifications require a lot of hoops."
> *~At-Code Builder*

However, most at-code builders agree they would pursue certifications or whole-home programs if customers demanded it.

More above-code builders construct more all-electric homes and/or include heat pump water heaters than at-code builders.

Interview responses and a focus group poll shows that twice as many above-code builders than at-code builders construct all-electric homes 76% to 100% of the time. Almost half above-code builders construct all-electric homes most of the time, while less than one-quarter of at-code builders construct all-electric homes most of the time (Figure 1).

Figure 1. New Home Construction by Space and Water Heating Fuel Type



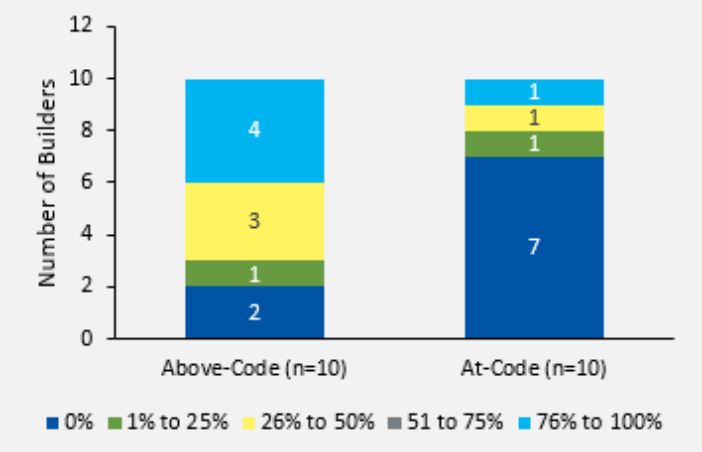
Focus Group Poll and Interview Question: "What percent of your homes have the following sources of space and water heating…?

Those who build all-electric homes were often motivated to build net zero homes in order to combat climate change. Some builders who build all-electric homes also said they received solar incentives or that building an all-electric home increases the home's energy efficiency. Most builders who include natural gas in their homes explained this is due to customer preference and the affordability of natural gas. Though a few respondents who build all-electric homes said that the lack of natural gas lines in their area drives this decision, most who lacked natural gas access said their homes use propane.

Most focus group builders agree their homes are capable of having heat pump water heaters (HPWHs) installed, yet focus group above-code builders install HPWHs more often than at-code builders (Figure

2).[6] Most above-code builders installed a HPWH in more than half their homes in the past year, but most at-code builders installed no HPWHs.

Figure 2. Percentage of Homes in the Past Year that Have a HPWH



Focus Group Poll Question. "For what percent of your homes in the past year have you installed a heat pump water heater?"

Research Objective 2. Identify opportunities to influence at-code builders to adopt above-code measures

Though builders look at resources such as online training videos and industry websites, many prefer to receive information about energy-efficient building practices from their network or industry experts.

NEEA promotes above-code practices through its public-facing BetterBuiltNW website, which contains builder guides, training videos, and information on utility rebate programs.[7] The website lets visitors filter its resources by technology type. However, of the five product plan measures assessed through this research, only super-efficient walls (labeled "advanced walls") are available using the filter function. NEEA also partners with organizations such as Earth Advantage and Northwest Ecobuilding Guild to promote above-code practices.

Builders receive information about energy-efficient building practices from a wide array of resources (Table 6).

Table 6. Most Common Sources of Builder Information About Energy-Efficient Building Practices

Category	Specific Sources of Information	
Networking	• Home Builders Association • Local building departments	• Other builders • Raters

[6] Cadmus asked only the focus group respondents about their frequency of installing HPWHs.

[7] BetterBuilt[NW]. "New Home for New Construction Efficiency Resources." Accessed March 2021. https://betterbuiltnw.com/

Category	Specific Sources of Information	
	• Local utilities	• Subcontractors
Publications	• Building Science Corporation • Fine Home Building • General Construction	• Green Building Advisor • Journal of Light Construction
Organizations	• BetterBuiltNW • BuiltGreen • Earth Advantage • Energy Trust of Oregon • Green Building Summit	• National Association of Home Builders • Northwest Ecobuilding Guild • Passive House • WSU Extension Services

Cadmus identified key differences in how at-code and above-code builders receive information about energy-efficient building practices:

- **Networking:** Both builder types rely on their network (of other builders, subcontractors, or suppliers) for education. They explained that utility rebates can also be a form of education in that they show what the industry considers to be energy-efficient. At-code builders mentioned home builder associations and utilities more often than above-code builders.

> "I don't trust any publications until I hear it directly from the company. I use publications, but I always call to discuss the results."
> *~Above-Code Builder*

- **Publications:** Both builder types receive information from a wide array of publications (e.g., websites, industry magazines) and green building organizations (through their websites, newsletters, and online trainings). No one publication or green building organization was mentioned by most builders, and each publication and green building organization shown in Table 6 were mentioned by both builder types.

- **Conferences:** More above-code builders than at-code builders attend conferences. Some builders explained that conferences enable them to look for education beyond their normal network. A subset of above-code builders considers themselves market leaders and seek to learn enough to educate their customers, subcontractors, and other builders about the benefits of above-code measures and how they can be done. These builders serve on boards of national and local green building organizations.

Builders are most influenced by subcontractors, but raters and architects also play a large role in builders' decisions.

Builders reported four main sources of influence in their decisions around energy efficiency: subcontractors, raters, architects, and homebuyers.

Subcontractors

Builders of both types most often said that subcontractors (especially HVAC and insulation) influence their decisions around energy efficiency, though more at-code builders than above-code builders said

subcontractors are a main source of influence. Cadmus found two key differences in how subcontractors influence at-code and above-code builders:

- Many at-code builders see subcontractors as a source of education about building practices. Above-code builders reported in the focus groups that education goes both ways between builders and subcontractors.
- Both builder types tend to use the same subcontractors over and over. If an at-code builder's preferred subcontractor lacks training or prefers not to install high-efficiency measures, the builder is unlikely to offer those measures to buyers. However, several above-code builders said they will teach their subcontractors about new practices to overcome this barrier.

> "Subcontractors are our number one go-to. We talk with them about how the new measures really work, their serviceability, and what's the long-term outlook for energy use."
> *~At-Code Builder*
>
> "[Above-code builders] are industry leaders, and the industry norm is what your trades are used to working with. You have to lead subcontractors."
> *~Above-Code Builder*

Raters

Above-code builders are more influenced by raters than are at-code builders. At-code builders in the focus groups indicated they most commonly interact with their rater at the end of the home-building process and seek advice from raters only if they fail blower door or duct blaster tests. Whereas, above-code builders are more likely to engage with raters throughout the homebuilding process rather than at the end, and raters often provide tips for improvement for how the builders' energy efficiency practices can improve.

Architects and Homebuyers

Builders agreed that architects and homebuyers often dictate home design upfront, which can limit the types of equipment and building practices builders can realistically incorporate after the fact (e.g., conditioned ducts). During the focus groups, several above-code builders indicated they work with the architect's design team up front to determine home characteristics, yet few at-code builders said the same. Several interview and focus group respondents said that architects design homes with aesthetics in mind, not energy efficiency.

Research Objective 3: Test value propositions and identify other values

Aspects of Value Proposition 1 resonated with all builders; however, at-code builders most valued the affordability aspect of lower bills, while above-code builders most valued environmental benefits.

Above-code and at-code builders recognized **lower utility bills** and **improved comfort** as desirable attributes for homebuyers, and both builder types agreed that building above-code aligns with their **values**. However, some key differences exist between the two builder types:

- When asked to rank the values include in the value proposition 1 statement, At-code builders ranked **values** and **lower bills** the highest.[8] Above-code builders ranked **values** and **environmental benefits** the highest.
- Above-code builders were more likely to view building above code as their **responsibility** to build high-quality, long-lasting homes. Additionally, more above-code than at-code builders saw **air quality** as a benefit.
- Above-code builders like being **recognized** for their focus on efficient building practices. This leads buyers to seek them out (competitive advantage), although these builders may not see a direct link to increased sales.

VALUE PROPOSITION #1: BUILDER VALUES.
Builders build above-code homes because it reflects their values and desire to provide their customers with really good homes that are more comfortable, provide better indoor air quality, last longer, have lower energy bills, and are good for the planet.

- Some at-code builders also saw **lower maintenance** as a value to above-code homes; this value is not included in NEEA's value proposition statement.

In Value Proposition 2, neither profit nor salability resonated with most builders.

Neither above-code nor at-code builders directly stated they think building above code can help them increase profits or sales. Builders perceived **several barriers to higher profits:**

VALUE PROPOSITION #2: PROFIT/SALABILITY.
Builders build above-code homes because they can make (more) money building this way and/or sell them.

- At-code builders expressed concern about the need to balance energy efficiency with cost.
- Some builders do not recoup the extra money they put into the home (appraisal gap).
- Some above-code builders actively try to keep their home price down.
- Builders agreed that predicting profit per home is difficult.
- Some above-code builders charge the same markup per home regardless how "green" it is.

Builders also perceived **barriers to salability:**

- Some above-code and at-code builders agreed that at-code homes will sell just as quickly as above-code homes.
- Many buyers are just happy they can afford a home, regardless of efficiency levels.
- Some at-code builders struggle to provide affordable homes.
- At-code builders want to balance quality with overall cost. Some at-code builders expressed concern about **diminishing returns for energy efficiency** and long payback periods and thought building

[8] Though Cadmus asked both interview and focus group respondents what value they see to building above-code homes, only focus group respondents were asked to rank elements of the value proposition statements.

above-code homes was not a good bargain for their buyers. They cited both **costs** and **lack of customer demand** as a barrier to building above-code.

Research Objective 4. Understand challenges and successes associated with installing product plan measures

Many builders did not immediately understand the product plan measure names; however, visuals and stated performance targets reduced builder confusion.

Many builders did not initially understand specifically what the product plan terms represented:

- **Air tightness.** The number of air changes per hour (ACPH) needed to be defined, though all builders understood the basic concept of air tightness and blower door tests.
- **Balanced ventilation with an HRV**. Some at-code builders lacked awareness or thought this meant having even heat and cooling throughout the house.
- **Super-efficient ducts.** Interview respondents (both builder types) needed the explanation that the ducts are located inside conditioned space, yet all builders understood the concept once explained.
- **Super-efficient walls.** There was confusion around which insulation levels or methods tie to this term (both builder types).
- **Super-efficient windows.** There was confusion around thin triple pane versus triple-pane windows (both builder types).

The terms super-efficient windows, super-efficient walls, and super-efficient ducts did not have much meaning to builders. Builders more easily understood these alternative descriptions:

- For walls, builders understood the terms “thermal break shear wall,” “exterior rigid insulation,” and “double stud wall.”
- For ducts, builders understood the concept of locating ducts inside conditioned space. However, most builders did not know the pressure drop of their ducted systems.

Focus group respondents thought NEEA’s visuals, descriptions of performance targets, and alternative terms accurately represented air tightness, HRVs, and efficient ducts. The visuals Cadmus tested during the focus groups are included in *Appendix C.*

Above-code builders more commonly implement the product plan measures than at-code builders.

Above-code builders most commonly implement air tightness and balanced ventilation with HRVs. Above-code builders somewhat commonly implemented super-efficient ducts, super-efficient walls, and

super-efficient windows.[9] Table 7 lists the product plan measures and their current inclusion in the four states by builder type.

Table 7. Current Inclusion of NEEA Product Plan Measures

Product Plan Measure	Performance Target	Key Takeaway
Air Tightness	• ACH50 ≤ 2.0 • Must pair with balanced mechanical ventilation with HRV	Common among above-code builders in Montana, Washington, and Oregon; somewhat common among above-code builders in Idaho. Somewhat common among all states' at-code builders.
Balanced Ventilation with HRV	• Balanced mechanical ventilation that meets ASHRAE 62.2 fresh air minimums with • high-efficient HRV (sensible recovery efficiency 80%, fan power ≤ 1.2 cfm/W)	Common among above-code builders in Montana, Washington, and Oregon and somewhat common among at-code builders. Not common in Idaho.
Super-Efficient Ducts	• Pressure drop of ducted system is less than 0.75 in WG • At least 95% of ducts are located inside conditioned space • Duct leakage to exterior meets ANSI standard 310 Grade 1 requirements	Common among above-code builders in Montana, Washington, and Oregon and somewhat common among at-code builders. Not common in Idaho.
Super-Efficient Walls	• U ≤ 0.045 for above-grade walls (nominal R21 + R4.5 ci) U ≤ 0.040 for below-grade walls (R21 2 ft + BG)	Common among above-code and at-code builders in Montana and Idaho; somewhat common among above-code builders in Oregon and Washington. Not common among at-code builders in Oregon and Washington.
Super-Efficient Windows	• Window U ≤ 0.20 (thin triple pane)	Somewhat common among above-code builders in Oregon, Idaho, and Washington and above-code and at-code builders in Idaho. Not common among Montana's builders or any at-code builders in Oregon and Washington.

Note: The table shows interview results only.

Lack of knowledge and cost were the most common barriers to installing all five product plan measures. Coordination among builders, subcontractors, and architects is important for specific measures.

At-code builders were more concerned about cost (equipment/labor) than were above-code builders. Results from both the interviews and focus groups are shown in Table 8.

Table 8. Challenges to NEEA Product Plan Measures

Product Plan Measure	Challenges	Summary
Air Tightness	• Cost and time (time relates to cost)	Achieving 2ACPH takes extra time and detail. Barriers include finding qualified subcontractors who are willing to take on this level of effort and lack of

[9] Some builders may have confused thin triple pane windows with triple-pane windows. Cadmus counted only those who said their window U ≤ 0.20 as having installed thin triple pane. However, some builders perceived barriers for triple-pane windows may apply to thin triple pane windows.

Product Plan Measure	Challenges	Summary
	• Subcontractor quality • Builder awareness of their ACPH and concern about the concept of super-tight homes	builder knowledge around the number of air changes per hour. However, many above-code builders said the additional effort needed to achieve this measure is worth it to achieve durable homes. Only Washington builders said that a blower-door test is required by state code, though some builders in other states said certain areas of their state require blower door tests. During interviews, half the Montana and Idaho builders and some Oregon builders indicated they sometimes or always skip blower door tests. Some at-code builders expressed concern about problems that can arise with super tight homes, but no above-code builders expressed those same concerns.
Balanced Ventilation with HRV	• Cost and Time • Subcontractor or builder knowledge • Builder doubts about home occupant ability to operate HRV (focus group finding) • Coordination with architect • Noise levels	The most reported barriers were lack of subcontractor knowledge, the need to coordinate with the architect on routing the ductwork, and lack of at-code builder trust in HRVs. Some at-code builders thought that HRVs were not user-friendly for the home occupant and worried that someone who does not operate the HRV correctly will damage the home.
Super-Efficient Ducts	• Coordination with architect • Aesthetics concerns • Subcontractor knowledge	The need to coordinate with the architect during the home design process was the largest barrier reported (space is an issue, and architects don't often consider mechanical spaces), followed by use of ductless heat pumps and lack of duct performance testing. Builders said that conditioned ducts would require lower ceilings or a larger home footprint, making it a difficult sell.
Super-Efficient Walls	• Cost • Sourcing materials • Subcontractor and builder knowledge • Moisture concerns	Lack of subcontractor knowledge, sourcing of materials (especially for rural builders), and cost were the most reported barriers. Some contractors perceived a lack of importance for super-efficient walls in mild climates and concern around moisture issues.
Super-Efficient Windows	• Cost • Builder awareness • Sourcing materials • Aesthetics	Cost and sourcing of materials were the most reported barriers, followed by the fact that some super-efficient windows look different than standard windows. Builders across the states explained that few North American manufacturers supply super-efficient windows, which creates long lead times for orders and requires builders to plan these purchases in advance.

Absent updates to building codes, most at-code builders do not expect to increase their inclusion of the product plan measures in their future home projects (Table 9).

Table 9. Future Inclusion of NEEA Product Plan Measures

Product Plan Measure	Increased Future Application	Key Challenge	Summary
Two or Fewer Air Changes per Hour	Unexpected	• Cost • Lack of familiarity	Neither builder type foresees increasing their focus on this measure. Some said they already achieve a higher than code requirement, others said it was not cost-effective or noted lack of familiarity with what they were achieving currently.
HRVs	Unexpected	• Lack of information/ familiarity	Most at-code builders said they were unlikely to install more HRVs; however, these builders also cited a lack of familiarity with the technology and the need for more information for themselves and their contractors

Product Plan Measure	Increased Future Application	Key Challenge	Summary
Super-Efficient Ducts	Unexpected, except for Washington	• Coordination with architects	Some Washington builders said the upcoming code will give them credit for including ducts in conditioned spaces.
Super-Efficient Walls	Most likely in Oregon and Washington (some Idaho)	• Upfront cost	At-code builders had mixed responses about their likelihood to install more efficient walls; however, those who said they may consider it said they are influenced by customer demand. • Oregon builders said yes, due to perceived increase in customer demand. • Montana builders said no, until upfront costs drop, unless customers requested them. • Washington builders said yes, noting the influence of upcoming code changes that will require more efficient walls. • Idaho builders were mixed; some said yes due to increased customer demand, others cited upfront costs as a barrier.
Super-Efficient Windows	Unexpected	• Upfront cost	At-code builders across the four states are unlikely to install more high-efficient windows until the upfront costs drop.

Note: The table shows interview results only.

Coordination with subcontractors and architects are key strategies reported by above-code builders to successfully install product plan measures (Table 10).

Table 10. Successful Strategies for Including Product Plan Measures in Homes

Product Plan Measure	Reported Methods Used to Achieve Measures
Air Tightness	Including target air tightness in the home's design and ensuring subcontractors understand this goal and the techniques needed to achieve it. Above-code contractors also spend more time with their design team and discussing appropriate building methods with the subcontractors.
Balanced Ventilation with HRV	Encouraging coordination between architects and HVAC contractor so the home is designed to include HRVs and so that the HRV is placed where noise levels can be minimized (e.g., the basement)
Super-Efficient Ducts	Coordination with architect to design homes for conditioned ducts (this cannot be an afterthought) and the use of AeroBarrier.
Super-Efficient Walls	Designing walls in a way to prevent moisture issues: use of continuous insulation to prevent moisture build up and the inclusion of moisture sensors in the walls.
Super-Efficient Windows	Plan for longer ordering timeframes and communicate air tightness benefits to customers.

Appendix A. Detailed Methodology

Cadmus collected primary information from home builders through in-depth phone interviews and online focus groups.

Builder Interviews

Cadmus conducted in-depth telephone interviews with 32 above-code builders and 35 at-code builders, a total of 67 builders across the Northwest region.[10] For the interviews, Cadmus segmented the builders by both state and whether they build above-code versus at-code. Table A-1 shows the number of interviews completed by builder segment and by state.

Table A-1. Interviewed Above-Code and At-Code Builder Backgrounds by State

State	Builder Type	Above-Code Builder	At-Code Builder	Total
Idaho	Custom	2	9	11
	Production	3	0	3
	Spec	4	2	6
	All Builders	**9**	**11**	**20**
Montana	Custom	2	3	5
	Production	0	1	1
	Spec	0	0	0
	All Builders	**2**	**4**	**6**
Oregon	Custom	6	8	14
	Production	3	0	3
	Spec	1	0	1
	All Builders	**10**	**8**	**18**
Washington	Custom	7	6	13
	Production	1	2	3
	Spec	3	4	7
	All Builders	**11**	**12**	**23**
All States	Custom	17	26	43
	Production	7	3	10
	Spec	8	6	14
	All Builders	**32**	**35**	**67**

Cadmus used the number of housing starts and completions per state in 2019 to set targets for the number of interviews per state.[11] Cadmus aimed to complete approximately half the interviews with above-code builders and half with at-code builders. To ensure a variety of builder types, Cadmus

[10] For the purposes of the interview research, Cadmus considered above-code builders as those who sought out a whole-home program certification (such as ENERGY STAR or LEED) for 25% of the homes they built in 2019.

[11] U.S. Census' "2019 ENERGY STAR Single-Family New Homes Map" https://public.tableau.com/profile/energystarhomes#!/vizhome/2019ENERGYSTARMarketPenetration/ENERGYSTARMarketShare2019

interviewed a mix of production and non-production builders.[12] Cadmus offered a $50 incentive to all builders who completed an interview.

During interviews, Cadmus used the definitions for the NEEA product plan measures shown in Table A-2.

Table A-2. NEEA Product Plan Measures Included in the Interview Task

Product Plan Measure	Performance Target
Air Tightness	• ACH50 ≤ 2.0 • Must pair with balanced mechanical ventilation with HRV
Balanced Ventilation with HRV	• Balanced mechanical ventilation that meets ASHRAE 62.2 fresh air minimums with • high-efficient HRV (sensible recovery efficiency 80%, fan power ≤ 1.2 cfm/W)
Super-Efficient Ducts	• Pressure drop of ducted system is less than 0.75 in WG • At least 95% of ducts are located inside conditioned space • Duct leakage to exterior meets ANSI standard 310 Grade 1 requirements
Super-Efficient Walls	• U ≤ 0.045 for above-grade walls (nominal R21 + R4.5 ci) U ≤ 0.040 for below-grade walls (R21 2 ft + BG)
Super-Efficient Windows	• Window U ≤ 0.20 (thin triple pane)

Builder Focus Groups

Using the Focus Vision Intervu platform, Cadmus hosted four online webcam-assisted 90-minute focus groups. Cadmus segmented the focus group builders by above-code and at-code, conducting two sessions with at-code builders and two sessions with above-code builders (Table A-3).[13] Though the groups contained a mix of builders across states, Cadmus did not set segment the focus groups by state or conduct focus group analysis at the state level. Instead, Cadmus segmented the focus groups by whether they build above-code or at-code. Cadmus offered a $150 incentive to all builders who participated.

Table A-3. Focus Group Segmentation

Segment	Number of Groups	Total Number of Builders
At-Code	2	12
Above-Code	2	12
Total	**4**	**24**

[12] Cadmus defined production builders as those who built 40 or more homes in 2019. Table A-1 shows how interview respondents characterized themselves.

[13] For the purposes of the focus group research, Cadmus considered above-code builders as those who sought out a whole-home program certification (such as ENERGY STAR or LEED) for 25% of the homes they built in 2019 and 2020.

During focus groups, Cadmus only tested builder response to three of the product plan measures: air tightness, heat recovery ventilators, and super-efficient ducts. Cadmus used stimuli provided by NEEA to gauge builder awareness to these measures (See *Appendix C*).

Appendix B. Interview Guide

Research Objectives	Corresponding Questions
Document respondent and company building background	Section B
Understand key building practices and how they differ (or are the same) between above-code and at-code builders in the region	Section C, E
Test value propositions and identify other values (these will be fully tested in the focus groups)	Section D
Understand challenges and successes associated with installing product plan measures	Section E
Identify opportunities to influence at-code builders to adopt above-code measures	Sections C, D, E
Identify potential focus group participants	Section F

General Instructions

- Interviewer instructions are in green **[LIKE THIS]**
- Programming instructions are in red **[LIKE THIS]**

A. Introduction

Phone Recruitment

A1. Hello, I'm **[INSERT NAME]** calling from Cadmus, a market research firm that is gathering information on residential building practices in the Pacific Northwest. May I speak with **[CONTACT NAME]**? OR **[IF NO NAME]** May I please speak to someone who can tell me about your company's standard building practices and any energy efficient features included in a home?

1. Yes
2. No, person is able to come to phone **[ASK FOR PERSON WHO IS AND START AGAIN]**
3. No, person is not able to come to phone **[GET NAME AND PHONE NUMBER, SCHEDULE CALL BACK]**

98. (Don't know) **[ASK TO SPEAK WITH SOMEONE WHO KNOWS AND BEGIN AGAIN]**
99. (Refused) **[THANK AND TERMINATE]**

A2. We are interviewing home builders to better understand building practices across **[STATE]**. The interview will take approximately 30 minutes and you will receive a $50 VISA gift card for your time. Is now a good time for me to ask about your standard building practices?

1. **[IF NEEDED, STATE "THIS INTERVIEW IS FOR RESEARCH PURPOSES ONLY AND THIS IS NOT A MARKETING CALL."]**

A3. **TO HELP WITH MY NOTETAKING, DO YOU MIND IF I RECORD OUR CONVERSATION? [IF NEEDED: YOUR RESPONSES WILL BE KEPT CONFIDENTIAL. WE WILL NOT PUBLISH YOUR COMPANY'S NAME OR TIE ANY RESPONSES BACK TO YOU]**

Email Recruitment

My name is [INTERVIEWER NAME] and I work for Cadmus, a market research firm that is gathering information on residential building practices in the Pacific Northwest**. I am reaching out in hopes of scheduling a 30-minute call with someone from your company about your standard building practices as they relate to the building energy code.**

Through these interviews, we hope to gain insight into current building practices, energy efficient equipment or practices commonly used in building single-family homes, and experience building above-code certified homes, if any. Your responses will be kept confidential and will inform future residential new construction program opportunities and support in your area.

Anyone who participates in our study will receive a $50 Visa gift card for their time.

Could you please let me know if anyone from your company is available this week or the next to answer some of our research questions?

Please let me know when you have a chance.

Best Regards,

[INTERVIEWER NAME]

B. Screeners and Building Background Information

I would like to start by asking you a few general questions about the types of homes your company builds.

B1. To begin with, please tell me a little about where in **[STATE]** you build most of your homes. **[PROBE FOR THE FOLLOWING: CITIES, REGIONS]**

1. Would you say you build more in urban, suburban, or rural areas?

B2. Thinking back to 2019, approximately how many single-family homes did your company build?

1. **[RECORD NUMBER]**
2. If less than one **[THANK AND TERMINATE. "I'M SORRY, WE ARE ONLY INTERVIEWING RESIDENTIAL BUILDERS THAT COMPLETED AT LEAST ONE HOME IN 2019. THANK YOU FOR YOUR TIME."]**

B3. What percentage of the homes your company built in 2019 were more custom in nature versus production built? **[IF NEEDED: WE ARE DEFINING THESE AS:**

CUSTOM HOMES ARE GENERALLY UNIQUELY DESIGNED HOMES FOR WHICH THE HOME BUYER IS HIGHLY INVOLVED IN THE DESIGN AND DECISION-MAKING PROCESS, OR A BUILDER USES THEIR OWN DESIGN ON A SPEC HOME.

PRODUCTION HOMES ARE GENERALLY THOSE WITH PRE-PLANNED LAYOUTS AND FEATURES. PRODUCTION IMPLIES A LARGE NUMBER OF THESE HOMES ARE BUILT.

SPEC HOMES ARE HOMES BUILT WITHOUT A BUYER AT THE TIME OF CONSTRUCTION, BUILT ON THE "SPECULATION" OF WHAT BUYERS MIGHT WANT IN A NEW HOME.]

1. Custom built homes percent:____
2. Production built homes percent: ____
3. Spec built homes percent: ____

B4. Did you participate in any green building programs or certifications back in 2019? **[PROBE: ENERGY STAR OR LEED? LEED, EARTH ADVANTAGE, PHIUS (PASSIVE HOUSE INSTITUTE US), NATIONAL GREEN BUILDING STANDARD, US DEPARTMENT OF ENERGY ZERO ENERGY READY HOME, OR ANY LOCAL OR SIMILAR PROGRAMS?**

1. **[If Yes]** Which green building programs or certifications did you participate in during 2019?

B5. **[ASK IF B4=YES]** Approximately what percentage of the homes you built in 2019 received a certification through these green building programs?

B6. **[ASK IF B4=NO]** Had you participated in these green building programs or certification programs before 2019?

1. **[IF YES]** Why did you start participating?
2. **[IF YES]** Why did you stop participating?

C. Overarching Energy Efficient Features Decision-Making Process and Information Sources

We are interested in learning more about where you receive information about energy efficiency building practices and new technologies, as well as which energy efficiency features you typically include in a home.

C1. How important is energy efficiency to **you** when selecting building materials and equipment or implementing building strategies? Why is that?

C2. What energy efficiency features do you typically include in a home? **[PROBE, IF NEEDED: MORE EFFICIENT HVAC EQUIPMENT OR STRATEGIES; HIGH EFFICIENCY WATER HEATERS; EFFICIENT APPLIANCES; ALL ELECTRIC; RENEWABLES]**

1. Do you happen to know the efficiency level of **[MEASURE STATED]**? **[PROBE FOR THE EFFICIENCY LEVEL AROUND THE FEATURES (E.G., WHAT R VALUE FOR INSULATION, U FACTOR FOR WINDOWS, EQUIPMENT EFFICIENCY)]**
2. Why do you include these energy efficient features?

C3. What role do you play in selecting a home's energy features? **[PROBE: SUCH AS HVAC OR INSULATION LEVELS]**

1. Who helps you make those decisions? [PROBE: Subcontractors, raters (verifiers/HERS raters), etc.]
2. What types of subcontractors do you regularly work with when selecting building materials and equipment? Tell me about that relationship.

C4. About what percentage of the homes you build are all-electric and what percentage include natural gas?
   1. [Record all-electric percentage]
   2. [Record natural gas percentage]
      (1) [IF using gas] What share of your homes built with natural gas include
         (a) BOTH gas water heating and space heating
         (b) Gas water heating ONLY
         (c) Gas space heating ONLY
         (d) Cooking [note if cooking is only gas use in home]
   3. What factors influence the fuel type you use? [PROBE: cost/budget, availability, efficiency, customer preference]
   4. Do you anticipate a change in the fuel type you select for your homes in the next 2-3 years?
      (1) Why/why not?

C5. When you're looking for information about energy efficient building practices, what are your most trusted sources? Why is that? **[PROBE FOR ORGANIZATIONS, NEWSLETTERS, CONFERENCES, TRAININGS, SUBCONTRACTORS, ETC.]**

D. Energy Efficiency in Home Building – Above Code Decision-making and Value Propositions

We are going to shift our discussion now to above-code certifications and programs**. When we say "above-code", we mean homes that exceed or perform higher than the building energy code in your state and meet the criteria of a green building program or certification.**

D1. How do you make the decision to build **at code** or **above code, in other words, homes that will qualify for a green building program or certification?**

D2. **[FOR ABOVE-CODE BUILDERS ONLY]** What motivates you to build above-code homes/achieve certifications? **[PROBE VALUE PROPOSTIONS: SPEED OF SALE, INCENTIVES, HOME BUYER DEMAND, PROFIT, HOME QUALITY, HOME COMFORT, AIR QUALITY, LOWER BILLS, LONGEVITY, GOOD FOR PLANET]**
   1. In your opinion, what value does an above-code home bring to a homeowner?
   2. What about to your company?

D3. **[FOR AT-CODE BUILDERS ONLY]** What would motivate you, if anything, to build above-code/achieve certifications?

1. In your opinion, what value would an above-code home bring to a homeowner?
2. What about to your company?

D4. What challenges, if any, do you see to building above-code homes(homes that achieve certifications)? **[PROBE: COST, LACK OF BUYER DEMAND, LACK OF BUYER DEMAND, ETC.]**

1. What information or resources would help you overcome those challenges?

E. Energy Efficiency in Home Building - Target Measures

Next, I would like to discuss five specific energy efficient features with you to better understand your company's building practices.]

Super-Efficient Walls (NET ZERO WALLS, DOUBLE STUD WALLS, THERMAL BREAK SHEAR WALL OR "MARTHA WALL", OR CONTINUOUS EXTERIOR RIGID INSULATION WALL)

E1. In a typical project, what level of above and below-grade wall insulation do you install? **[PROBE FOR R-VALUE OR U-VALUE OF ABOVE AND BELOW-GRADE WALLS]**

1. In what percentage, if any, of your single-family residential projects do you install super-efficient walls? **For our purposes, these are defined as above grade walls with a U-value ≤ 0.045 Btuh/ft^2-F (nominal R21 + R4.5 ci) or below grade walls with a U-value ≤ 0.040 (R21 2** ft + BG). **[READ IF NEEDED: OTHER NAMES FOR THIS MEASURE INCLUDE ADVANCED WALLS, NET ZERO WALLS, DOUBLE STUD WALLS, THERMAL BREAK SHEAR WALL OR "MARTHA WALL", OR CONTINUOUS EXTERIOR RIGID INSULATION WALL.]**
   (1) Who installs the super-efficient walls for your projects?
   (2) What challenges, if any, have you/they experienced with super-efficient wall installation? **[PROBE EASE OF FINDING MATERIALS, QUALIFIED SUBCONTRACTORS]**
2. **[IF NOT INSTALLING AT ALL] WHY NOT?**

E2. What information or support would be helpful for builders and subcontractors to make the implementation of super-efficient walls easier?

E3. Do you anticipate a change in the amount of super-efficient walls you install each year over the next few years?

1. **[IF YES] [PROBE HOW THIS WILL CHANGE AND WHY]**
2. **[IF NO]** Why do you say that?

Super Windows (U factor ≤ 0.2)

E4. In a typical project, what window U-factor do you install?

1. In what percentage, if any, of your single-family residential projects do you install super windows? For the purposes of this research, we define these as windows with a U-factor ≤ 0.20 Btuh/ft^2-F (nominal triple pane with argon). **[OTHER NAMES FOR THIS MEASURE INCLUDE TRIPLE PANE WINDOWS AND THIN TRIPLE PANE WINDOWS]**

(1) Who installs the super windows for your projects?
(2) What challenges, if any, have you experienced with super window installation? **[PROBE EASE OF FINDING MATERIALS, QUALIFIED SUBCONTRACTORS]**
(a) Why do you say that?

2. **[IF NOT INSTALLING AT ALL] WHY NOT?**

E5. What information or support would be helpful for builders and subcontractors to make the implementation of super windows easier?

E6. Do you anticipate a change in the amount of super windows you install each year over the next few years?
1. **[IF YES] [PROBE HOW THIS WILL CHANGE AND WHY]**
2. **[IF NO]** Why do you say that?

Balanced Ventilation with Heat Recovery Ventilator (dedicated outdoor air system)

E7. Please describe the ventilation system installed in typical project.
1. What percentage, if any, of your single-family residential projects have balanced fresh air ventilation and use an HRV, or Heat Recovery Ventilator? For our purposes, this is balanced mechanical ventilation providing fresh air to each room using either a dedicated ventilation system or is integrated with a central HVAC system. **[OTHER NAMES FOR THIS MEASURE INCLUDE BALANCED MECHANICAL VENTILATION, HEAT RECOVERY VENTILATION, ENERGY RECOVERY VENTILATION, AND DEDICATED OUTDOOR AIR SYSTEM. THIS DOES NOT INCLUDE EXHAUST ONLY SYSTEMS OR RETURN AIR VENTS.]**
(1) Who installs the balanced ventilation system with an HRV? **[PROBE: AND AT WHAT POINT ARE THEY BROUGHT INTO THE PROCESS?]**
(2) What challenges, if any, have you experienced with balanced ventilation system installation? **[PROBE EASE OF FINDING EQUIPMENT, QUALIFIED SUBCONTRACTORS / INSTALLERS]**
2. **[IF NOT INSTALLING AT ALL]** Why not?

E8. What information or support would be helpful for builders and subcontractors to make balanced ventilation with HRV more easily achieved?

E9. Do you anticipate a change in the number of your homes that use balanced ventilation with HRV each year over the next few years?
1. **[IF YES] [PROBE HOW THIS WILL CHANGE AND WHY]**
2. **[IF NO]** Why do you say that?

Air Tightness (of two air changes per hour or less)

E10. How often are your homes blower door tested?

1. When you have had your homes blower door tested, how are tight are they typically (in air changes per hour)?
2. How often do your homes achieve a blower door test of two air changes per hour or less, or 2ACH50?
   (1) What is it you do beyond basic air sealing that helps you get to two air changes per hour or less?
   (2) What challenges, if any, have you experienced to achieving two air changes per hour? **[PROBE EASE OF FINDING MATERIALS, QUALIFIED SUBCONTRACTORS, PUSHBACK]**
   (3) Please share any best practices or lessons learned for correcting issues that may have increased the number of air changes per hour.
3. **[IF NOT INSTALLING AT ALL]** Why not?

E11. What information or support would be helpful for builders and subcontractors to make airtight construction more easily achieved?

E12. Do you anticipate a change in the number of your homes achieving this level of air tightness each year over the next few years?

1. **[IF YES] [PROBE HOW THIS WILL CHANGE AND WHY]**
2. **[IF NO]** Why do you say that?

Efficient Ducts (located inside the conditioned space and the pressure drop of the system is less than .75 inches of water column)

E13. Finally, please describe typical duct design for your projects. **[PROBE LOCATION (INSIDE/OUTSIDE CONDITIONED SPACE), SEALED, PROPER INSTALLATION]**

1. In what percentage, if any, of your single-family residential projects do you install efficient ducts? Efficient ducts are located inside the conditioned space and the pressure drop of the system is less than .75 inches of water column.
   (1) Please describe the process for installing efficient ducts. Please include any additional design and performance testing that occurs as part of this process.
   (2) What challenges, if any, have you experienced installing efficient ducts? **[PROBE EASE OF FINDING MATERIALS, QUALIFIED SUBCONTRACTORS, ARCHITECTURE ISSUES]**
2. **[IF NOT INSTALLING AT ALL]** Why not?

E14. What information or support would be helpful for builders and subcontractors to install efficient ducts?

E15. Do you anticipate a change in the amount of efficient ducts you install each year over the next few years?

1. **[IF YES] [PROBE HOW THIS WILL CHANGE AND WHY]**

2. **[IF NO]** Why do you say that?

F. Closing

Thank you for taking time for this discussion today. We appreciate your insights. Our company is inviting home builders to participate in a virtual focus group discussion in January related to the topics we've discussed today. This is an online group discussion with other residential builders led by a moderator, and we would really appreciate your further insight and input! The focus group will last 90 minutes, and participants will receive a **$150 gift card.**

F1. Are you interested in participating in the second phase of this research as a focus group participant?
   1. Yes **[INFORM INTERVIEWEE THAT WE WILL BE IN TOUCH TO SCHEDULE PARTICIPATION IN FOCUS GROUP.]**
   2. Maybe **[INFORM INTERVIEWEE THAT WE WILL BE IN TOUCH TO INVITE THEM TO PARTICIPATE IN FOCUS GROUP.]**
   3. No

F2. This completes our interview for today. Your responses are very important to us and we appreciate your time. Please provide the best address for your **$50 VISA gift card.**
   1. **RESPONDENT NAME:**
   2. **RESPONDENT ADDRESS:**

Appendix C. Builder Focus Group Discussion Guide

***Note for reviewers**: Although Cadmus will use this guide to frame the focus group discussion, it is not meant to be a verbatim script. As with all focus groups, the results are qualitative and cannot be used to represent all home builders in the Northwest. Reminder: Each session is dedicated to either At-Code or Above Code builders.*

Research Objectives

Research Objectives	Corresponding Sections[1]
Understand key building practices and how they differ (or are the same) between above-code and at-code builders in the region	Section A, D
Identify opportunities to influence builders to adopt above-code measures	Sections A, E, G
Test the current value propositions for above-code homes and identify any new value propositions	Section F
Understand challenges and successes associated with installing product plan measures	Section G

[1] Section B provides discussion guidance and Section C is the discussion introduction.

Target Audience

Segment Requirements[1]	Number of Groups	Number of Respondents Per Group[2]	Total Respondents Per Segment	Group Dates and Times
At-Code Builders[3]	2	6 to 8	12 to 16	2/2/21: 4:30-6:00pm PST 2/3/21: 6:30-8:00pm PST
Above-Code Builders	2	6 to 8	12 to 16	2/2/21: 6:30-8:00pm PST 2/3/21: 4:30-6:00pm PST
All Respondents	Respondents must be responsible for making residential building practice decisions for their company/the homes they build.			

[1]For the purposes of this study, above-code builders are those who self-identify as seeking a whole-home program certification (such as ENERGY STAR® or LEED) for 25% of the homes they built in 2019 and 2020.

[2] Cadmus will aim to recruit 8 builders per group

[3]To ensure we talk to At-Code builders who sometimes exceed code without achieving certifications, Cadmus will aim to recruit some At-Code builders who receive utility incentives for the measures that they install.

A. Pre-Group Activity (3 min)

Please answer the questions you see on the screen as you wait for the groups to begin. Please note, there are no wrong answers to these questions.

A1. How important is it to you to include energy-efficient features in the homes you build?

1. Very important
2. Somewhat important
3. Not too important
4. Not at all important

A2. How often do some aspects of the homes you build exceed the state energy code?

1. Very often
2. Somewhat often
3. Not too often
4. Not at all often

A3. In what areas do you typically exceed the state energy code in the homes you build? (select all that apply)

1. Insulation levels
2. Air Sealing
3. High-efficiency HVAC
4. High-efficiency water heaters
5. Windows
6. High-efficiency appliances
7. I don't typically exceed the state energy code

A4. Who most influences your decision to seek out a whole-home energy efficiency certification (e.g., Passive House, ENERGY STAR, DOE Zero Energy Ready Home, etc.)? (please select one)

1. Subcontractor
2. Customer
3. Architect
4. Rater/verifier for certification
5. Other
6. I don't seek out home energy efficiency certifications

B. Warm-Up (2 min)

Thanks for joining today! We're glad you're here, and we really appreciate that you could take some time to share your insights with us.

First, I'd like to cover a few technical items:

- If you called in on a phone, please make sure to keep your computer speakers muted.
- Please refrain from using speaker phone during the course of the meeting to prevent feedback/echo.
- If you experience any issue with the connection to the online meeting room, please log back in by following the same link in your email to the meeting room.
- If the call drops, you can dial back in using the same conference number you first used.

Let's go ahead and get started:

- Our discussion will take about 90 minutes.
- As you may remember from the invitation call, we'll be talking about residential building practices and challenges you see or experience to exceeding the energy code in the areas you build homes. We invited builders from across the Pacific Northwest to participate in this

discussion. States represented include Idaho, Montana, Oregon, and Washington.

- You all have been invited here today because of your individual experiences and we want to hear from everyone. We want to hear your opinions, no matter how much you feel you know about the topics we discuss.
- Remember there are no right or wrong answers.
- We'll be recording the session today, but this is for our research purposes only. Your name will not be attached to any quotes if we use them in our reports. Some of our clients are also observing this group.
- Any questions before we begin?

C. Introduction (5 min)

Let's start with introductions.

C1. I will go ahead and call on each of you. Please unmute your phone and tell us your name, the state in which you build, and how long you've been in the industry.

D. Current Building Practices (15 min)

I'd like to start by asking about your typical homebuyers and building practices.

D1. Tell me about your typical homebuyer. What two phrases would you use to describe your average homebuyer? *[Probe, if needed: first-time buyer, budget-conscious, experienced homebuyer, high-income, open-minded, quality-seeking, seeks high performance or new technologies]*

D2. The results from the pre-group poll shows that most of you think it's **[Result of A1]** to include energy efficient building materials and equipment in the home, why is that?

D3. According to that poll, [Most, Some, A few] of you said that some aspects of the homes you build typically exceed energy code. What influences where you exceed code? *[Probe: listed measures, influence of incentives, other]*

1. Insulation levels
2. Air Sealing
3. High-efficiency HVAC
4. High-efficiency water heaters
5. Windows
6. High-efficiency appliances

D4. I'd like to do a quick poll about the space heating and water heating fuels included in the homes you build. *[Probe after poll is complete: What factors influence the fuel type you use? (e.g., cost/budget, availability, pursuit of net zero homes, customer preference)]*

Poll Question:

1. Approximately what percent of the homes you build have the following fuel types:
    a. All-Electric space and water heating: ____
    b. Natural gas space heating only: ___
    c. Natural gas water heater only: ___
    d. Both Natural gas space heating and water heating: ___

2. For what percent of your homes in the past year have you installed a HPHW?

3. What percent of your homes are capable of having a heat pump hot water heater installed?

4. From where do you purchase heat pump hot water heaters for the homes you build?
    a) Distributor
    b) Manufacturer
    c) Retailer
    d) HVAC Contractor
    e) I don't purchase heat pump hot water heaters

D5. Do you expect the fuel mix in the homes you build will change in the next few years? *[If yes: Why is that? And where is the market trending?]*

D6. How easy or challenging is it for you to meet your state's current residential building code requirements? Why is that?

1. How do you think residential building codes will impact your business in the next 3 to 5 years? [Note to moderator to probe for their respective states]

E. Opportunities to Influence Builders (15 min)

Now I'd like to delve into your building practice decision-making.

E1. What resources do you most often use for learning about building practices? *[Probe: market actors such as raters; organizations such as home builder associations.]*

E2. Who typically most influences building practices and equipment selection? For example, when you choose high efficiency equipment or not? *[Probe: builders, raters (verifiers/HERS raters), homebuyer, subcontractors (what type), architect, etc.]*

1. **At what point** in the home building process do these people influence your decisions? *[probe interaction between influencers (e.g., sub, rater, architects)] [Note to moderator: for example, with your HVAC subcontractor, is it during the design of the home, the time of the equipment selection, or some other time?]*
2. Does this vary by type of equipment or building practice? For example, is there a difference between who drives the decision for HVAC equipment, insulation selection, or air tightness?
3. **What else** influences these decisions? [Consider responses to D3. Probe: equipment prices, availability of rebates, perceived best practices, etc.]

E3. [IF AT-CODE] In the past, have you considered building above-code, pursuing green building certifications such as LEED or ENERGY STAR, or participating in a utility-sponsored new construction program that promotes above-code building practices? *[Document which ones, as appropriate]*

1. [IF NO] Why not?
2. [IF YES] What was the motivation to [build above code, pursue a certification, participate in the utility program]?
3. Who was most influential in the decision to pursue [the certification/program]? *[Probe, home buyer, subcontractors (what type?), architects, developers, etc.]*
4. *[Certification only]* And were you able to obtain the certification? *[If no: why not?; If yes: what, if anything, has stopped you from pursing similar certifications?]*

E4. [IF ABOVE-CODE] All of you were invited to join this focus group because you have sought out green building certifications for at least some of the homes you have built over the past two years. Which certifications do you most often pursue? *[For example, if needed: ENERGY STAR, LEED, Passive House, DOE Zero Energy, etc.]*

1. What is your motivation for pursing these certifications?
2. For those of you who said you sometimes pursue certifications, how do you decide whether or not to pursue the certification?
3. Who is most influential in deciding whether you pursue a green building certification for a particular home? *[Probe: builder company management, homebuyer, subcontractors (what type?), architects, certification program, rater, etc.]*

E5. What challenges do you see when aiming to build above-code? ***[PROBE: HIGHER COST TO BUILD, LACK OF BUYER DEMAND, PROJECT TIMELINE RISK, PROJECT MANAGEMENT BURDEN, LACK OF QUALIFIED SUBCONTRACTORS, ETC.]***

E6. What would make it easier for you to build above-code [Probe: training (for who), information (what kind and from whom), incentives, marketing materials or educational resources for customers)]

E7. And if you got everything you just mentioned [IN E6], would you then build above-code homes?

MODERATOR BRIEFLY FACILITATES FOLLOWUP QUESTIONS A-E

F. Test Value Propositions (15 min)

*[**Note to reviewers**: The moderator will flip the order in which value propositions are]*

My next few questions are about what value you [might] see to building above-code homes. For the purpose of this discussion let's think about above-code homes as those that are very efficient, might be Zero Energy Ready or Net Zero, or meet certification requirements such as PASSIVE HOUSE or LEED.

Value Proposition: Builder Values

F1. What is a "quality" to you? What characteristics would that home have?

[SHOW VALUE STATEMENT ON SCREEN]

I build above-code homes because it **reflects my values**. I want to provide my customers with quality homes that are **comfortable**, ensure **indoor air quality**, **last longer**, have **lower energy bills**, and are **good for the planet**.

F2. What, if anything, about this statement resonates with you? *[Probe for specific words and why]*

F3. What doesn't resonate? *[Probe for specific words and why]*

F4. Are there values you see to building above code homes that are missing from this statement?

Value Proposition: Profit/Salability [SHOW VALUE STATEMENT ON SCREEN]

I build above-code homes because I can **make (more) money** building this way and/or **sell them more quickly than at-code homes**.

F5. What, if anything, about this statement resonates with you? *[Probe for specific words and why]*

F6. What doesn't resonate? *[Probe for specific words and why]*

F7. Are there values you see to building above code homes that are missing from this statement?

F8. How, if at all, does [would] building above-code affect your ability to sell the home? *[Probe: Impact of certifications on home price and customer demand]*

F9. How, if at all, does [would] building above-code affect your profit? *[Probe: Ability to recoup higher builder costs in the sale price]*

Value Proposition Selection Exercise [SHOW LIST OF VALUES ON THE SCREEN]

1. Easier to sell
2. Environmental benefits
3. Improved home comfort
4. Improved indoor air quality
5. Increased home longevity
6. Increased profit
7. Lower home energy bills
8. Reflects my values as a builder

F10. Of the values we just discussed, which two best reflects why you would build above-code homes? *[Probe additional values if provided in F4 and F7]*

G. Understand challenges and successes with product plan measures (30 minutes)

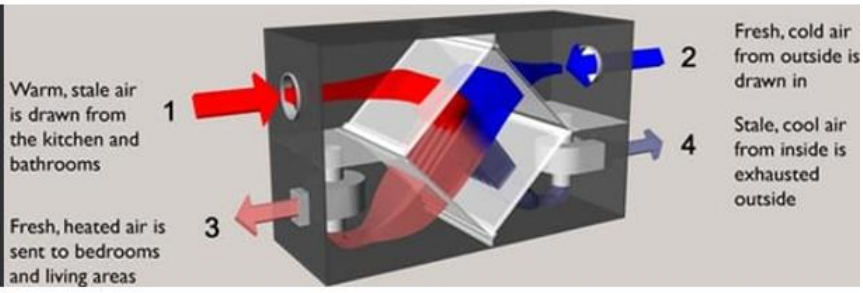
For the last part of our discussion, I would like to ask you about your experience with three types of equipment types or building practices and your opinions of them.

Balanced Ventilation with HRV

G1. What does the phrase "balanced ventilation with Heat Recovery Ventilator" mean to you?

G2. How, if at all, does the image and definition on the screen align with what you think of as balanced ventilation? *[Probe: Is there anything missing from this description that would inform you what this product/process is? Is anything confusing/unclear?]* **[SHOW PERFORMANCE CRITERIA AND IMAGE ON SCREEN]**

Balanced Ventilation with Heat Recovery Ventilator (HRV):
Systems that distribute air to all occupied areas

PERFORMANCE CRITERIA	Balanced mechanical ventilation that meets ASHRAE 62.2 fresh air minimums an HRV that has a sensible recovery efficiency 80% and fan efficacy > 1.2 cfm/W
TYPES OF BALANCED VENTILATION WITH HRV SYSTEMS	• Dedicated Outside Air System (DOAS) • HRV Integration with central air handling unit: supply side or return side • Small zonal HRVs (multiple per home)
OTHER NAMES	• Energy Recovery Ventilation (ERV) • Is NOT accomplished through "exhaust only", "return air vents", or "central forced air" systems
HOW AN HRV WORKS	
EXAMPLE SYSTEMS	Zender HRV System  Honeywell HRV System 

G3. Is the phrase "balanced ventilation with HRV" the best way to describe equipment with this performance criteria, or would you and your subcontractors use one of the terms shown on the screen? If not, what's the best phrase?

G4. How often do you include balanced mechanical ventilation with HRVs in the homes you build? Why is that?

1. What situation would you consider installing HRVs?
2. Would installing this equipment and integrating it with the home design be easy or difficult for you or your subcontractors? *[Probe to identify challenges]*
3. What, if any benefits do you see related to installing this equipment?

G5. Do you anticipate a change in the number of homes you build that will have balanced mechanical ventilation with HRVs over the next 3-5 years? *[If change: What will drive this change?]*

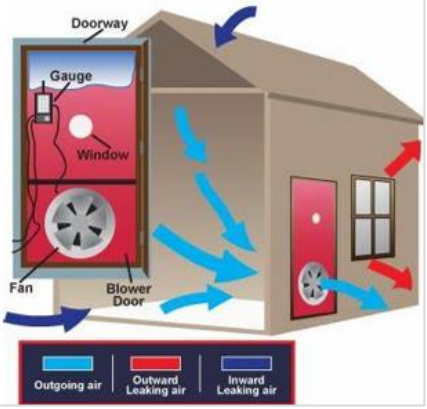
G6. What would it take for you to install this equipment more often? *[Probe: incentives, training (for who and what kind of training?) etc.]*

Air Tightness

G7. What does the phrase "air tightness" mean to you?

G8. How, if at all, does this image and definition on the screen align with your ideas of air tightness? *[Probe: Is there anything missing from this description that would inform you what this product/process is? Is anything confusing/unclear?]* [SHOW PERFORMANCE CRITERIA AND IMAGE ON SCREEN]

Air Tightness

PERFORMANCE CRITERIA	• Air changes per hour at 50 pascals ≤ 2.0 (ACH50 ≤ 2.0) • Must pair with balanced mechanical ventilation with HRV
OTHER NAMES	• Airtight Envelope Construction • Low Infiltration Rate • Air Sealed • Blower-door tested with ACH ≤ 2.0
COMMON AIR LEAKAGE LOCATIONS	• Attic Hatch • Chase • Crawl Space • Dryer vent • Electrical Outlet • Kitchen fan vent • Outdoor faucet • Plumbing Stack Vent • Recessed Lights
SUGGESTED TESTS	Smoke Test for Leaks  Calibrated Blower Door Test 

G9. Is the phrase "air tightness" the best way to describe this performance criteria, or would your subcontractors use one of the terms shown on the screen? If not, what's the best phrase? *[For example, if needed: air sealed, blower-door tested w/ ACH 2.0, low infiltration rate, airtight envelope construction]*

G10. How often do the homes you build have blower door tests completed to identify the air tightness? *[Probe: If not conducting tests – why not? Is there anxiety around failing and needing to do it again?]*

G11. For those of you that do run blower door tests, how often do the homes you build achieve 2 or fewer changes per hour paired with balanced mechanical ventilation with HRV?

1. What are the challenges to achieving this level of tightness?
2. In what situation would you consider trying to achieve 2 or fewer air changers per hour and pairing that with an HRV?
3. What, if any benefits do see with achieving 2 or fewer changes per hour paired with balanced mechanical ventilation with HRV?

G12. Do you anticipate a change in the number of homes you build achieving this level of air tightness paired with an HRV over the next 3 to 5 years? *[If change: What will drive this change?]*

G13. What would it take for you to more often achieve this air tightness paired with an HRV? *[Probe: incentives, training (for who and what kind of training?), increased customer demand, etc.]*

Efficient Ducts

G14. What does the phrase "efficient ducts" mean to you?

G15. How, if at all, does this image and definition on the screen align with what you think of as efficient ducts? *[Probe: Is there anything missing from this description that would inform you what this product/process is? Is anything confusing/unclear?]* [SHOW PERFORMANCE CRITERIA AND IMAGE ON SCREEN]

Efficient Ducts

PERFORMANCE CRITERIA	• Pressure drop of ducted system is less than 0.75 in WG • At least 95% of ducts are located inside conditioned space • Duct leakage to exterior meets ANSI standard 310 Grade 1 requirements

OTHER NAMES	• Designed to ACCA Manual D
	  ○ Quiet (low velocity)
	  ○ <0.75 in WG pressure drop
	  ○ Distributed (to all primary rooms)
	  ○ Properly sized and located return air duct(s)
	• Ducts inside
	• Duct Blaster® tested duct work
	• Sealed Ducts
	• Deeply varied ducts

DUCT TESTING PROCESS	1. Seal vents 2. Pressurize ducts to 25Pa 3. Measure air leakage
COMMON METHODS AND TOOLS	Minneapolis Duct Blaster  Mastic duct sealing  Areoseal duct sealing 

G16. Is the phrase "efficient ducts" the best way to describe this type of duct system, or would you and your subcontractors use one of the terms shown on the screen? If not, what's the best phrase?

G17. To what extent are you implementing the practices show on the screen? Are you doing a combination of some of these? **[Probe items below]**

1. How often do you install 95% of a home's ducts in conditioned space? How easy or hard is this to do?
2. How often does the pressure drop of the ducts systems less than 0.75 in WG (water gage)? How easy or hard is this to do?
3. How often do you meet ANSI standard 310 Grade 1 requirements? How easy or hard is this to do?

G18. Do you anticipate a change in the number of homes that you build with efficient ducts over the next 3-5 years? *[If change: What will drive this change?]*

G19. What would it take for you to install efficient duct systems more often? *[Probe: incentives, training (for who and what kind of training?), coordination with architect, increased customer demand, etc.]*

H. Closing (5 min)

H1. Those are all the questions I have for you this evening. Does anyone have any other comments they would like to share before we end tonight's discussion?

Thank you for sharing your opinions and taking the time to participate, your input is greatly appreciated. By Friday, your $150 Amazon gift card should be emailed to the email address you provided during the invitation call.

Appendix D. Additional Research Considerations

Table D-1 shows additional research opportunities for NEEA to consider.

Table D-1. Additional Market Actor Research

	Research Objective	Research Questions	Research Methods
Builders and Industry Experts 	**Identify successful strategies for building above-code affordably or without reducing profits**	• What strategies do above-code builders use to keep costs reasonable for their customers? (this can apply to product plan measures or above-code in general) • As codes continue to tighten, how can builders keep home prices and building costs reasonable?	• Above-code builder interviews/focus groups • Interviews with representatives from Passive House, DOE Net Zero, or other green building organizations • Literature review
Subcontractors 	**Investigate subcontractor knowledge/attitudes of above-code building and product plan measures** **Understand how to encourage subcontractors to promote above-code measures**	• How do subcontractors learn about building practices and what barriers do they see to above-code homes? • Do subcontractors typically work with both at-code and above-code builders? Or do they work with one type of builder? • (If subcontractors work with both types of builders) How, if at all, is information from above-code builders passed on to at-code builders through shared subcontractors? • What will it take for subcontractors to promote and install above-code measures on a regular basis?	• Subcontractor focus groups/ interviews (both at-code and above-code)
Architects 	**Explore how to influence architects to design homes that can accommodate product plan measures**	• Are architects aware of NEEA's product plan measures and their benefits? • Are architects aware that certain aspects of their home design can make it difficult for builders to include HRVs or Super-Efficient Ducts? • What would motivate architects to design above-code homes that can accommodate product plan measures?	• Architect focus groups/interviews (both at-code and above-code)