October 08, 2020

REPORT #E20-410

HVAC/ Very High Efficiency Dedicated Outside Air Systems Specifier Focus Groups Report

Prepared For NEEA:
Lauren Bates, Sr. Project Manager, Market Research & Evaluation

Prepared by:
Jen Urich, Co-founder/ Business Strategist
Jen van Arkel, Co-founder/ Marketing Strategist
Jon Pauly, Associate Brand Strategist

Sparrow Strategy
2360 NW Marshall St.
Portland, OR
97210

Northwest Energy Efficiency Alliance
PHONE
503-688-5400
EMAIL
info@neea.org

TABLE OF CONTENTS

EXECUTIVE SUMMARY

This report focuses on a commercial HVAC (heating, ventilation, and air conditioning) solution that NEEA (Northwest Energy Efficiency Alliance) currently refers to as Very High Efficiency Dedicated Outside Air Systems (abbreviated as VHE DOAS in this report). The VHE DOAS approach is relatively new to the Northwest and to the US overall, and NEEA seeks to stimulate its adoption among market actors involved in HVAC sales, design, and installation.

Building on past research, Sparrow conducted qualitative research so that NEEA could better understand HVAC market actors and learn how to effectively communicate with them about VHE DOAS through marketing, training sessions, and other outreach efforts. The three objectives of this research were to:

1. **Learn market actors' on-the-job mindsets (motivations, frustrations, and business models);**
2. **Learn how market actors think about VHE DOAS (perceptions and misconceptions); and**
3. **Gain feedback on the VHE DOAS "selling points," diagram, and naming options.**

For this research, Sparrow took an iterative qualitative research approach including desk research, a questionnaire, and small focus groups of three participants each.[1] During the focus groups, the participants completed a range of interactive activities in order to provide feedback on prototype NEEA messaging materials and possible names for the VHE DOAS approach.

The questionnaire was fielded via SurveyMonkey from July 2 to July 29, 2020. Sparrow moderated six focus groups between July 13 and 15, 2020, using two online platforms: 20|20's QualMeeting (for video discussion on Zoom) and Mural (for interactive activities).

Participants in this research were market actors who play a role in HVAC system design, specification, and selection for small- to mid-sized commercial buildings: architects, engineers, and HVAC contractors/installers. Their offices were located in Washington, Oregon, Idaho, and Montana, with a skew towards urban Oregon and Washington, due to the higher incidence of market actors who were familiar with VHE DOAS, and because DOAS is in Washington's code. Due to the small incidence of those who were familiar with this approach, the recruit prioritized market actors who were unfamiliar with VHE DOAS. Each focus group consisted of three different market actor types, functioning as a snapshot of the dynamics present in a real-life HVAC system design team. Nineteen people completed the questionnaire, and seventeen participated in the focus groups.

OBJECTIVE 1 LEARN MARKET ACTORS' ON-THE-JOB MINDSETS (MOTIVATIONS, FRUSTRATIONS, AND BUSINESS MODELS)

KEY INSIGHT 1

The typical on-the-job HVAC concerns and success factors revealed in the pre-session questionnaire—team communication, project planning, on budget/on time—not only apply, but also amplify in importance, with VHE DOAS. This approach requires even more cross-functional communication and shared understanding of the criteria (design principles). Currently, HVAC is either "the caboose of a project," as one engineer declared, or the responsibility of a single market actor, most often the engineer.

1. Disclaimer: Due to the qualitative approach and small sample sizes of both the questionnaire and focus groups, learnings from this research should be used for *directional purposes only*.

RECOMMENDATION

Educate, reinforce, and support the collaborative, coordinated human effort required by this approach. Foster teamwork and encourage ongoing interaction for the duration of a job, with NEEA's prior integrated design information as a starting point in project planning.

KEY INSIGHT 2

Market actors shared remarkably similar perspectives on key market drivers, motivations, and barriers regarding HVAC projects and the adoption of new technology and methods. In determining the viability of the VHE DOAS approach, factors such as building type, retrofit or new installation, and funding source were much more salient than job role or geographical location. Ultimately, the owner/client's priorities were top of mind for all, regardless of job role or location.

RECOMMENDATION

Acknowledge and leverage the commonalities across the market actors by engaging them, along with owners/clients when appropriate, in a cross-functional manner (e.g., training, outreach, and communication programs). Additionally, conduct a quantitative segmentation study that incorporates the most relevant decision factors to identify and size the true market transformation opportunities and prioritized targets for VHE DOAS.

OBJECTIVE 2

LEARN HOW MARKET ACTORS THINK ABOUT VHE DOAS (PERCEPTIONS AND MISCONCEPTIONS)

KEY INSIGHT 3

Across the groups, market actors displayed familiarity with DOAS in general, accurately unpacking the acronym as "dedicated outside air." It was not a new idea to many, described simply as "a slightly fancier way to bring ventilation in." However, most market actors were not aware that a range of DOAS configuration options exists, including VHE DOAS. Consequently, most were unable to articulate the differences between the various approaches to DOAS. Being accustomed to ongoing evolution and creative thinking within the HVAC category, market actors were eager to learn more about a new option that promised, and delivered, "very high efficiency."

RECOMMENDATION

Position the VHE DOAS approach as part of the ongoing evolution of the HVAC category. In communication materials, compare VHE DOAS to familiar options, components, and approaches. Consider the following:

- **Use infographics to show where VHE DOAS fits in the evolution of modern HVAC systems.**
- **Emphasize that this is a system, not merely an HVAC unit paired with an HRV (heat recovery ventilator), as this will greatly enhance understanding.**
- **Create a side-by-side comparison chart of key features and benefits to explicitly show how the VHE DOAS approach differs from current DOAS and popular HVAC options.**
- **Develop a range of versions of this chart—from detailed and feature-heavy for engineers and installers, to less technical and more end-benefit-driven for architects, contractors, salespeople, and client/owners.**

Such a categorical juxtaposition will ensure that the most differentiating facts, features, and benefits of the VHE DOAS approach are highlighted. Context can be everything.

KEY INSIGHT 4

Upon introduction to the phrase "Very High Efficiency DOAS Approach," market actors quickly equated the words "very high efficiency" with "meeting stricter energy codes," "better functionality," and "improved life cycle costs"—all key consideration factors when choosing an HVAC solution. On the downside, the phrase also meant "expensive," which is the most significant barrier to adoption. Regarding a project's cost, HVAC is one of the first line items to be reduced or "value engineered." Despite the important benefits, it's very difficult to justify and sell new approaches to the majority of owners/clients.

RECOMMENDATION

Educate all market actors, including owners/clients and key stakeholders such as regulators and legislators, on the value and the ROI (return on investment) of VHE DOAS. Make the case so compelling that the system is not dismissed from the start or "value engineered out." This can be accomplished in the following ways.

- **Analyze cost data from the pilot projects to produce compelling case studies showing side-by-side comparisons of the installed cost of VHE DOAS vs. other options.**
- **Promote an understanding of the long-term, future-proofed value of VHE DOAS through a life cycle cost story that incorporates externalities and non-financial factors.**
- **Explore ways to bring the VHE DOAS equipment costs down, either through manufacturer discounts or a published price list (combatting the tendency to mark up new, more energy-efficient technology).**

KEY INSIGHT 5

Meeting code is a main driver in the adoption of new technologies/approaches. Seen as the cost of entry on all projects, the motivational power of meeting code was no stronger for market actors from Washington/Seattle than for those based in other states/cities.

RECOMMENDATION

Continue working to elevate code through regulation and/or legislation. Focus on changes that solve for future-facing issues by applying new technology and design principles such as the VHE DOAS approach. Proactively drive toward these long-term, sustainable end benefits: health and safety through better IAQ (indoor air quality), energy efficiency, conservation, and/or carbon reduction.

OBJECTIVE 3

GAIN FEEDBACK ON THE VHE DOAS "SELLING POINTS," DIAGRAM, AND NAMING OPTIONS

KEY INSIGHT 6

Two of the prototypes, the description and diagram, employed standard category terms, calculations, acronyms, and visuals that market actors both recognized and appreciated. Together, these two

prototypes *began* to enlighten them about what VHE DOAS is and what unique features and benefits it offers in comparison to other HVAC options (downsizing, minimizing pressure drop, 82% sensible recovery, decoupled). Unfortunately, even after the phrase "*includes key design principles*" was added to the description, these two pieces failed to communicate the crucial fact that the VHE DOAS approach is not just components making up a system but a new way of working, thinking, and designing.

RECOMMENDATION

Improve upon the current description, and the diagram, by clearly establishing that this system utilizes a set of off-the-shelf components which require thoughtful design and integration into a space in order to meet the qualifying criteria of VHE DOAS. Because this approach relies on both specific equipment and the human elements of collaboration and communication, consider adding dynamism to the diagram, such as design elements to communicate cross-team interaction, role-specific decision making, and a sense of the process from start to finish.

KEY INSIGHT 7

The following list reflects the most compelling VHE DOAS selling points, ranked in terms of both their perceived impact on the market actors and their differentiation from other HVAC options:

- **Better IAQ;**
- **Affordable project cost/ROI;**
- **Improved energy efficiency; and**
- **Increased engineering/design flexibility.**

These are especially relevant today, as a response to both COVID-19 and an increased focus on financial accountability, environmental impacts, and innovative thinking. The market actors foresee a future need to comply with ever-stricter code requirements, show HVAC payback over time, and meet owner/client and end-user demands for control, comfort, and safer indoor air.

RECOMMENDATION

Develop the VHE DOAS approach value proposition, using these four highly differentiating, compelling and convincing selling points. Use existing data, evidence, and case studies to support all claims. This will establish a foundation from which to customize outreach and adjust the level of detail required by specific market actors and/or additional stakeholders (owners/clients, regulators, legislators, and the general public).

KEY INSIGHT 8

COVID-19 is driving awareness of, and heightening the importance of, indoor air quality. The pressing need to rethink ventilation, reexamine HVAC choices, revisit design approaches, and reinvest in new technology was palpable in every group conducted. Many of the market actors shared recent requests for solutions to improve the ventilation in existing buildings. Others predicted future code changes will bring about higher air quality standards, leading to the installation of more DOAS approaches. They appreciated learning about VHE DOAS as a new potential solution. As one engineer said, "This is another tool in the tool box."

RECOMMENDATION

Use this opportune moment to communicate that VHE DOAS is the only HVAC approach available today that is both energy efficient and potentially capable of minimizing the viral spread of COVID. Show the difference in air quality attained by the VHE DOAS approach and explain how such results are achieved. Put it in language that can be understood by all market actors, key stakeholders, and influencers, including journalists and citizens. Consider a public relations effort to gain media coverage of this HVAC solution for safer home, school, and work environments.

KEY INSIGHT 9

Given the general lack of familiarity among most market actors, NEEA essentially has a blank slate for communicating the VHE DOAS approach.

RECOMMENDATION

Use this research and existing NEEA knowledge to identify and establish a unifying VHE DOAS value proposition that will resonate broadly across all market actors. The high-level themes that emerged during the "Convince a Peer" exercise can serve as a starting point for this exercise: more efficient with the same cost, better IAQ, flexible/adaptable, and future-proofed.

KEY INSIGHT 10

Understanding of the category vocabulary, terms and acronyms, technical detail, and emphasis on features or end benefits varied significantly across market actors. Engineers required data in order to believe the claim of superior energy efficiency. Architects wanted to see the space savings gained by smaller ductwork or by placement of the system on the roof rather than in a utility room. Market actors responsible for sales needed to be able to explain the overall value of VHE DOAS in a way that owners/clients would understand. All expressed an interest in experiencing the VHE DOAS approach themselves, to see the features and benefits in real-world applications.

RECOMMENDATION

Build a comprehensive communication plan that recognizes both the similarities and differences across the key market actors. The following is an approach to consider that will ensure the right message reaches the right market actors in the right way.

1. **Identify and prioritize the key market actors and/or other stakeholders to target with outreach.**
2. **For each type of market actor or stakeholder, define the primary communication objective.**
3. **Identify the relevant tactical messaging, based on the motivators, barriers, and other insights from this research.**
4. **Select the most effective messenger.**

Developing this plan may require additional research and/or moderated work sessions.

KEY INSIGHT 11

Market actors gravitated toward the familiar and pragmatic when learning about new technology and approaches. They prefer training that is hands-on and experiential. Seeing is believing.

RECOMMENDATION

Utilize the established education and communication norms within the HVAC and construction categories, such as ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) and the two current manufacturers (Swegon and Ventacity), to increase awareness of VHE DOAS. Update communication norms by developing and disseminating training content through new channels (e.g., a microsite with video content, community chat, etc.) to generate a sense of community. Develop means by which learning can be easily shared with colleagues and peers via videos, testimonials, conference appearances, on-site visits to pilot projects, etc.

KEY INSIGHT 12

The power of word of mouth, colleague recommendations, and networking were evident in each and every session conducted. The collaborative nature of the work and the natural sharing of information across functions were evident in the way the market actors interacted in the groups. As one respondent revealed in the questionnaire, HVAC data is often shared via professional relationships with peers.

RECOMMENDATION

Recruit and arm credible influencers who are familiar with VHE DOAS data, features, and benefits to evangelize the approach, amplify the message, and drive improvements (e.g., actual downsizing of equipment). Encourage networking by featuring the current and future pilot projects and their teams to bring a real (or virtual) experience of the full VHE DOAS approach to the market actors.

KEY INSIGHT 13

The naming exercise revealed the need to balance the hook of a brand name with a solid HVAC reference(s). Market actors appreciated names that tapped into the familiar, while also communicating this option's unique value and its suitability across a range of applications. DOAS + and Very High Efficiency DOAS met these criteria, whereas HealthVac, for example, was too limiting due to its focus on IAQ.

RECOMMENDATION

Continue exploring naming options, using feedback from this research to inform and guide development. Consider conducting name evaluation research with market actors to guide the final selection. Alternatively, go with DOAS+ supported by a description or tagline such as "The Very High Efficiency Approach to HVAC."

OVERVIEW

BACKGROUND

NEEA (Northwest Energy Efficiency Alliance) is focused on accelerating energy efficiency through innovative and transformative market solutions. The focus of this report is on a commercial HVAC (heating, ventilation, and air conditioning) solution that NEEA currently refers to as Very High Efficiency Dedicated Outside Air Systems (abbreviated as VHE DOAS throughout this report). VHE DOAS pairs a high efficiency heating and cooling system with a very high efficiency HRV (heat recovery ventilator) or ERV (energy recovery ventilator), along with key design principles. The VHE DOAS approach is relatively new to the Northwest and to the US overall, and NEEA seeks to stimulate its adoption among market actors involved in HVAC sales, design, and installation, including distributors, mechanical engineers, general contractors, and HVAC installers. Currently, very few of these key market actors are familiar with the value and benefits of VHE DOAS. According to NEEA's theory of change for the VHE DOAS program, commercial businesses would benefit from the energy use reduction from these systems, and the positive ripple effect would ultimately be felt throughout the Northwest region.

Building on past research, Sparrow conducted qualitative research so that NEEA could better understand HVAC market actors and learn how to effectively communicate with them about VHE DOAS through marketing, training sessions, and other outreach efforts.

RESEARCH OBJECTIVES

OBJECTIVE 1	*OBJECTIVE 2*	*OBJECTIVE 3*
Learn market actors' on-the-job mindsets (motivations, frustrations, and business models)	**Learn how market actors think about VHE DOAS (perceptions and misconceptions)**	**Gain feedback on the VHE DOAS "selling points," diagram, and naming options**

METHODOLOGY

For this research, Sparrow took an iterative qualitative research approach including desk research, a questionnaire, and small focus groups of three participants each.[2] Each phase of the research (Immersion and Discovery, outlined below) informed the next, and was mindfully designed to ask the right questions in the most effective ways.

IMMERSION: DESK RESEARCH

To prepare for focus groups, Sparrow reviewed key background materials shared by NEEA, turning to NEEA and an engineer assigned by NEEA to complement that learning (e.g., regarding category complexities, technical aspects of the system and components, insights about market actors, unique vocabulary, etc.). This phase of the project directly informed the moderator guides and activities/exercises in the following qualitative research sessions.

DISCOVERY: ONLINE QUALITATIVE RESEARCH

To explore the key topic areas and questions outlined in the RFP (request for proposals), Sparrow conducted online focus groups with market actors. Preceding the groups, market actors were sent a

2. Disclaimer: Due to the qualitative approach and small sample sizes of both the questionnaire and focus groups, learnings from this research should be used for *directional purposes only*.

questionnaire, which some completed prior to their group, and others finished afterwards.

QUESTIONNAIRE

The primary goal of the pre-group questionnaire was to cover Objective 1. This brief questionnaire was fielded via SurveyMonkey from July 2 to July 29, 2020. Sparrow estimated that it took market actors approximately fifteen minutes to complete.

FOCUS GROUPS

Between July 13 and 15, 2020, Sparrow moderated six focus groups. The primary goals of the focus groups were to explore all three objectives. The 75-minute group duration respected the market actors' time and recognized the attention limitations many people were experiencing due to COVID-related "Zoom Overload." These groups were conducted across two online platforms: 20|20's QualMeeting (Zoom, the video conference platform) and Mural (an interactive collaboration platform). By using Zoom, the participants and moderator were able to establish more convivial connections via "face-to-face" conversations. Throughout the session, everyone in the group kept Zoom open in one browser tab and Mural open in a separate tab. This dual-tab approach allowed the group to continue having an audio dialogue during the Mural-based activities and made it easy to maintain the human connection provided via Zoom. Observers were able to follow along on both platforms; participants could not see them, but did know they were present.

Importantly, these focus groups were purposefully designed to be more than just question-and- answer discussions. The smaller size enabled individuals to share their unique opinions and experiences; everyone's voice was heard. Additionally, by leveraging the group dynamic and mimicking HVAC system design teams, the groups encouraged active dialogue among all participants. Building on each other's comments, they were able to provide more detailed responses to the research questions and/or reinforce commonalities. Furthermore, these groups were also designed to be highly interactive. Hands-on/minds-on activities stimulated feedback and made market actors' thinking and interpretations visible to all (the others in the group, the moderator, and the observers). Lastly, the purposeful design of both the questions and the activities gave Sparrow the opportunity to follow up on market actors' responses, probing to reveal more detail, such as relevance or underlying motivations.

The following outlines the sequence of the discussion topics and activities. The detailed discussion guide and activities are provided in the Appendix.

1. **INTRODUCTIONS**
   - **Introductions—where you live and your role**
2. **OBJECTIVES 2 + 3 (VII)**
   - **Awareness and familiarity with DOAS (Dedicated Outside Air Systems) and the range of DOAS options, including VHE DOAS**
   - **Top-of-mind descriptive word that describes the VHE DOAS approach**
   - **Feedback on the prototype description of the VHE DOAS approach**
   - **Feedback on the prototype diagram of the VHE DOAS approach**
   - **Pros and cons of the VHE DOAS approach**
   - **"Card sort" of VHE DOAS approach consideration factors**

3. OBJECTIVE 3

- **Feedback on prototype "Selling points" for the VHE DOAS approach**
- **Feedback on prototype naming options**
- **Share the ONE most convincing thing/piece of information that makes you consider the VHE DOAS approach**
- **"Convince a Peer" to consider the VHE DOAS approach**

4. WRAP UP

- **Top-of-mind descriptive word that describes the VHE DOAS approach and discussion of shift between initial and second impressions**
- **Discussion about what the future holds for the VHE DOAS approach**

SAMPLE

The following outlines the key Recruit Specifications for this research. The recruiter used these specifications to create the screening questionnaire (screener), and to ensure that all participants fit the profile of NEEA's intended target audience. (The full screener is included in the Appendix.)

For this research, NEEA sought to talk with market actors who play a role in HVAC system design, specification, and selection for small- to mid-sized commercial buildings. Their job titles and roles were: architects, mechanical engineers, general contractors, HVAC contractors and installers, and vendors (manufacturers' representatives, account managers, product managers, distributor branch managers, and sales staff).

Additionally, this research strove to recruit market actors whose offices were located in Washington, Oregon, Idaho, and Montana, with a skew toward urban Oregon and Washington due to: the pilot projects previously completed in each state (four and two, respectively); the relatively high number of available professionals in those states; Washington's code requirement for "a Dedicated Outdoor Air System (DOAS) with energy recovery for office, education, and retail buildings; and for libraries and fire stations…" (Source: Washington building code WAC 51-11C-40360); and expected adoption rates. The sole rural group included market actors from two states (Oregon and Montana).

Lastly, the recruiting effort skewed toward market actors who were unfamiliar with VHE DOAS (due to the small incidence of those who were familiar with this approach). Familiarity with VHE DOAS was gauged by awareness of the "VHE DOAS HVAC system," previous experience working on a pilot project in conjunction with NEEA that involved the VHE DOAS system, or previous work on an HVAC system that included a Ventacity HRV.

RECRUIT NOTES ABOUT THE FINAL SAMPLE

The final sample included a range of different types of engineers (based on their self- identification in the sessions): mechanical engineer, design engineer, design engineer/project manager, or sales engineer. The HVAC contractors/installers sub-sample also included one individual who identified as an HVAC salesperson/project manager. Note that across engineers and HVAC contractors/installers, the recruitment included two sales perspectives. For the purposes of this report, we have consolidated the titles/roles into three categories: engineers, HVAC contractors/installers, and architects.

The recruiter attempted to include general contractors and vendors, inviting them to participate in both the questionnaire and the focus groups. No general contractors or vendors confirmed for the groups,

but one vendor responded to the questionnaire.

Because there was only one self-identified vendor who completed the questionnaire, any analysis of this market actor group would have compromised this respondent's anonymity. Based on a conversation with NEEA's Market Research and Evaluation Project Manager Lauren Bates, Sparrow folded all aggregate analysis for this respondent into the HVAC contractor group.

Two market actors who completed the questionnaire did not participate in the focus groups.

QUESTIONNAIRE AND FOCUS GROUPS COMPOSITION

The following table outlines the final sample across both the questionnaire and focus groups.

Each focus group functioned as a snapshot of the dynamics present in a real-life HVAC system design team, recreating the "natural partnerships" that form between certain members of a team who tend to work more closely together (e.g., HVAC contractors and installers; architects and mechanical engineers).

<table>
<tr><td>PRE-GROUP QUESTIONNAIRES (N=19)
12 Urban, 7 Rural
10 OR, 6 WA, 2 ID, 1 MT
11 respondents indicated that they specialize in highly efficient HVAC systems*</td><td>Architects – 7
• Oregon – 5
4 urban, 1 rural
• Washington – 2
1 urban, 1 rural</td><td>Engineers – 6
• Oregon – 1
1 urban
• Washington – 3
2 urban, 1 rural
• Idaho – 2
1 urban, 1 rural</td><td>HVAC Contractors/ Installers – 6
• Oregon – 4
3 urban, 1 rural
• Washington – 1
1 rural
• Montana – 1
1 rural</td></tr>
<tr><td rowspan="2">FOCUS GROUPS (N=17)</td><td>Group 1
• Washington
• Urban
• Familiar
• 2 engineers
1 architect</td><td>Group 2
• Washington
• Urban
• Unfamiliar
• 2 engineers
1 architect</td><td>Group 3
• Mixed Geography
• Rural
• Unfamiliar
• 1 engineer, 1 HVAC contractor/ installer, 1 architect</td></tr>
<tr><td>Group 4
• Oregon
• Urban
• Familiar
• 1 engineer, 1 HVAC contractor/ installer, 1 architect</td><td>Group 5
• Oregon
• Urban
• Unfamiliar
• 1 engineer
1 architect</td><td>Group 6
• Mixed Geography
• Urban
• Unfamiliar
• 1 engineer, 1 HVAC contractor/ installer, 1 architect</td></tr>
</table>

* Based on responses to Question 8: When it comes to selecting and designing HVAC systems, do you or your firm specialize in those that are highly energy efficient?

The table below summarizes the state in which each market actor was based, and also where they worked.

Office Location	*States Served*
Bend	OR
Bend	WA, OR, MT
Billings	MT, WY
Boise	ID
Olympia	WA
Portland	OR
Portland	OR
Portland	OR
Portland	OR
Portland	Pacific Northwest
Portland	WA, OR
Portland	OR, WA, ID
Redmond	WA
Seattle	WA
Seattle	WA, ID
Seattle	WA, MA, MD
Seattle	WA, OR, CA, AK

Source: Final sample; Focus Crossroads

DETAILED LEARNING

MARKET ACTOR DIFFERENCES

During this research, Sparrow purposefully listened for differences in market actors' responses related to their geography and/or roles/titles, as NEEA uses these characteristics to define its target markets. The following learnings about market actor differences are not linked to a specific Research Objective, but instead act as general contextual information that is important for understanding any of the Research Objectives.

Across all groups and market actors, there were more similarities than differences. Notable differences by geography and roles/titles are cited below. Any additional differences by geography or roles/titles that are specific to a Research Objective or question will be noted within that corresponding section.

WASHINGTON VS. OTHER STATES

Across the groups, market actors indicated that energy costs are currently low across the Northwest, due to hydroelectric and renewable power options. Consequently, their customers have expressed a lower need to be energy efficient in order to save costs.

One market actor mentioned that in the past, Seattle and Portland were more progressive in terms of new technology and prioritizing energy efficiency, but other cities and states in the Northwest have since caught up because of a general societal "green" movement.

> "Even a few years ago in Oregon, owner teams and project teams had a little bit more of a willingness to talk about sustainable solutions. I've done projects in California before, and some people there were a little bit more nervous about even using the word—the same goes for Montana. I think that's changing, so I would say that now, the benefits are pretty similar [across different states]."
>
> **—Architect, Portland**

Another geographic difference that a group discussed was weather-related. While the Mechanical Engineer from Boise shared that humidity preservation was an appealing benefit of VHE DOAS in his market, the Portland market actors commented that it was a less important factor to consider in their locales. The following is their exchange:

> "I was curious what it does with humidity?"
>
> **—Architect, Portland**

> "That is a really good question. If the heating system is in AC mode, you are automatically reducing the humidity, but if it's using outside air, how are you going to moderate the humidity in that situation?"
>
> **—HVAC Contractor/Installer, Portland**

> "Those are really good points for Portland. For Boise, we want to preserve the humidity, so we like 'sensible latent' on ERVs rather than just 'sensible,' unless we are doing a pool."
>
> **—Engineer, Boise**

URBAN VS. RURAL

The only notable difference between urban and rural locations was the ease of networking. For example, market actors from Seattle took advantage of the networking opportunity present during the focus groups to learn about other firms in the area and to exchange contact information. This may happen more often in larger municipalities, due to a larger population of industry peers and more opportunity to job-hop, broadening one's professional contacts.

ROLES/TITLES

There were few overarching differences of significance among the different market actor roles/titles. In fact, they shared remarkably similar perspectives on key market drivers, motivations, and barriers regarding both HVAC projects and the adoption of new technology and methods within the category. Not surprisingly, the most salient difference, both in the focus groups and in the questionnaire, was their baseline category understanding. Mechanical engineers and installers were closer to features, functions and benefits, while architects and salespeople had a higher-level overview of the category and relied on more technical colleagues to provide details as needed.

ADDITIONAL DIFFERENCES NOTED

This research revealed other variables that also appear to influence consideration and adoption of VHE DOAS: building type, funding source, future-focused orientation, and owner goals.

BUILDING TYPE

The type of project (e.g., retrofit vs. new construction, number of stories—single and mid-rise vs. high-rise) appeared to be an important factor that could influence market actors. For example, when considering VHE DOAS for a retrofit, market actors faced obstacles related to the existing physical limitations of the building (e.g., holes, ductwork, or footprint). New construction, in comparison, was more of a "blank slate," since it had yet to be designed.

FUNDING SOURCE

PUBLIC FUNDING

Market actors in this research reported that their publicly funded projects need to take a long-payback approach. Often financed by bonds (long-term debt), the projects need to pass the scrutiny of voters and taxpayers. As a result, the market actors are encouraged to be future-focused in their recommendation of durable, long-lasting designs and solutions (that is, thinking toward the future and predicting how this system will hold up).

PRIVATE FUNDING

For projects that are privately funded, recommendations and decisions are driven by the owner's budget, expected tenant requirements, and values (e.g., if sustainability matters, the owner might be more open to LEED).[3]

OWNER GOALS

Market actors also remarked that the owner's goals for the building were an additional driver. For example, a developer primarily seeking to quickly make a profit would be harder to influence, because s/he would be more motivated by upfront versus longer-term benefits (e.g., lower initial costs vs. savings amortized over time). On the other hand, if the building were owner-occupied, life cycle costs and occupant comfort would be more motivating.

3. Leadership in Energy and Environmental Design (LEED) is a division of the US Green Building Council, a non-profit organization promoting sustainable building design, construction, and operations. The LEED program and certification requirements are outlined on the organization's website.

OBJECTIVE 1

LEARN MARKET ACTORS' ON-THE-JOB MINDSETS (MOTIVATIONS, FRUSTRATIONS, AND BUSINESS MODELS)

i. **What motivates market actors about their work in general, and about HVAC system design or selection specifically?**

ii. **What do market actors dislike about their work?**

iii. **What are the business models of market actors?**

MARKET ACTORS' ON-THE-JOB MINDSETS

To gain an understanding of how the market actors view and approach their work in general, and the HVAC business in particular, all market actors who participated in the focus groups were asked to complete a brief, 15-minute pre-session questionnaire. (Note: One additional market actor who was recruited, but did not participate in the groups, also completed the questionnaire.) Reviewing the questionnaire responses prior to the groups helped to reveal the degree to which market actors viewed HVAC in general and the VHE DOAS approach specifically through different mindsets.

HVAC MARKET ACTOR MOTIVATIONS AND FRUSTRATIONS

WHAT DO MARKET ACTORS LIKE ABOUT THEIR WORK IN GENERAL?

When asked what most excites them about their work in general, all three market actor groups reported being motivated by delivering on the same ultimate goal: effective solutions. They realized this goal by meeting the needs of clients, engaging in creative problem solving, hitting project milestones, and—in the best of cases—making a positive environmental impact.

Source: Questionnaire responses

PROBLEM SOLVING

Market actors expressed a shared enthusiasm for coming up with elegant solutions to challenging problems. Responses also revealed their openness to both ongoing learning and innovative options.

> "Solving challenging problems that others can't, and creating great relationships."
> **—Engineer, Seattle**

> "Solving problems that building owners have been burdened with for a long period of time."
> **—HVAC Contractor/Installer, Montana**

CLIENT SATISFACTION

A big source of personal motivation for market actors was keeping their clients happy by providing them with truly effective solutions. Architects and engineers tended to focus more on the day-to-day impact an HVAC system has on the occupants, while HVAC contractors/installers gravitated toward the individual components and the aftercare experience.

> "Seeing how the improvements we have made impact the end users (residents) is the most exciting and rewarding part of our work."
> **—Architect, Portland**

> "Offering superior products and backing them with unparalleled service."
> **—HVAC Contractor/Installer, rural Oregon**

EFFICIENCY AND SUSTAINABILITY

Three architects and one engineer mentioned their interest in designing buildings or systems that are efficient, sustainable, and/or environmentally friendly. Importantly, all of these responses reflect a general market actor orientation toward seeing a positive impact realized in the world, based directly or indirectly on their collective accomplishments.

> "The opportunity to design beautiful, efficient buildings that last a lifetime."
> **—Architect, Seattle**

> "When I do energy studies and work on energy efficiency, it's nice to feel that the work will have a positive impact on the environment."
> **—Engineer, Portland**

PROJECT MILESTONES

One architect and two HVAC contractors expressed the deep satisfaction they feel when passing major project milestones, including making a sale, getting contracts signed, and crossing the finish line.

> "Getting a project completed." —**Architect, rural Oregon**

> "The thrill of the sale." —**HVAC Contractor/Installer, Portland**

Question 17: Thinking about your work in general, what excites you the most about what you do?

WHAT DO MARKET ACTORS DISLIKE ABOUT THEIR WORK IN GENERAL?

When asked what excites them the least about their work in general, market actor responses revealed factors that could jeopardize the effectiveness of their solutions, resulting in frustration and dissatisfaction.

TEAM DYSFUNCTION

All three market actor groups mentioned a variety of dislikes related to general team dysfunction. They disclosed that individual weak links and/or breakdowns in the process had a negative ripple effect on the entire project. These disruptions manifested as preventable last-minute alterations, unhappy clients, disgruntled team members, and/or stalled projects.

> "Having to take care of problems that could have been prevented by being better prepared or better trained." —**HVAC Contractor/Installer, rural Oregon**

> "Being dragged down by counterproductive people and/or processes." —**Architect, Portland**

BUDGET AND/OR CODE RESTRICTIONS

All market actors shared the impact that budget and/or building code can have over project scope and design. These factors limited the types of equipment or the creative solutions they were able to recommend or use, in some cases forcing them to install sub-optimal systems.

> "Trying to be 10 cents cheaper to meet a budget; jamming a mechanical system into a ceiling space that won't accommodate it." —**Engineer, rural Washington**

> "Dealing with building code and jurisdictions." —**Architect, Portland**

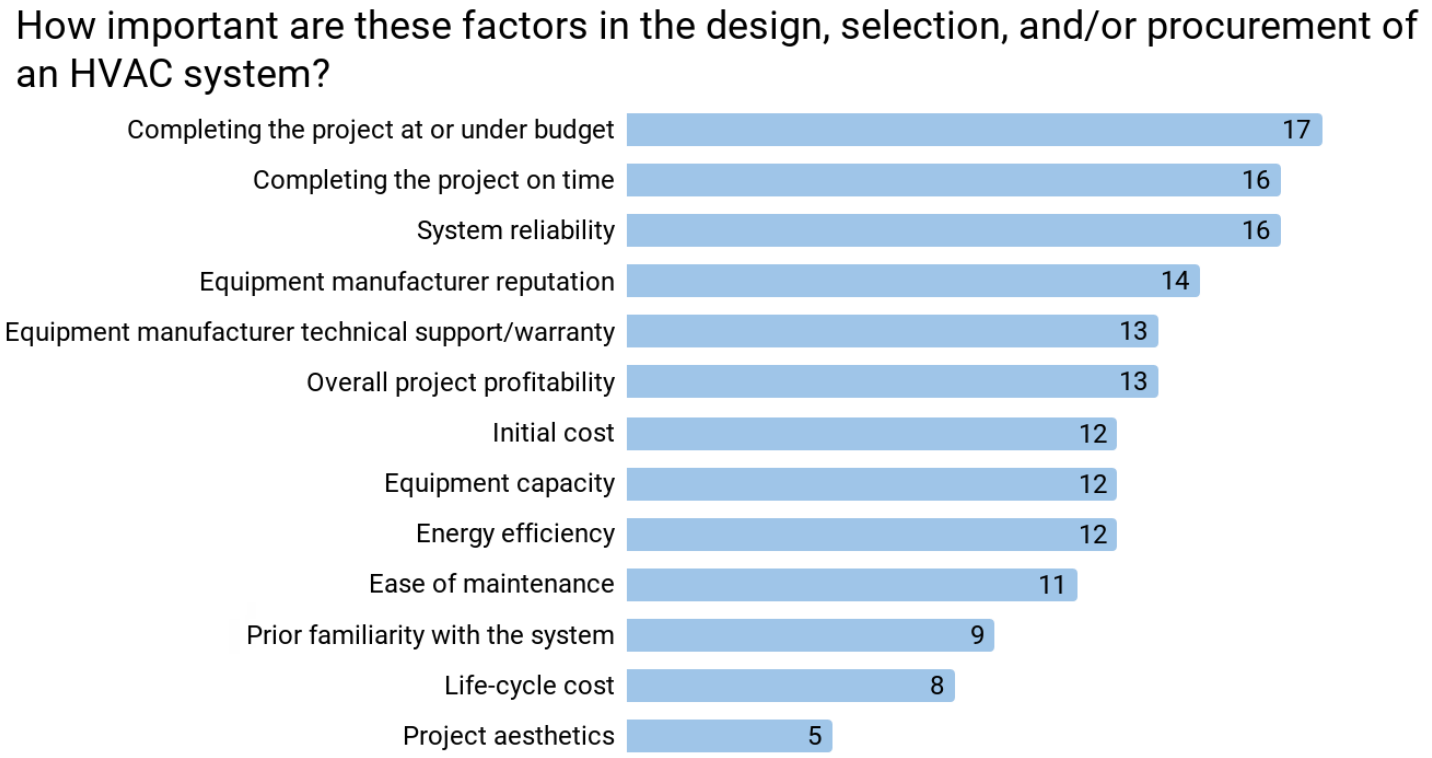
Question 18: Thinking about your work in general, what excites you the least about what you do?

WHAT FACTORS ARE MOST IMPORTANT TO MARKET ACTORS IN THE DESIGN, SELECTION, AND/OR PROCUREMENT OF AN HVAC SYSTEM?

Consistent with their general on-the-job mindsets, the market actors' top five most important factors were related to effectively satisfying their clients' most critical HVAC need: delivering a system—on time and on budget—that will perform reliably over the long term.

Market actors were presented with a list of 13 factors to consider in the design, selection, and/or

procurement of an HVAC system, rating the level of importance using a five-point Likert-type scale from *Not Important* to *Extremely Important*. The chart below reflects the importance rankings across architects, engineers, and HVAC contractors/installers.



Question 11: Please indicate how important each of the following factors are to you in the design, selection, and/or procurement of an HVAC system.

Overall, budget was reported as the most important consideration for all market actors. Within each role, there were slight differences in rankings. Architects and engineers both rated completing the project at or under budget as their number one most important factor, likely because they often work on a contract basis. HVAC contractors/installers rated overall project profitability as their number one factor, with completing the project at or under budget falling to number three, which aligns with HVAC contractors/installers' general focus on equipment and installation costs.

The questionnaire included an option to add additional factors. These open-ended answers revealed key differences associated with the different market actor roles.

Architects	***Engineers***	***HVAC Contractors/Installers***
• End-user familiarity with the system *Very Important* • Architectural impacts: shaft size, plenum depth, effect on floor-to-floor height, mechanical room size, rooftop impacts *No Ranking*	• Ease of user interface *No Ranking*	• Availability of equipment *Moderately Important*

Notably, none of the respondents utilized the "Not Important" option, and every single factor was rated as being highly important by at least five people. These decisions likely reflect the complexity inherent in HVAC projects, with numerous competing project factors needing to come together to result in a successful and profitable installation.

WHAT MADE PAST HVAC PROJECTS SUCCESSFUL?

Interestingly, the questionnaire revealed that it's the human element that makes or breaks an HVAC project. It's not the equipment or the vendors or the technology, but rather the people, the planning, and the process, that lead to a project's success.

EFFECTIVE COMMUNICATION AND COLLABORATION

Market actors overwhelmingly identified effective communication and collaboration as major success drivers on HVAC projects. Whether they were coordinating with external contractors, identifying client needs and setting expectations, or working with their colleagues, all of their HVAC projects were described as requiring an extraordinary amount of ongoing interpersonal interaction.

> "Our most successful HVAC projects are a result of having the HVAC installer on board during the design process."
> **—Architect, Portland**

> "Listening to the client, understanding needs, good communication and coordination."
> **—Engineer, rural Washington**

PROJECT PLANNING AND DESIGN

Project planning and design was the second most common reason for past HVAC project success, due to the importance of detailed plans and clearly delineated scopes of work. These responses came mostly from five HVAC contractors; one engineer response called out the "Plan & Specify" model by name, implying that this procurement model—which calls for the system design being finalized before an installer is hired—directly contributed to past project success.

> "Adequate planning, and all disciplines understanding their scope."
> **—HVAC Contractor/Installer, Montana**

> "A well designed job that has mainly issues figured out in the design phase."
> **—HVAC Contractor/Installer, Portland**

All project stakeholders—across market actors and clients—were seen as important contributors to the design, selection, and configuration of an HVAC system, often at numerous points in the decision-making process.

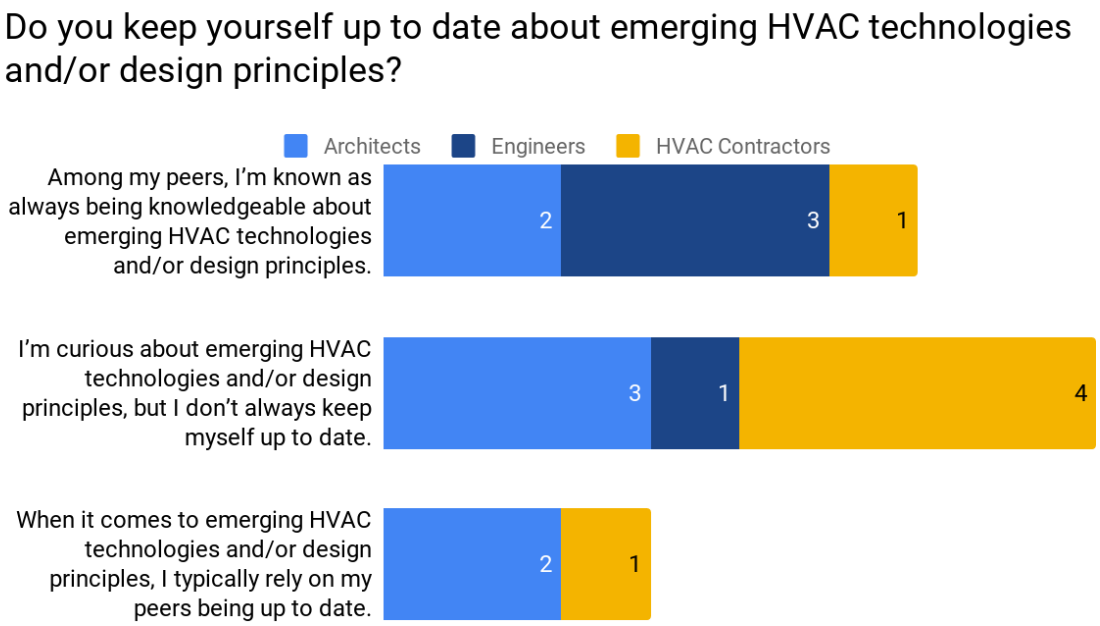
> "To design a system, all stakeholders need to be involved. The customer needs to be comfortable with the design team [to make sure] they receive the system they want. The customer needs to specify the right requirements so the proper system can be selected. The design team needs to have a good relationship with the HVAC vendor so the proper system can be selected."
>
> **—Engineer, rural Idaho**

> "There is a lot of nuance in the operation of these systems. The interface of staff that adjusts set points and the like is critical."
>
> **—Architect, rural Washington**

Question 8: Thinking back to your past HVAC projects, what made them successful when it came to overall project success and ongoing decision making?

WHICH MARKET ACTORS STAY UP TO DATE ON HVAC TECHNOLOGIES?

Market actors were asked how likely they were to keep themselves up to date about emerging HVAC technologies and/or design principles. Based on their responses, the "go to" HVAC experts appear to be the engineers, who reported being the most likely to keep themselves up to date. HVAC contractors characterized themselves as the least likely to keep abreast of innovations, and architects were closely split between staying up to date, not staying up to date, and relying on others.



Question 27: Please select the statement that most accurately applies to you.

These differences in response are consistent with the fluid nature of stakeholder decision-making milestones noted previously, suggesting that market actors contributed their different types of expertise throughout each phase of previous HVAC projects, turning to their colleagues when needed.

Building on the concept of tapping into inter-team expertise, one architect shared an interesting outlier response when asked about prior project success factors: the idea that a market actor who possessed HVAC skills and knowledge outside of their traditional purview would contribute to overall project success.

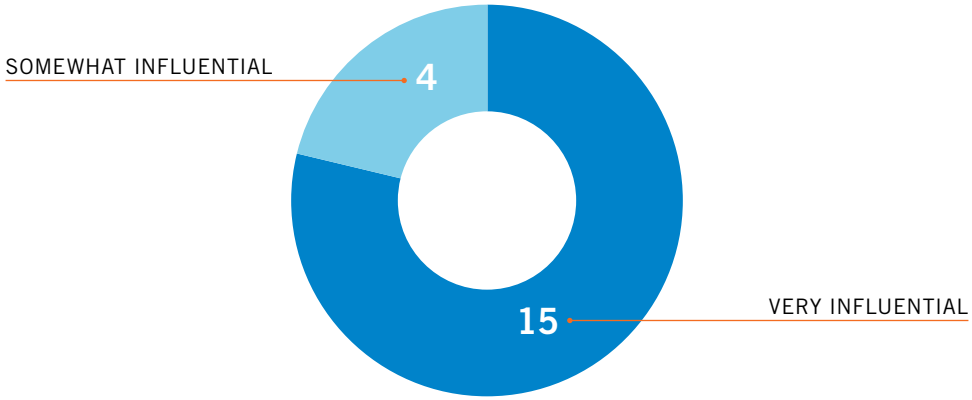
> "Having an architect knowledgeable about HVAC systems and also knowledgeable with the maintenance needs and capabilities of the end client." —**Architect, rural Washington**

Question 8: Thinking back to your past HVAC projects, what made them successful when it came to overall project success and ongoing decision making?

DO PROFESSIONAL RELATIONSHIPS INFLUENCE PROJECT SUCCESS?

When asked how influential their professional relationships were to the success of a project, most market actors answered, "Very influential."

Specific examples were uncovered with a follow-up question, which revealed the positive or negative effect these relationships can have on reputation, communication, and the ability to credibly recommend innovative technologies.



Question 13: How influential are your professional relationships to the design, selection, and/or procurement of an HVAC system, and/or the ultimate success of that HVAC project?

> "Professional relationships between the engineer, equipment supplier, contractor, owner, and parties responsible for future maintenance promote good communication and an overall understanding that all parties involved should view the project as being successful." —**HVAC Contractor/Installer, Montana**

> "It is essential to have willing and flexible partnerships with all parties, so we have to work hard to build and/or find those key relationships that can lead to success while sidestepping those who don't help." —**Architect, Portland**

> "Professional relationships build trust and expertise that are beyond any submittal or testing data."
> **—HVAC Contractor/Installer, Portland**

> "As a design-builder who is primarily hired based upon reputation, relationships are everything. We aren't afraid of trying new technologies, but we need to have confidence in the science and in the rep/manufacturer that it will work as advertised and will be maintainable."
> **—Engineer, Seattle**

Question 16: Please explain why professional relationships are very influential to the design, selection, and/or procurement of an HVAC system, and/or the ultimate success of an HVAC project.

The four respondents who answered "Somewhat influential" revealed the limitations of an individual's role; not all decisions are within a certain market actor's control.

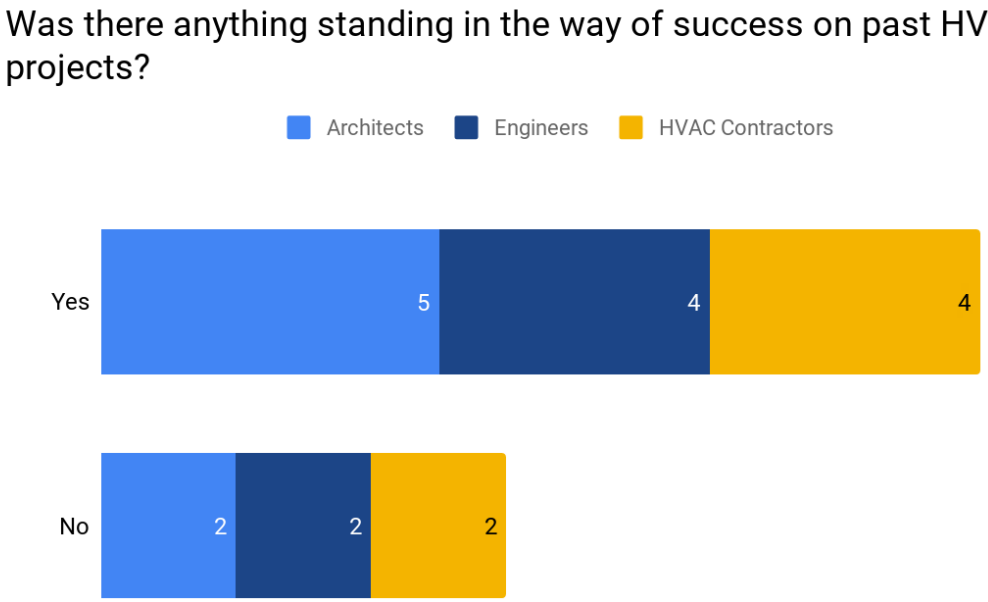
> "Ultimately, I am an architect and not a mechanical engineer. We hire experts to design and select the system, but help make sure their decision is integrated into the design and informed by other project goals."
> **—Architect, Portland**

Question 15: Please explain why professional relationships are somewhat influential to the design, selection, and/or procurement of an HVAC system, and/or the ultimate success of an HVAC project.

WHAT WERE THE BARRIERS TO PAST HVAC PROJECT SUCCESS?

When asked if there was anything standing in the way of past HVAC project success and decision making, the majority of respondents answered "Yes," signaling a high likelihood of general internal and/or external project friction. While responses showed the majority of market actors experiencing these roadblocks, there were also six "No" responses, which suggests that HVAC projects are not always forced to endure barriers to success.

There were no notable differences across states or between urban and rural locations.



Question 9: Thinking back to your past HVAC projects, was there anything standing in the way of overall project success and ongoing decision making?

Market actors who indicated prior experience with project success barriers were asked to give specific examples in a follow-up question, and their responses were generally focused on a combination of personnel factors and cost factors.

INEFFECTIVE COMMUNICATION AND LACK OF EXPERTISE

Most of the barriers market actors mentioned were challenges related to people, process, and/or planning—the converse of the factors they attributed to successful projects.

> "Typically a bottle neck in the communication flow and indecisive stakeholders or stakeholders that have conflicting desires." —**Engineer, Seattle**

> "Inadequate planning; not understanding scope or owner's requirements." —**HVAC Contractor/Installer, Montana**

> "Lack of expertise or knowledge on the part of the mechanical engineer in high-performance systems; inability to articulate different options to the client." —**Architect, Portland**

PRICING, COST AND SCOPE CONFUSION

Market actors also reported that budgetary issues jeopardized project success, particularly when a market actor's scope of work wasn't clear, and/or when contractors were unwilling to transparently discuss pricing.

> "We can generally find success, but sometimes it is difficult to get contractors and subcontractors to approach discussions openly, and to provide fair pricing for alternative systems." —**Architect, Portland**

> "Cost." —**Architect, rural Oregon**

Question 10: During your previous HVAC projects, what was standing in the way of overall project success and ongoing decision making?

BUSINESS MODELS AND DECISION MAKING

Overall, there were more similarities than differences between responses regarding business models and decision-making drivers. Across the questions in this section of the questionnaire, market actors consistently communicated that managing overall project complexity was a crucial factor in realizing a successful and profitable project, whether by accurately allocating resources and expertise, managing the client-facing relationship, or navigating through a variety of procurement models.

WHAT ARE THE BUSINESS MODELS OF MARKET ACTORS?

Across all three types of market actors, key similarities in business models emerged regarding revenue, profitability, and cost management. There were also some role-specific differences: HVAC contractors were more focused on equipment and materials costs, while architects and engineers zeroed in on overall design costs.

GENERATING REVENUE

All three types of market actors indicated that design services are a primary way they generate revenue, and architects and engineers also mentioned working on a contract basis. There were two notable differences by market actor type: one architect indicated making a percentage fee on the cost of construction, while HVAC contractors reported generating revenue from HVAC equipment sales, maintenance, and repair in addition to design services.

Question 23: How do you and/or your firm primarily generate revenue?

ENSURING HVAC PROJECT PROFITABILITY

Echoing their descriptions of general project success factors, all three market actor groups also reported HVAC project profitability as a direct result of proper planning, coordination, and execution. Within each response group, role-specific nuances were explained: Architects focused on system compatibility, working with knowledgeable mechanical engineers, and managing their reputations; Engineers focused on bidding projects correctly and delivering designs that will last; HVAC contractors/installers focused on anticipating potential "pitfalls" during the estimating/bidding phase and building in a "nest egg" to protect against them.

Notably, two architects revealed that HVAC projects were not at all profitable for them and/or their firms.

Question 24: How do you ensure that your HVAC system design, sales, and/or installs will be profitable for you and/or your firm?

MANAGING COSTS

All three market actor groups named labor as a cost they must manage to remain profitable. Additionally, billable hours were specifically mentioned by both architects and engineers. Architects also specified operational, payroll, and overhead expenses, while HVAC contractors listed materials costs and additional work resulting from customer callbacks.

Question 25: What are the major costs you and/or your firm need to manage to remain profitable? Who are their most profitable customers?

All market actors reported cultivating profitable relationships with their customers by managing relationships and meeting customer needs to drive repeat business. More concrete examples differed between each type of market actor, typically including certain types of customers who were willing to de-emphasize cost in the service of their needs, and/or specific types of projects and/or customers that tended to be more profitable.

ARCHITECTS

One Portland architect characterized their most important and/or profitable customer as a client seeking holistic value, which echoed a comment in one of the groups about the rare client who just wants the best system that will meet their needs. This type of client is likely to prioritize functionality and life cycle cost over initial cost.

> "Clients who trust us and seek holistic value—they are willing to take some risks, and they cost us less time in getting to the best performance outcomes." **—Architect, Portland**

Other architects explained this type of client by citing specific examples, referring to "civic agencies" that don't shy away from paying for additional work, high-end custom projects with bigger budgets, and residential customers who pay by the hour.

ENGINEERS

Two engineers offered specific examples of profitable and/or important customers. One engineer in Boise explained that architects and architectural firms comprise 90% of their work, while an engineer in rural Washington pointed out that both privately owned buildings and retrofits are lucrative in their area.

> "Private landlords who lease to government and small businesses, as well as energy retrofits. This is the available market in our location and we are VERY good at energy retrofits for owners to re-tool their buildings." **—Engineer, rural Washington**

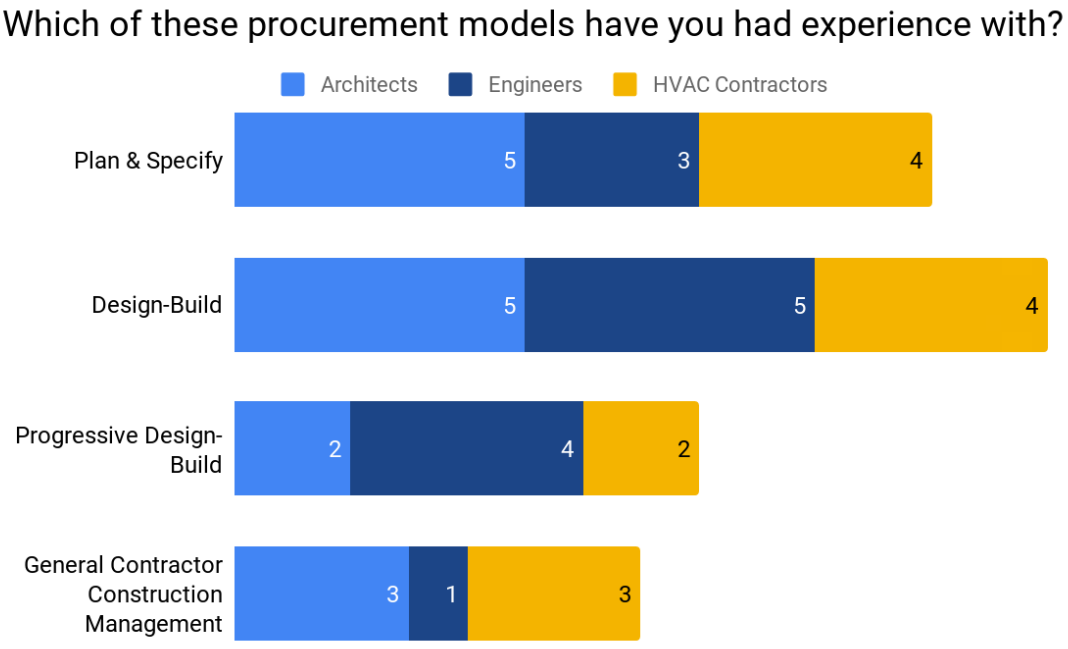
HVAC CONTRACTORS/INSTALLERS

Specific examples of profitable customers from this market actor group included mixed use developers, retrofit customers, and design-build customers.

WHICH PROCUREMENT MODELS DO MARKET ACTORS USE?

After reviewing a high-level explanation of the four most common HVAC procurement models (Plan & Specify, Design-Build, Progressive Design-Build, and General Contractor construction management), market actors were asked to indicate which models they'd had prior experience with. All market actors indicated having prior experience in all four models, with Plan & Specify and Design-Build being the two most common.

There were no notable differences by geography (between states, or in urban vs. rural locations).



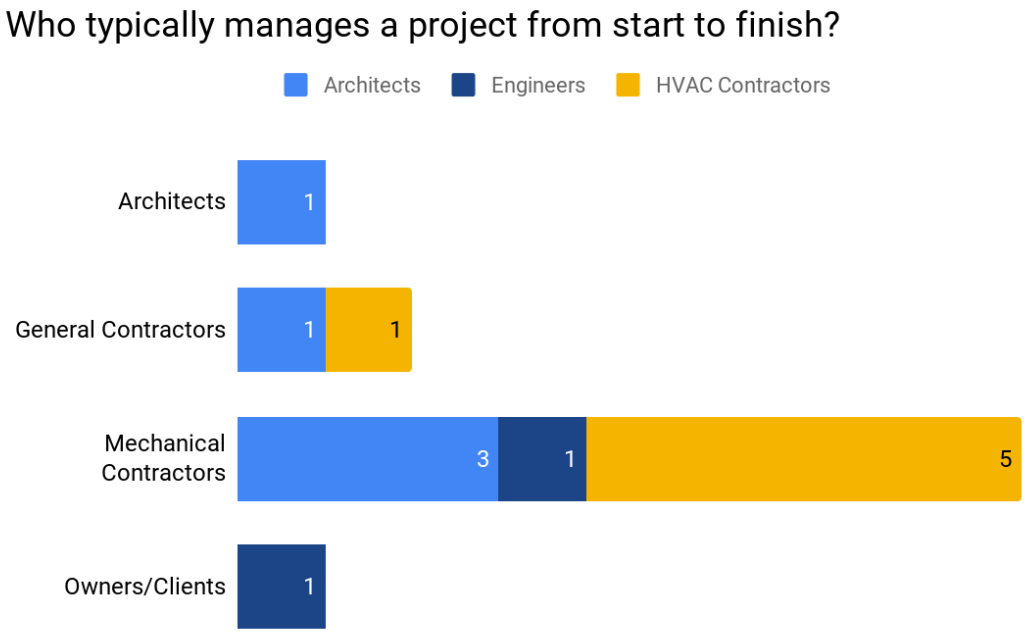
Question 7: Thinking back to your past HVAC projects, which of the following models have you had experience with? Please check all that apply.

WHO MANAGES THE TYPICAL HVAC PROJECT?

According to Sparrow's initial desk research, HVAC projects are most often managed by general contractors. The questionnaire asked market actors to identify who the overall project manager had typically been in their experience, offering a choice between general and mechanical contractors, architects, and owners/clients. Market actors reported having the highest level of experience with

mechanical contractors acting as the project manager from start to finish.

Considering their familiarity with all four procurement models, the fact that the majority of market actors named mechanical contractors as the usual project managers implies that general contractors may no longer be managing the majority of HVAC projects. If this is true, it may be explained by the additional HVAC expertise that mechanical contractors are more likely to have when compared to their general contractor counterparts.



Question 22: In your experience, who typically manages the overall HVAC project from start to finish? Please check all that apply.

WHO ARE THE DRIVERS OF DECISION MAKING WITHIN AN HVAC DESIGN TEAM?

Overall, market actors recounted that general contractors, HVAC contractors, and design engineers are the three primary groups of decision makers on an HVAC design team, acting as a bridge between all internal and external stakeholders. For HVAC contractors, this high level of inter-team contact is unsurprising, considering that their roles are often managerial and/or logistically focused. Design engineers were reported to have an influence over system design and project outcomes, which aligns with their foundational expertise and purview over high-level HVAC system design.

WITHIN AN HVAC DESIGN TEAM, WHICH MEMBERS OFTEN WORK TOGETHER?

When asked how often they worked with each member of the design team, architects, engineers, and HVAC contractors/installers each selected their own roles as the most frequent partnerships, suggesting a preference for delegating project tasks based on respective ability and expertise. There were no notable differences in responses across geographic locations.

Second to working with their own colleagues, all market actors indicated spending the majority of their time working with general and HVAC contractors, who are likely to become the foundational link among all other market actors because they typically manage HVAC projects and/or are tasked with installing the equipment.

WHICH HVAC TEAM MEMBERS WORK TOGETHER MOST OFTEN?

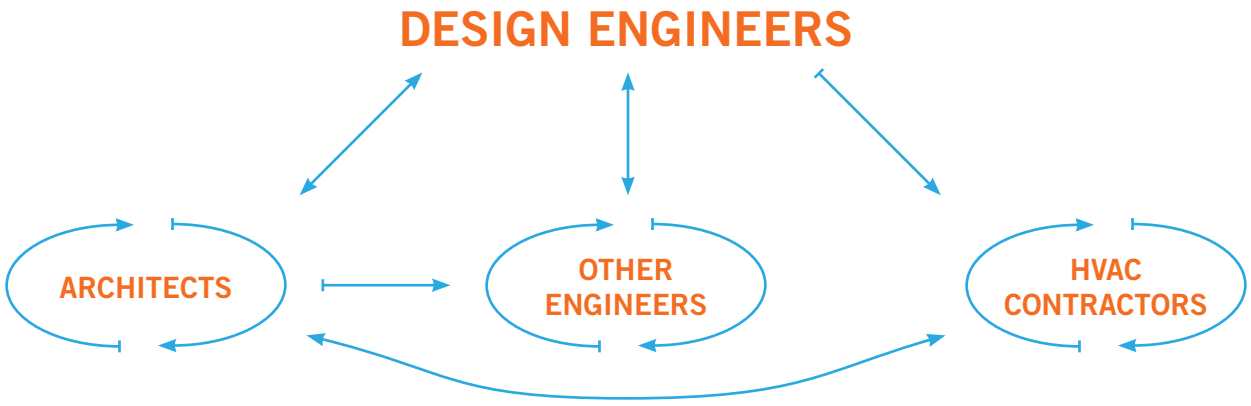
Architects	*Engineers*	*HVAC Contractors/Installers*
• Architects • General Contractors • Design Engineers • HVAC Contractors/Installers	• Engineers • HVAC Contractors/Installers • Manufacturer Representatives • Architects	• HVAC Contractors/Installers • General Contractors • Vendors • Distributor Sales

Question 19: During a typical HVAC project, how often do you work with each member of the design team?

Using the "other" response option, a few respondents reported working with additional team members. One HVAC contractor/installer described working with HVAC service and maintenance personnel *often*, while an engineer and an HVAC contractor/installer both said they worked with owners/users (the engineer *often*, and the HVAC contractor/installer *rarely*). Through these responses, market actors demonstrated two points: 1) that they saw their clients as an important part of the design team; and 2) that some market actors differentiated between HVAC contractors/installers and HVAC service/maintenance personnel.

HOW DOES INFLUENCE FLOW BETWEEN MARKET ACTORS ON AN HVAC DESIGN TEAM?

Market actors indicated that while influence flows among all members of an HVAC system design team, design engineers are the most influential, likely because their system designs must be integrated and/or installed by their colleagues. The diagram below illustrates that team members beyond the design engineer can also be swayed by both intra- and cross-discipline colleagues.



Source: Questionnaire responses

Ultimately, two factors drove HVAC project market actor influence.

COLLABORATION BETWEEN COLLEAGUES IN THE SAME ROLE

All three market actor groups reported having influence over, or being influenced by, their immediate colleagues (e.g., architects working with fellow architects), indicating a moderate to high level of existing collaboration within each individual market actor group.

LOGISTICAL REALITIES IN HVAC SYSTEM DESIGN AND IMPLEMENTATION

Each market actor's expertise is required and applied throughout the different stages of an HVAC project, with certain roles needing to be involved more frequently than others. Keeping project realities in mind, the high levels of bi-directional influence for design engineers revealed that they need to work closely with architects on the space, with their fellow engineers on the best/most relevant system composition, and with HVAC contractors on equipment selection.

Using the "other" response option, four respondents shared other individuals they influenced.

Architect → Facility director
This pairing reflected a shared focus on integrating an HVAC system into a space.

HVAC contractor/installer → HVAC service and maintenance personnel
This response echoed market actors' distinction between these roles.

Engineer, HVAC contractor/installer → Owner
These responses reflected the engineer's need to identify client needs and the HVAC contractor/installer's client-facing responsibilities during installation and/or implementation.

Questions 20 & 21: Which team members did you influence?; Which team members influenced you?

In summary, the pre-session questionnaire provided a contextual understanding of market actors' views about the HVAC category, addressing Objective 1. The focus groups then built on that learning by exploring DOAS and VHE DOAS in greater detail. By leveraging the questionnaire responses and using a series of open-ended questions and interactive activities to stimulate the discussions, the moderators addressed the remaining Objectives 2 and 3 during the focus groups.

OBJECTIVE 2 LEARN HOW MARKET ACTORS THINK ABOUT VHE DOAS (PERCEPTIONS AND MISCONCEPTIONS)

iv. **What is clear or unclear about VHE DOAS?**

v. **What features, benefits, and drawbacks do they ascribe to VHE DOAS?**

vi. **What challenges do they anticipate in designing and/or installing using the system approach that is unique to VHE DOAS?**

INITIAL PERCEPTIONS & MISCONCEPTIONS ABOUT VHE DOAS

AWARENESS AND FAMILIARITY OF THE RANGE OF DOAS OPTIONS

Across the groups, market actors displayed familiarity with DOAS in general, accurately unpacking the acronym as "dedicated outside air." It was not a new idea to many, described simply as "a slightly fancier way to bring ventilation in." However, most market actors were not aware that a *range* of DOAS configuration options exists, including VHE DOAS. Consequently, most were unable to articulate the differences between the options.

Across all groups, even those who were allegedly "familiar" with VHE DOAS, there was low understanding of this unique approach. The question "Has anyone heard of Very High Efficiency DOAS?" was most often met with a prolonged silence. To break the quiet, one HVAC contractor/installer playfully offered:

> "DOAS sounds like a donut topping!" —HVAC Contractor/Installer

The person who was the most familiar with VHE DOAS reported having hands-on experience on a VHE DOAS project,[4] which enabled him to understand its benefits and limitations. One other person was somewhat familiar with VHE DOAS because he had previously seen the diagram that was shown in these focus groups.

> "[This diagram] is a very simplified version. I've seen several designs [and installations] now that I've been a part of." —Architect, Portland

WHAT IS CLEAR OR UNCLEAR ABOUT VHE DOAS?

Given the low levels of familiarity with VHE DOAS, initial perceptions about it were generally based solely on the impressions that the name alone conveyed, and they tended to reflect a category perspective (e.g., cost, the components that make up the system), and/or simply reiterated a benefit alluded to in the name. With the exception of the architect who was familiar with the VHE DOAS approach, the market actors were not aware of the features and fuller benefits of VHE DOAS, nor were they aware that it is a system design approach rather than simply a set of individual pieces of equipment.

First impressions of VHE DOAS (pre-exposure to prototypes) were as follows.

WHAT IS AN ADJECTIVE OR DESCRIPTIVE WORD THAT DESCRIBES THE VERY HIGH EFFICIENCY DOAS APPROACH?

Engineers	*Architects*	*HVAC Contractors/Installers*
• Expensive; Efficient • More efficient • Recovery • Energy recovery • Payback • Simplified • Complicated • Refined	• Costly • Coupled with geothermal • Net zero • Adaptive • New • Elegant	• Expensive (2 mentions) • Extreme (efficiency realm)

Source: Descriptive word activity

In reference to the "Very High Efficiency" part of the name, positive impressions were often couched with caveats borne of learned associations with "highly efficient" products and systems.

> "High efficiency sounds like expensive equipment. Yes, it is going to save energy, I get that. But it sounds like maybe you are going to have exotic equipment that might cost more to replace or maintain in some way." —Architect, Portland

4. This project was not affiliated with NEEA.

Similarly, past experiences with DOAS or understanding of DOAS had the power to affect participants' perceptions of VHE DOAS. For example, one market actor who had previously had a negative experience with VRF (variable refrigerant flow), which is often used as part of a DOAS system, expressed skepticism about VHE DOAS.

> "At my company, we've been brought into projects where VRF systems or similar things have failed, so I'm kind of wary about them." **—Engineer, Portland**

MOTIVATORS AND BARRIERS TO CONSIDERATION

WHAT FEATURES, BENEFITS, AND DRAWBACKS DO THEY ASCRIBE TO VHE DOAS? WHAT CHALLENGES DO THEY ANTICIPATE IN DESIGNING FOR/MOVING FORWARD WITH VHE DOAS?

To identify the key motivators and barriers for VHE DOAS consideration, Sparrow asked the market actors to complete two activities. It is important to note that these activities came after exposure to and discussion of two of the prototypes, the description and the diagram, so the participants had that new information to draw upon.

The two "Familiar" groups (focus groups composed entirely of individuals who self-reported familiarity with VHE DOAS before joining this study) participated in a debate. They argued the pros and cons of the VHE DOAS approach "as a realistic (or not) HVAC option," revealing the most salient, top-of-mind motivators and barriers. The positives went beyond efficiency to include more flexibility in routing the system through the building, better life cycle costs, higher comfort, and ultimately fewer complaints for end users. The negatives centered around the hassle, headaches, and rippling costs, in time and money, associated with learning, designing for, installing, and maintaining a new, "more exotic" system. They pointed out that the VHE DOAS approach would be complicated for retrofits but ideal for some new construction projects.

Following the debate, both the "Familiar" and the "Unfamiliar" groups completed an aided card sort activity. For this activity, market actors within each group collaborated as a team to sort 20 "cards" that outlined a range of possible factors they could consider when selecting an HVAC option. (Note: The complete list of cards used in this sort can be found in the Appendix.)

Based on the learning from the first group, cards were added and refined to reflect the real market factors the participants had experienced. The following changes were made, for use in the subsequent groups: "Cost" was split into two separate cards, "Initial cost" and "Life cycle cost"; "Your" was added preceding "professional reputation," "professional relationships," and "vendor relationships"; and two new cards were added, "Equipment weight" and "Aftermarket manufacturer support." After Group 2, another meaningful factor was added: "Ease of operation."

Across all groups (both "Familiar" and "Unfamiliar"), each team's responses were internally consistent. This uniformity makes sense, since all market actors live in the same context and experience similar project realities.

The following table outlines a summary of the top three Motivators and top three Barriers across all groups.

Key Motivators (Pros)	*Key Barriers (Cons)*
• Meeting code • Functionality • Life cycle cost	• Initial cost • Lack of experience with a very high efficiency DOAS approach • Equipment weight

Source: Mural card sort activity | Note: This analysis focuses on the key motivators and barriers, and therefore excludes a third column option included in the activity, "Neither Pro Nor Con."

KEY MOTIVATORS

Across all groups, three "cards" consistently appeared in the top three motivators: meeting code, functionality, and life cycle cost. The market actors explained that they considered these as "cost of entry" in the HVAC category, and the VHE DOAS approach appeared superior in these important areas. In their eyes, all the other motivators listed (e.g., durability, ease of operation) were essentially a function of those three. Additionally, the motivational power of meeting code was no stronger for market actors from Washington/Seattle than for those based in other states/cities.

> "[When it comes to] meeting code, we have to do it on every project. Additionally, HVAC system functionality is important because it's a major consideration. Tied closely with that is the life cycle cost. How much the system is going to cost over the lifetime, and what you are going to get out of it." **—Architect, Portland**

> "Meeting code is becoming increasingly more difficult. If this system helps do that, then that's a bonus. By functionality, I mean, what does the occupant in the space feel? Is it comfortable for them or not? If high efficiency means you're recovering more heat so the discharge to air temperature of the ventilation air is closer to neutral, it's going to be more comfortable, then, I would call that more functional." **—Engineer, Olympia**

> "I am a big fan of designing efficient systems and not necessarily focusing on the initial cost, but trying to look at the life cycle costs in general." **—Engineer, Seattle**

For all market actors, customer demand was also an important motivator. While this factor was not included in the card sort activity, it was mentioned spontaneously across the groups and market actors, and to a large degree in the pre-session questionnaire. Engineers stated that they wanted to please building owners, and HVAC contractors/installers indicated concern for tenants' safety and comfort. Architects sought more leasable space for building owners.

> "As a design build contractor that gets hired by repeat business and word of mouth, owner expectations are huge. If I know that they're going to be happier with this system, then that's a big deal." **—Engineer, Olympia**

> "On top of that, improving the COMFORT of everybody inside the building because you will have more control over the temperature set points within the building and fewer complaints."
>
> **—Engineer, Portland**

KEY BARRIERS

Across multiple groups, cost was cited as the top challenge they must address on their projects. Cost covered both initial and net/lifetime expenses, as clients demanded to see a good return on their investment. Because the HVAC system is an "invisible" part of a building, it is often "value-engineered"; it's one of the first line items market actors feel compelled to reduce. And they're faced with this dilemma repeatedly throughout the decision-making process.

> "Nobody sees [HVAC]...it doesn't add to the eye appeal to the building. The HVAC stuff is always the caboose on the building—the first place where they go to see if they can save money to make it look better." **—HVAC Contractor/Installer, Portland**

Because energy is relatively inexpensive across the Northwest, due to hydropower and renewables, market actors were less inclined to be motivated by the energy cost savings associated with the improved efficiency of VHE DOAS.

> "Energy efficiency is great, but Washington power is so cheap already. We have hydro everywhere; it's a third of our power. The companies that we work with—Boeing and people like that—they laugh at us. They've even got cheaper power because they actually negotiate their rates. There is zero incentive for them." **—Engineer, Seattle**

Validating previous NEEA research, market actors expressed that lack of experience with the VHE DOAS approach was also a barrier to consideration. In terms of both installation and maintenance, many market actors might feel more comfortable with systems that are already familiar. They alluded to having a fear of failure when venturing into uncharted territory to try something new. Furthermore, even when one (or more) members of the design team were convinced to take on a different approach, others might be reluctant, and convincing them was yet another hurdle.

> "If people aren't used to it, especially the contractor and subcontractors who are going to put the system in, that kills the idea right out the gate. If they are not comfortable, it doesn't happen. Then you don't even have a conversation about cost or time or anything else." **—Architect, Portland**

> "Maintenance staff, they are having to learn a new system, a new process. So, there is an education piece there that goes with that. They previously had a simplistic system, if it is retrofit. A system they are very familiar with. They are going to be resistant to systems that are different. Requires a whole bunch of new education." **—Engineer, Portland**

Half of the groups expressed concern about the weight of the VHE DOAS equipment and how it might affect a building's structural and seismic integrity, which could trigger structural code requirements and corresponding increases in cost and time. Their perception was that because VHE DOAS includes two systems (ventilation and heating/cooling), it would be heavier. They also commented that

weight might be more of a challenge for retrofits than for new construction. According to Sparrow's conversations with the NEEA-assigned engineer, while market actors' concerns about weight are justified, a VHE DOAS approach will not necessarily always be heavier. In conclusion, market actors will require weight specifications in order to properly assess the ramifications of using the VHE DOAS approach.

TEAMWORK AND COMMUNICATION

As noted above in the Objective 1 section, market actors said that for contracting in general and for HVAC work in particular, teamwork and communication can make all the difference for a project's success. Sparrow's background research further revealed that these factors are especially relevant to the VHE DOAS approach, given the integration necessary for its successful implementation.

However, during the card sort activity in the focus groups, market actors did not perceive these factors to be either a significant motivator or a significant barrier. Their placement of these cards was either neutral (in the third sorting column: Neither Pro Nor Con), or lower ranked in the Pro or Con columns. These responses likely reflected both their low familiarity with the VHE DOAS approach and the heightened need for strong relationships and communication across the design team and throughout the design process.

	Neither Pro Nor Con	*Lower-Ranked Pro*	*Lower-Ranked Con*
Team communication	3 groups		2 groups
Your vendor relationships	3 groups	2 groups	1 group
Your professional relationships	2 groups	3 groups	1 group

Source: Mural card sort activity

OBJECTIVE 3 GAIN FEEDBACK ON THE VHE DOAS "SELLING POINTS," DIAGRAM, AND NAMING OPTIONS

vii. **How do market actors react to NEEA prototype descriptions, diagrams, messaging, and naming for VHE DOAS?**

viii. **What questions do HVAC system designers have about the prototypes?**

ix. **What changes do HVAC system designers recommend to the prototypes, and why?**

FEEDBACK ON PROTOTYPES

To address the overarching goal of this research (to increase consideration and adoption of VHE DOAS), Sparrow shared more information about VHE DOAS, presented as a range of different prototypes: a text-only description, a diagram of the approach, features and benefits (AKA "selling points"), and potential names. The market actors' feedback was solicited in order to gain a better understanding of what was most compelling in each prototype, and how these prototypes might work

collectively to inform and persuade everyone on an HVAC design team.

DESCRIPTION

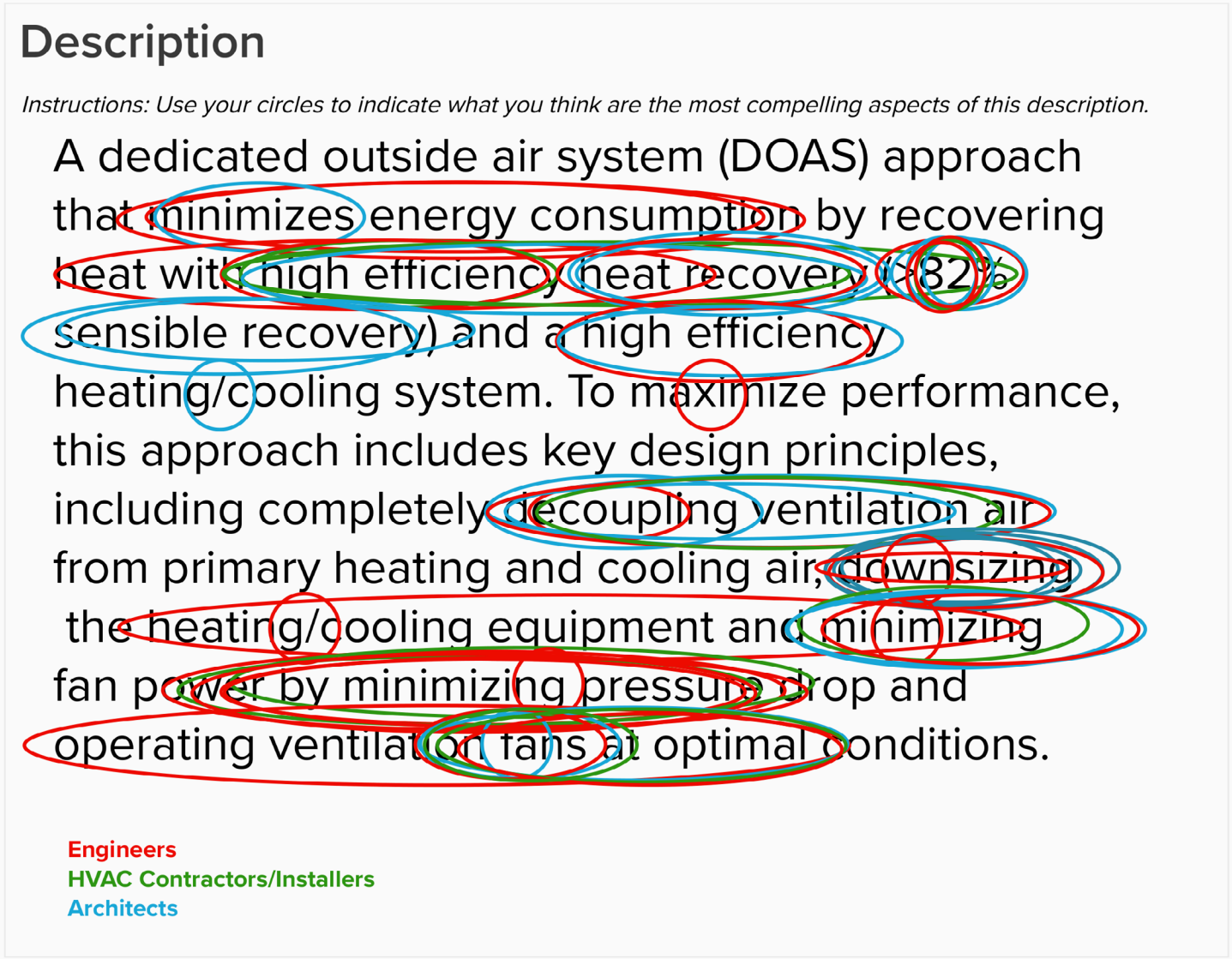
The first prototype shown was the description of VHE DOAS. The description text was shown in Mural. After reading the description, market actors worked individually to identify the specific elements they found most compelling. To complete this task, each person used five circles to "vote" (the circles were color-coded to indicate each person's selections). In Mural, they could move and stretch the circles to customize their choices. No one used more than one circle per "vote," and a few market actors did not use all five of their circles.

Across the groups, market actors reported that the description was helpful in explaining what VHE DOAS is and how it works. It also *began* to enlighten them about how this approach might be unique in its design and end benefits when compared to other HVAC options. Those who were already familiar with VHE DOAS thought that it was accurate and clear. For the unfamiliar, it established a foundational understanding of this approach.

> "It is nice to kind of see it written out, but it's basically what I thought it was."
>
> **—Engineer, Portland**

> "Just given the description of a Very High Efficiency DOAS unit, it's pretty hard to think of specific adjectives...but providing a number or baseline to judge the system off of—the 82%—certainly makes it easier to understand what we're talking about." **—Architect, Seattle**

The graphic below reflects the aggregated feedback from all six groups, illustrating exactly which words and phrases were universally most compelling, and which intrigued each specific type of market actor. It reveals that elements throughout the description were appealing to the market actors, confirming its overall value as a source of high-level information.



Source: Mural description feedback activity | Note: This graphic reflects the final copy of the description.

The following summary outlines the specific elements of the description that were most compelling across all* market actors (*unless otherwise noted). (Reminder: This graphic reflects the final sample of 8 engineers, 3 HVAC contractors/installers, and 6 architects.)

82%
(8 "votes" — 3 engineers, 2 HVAC contractors/installers, 3 architects)

Market actors were impressed by this percentage, especially compared to what other options deliver (60–70% were mentioned). However, several people expressed skepticism and/or wanted more information to justify this result (e.g., case studies).

> "It is a really high number. That is higher than anything currently operating."
>
> **—Engineer, Seattle**

> "82% sensible recovery—that's really high. That would be fantastic. In the commercial realm, [we're used to seeing] I'd say 60 or 65%."
>
> **—Architect, Bend**

OPTIMAL OR OPTIMAL CONDITIONS

(8 "votes" — 3 engineers, 2 HVAC contractors/installers, 3 architects)

This claim helped to differentiate VHE DOAS from other options because of the comparative language. For one group, this phrase also implied energy efficiency/low waste.

> "I guess the optimal condition one could be getting at what I was talking about with the system being adaptive, so if there's a variable fan speed or something, you're only using as much energy as you need."
>
> **—Architect, Portland**

DOWNSIZING

(8 "votes" — 3 engineers, 1 HVAC contractor/installer, 4 architects)

This aspect of the system design suggested a range of interesting implications that collectively implied *simplification*, and that could create an overall positive ripple effect throughout the building and ownership experience, such as: smaller, less expensive equipment; more space; upfront vs. net/long-term costs; and reduced weight.

> "I think that's one of the biggest benefits of DOAS—you're not directly using your HVAC equipment to heat or cool outside ventilation air. Your equipment potentially can get smaller and more efficient. That's a big benefit of DOAS as a whole, whether it's high efficiency DOAS or just a standard DOAS unit."
>
> **—Engineer, Redmond**

> "Whenever we can downsize equipment, usually the owner's going to save money. I think that if you can use heat recovery and some of these other methods to make things more efficient and as a result downsize the primary heating and cooling equipment, that's going to be a big benefit. I think it's all part of the strategy of improved energy efficiency and sustainability which is really important to me, personally. I think a lot of Architects try to advocate for that. Then, depending on where in the building the equipment is downsized and if that has ripple effects on the use of space in the building—talking about shafts and equipment rooms and rooftop equipment—if there are solutions that are more compact and affect less of the real estate, that's always great, too."
>
> **—Architect, Portland**

> "From a sales perspective, it means my equipment costs are going to go down. That helps me sell a job. If you are downsizing equipment, [you'll end up with] lower tonnage, smaller fans, all of that. Equipment is just going to cost less for us, [and we] pass that savings onto the customer." **—HVAC Contractor/Installer, Portland**

MINIMIZING PRESSURE DROP
(7 "votes" — 5 engineers, 2 HVAC contractors/installers, 0 architects)

and

MINIMIZING FAN POWER
(6 "votes" — 3 engineers, 1 HVAC contractor/installer, 2 architects)

Some market actors spoke of a link between pressure drop and fan power. These two claims were especially compelling to the engineers, who immediately saw benefits from these claims for both occupants (comfort) and owners (operational cost savings). One HVAC contractor/installer wanted more evidence to back up the pressure drop claim. Some of the architects found "minimizing fan power" compelling, but none were drawn to "minimizing pressure drop."

> "The reason that I circled minimizing pressure drop is because static pressure is just one of these silent eaters of money for the owner. A lot of times people will reduce upfront costs but they won't think about this ongoing pressure drop. I was just happy that it was thought about here, because anytime that fan is turning, which is any time the building is occupied, you are burning static pressure. If you can minimize that, it is going to reap benefits over time." **—Engineer, Boise**

> "Anytime you can minimize the fan power, that's less energy used. If you can take your fan power down, your fans are smaller, and all of your equipment gets smaller; it's a lot less of a construction cost." **—Engineer, Portland**

> "When you are doing dedicated outdoor air systems, it is hard to pressurize the building because you are moving air out of the building—you are not getting cold drafts and stuff of that nature. That is how you increase occupant comfort. You can actually drive down or up temperature settings and save energy that way so the gals at the front desk aren't getting that cold draft of air when the doors open." **—Engineer, Boise**

> "I just want to know how you're achieving a minimized pressure drop." **—HVAC Contractor/Installer, Bend**

HIGH EFFICIENCY OR HIGH EFFICIENCY HEAT RECOVERY

(6 "votes" — 2 engineers, 3 HVAC contractors/installers, 1 architect)

Market actors associated the term "high efficiency" with solutions that are more expensive. In this description, they assumed that VHE DOAS would be more expensive up front, but would yield payback over the long run. They perceived that this approach's overall goal of achieving sustainability would deliver energy savings.

> "[High efficiency heat recovery] is a really key part of simplifying. By not needing to have supplemental heating and cooling on your ventilation air, [you move toward] simplification and cost reduction." **—Architect, Portland**

> "From a sales perspective, I can tell the customer that maybe they are going to spend a little bit more now, but they are going to save down the road. It is helpful." **—HVAC Contractor/Installer, Portland**

> "If you're doing heat recovery, that means that you're using less energy. Any heat that you recover is heat that you don't have to put in, whether you're taking it out with air conditioning or [putting it] back in with heating." **—Engineer, Portland**

DECOUPLES OR DECOUPLES VENTILATION AIR

(6 "votes" — 2 engineers, 1 HVAC contractor/installer, 3 architects)

Compared to other HVAC options, decoupling was a key differentiator for the VHE DOAS approach. Market actors were drawn to the idea that independent components would make the system more adaptable. And because each part could be optimized, they hypothesized that there was a greater likelihood the overall system would also perform better. An architect who was unfamiliar with the term "decoupled" expressed curiosity to learn more.

> "Decoupling makes systems more versatile. You don't have to have everything connected. You are not putting holes through every single wall that the Architect is trying to put up. It also allows you on a control side to basically control two different devices instead of having them function perfectly together. They can have their own smaller control strategies that can make the system a little bit more efficient." **—Engineer, Seattle**

> "Typically we see the DOAS as bringing air in and putting it in the supply duct of the air handler—not as a separate supply system. This system could run independently. The immediate advantage would be that you wouldn't have to run your air handler if the HRV could keep up with your cooling loads, you wouldn't have to operate your condenser." **—Engineer, Montana**

> "I circled the terms that I didn't quite understand and was curious about. So, decoupling the ventilation air from the primary heat makes me think of having two systems. One for heating and cooling, and one for ventilation. I was curious about the decoupling. In a lot of our buildings, we are trying to get a tight air barrier at the building envelope. There are different ways of providing heating and cooling that don't necessarily involve ventilation. Here in Portland, we have much more need for heat than we do cooling. It is an interesting idea for me to separate the ventilation from the heating and cooling, because you can think about indoor air quality separately from your heating and cooling needs." **—Architect, Portland**

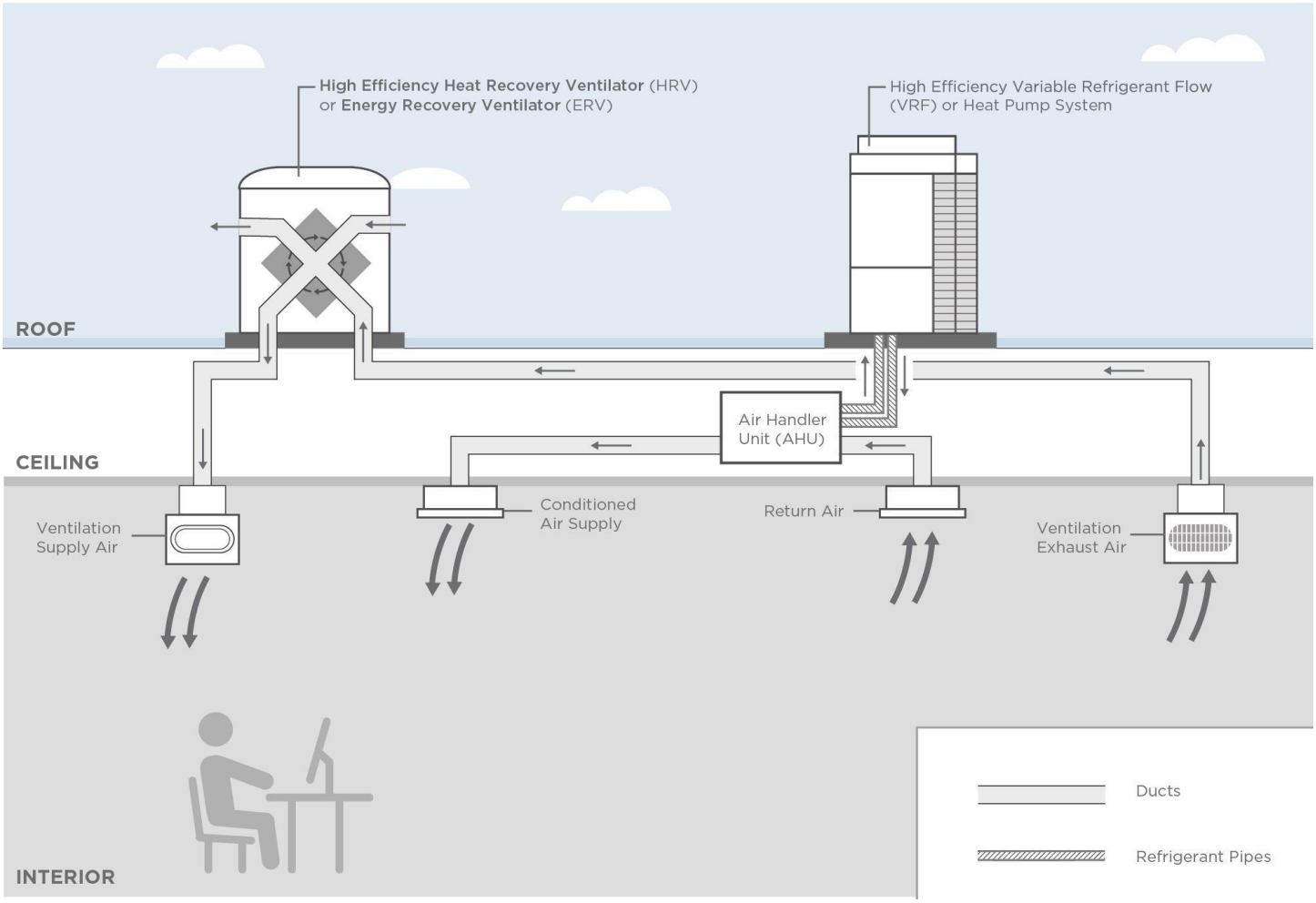
DESCRIPTION CONFUSION AND QUESTIONS

In the first four groups, market actors did not appear to fully understand that VHE DOAS is an approach (as opposed to a set of equipment components) that relies on system design created by the full team. Therefore, for the last two groups, the description was adjusted to communicate the importance of these decisions, as follows. "… To maximize performance, this approach *includes key design principles*, including completely decoupling ventilation air from primary heating and cooling air, downsizing the heating/cooling equipment and minimizing fan power by minimizing pressure drop and operating ventilation fans at optimal conditions."

While the description *began* to educate and inform market actors about VHE DOAS, it was not compelling enough on its own, nor did it provide all the information they needed to address questions and alleviate skepticism.

DIAGRAM

Across the groups, market actors enthusiastically welcomed the next prototype shared: a diagram of the VHE DOAS approach (see below).



Source: Mural diagram feedback activity

This illustration complemented the description nicely and provided an additional layer of understanding. As a visual information source, it reflected a mode of communication that was very familiar in the participants' various industries. Additionally, it acknowledged that people learn in different ways, and they appreciated having options that met individual learning preferences. Some of the market actors in the "Familiar" groups said they had seen this graphic or similar graphics explaining VHE DOAS before, and they felt it was an accurate portrayal of how this approach works.

Across the groups, market actors identified three key reasons for how and why the diagram was helpful.

1. **It *clarified* how specific components work by *showing*, not telling. For example, the architect who was curious to learn more about decoupling appeared satisfied by how it was described visually in the diagram, and by how seeing it in action expanded upon the text description.**

> "The biggest thing is the core right at the 'x' on the heat recovery ventilator to the left—that's where it all happens. That's where heat from indoor air is transferred to incoming air."
>
> **—Engineer, Redmond**

> "It shows what they meant by decoupled in the description, which appears to be accurate."
> **—Engineer, Olympia**

> "If you have to filter your air, you need to do double filtration. This shows there are two sources; one is outside air."
> **—Engineer, Portland**

2. **It illustrated *flexibility*, expanding upon what they covered in their description feedback to include addressing changing tenants or changing tenant needs.**

> "Distinction between the ventilation air and the conditioned air suggests the conditioned air can be more flexible, not as rigid or fixed."
> **—Architect, Portland**

3. **Market actors imagined using it as a *client sales tool*, because visuals help demystify unfamiliar approaches.**

> "When it comes to clients, seeing something visual helps them understand what's going on more than if you're trying just to explain it."
> **—Architect, Bend**

DIAGRAM CONFUSION AND QUESTIONS

After reviewing and discussing the diagram, some market actors shared the following unanswered questions. As observed throughout the discussions, engineers wanted (and needed) more detailed information than other market actors. Architects shared that they were less interested in detail because it was overly technical.

Engineers:

- **Felt confused about the ventilation supply air. Wanted clarity about how the economizer would work on the cooling side (the current practice mentioned was to add a coil to ensure comfortable supplier temperatures on the ventilation air supply side).**
- **Wanted more information about how VHE DOAS would deal with condensate at a high temperature/high humidity. (This question was echoed by an architect and a HVAC contractor/installer, both based in Portland.)**
- **Were curious about VHE DOAS payback compared to standard DOAS.**
- **Wanted confirmation that VHE DOAS uses a heat wheel rather than a plate frame.**
- **Asked if VHE DOAS used separate fans for supply and exhaust.**
- **Wanted to know what kinds of controls VHE DOAS could integrate with, since controls were important, and whether it could integrate seamlessly with the other VRF manufacturers (e.g., Daikin, Mitsubishi).**

HVAC Contractors/Installers:

- **Wondered if the motor or process of heating coming in were variable speed.**

To make the diagram even more helpful and clear, market actors also suggested improvements. Several groups were eager to *see* how VHE DOAS compares to and improves upon other approaches. Additionally, a few people commented that in the diagram, the single cold air flow appeared to hit one area, which would negatively affect occupants' comfort. To address this concern, they suggested

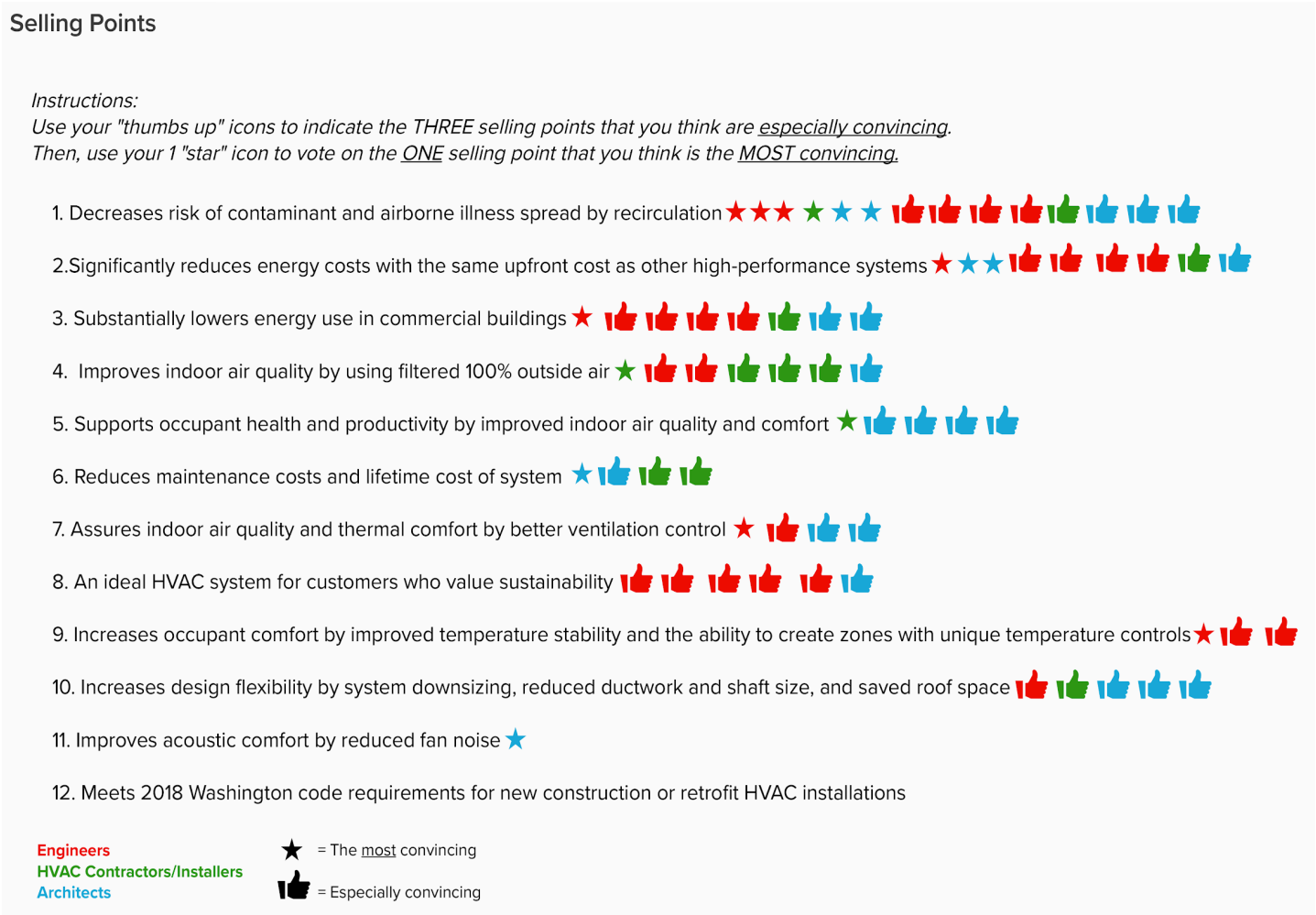
showing that VHE DOAS could include independent climate controls for different indoor areas. Lastly, market actors also suggested adding the idea of "control strategies" to further substantiate flexibility, comfort, and the PLUS of DOAS+. (Note: This comment was shared towards the end of the focus group, after the market actors had reacted to potential names.)

A final observation about market actors' feedback to the diagram was their lack of discussion about VHE DOAS as a *system* (including heating/cooling and an HRV), and/or as an *approach* that requires the full system design team to follow specific design principles. This research is unable to determine why this aspect wasn't mentioned during the diagram discussion.

SELLING POINTS

After discussing the diagram, market actors then reviewed a range of different features and benefits (AKA "selling points"). Would this list provide the kind of detail they were craving? Working individually, they voted on the four selling points that were the most compelling. Each person was granted multiple votes; they used three "thumbs up" icons to indicate the selling points they found compelling and one "star" icon to indicate the one that was the *most* compelling. Across all groups and market actors, there was a high level of consistency in their top votes. The most compelling selling points addressed four key topics: IAQ (Indoor Air Quality), Cost/ROI (Return on Investment), Energy Efficiency, and Engineering/Design Adaptability.

Note: The diagram below reflects final rankings across all market actors. Within the rank order, "star" icons represent the equivalent of three "thumbs up" icons to account for the difference between "especially convincing" and "most convincing."



Source: Mural selling points feedback activity | Note: The list was randomized across the groups to eliminate order bias.

INDOOR AIR QUALITY (IAQ)

KEY IAQ SELLING POINTS

- **Decreases risk of contaminant and airborne illness spread by recirculation;**
- **Improves IAQ by using filtered 100% outside air; and**
- **Supports occupant health and productivity by improved IAQ and comfort.**

In all groups, market actors shared that demand exists and is increasing for indoor air quality/increased ventilation across a range of constituents, particularly within publicly funded buildings (e.g., schools, affordable housing) and healthcare facilities. Recent articles corroborate this learning, pointing out that COVID has accelerated latent public demand, driven by the reactionary desire to "get back to normal" (McKinsey & Company, The Atlantic). The clarification that VHE DOAS uses 100% outside air (which was also visualized in the diagram) strongly supported VHE DOAS as a possible way to address COVID concerns. Market actors preferred to think longer term (beyond COVID specifically) and saw VHE DOAS as a viable solution that could address the *ongoing* need for better IAQ. HVAC contractors and engineers required additional details about VHE DOAS to understand, from a technical standpoint, how ventilation would be improved, to what extent, and at what cost, when compared to other options.

> "We are actually putting together a memo right now for a school district to give them recommendations on what they can do. If somebody had a bunch of money, this is what I would probably recommend—something similar to [VHE DOAS]. Just because you are flushing all that air out all the time…it is paramount right now. If this was last year, I wouldn't have selected it."
>
> **—Engineer, Portland**

These IAQ selling points were motivating to all but were especially compelling to architects, perhaps because they, even more than other market actors, prioritized the occupants' experiences in the building. Additionally, the other market actors also discussed their interest in striving for other IAQ and comfort benefits (such as those achieved through better zone control).

> "This shows the value HVAC can bring—ultimately how important HVAC systems are to the spaces we gather—places we want to be social; places we like to be human beings."
>
> **—Architect, Seattle**

> "Any time it can support occupant health and productivity, that helps the client because they have less people that are calling in sick or not working. If they could be more productive during a workday, that's also something the client is looking for. [Next], indoor air quality and thermal comfort cuts down on people complaining when they're working—it just makes everyone have a better work environment. [Finally], the risk of contamination—I think with the COVID stuff now, people are going to be more aware of that and start asking for options for their systems."
>
> **—Architect, Bend**

> "Most of what I do on a day-to-day basis is addressing the client's comfort issues. It's always, 'This office is too hot; this office is too cold.' We need more zoning—how do we make a single-zone system into a 40-zone system?"
>
> **—Engineer, Montana**

COST/ROI

KEY COST/ROI SELLING POINTS

- **Significantly reduces energy costs with the same upfront cost as other high-performance systems; and**
- **Reduces maintenance costs and the lifetime cost of the system.**

Given that cost is a significant hurdle throughout the HVAC decision-making process, these selling points were especially compelling to the market actors. The promise of "more for the same cost" in the first selling point seemed universally appealing, to assuage fears about cost hurdles early on in a project. Some groups discussed the ripple effect that choosing VHE DOAS could have on reducing net and material costs such as sheet metal, ducting, etc. Ongoing and life cycle costs were also motivating. In multiple groups, market actors discussed the long-term value of VHE DOAS (i.e., simplifying the required equipment would lead to lower maintenance and other ownership costs). In order to address their "it's too good to be true" skepticism, many agreed that both of these points would need to be substantiated with more explicit proof of the ROI of VHE DOAS.

> [Reduces maintenance and lifetime costs] is my number one choice because whenever we select a system, even if we are going for a certain air quality or efficiency, the number one question that always comes up is, 'What is the cost and what is the maintenance on it?' It seems like that is something that shoots down a lot of design ideas that we have."
>
> **—Architect, Portland**

> "You're going to spend more on the DOAS than you would typically for ventilation air. But, if it's going to reduce the cost of your other systems, then your net costs are going to be lower. If your energy recovery is higher, your heating load on your primary system is lower. Your heating, your system, the size of your system equipment can be smaller. Smaller boilers or heating sections, smaller handlers. If that's true, somebody could prove it to me, I could, I could sell it pretty easily."
>
> **—Engineer, Montana**

> "[With] the reduced duct work, if you can reduce the floor-to-floor of your building and save six inches, or 12 inches, then you're paying for six to 12 inches less skin for however many floors that you have, including all of the other materials."
>
> **—Architect, Portland**

> "I think in the scheme of things, [when I'm] searching for the best solutions to be used and to push forward with clients, that is what it comes down to, because it has to meet their costs, but I also really want to push the energy savings. That is the main goal, and it seems to do both of those things, which is a really important combination."
>
> **—Architect, Portland**

> "About 20% of people constructing buildings are the ones like universities and hospitals that are planning to complete a building and maintain it for the next hundred years. Eighty percent of people constructing buildings aren't planning on keeping it for the next hundred years. They're planning on keeping it for two to three years so they can sell it and make a profit. They don't care about the lifetime cost of the system. They only care about upfront cost."
>
> **—Engineer, Boise**

ENERGY EFFICIENCY

KEY ENERGY EFFICIENCY SELLING POINTS

- **Substantially lowers energy use in commercial buildings; and**
- **Provides an ideal HVAC system for customers who value sustainability.**

These energy efficiency selling points were especially compelling to engineers. Given their role, training, and knowledge, engineers appreciate better, more efficient solutions. In contrast, the HVAC contractors were more concerned with profitability and cost, and the architects prioritized aesthetics. Additionally, engineers also shared that they enjoyed designing efficient systems and wanted to build energy models that would prove the efficiency of the approach, which would then make it easier for clients to achieve sustainability certifications (as mentioned in the quotes below).

The first of these two selling points was motivating because lower energy use had an obvious correlation to lower lifetime costs (which were highly motivating, as mentioned above). The selling point that focused on clients' values was compelling because there is widespread interest in sustainability across the Northwest region. To make these points even stronger, one group suggested contextualizing lower energy use—for example, by providing payback information—and reported that this approach worked well to convince clients to adopt LED lights.

> "[Achieving] higher efficiency than what [code requires] makes it easier to attain your LEED and ILFI[5] certifications, which are becoming a really big thing, particularly in the Seattle area. I can't speak to more rural areas, but big cities in Oregon and Washington for sure. Everybody hates jumping through the LEED hoops, so if they know they got one in the bag, particularly with energy modeling, it is really nice."
>
> **—Engineer, Seattle**

> "That's what it's bringing to the table that the others can't. For LEED and other reasons, lower energy use over time is a big deal. It adds up. It's an annual cost. Over 20 years, it can be a big number."
>
> **—Engineer, Olympia**

> "When we went to LED [light-emitting diode] lights in our commercial buildings, the payback was there in about five years. If you can show an owner the payback period and they have multiple buildings, they'll be on the hook for life."
>
> **—Architect, Bend**

5. The International Living Future Institute is a global non-profit organization focused on a range of sustainability goals. The Living Building Challenge is one program. Certification requirements are outlined on the Institute's website.

ENGINEERING/DESIGN ADAPTABILITY

KEY ENGINEERING/DESIGN ADAPTABILITY SELLING POINTS

- **Increases design flexibility by downsizing the system, reducing ductwork and shaft size, and saving roof space; and**
- **Increases occupant comfort by improving temperature stability and creating separate zones with unique temperature controls.**

One key takeaway from these engineering/design selling points was simplification. Fewer, reduced elements and components implied durability (less chance of an individual piece failing), and also potentially less of an impact on interior design/aesthetics.

The adaptability and flexibility of VHE DOAS was appealing, because these qualities suggested that there were infinite possibilities. Across the details of the selling points (and other prototypes), market actors were drawn to multiple expressions of the flexibility of VHE DOAS: its use in both building types (retrofit and new construction); the equipment and how it's connected (alluding to the unique design principles used in the VHE DOAS approach); its adaptability to the needs and uses of owners and occupants; and the ease with which the system can be future-proofed.

> "The design flexibility...frees up architectural opportunities. It can be a pro from a cost and a leasable area standpoint. Anytime that you're not dedicating floor area to shaft size, it can presumably be used for something more lucrative." **—Architect, Portland**

> "With any type of renovation or retrofit, you are layering in—working with what is already existing and trying to make the best use of that. When it's new construction, you just get to decide. While you have to think differently about what you're going to do based on the project type, overall, it works really well in both circumstances." **—Architect, Portland**

LESS COMPELLING SELLING POINTS

Two selling points were less compelling across the market actors:

- **Meets 2018 Washington code requirements for new construction or retrofit HVAC installations (Washington groups only); and**
- **Improves acoustic comfort by reduced fan noise.**

Across market actors from all states, meeting code was considered a "cost of entry" for any HVAC approach. Therefore, this selling point didn't stand out over others. Only one architect selected the acoustic comfort selling point, which revealed that it didn't have widespread appeal across all groups.

NAMING OPTIONS

Throughout the groups, the moderator and market actors referred to VHE DOAS as "Very High Efficiency DOAS approach." Both VHE DOAS and Very High Efficiency DOAS approach are placeholder names that NEEA had been using to describe the system.

In their final individual activity on Mural, market actors provided their feedback on prototype naming options. Each person used stars to indicate which names they thought were most compelling and which best fit this unique approach. The goal of this activity was not necessarily to determine a

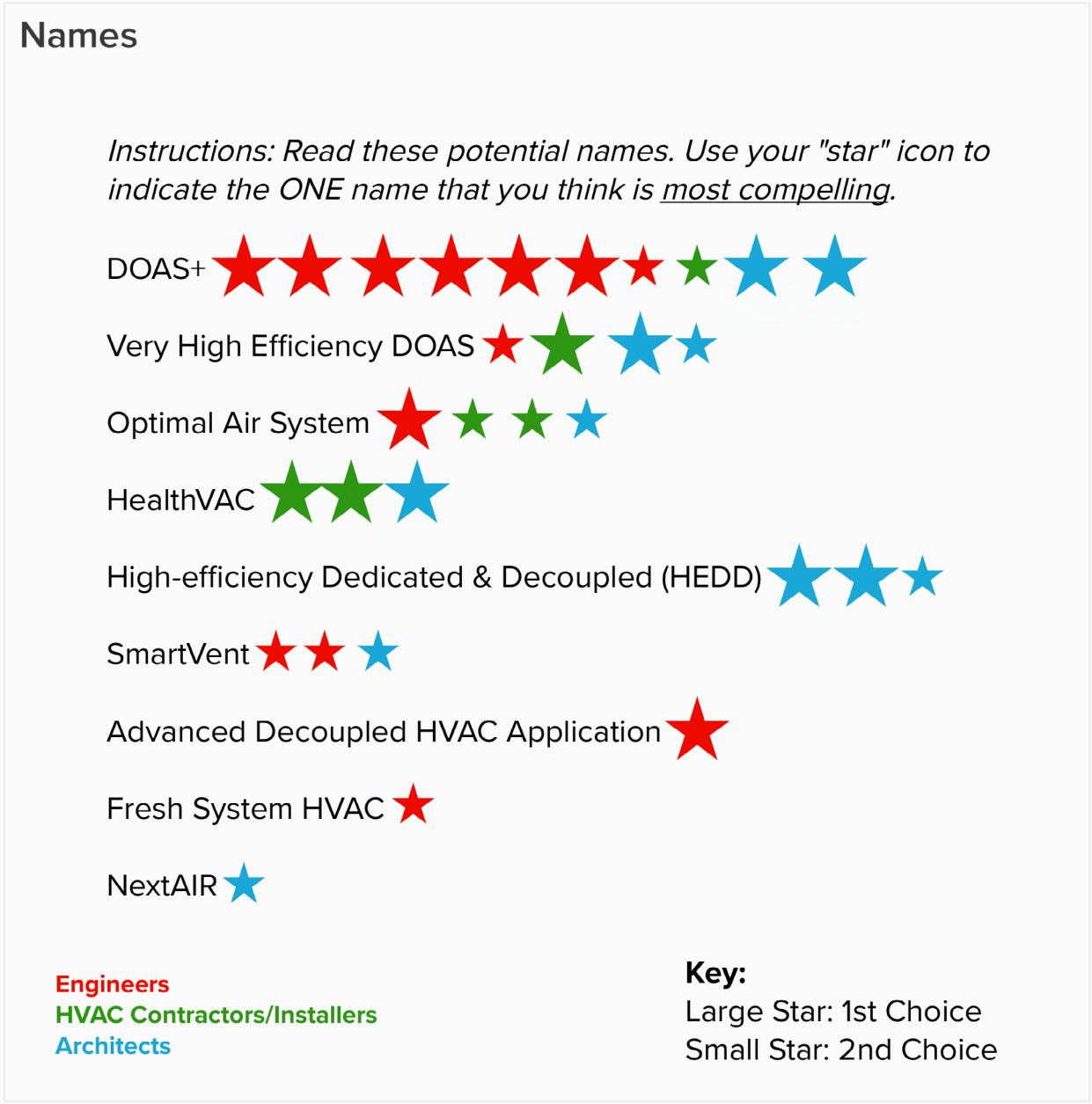
"winning" name, but rather to learn which direction(s) had the most traction and why, in order to help inform and guide future naming development. In the first group, participants used only one star, but in all subsequent groups, each person used two stars: a large star for their "top pick" choice, and a smaller star for their "second pick."

The prototype names shared in the groups reflected a range of five possible directions, as outlined below.

- Boasts superior efficiency
    - **Very High Efficiency DOAS** (also: leverages familiarity of DOAS)
    - **High-Efficiency Dedicated & Decoupled (HEDD)** (also: calls out "decoupled"; explains the "D" from "DOAS")
- Emphasizes "system" and claims superiority
    - **Advanced Decoupled HVAC Application** (also: emphasizes "decoupled"; capitalizes on familiarity of HVAC)
    - **Optimal Air System**
- Conveys improvement and superiority
    - **DOAS+** (also: uses familiarity of DOAS)
- Focuses on health benefits
    - **HealthVAC** (also: plays on familiarity of HVAC/plays on HVAC)
    - **Fresh System HVAC** (also: emphasizes "system"; leverages familiarity of HVAC)
- Implies innovation
    - **NextAIR**
    - **SmartVent**

Across all groups, market actors gravitated towards the names that were straightforward, indicated superiority, and included at least one component that was already familiar. They also favored names that were industry-appropriate and that could be used for business-to-business (B2B) marketing purposes. In contrast, names that were more "branded" seemed more consumer-facing, targeting their clients (owners), instead of professionals (themselves and their peers).

The summary below shows that across all market actors, the names *DOAS+*, *Very High Efficiency DOAS*, and *Optimal Air System* were the most highly favored.



Source: Mural naming activity | Note: After Group 1, two changes were made to this activity. "Very High Efficiency DOAS" was added as an option, and "(HEDD)" was removed from "High-Efficiency Dedicated & Decoupled."

DOAS+

Market actors, particularly the engineers, were drawn to "DOAS+." As mentioned earlier in this report, engineers were the most familiar with the term "DOAS," while architects were the least familiar, which could explain this skew. Market actors liked this name because its simple and direct structure clearly identified what this approach is. This name also reflected B2B naming practices that market actors liked, but gave a nod to consumer-facing naming as well (in the "+"). They shared that they were very used to acronyms, which are used liberally in their industries. That said, some architects shared that while they're used to acronyms, they didn't always know or remember what they stood for, so they appreciated having an acronym explained at some point in the communication materials. Lastly, the "+" did some heavy lifting. It invited comparison with other options (DOAS, and HVAC in general), thereby raising awareness of a range of different HVAC and DOAS options. Importantly, it piqued curiosity about *how* this DOAS is better or improved (e.g., quality, energy efficiency, comfort,

cost-effectiveness, controllability, flexibility in design, health, etc.). In summary, the "+" said that "DOAS+" is simply better when compared to other options.

> "It has to be an acronym that we are familiar with—DOAS+ takes something that everybody is talking about and it is something better. That's a selling point. Everybody is going to say, 'What is DOAS Plus?' Because everybody knows DOAS. It is going to create a question."
> **—Engineer, Seattle**

> "I like DOAS Plus because it's simple. It doesn't rename DOAS, because DOAS is very specific in the code. I think it's good to stay along those lines." **—Engineer, Redmond**

> "The reason why I didn't pick [HealthVac or SmartVent] is because they sound like brand names...you can go to Home Depot and you can get a Smart Vent. When I'm dealing with mechanical systems, acronyms are more helpful to me because it's a shorter way of describing exactly what they are." **—Architect, Seattle**

> "For me, 'DOAS Plus' causes a question instantly. It makes me want to call up the manufacturer and ask them what the 'Plus' means. It's an opportunity for them to sell the system to me. Everybody knows what DOAS is, so when I see the 'Plus,' it's just my inquisitive nature—I have to know what the 'Plus' is. What makes it a 'Plus?'" **—Engineer, Boise**

VERY HIGH EFFICIENCY DOAS

This name was added after the first group. It is also important to note that throughout the discussions, moderators and the prototypes used the phrase "Very High Efficiency DOAS approach," so it is possible that market actors' selection of this name reflects bias.

Market actors who selected this name appreciated its clarity. It leveraged the familiarity of what it is (DOAS), and differentiated it from other options by highlighting a key net benefit (very high efficiency). Additionally, as with "DOAS+," market actors liked that this name included an acronym.

> "At first I was leaning towards a less technical sounding name—something the client might find compelling—but I think there's a need to have a technical aspect. The fact that you have very high efficiency in there—that's a really important aspect of it. It tells you more than typical generic-ized branding. The audience is also sometimes the contractor, or your mechanical designer, and you want to be very clear what you are talking about and what your goal is." **—Architect, Portland**

OPTIMAL AIR SYSTEM

With a skew towards HVAC contractors/installers, some market actors chose "Optimal Air System" as their preferred name. In contrast to the other favored name options, this one is more straightforward—it contains no acronyms or industry jargon. Its simplicity derives from the fact that it uses more general language to describe what it is ("air system") and how it's better/best ("optimal"). Many market actors

circled "optimal" in the prototype description; it's possible that the people who liked this name chose it because it reinforced what they liked in the description.

> "'Optimal Air System' has a nice sound to it, and makes it sound like it's more of a progressive idea. It means it's optimized. It's where they want it to be." **—Architect, Portland**

> "'Optimal Air System' speaks to comfort and purity in my mind, because you're optimizing the air in the building." **—HVAC Contractor/Installer, Bend**

OTHER NAMES FAVORED BY SPECIFIC MARKET ACTORS

In the naming discussion, there were some noticeable differences by market actor type. Some architects also liked "High-Efficiency Dedicated & Decoupled," in addition to their other generally favored names. This name avoided acronyms, yet alluded to (and therefore reinforced) the "D" in "DOAS." It also highlighted that it was decoupled, an important differentiator clarified by the diagram. Additionally, "HealthVAC" was a strong contender with some HVAC contractors/ installers, because it capitalized on the heightened relevance of the health benefits of VHE DOAS. This name also reflected a clever twist on "HVAC."

HEALTHVAC

> "I think this one would provide a question to buyers—what is healthy about this over other stuff?" **—HVAC Contractor/Installer, Portland**

HIGH-EFFICIENCY DEDICATED & DECOUPLED

> "I like the high-efficiency part because that's the main driver when we ask our mechanical engineers to present options…It's a dedicated system, and it doesn't say decoupled from what, but I think it starts to talk about how it's different and what the system is. Most architects do not really get very savvy with the lingo and the terminology…this is actually telling me what it is." **—Architect, Portland**

NEXTAIR

> "It's like the next generation. It's one step further than what we currently have—it's always getting better as we look forward. Short and sweet. People are going to latch onto something that they can remember and something that's a little catchy." **—Architect, Bend**

ADDITIONAL NAME SUGGESTIONS

One group (a "Familiar" group) offered three new names to consider: "VHE DOAS," "VDOAS," and "VHDOAS." All three names leverage acronyms, the familiarity of DOAS, and an abbreviation/allusion to the claim of superior efficiency.

SEVEN GUIDELINES FOR NAMING

After discussing all the name options, market actors across all six focus groups offered key guidelines

for future naming development (listed below). Importantly, the second guideline points out that while some of these options reflected the idea of a "system" (implying multiple equipment components), none expressed the notion of an "approach" (e.g., design principles, collaborative design team). Consideration of all seven of these guard rails will help ensure that the name is compelling and memorable.

1. **Be straightforward.**
2. **Clarify that this is an *approach*.**
3. **Acronyms are OK.**
4. **Include "DOAS" in the name.**
5. **Context clarifies. Be sure other elements help explain what it is.**
6. **Use language that indicates differentiation from, and ideally superiority over, other options.**
7. **Reflect familiarity with existing names, and also inject something that stimulates intrigue (as "+" does, for example).**

CRAFTING CONVINCING COMMUNICATIONS

POTENTIAL VALUE PROPOSITIONS

Originally, Objective 3 for this study included prototype value propositions, but these were ultimately excluded from the materials developed for the groups. Interestingly, through analysis of responses from across the groups and exercises, potential value propositions did emerge, especially in the final activity. In that exercise, the market actors collaborated as a team to craft a convincing presentation that would convince a peer to consider the VHE DOAS approach. Each team's argument included a concise sales pitch, backed up by compelling selling points and the name that they thought best described the VHE DOAS approach. As a culmination of the discussion, this activity enabled the market actors to leverage the most salient information discussed throughout the session.

Group 1	Group 2	Group 3
• This system meets energy code, and will continue to meet energy code for a long time. • Easier certification and a flexible system. Well suited for retrofits and new construction.	• The next level in energy-efficient systems. • Next generation DOAS.	• This is an advanced decoupled HVAC application with fresh air separated from the heating system to better control building comfort and ventilation.
Group 3	**Group 5**	**Group 6**
• Does everything better for the same price you're used to paying. • Checks all the boxes: better performance, better health—all of those things that we want, and it will fit our current budget. This is the magic bullet. • Energy efficiency and a lower life cycle cost. Flexibility with temperature and ventilation control. You are going to have happy occupants.	• The best mechanical system for healthy and efficient buildings. • Better energy efficiency at the same cost. • A broadening of what adaptive can mean—flexibility in the system design and the ripple effect over other aspects of the building. • Flexibility to control the quality of the indoor air and climate for occupants.	• The very best situation for you is fresh air, reduced pathogens, and occupant comfort. • We're all trying to increase ventilation and air quality with everything that's going on in the world. Are you interested in a safer building at an ongoing cost that is very manageable, in an energy saving and cost-effective manner?

Source: Mural convince a peer activity — sales pitch | Note: This is a summary of all groups' sales pitches.

Across all of the groups' sales pitches, the following five value propositions emerged:

1. **Very High Efficiency. Straightforward, with a focus on engineering and sustainability. Consistent with and supportive of NEEA's overall mission.**

> "More people are becoming increasingly serious about trying to reduce energy consumption. Code is pushing us in that direction. A lot of architects have signed on to the 2030 Challenge to reach net zero by 2030. We're lagging behind, but it's gaining momentum. I would expect that there would be more of these types of systems in the future." **—Architect, Portland**

2. **Better Performance at the Same Cost. Better performing in terms of efficiency, air quality, occupant health, and safety. All at (about) the same cost as other DOAS options.**

> "When something is double the price and is 10% more efficient, I won't even bring that up to a client—it's a deal breaker. But if it's significantly more efficient and not much more expensive, which is what I got from the VHE DOAS descriptions that were provided, that is something that I could sell. We could show it to people like universities—they want to be 30% better than code. If VHE DOAS is something that will help us get there, and it's a reasonable cost increase, I could get it on my project and it won't be value engineered out."
>
> **—Engineer, Boise**

3. **Adaptability/Flexibility. Greater flexibility over system design and occupant comfort: design principles, equipment, project type (retrofit and new construction), interior space, controls.**

> "I like the versatility. You can move things around without affecting the architect or construction too much. You usually get pushback when something affects someone else's design, but VHE DOAS doesn't do that. I also like the ability to mix and match the equipment."
>
> **—Architect, Portland**

4. **Healthy Inside Air. The invisible is now visible (health-centric and COVID-relevant). Across numerous sectors, COVID is accelerating behavior change, HVAC included. VHE DOAS could help speed up this process.**

> "Right now, I have so many schools and other businesses calling specifically asking about decreasing risk of contamination. That's the main concern that I'm hearing—using this product for COVID-19. There's a charter school in Hood River that thinks they are going to be opening up part time, and they want to make sure they're doing everything they can to mitigate any issues. We've talked a lot about bringing in fresh air. How do we use their existing systems, and what systems can we add on if they happen to have the budget?"
>
> **—HVAC Salesperson/Project Manager, Portland**

5. **Future-Proofed. The right choice for today and tomorrow. The future of HVAC is available now: VHE DOAS is ahead of the code curve. Change the paradigm and lead HVAC market transformation.**

> "Everyone is trying to be more green. There isn't anybody in the profession that isn't onboard with that. That's where the world is moving. VHE DOAS seems to be in sync with that. I think you could even call it the future of DOAS, because I think it is. I bet 10 years from now, every DOAS system will be like this."
>
> **—Architect, Seattle**

IMPACT ON SHIFTING PERCEPTIONS

The groups concluded with an activity designed to gauge the impact of all the information shared during the session. How had the market actors' perceptions, understanding, and openness regarding VHE DOAS been affected?

Revisiting an activity from the beginning of the session, market actors were asked to share another word that described the VHE DOAS approach. As outlined in the table below, the evident shift reflects the power of knowing more about the VHE DOAS approach. Initial perceptions expressed literal, rational, and general category-related perspectives (e.g., componentry, energy efficiency, and cost); some of these were hopeful, while others were rooted in skepticism or negativity. But at the end of the session, armed with more information, the market actors honed in on the distinctive merits of the approach, reflecting: true value on a professional level (e.g., flexibility to do my job, a tool to add to the tool box); meaningful performance (e.g., air purification, sustainability); and a more emotional and end-user-focused experience (e.g., safety and comfort).

This change in perceptions occurred because of the iterative and cumulative build of knowledge the market actors gathered across *all* of the prototypes offered, and because of what they learned from each other. They simply knew more. The selling points exercise, which utilized compelling, feature-benefit selling points unique to VHE DOAS, gave them the final critical information they needed. They could now see a role for this approach in their real-world HVAC context.

WHAT IS AN ADJECTIVE OR DESCRIPTIVE WORD THAT DESCRIBES THE VERY HIGH EFFICIENCY DOAS APPROACH?

	First Impression (pre-exposure to prototypes)	***Final Impression (post-exposure to prototypes)***
Engineers	• Energy recovery • Simplified • Payback • More efficient • Complicated • Refined • Expensive; Efficient	• Versatile; Adaptability • Versatile • Decoupled • Simple; 82% • Stupendous • Air purification • Efficient • Safe
Architects	• Coupled with geothermal • Elegant • Costly • Net zero • Adaptive • New	• Flexibility • Ideal (and still elegant) • Healthy HVAC • More green/sustainable • Adaptive • Sensible
HVAC Contractors/ Installers	• Extreme (Efficiency) • Expensive • Expensive	• Potential • Fresh air comfort; Occupant-safe air • Healthy

Source: Descriptive word activities (at the beginning and end of the focus group)

"(First impression) Expensive and complicated. The idea is great, but the cost, typically, outweighs the efficiency in the commercial realm. (Final impression) Potential. I learned things that can be helpful in selling and in applying and meeting needs for a customer."
—HVAC Contractor/Installer, Bend

"I thought and still think it is elegant. But, indoor air quality is just at the front of my mind right now. So, I put healthy, in a couple ways, from a contaminant perspective; but, also just happy, happy occupants."
—Engineer, Portland

"I learned more about the system and just what it's all about with the efficiency levels and applications and what not. Actually, hearing from the other guys here, they had some good insight that made me think about different angles of this product as well."
—Engineer, Redmond

[What caused the change from new to sensible, from expensive and efficient to safe, and from expensive to fresh air comfort?] "Well, you provided us with education on DOAS+. We were all working in a vacuum before. Except for him [the one person who had worked on a pilot project]. I think he knew what it was right off the bat." **—HVAC Contractor/Installer, Portland**

RECOMMENDATIONS

The following 13 recommendations are based on Sparrow's review of the background information, analysis of the pre-session questionnaire responses, and conversations with market actors. Fulfilling the promise to deliver insightful research with actionable results, this section describes the next steps NEEA can take to encourage adoption of the VHE DOAS approach. These include: determining a high-level value proposition, crafting messaging that is relevant to prioritized market actors, and developing education and training to bring about market transformation. Each recommendation is preceded by a key insight uncovered during research.

OBJECTIVE 1 LEARN MARKET ACTORS' ON-THE-JOB MINDSETS (MOTIVATIONS, FRUSTRATIONS, AND BUSINESS MODELS)

#1. *Key Insight: The VHE DOAS approach requires even more cross-functional communication and shared understanding of the criteria (design principles) than traditional HVAC projects.*

RECOMMENDATION
Educate, reinforce, and support the collaborative, coordinated human effort required to successfully implement and deliver the VHE DOAS approach.

Foster teamwork and encourage ongoing interaction for the duration of a job, using NEEA's prior integrated design information as a starting point in project planning. Include specific references to this important process piece in training and outreach efforts.

Establish HVAC choice as a lead consideration from the beginning to the end of a project. Make the VHE DOAS approach a project hero, not your typical HVAC or DOAS solution: more "elegant" for the engineers, more "flexible design options" for the architect, and ultimately, as one HVAC contractor claimed,"happier" client/owners and more satisfied tenants.

#2. *Key Insight: Market actors shared remarkably similar perspectives regarding HVAC, all displaying interest in VHE DOAS as a new option to consider in a range of scenarios.*

RECOMMENDATION
Acknowledge market actors' shared mindsets, motivations, and orientations.

Unite them by engaging them, along with owners/clients when appropriate, in a cross-functional manner (e.g., training and outreach). Use this research to identify a communication theme that is broadly relevant and appeals to all.

Conduct a quantitative segmentation study to identify and size the true market transformation opportunities and priority targets. In addition to market actor role and location, incorporate a range of the most relevant decision factors uncovered in this study in the research. For example, building type, retrofit or new installation, and funding source are a few of the critical drivers of VHE DOAS consideration.

OBJECTIVE 2

LEARN HOW MARKET ACTORS THINK ABOUT VHE DOAS (PERCEPTIONS AND MISCONCEPTIONS)

#3. *Key Insight: Market actors are accustomed to seeing advances in HVAC technology and approaches.*

RECOMMENDATION
Position the VHE DOAS approach as part of the ongoing evolution of the HVAC category.

In communication materials, compare VHE DOAS to familiar options, components, and approaches.

- **Use infographics to show where VHE DOAS fits in the evolution of modern HVAC systems.**
- **Emphasize that this is a system, not merely an HVAC unit paired with an HRV, as this will greatly enhance understanding.**
- **Create a side-by-side comparison chart of key features and benefits to explicitly show how the VHE DOAS approach differs from current DOAS and popular HVAC options.**
- **Develop a range of versions of this chart—from detailed and feature-heavy for engineers and installers, to less technical and more end-benefit-driven for architects, contractors, salespeople, and client/owners.**

Such a categorical juxtaposition will ensure that the most differentiating facts, features, and benefits of the VHE DOAS approach are highlighted. Context can be everything.

#4. *Key Insight: Despite their benefits, it's very hard to justify and sell new HVAC approaches to the majority of owners/clients.*

RECOMMENDATION
Educate all market actors, including owners/clients and firms that are contracted to perform cost reduction studies, on the value and/or the ROI of VHE DOAS.

Make the case so compelling that the system is not dismissed from the start, or "value engineered out." This can be accomplished in the following ways.

- **Analyze cost data from the pilot projects to produce side-by-side comparisons of the installed cost of VHE DOAS, compared to other options. Show initial increases and decreases in cost of materials (and time, if possible) to reveal net project costs.**
- **Promote an understanding of the long-term, future-proofed value of VHE DOAS through a life cycle cost story that includes tangible benefits (e.g., energy savings, durability, maintenance costs) and, if possible, incorporates externalities and non-financial factors (e.g., comfort, safety, productivity, etc.).**
- **Explore ways to bring the VHE DOAS equipment costs down, either through manufacturer discounts or a published price list (combatting the tendency to mark up new, more energy-efficient technology).**

- **Revise the existing case studies to address the knowledge gaps identified in this research. Showcase a range of retrofits and new construction. Highlight the equipment used, the design principles employed, and the cross-functional teamwork and communication required. Tailor these to specific target audience needs.**

#5. *Key Insight: Meeting code is a main driver in the adoption of new technologies/approaches.*

RECOMMENDATION
Continue working to elevate code through regulation and/or legislation.

Encourage regulators to create codes—and policy makers to pass legislative measures—that solve for future-facing goals by applying new technology and design principles such as the VHE DOAS approach. Proactively drive toward these long-term, sustainable end benefits: health and safety through better IAQ (indoor air quality), energy efficiency, conservation, and/or carbon reduction. This effort can draw from the materials created for the market actors (e.g., a pilot project case study that shows real-world impact, testimonials, etc.) Such changes would spark broad-reaching market transformation by compelling market actors to seriously consider and/or pre-spec a VHE DOAS or equivalent approach.

Proactively drive toward these long-term, sustainable end benefits: health and safety through better IAQ (indoor air quality), energy efficiency, conservation, and/or carbon reduction.

OBJECTIVE 3 GAIN FEEDBACK ON THE VHE DOAS "SELLING POINTS," DIAGRAM, AND NAMING OPTIONS

#6. *Key Insight: The description and diagram employed standard category approaches (e.g., terms and visuals) that market actors appreciated, but these prototypes didn't fully address their knowledge gaps.*

RECOMMENDATION
Update the existing diagram, and create new visuals and copy, to more fully explain what VHE DOAS is and, especially, how it is different from other HVAC solutions.

- **Improve both the description and the diagram to clearly establish that this is a system utilizing a set of off-the-shelf components which require thoughtful design and integration into a space to meet the qualifying criteria of VHE DOAS.**
- **Add dynamism to the diagram, using icons or other design elements to communicate cross-team interaction, role-specific decision making, and a sense of the process from start to finish.**
- **Create an additional set of diagrams, each customized with the level of detail that is most relevant to the market actor, to address the knowledge gaps identified in this research (e.g., engineers require a lot of technical information that is incomprehensible to architects, architects want to understand changes to interior space planning, etc.).**
- **To highlight the features and the (especially critical) benefits of VHE DOAS, use diagrams, visuals, graphics, and acronyms that match each type of market actor's level of familiarity and interest regarding DOAS and/or VHE DOAS. Provide these details in a format the market actors can understand and, more importantly, will use and share.**

#7. *Key Insight: Four key selling points emerged as most relevant to, and resonant with, all market actors, clearly establishing VHE DOAS as a realistic option to consider.*

RECOMMENDATION
Make sure to incorporate these highly differentiated messages in future outreach and communication efforts.

- **Better IAQ;**
- **Affordable project cost/ROI;**
- **Improved energy efficiency; and**
- **Increased engineering/design flexibility.**

Use existing data, evidence, and case studies to support all of these claims. The credibility of the VHE DOAS approach requires solid evidence to support any claims of superiority, especially with the engineers, who demand more technical detail. Cite sources, provide data, share white papers, and quote category influencers.

Pair VHE DOAS features with the corresponding benefits identified in this research to encourage meaningful linkage between what VHE DOAS is, what it contributes to the project, and how it ultimately affects the end-user.

Customize the outreach for each specific type of market actor, adjusting the level of detail used. Additionally, consider broadening the conversation to include key stakeholders who can influence the adoption of better HVAC solutions, such as owners/clients, regulators, legislators, and even the general public.

#8. *Key Insight: COVID is driving awareness of, and heightening the importance of, indoor air quality.*

RECOMMENDATION
Use this opportune moment to communicate that VHE DOAS is the only HVAC approach available today that is both energy efficient and potentially capable of minimizing the viral spread.

Only as warranted by evidence, promote the VHE DOAS approach as a means to address the current COVID concerns and future pandemic concerns about IAQ, worker and tenant health, safety, and productivity. Show the difference in air quality attained by the VHE DOAS approach and explain how such results are achieved. Put the case in language that can be understood by all market actors, key stakeholders, and influencers, including legislators, regulators, journalists, and citizens. Consider a public relations effort to gain media coverage of this HVAC solution for safer home, school, and work environments. Incorporate an IAQ message into NEEA efforts for code changes.

#9. *Key Insight: Given the general lack of familiarity among most market actors, NEEA essentially has a blank slate for communicating the VHE DOAS approach.*

RECOMMENDATION

Develop a foundation to ground the VHE DOAS communication efforts in a broadly relevant value proposition supported by a range of selling points that will satisfy the knowledge requirements across the range of market actors and other stakeholders.

Use this research and existing NEEA knowledge to identify and establish the following elements, which can be used to inform the future outreach, education, training, and other market transformation initiatives related to the VHE DOAS approach:

1. **The value proposition (overarching theme) that resonates across all market actors;**
2. **The key differentiating end benefits unique to the VHE DOAS approach, and most motivating to market actors (pillars);**
3. **The key selling points; and**
4. **The supporting evidence to back up the benefit claims (features, results, etc.).**

The following is a hypothetical VHE DOAS Approach Communication Foundation created with the insights gathered during this study—specifically, the high-level themes that emerged during the "Convince a Peer" exercise: more efficient with the same cost, better IAQ, flexible/adaptable, and future-proofed.

Developing this foundation may require several moderated work sessions.

VALUE PROPOSITION: THE FUTURE OF HVAC. NOW.

Selling Points			
+ Better energy efficiency	+ Better ROI over lifetime	+ Better IAQ	+ Better engineering/design
Evidence			
• Ahead of the EE code curve • 82% • Path to NetZero	• Net costs reduced • Payout pays off – tangible and intangible ways • Durability	• Ahead of the IAQ code curve • Dedicated outside air in • Occupant comfort	• Collaborative design teams • More flexible and adaptable • Customizable • Space savings • Control of indoor conditions

Source: Sparrow Team Strategy Session, 8.10.2020

#10. *Key Insight: Understanding of the category vocabulary, terms and acronyms, technical detail, and emphasis on features or end benefits varied significantly across market actors, depending on their role and influence.*

RECOMMENDATION
Build a strategic communication plan that recognizes the similarities and differences across the key market actors and the roles they play in the selection, planning, and installation of HVAC solutions.

The following is a four-step approach to consider that will ensure the right message reaches the right market actors in the right way.

1. **Identify and prioritize the key market actors and/or other stakeholders to target with outreach.**
2. **For each type of market actor or stakeholder, define the primary communication objective.**
3. **Identify the relevant tactical messaging based on the motivators, barriers, and other insights from this research.**
4. **Select the most effective messenger.**

Developing this plan may require additional research focused on messenger vehicles.

#11. *Key Insight: Market actors gravitated toward the familiar and pragmatic when learning about new technology and approaches. In VHE DOAS education techniques, the more hands-on, visual, and experiential, the better.*

RECOMMENDATION
Utilize and update the established education, training, and communication norms within the HVAC and construction categories.

- **Leverage existing and familiar channels and sources, such as ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) and the two current manufacturers (Swegon and Ventacity) to increase awareness of VHE DOAS.**
- **Create a microsite that allows market actors to go into the depth appropriate for their role/ needs.**
- **Develop content that brings the VHE DOAS approach to life and generates a sense of "hands on" familiarity. Create training and education videos covering the following topics: the components of VHE DOAS; installing VHE DOAS; NEEA's "Integrated Design Approach" in action; a tour of downsized features; and a montage showcasing the cascading end benefits of an installed VHE DOAS.**

#12. *Key Insight: Word of mouth, colleague recommendations, and networking are key sources of HVAC information and education.*

RECOMMENDATION
Build and leverage the market actors to evangelize and amplify the VHE DOAS message.

- **Recruit and arm credible influencers who are familiar with VHE DOAS data, features, and benefits to share their knowledge and drive improvements (e.g., actual downsizing of equipment).**
- **Encourage networking and create shared educational and training experiences (virtual and real-world).**
- **Feature the current and future pilot projects and their teams to bring a real (or virtual) experience of the full VHE DOAS approach to the market actors.**
- **Solicit testimonials from design teams, owners/clients, and end users of VHE DOAS, from the Pacific Northwest and across the globe.**
- **Develop means by which learning can be easily shared with colleagues and peers via video, testimonials, conference appearances, on-site visits to pilot projects, etc.**

#13. *Key Insight: The naming exercise revealed the need to balance the hook of a brand name with a solid HVAC reference(s).*

RECOMMENDATION
Continue exploring naming options, or go with "DOAS+."

- **Option 1: Consider conducting name evaluation research with market actors to guide the final selection. Make sure to create a name that taps into the familiar, and also communicates this approach's unique value across a range of applications and market actors.**
- **Option 2: Go with "DOAS+," supported by a description or tagline, such as "The Very High Efficiency Approach to HVAC." Adding the description emphasizes that DOAS+ is an approach, not a component. Evaluate the opportunity to leverage the "+" sign as a visual asset (like the Nike swoosh) to communicate all the advantages, the "pluses," of the VHE DOAS approach.**

APPENDIX

FOCUS CROSSROADS
ONE MEADOWLANDS PLAZA, SUITE 1001
EAST RUTHERFORD, NJ 07073
(201) 528-0400

FG-20-100
June 2020

NEEA QUALITATIVE MINI GROUPS
SCREENER

S. Client sample being used: **(CHECK ONE ANSWER.)**

Unfamiliar with VHE DOAS	❒1
Familiar with VHE DOAS	❒2

1. Hello [First Name], My name is [NAME], calling from [FOCUS CROSSROADS]. I know these are stressful times and hope you and your loved ones are well. I value your time and expertise, and hope you can spare a few minutes to talk with me. Is now a good time to talk?

   [If yes, continue with script below. If not, ask for a better time. If they aren't interested and mention concern about the pandemic and/or economy, thank them for their time and wish them well. It's essential to be understanding and empathetic.]

   IF "UNFAMILIAR WITH VHE DOAS" CONTINUE WITH:
   Ok. We are planning to hold online focus groups with professionals who have decision-making roles in the design and installation of commercial HVAC systems, including architects, mechanical engineers, general contractors, HVAC contractors, and HVAC vendors to learn about your work. We expect the focus group to take approximately an hour and 15 minutes.

   IF "FAMILIAR WITH VHE DOAS" CONTINUE WITH:
   Ok. On behalf of The Northwest Energy Efficiency Alliance (NEEA) we are planning to hold online focus groups with professionals who have decision-making roles in the design and installation of commercial HVAC systems, including architects, mechanical engineers, general contractors, HVAC contractors, and HVAC vendors to learn about your work. We expect the focus group to take approximately an hour and 15 minutes.

   ALL CONTINUE FROM HERE:
   You will also be asked to fill out a questionnaire before participating in the focus group which should take less than 15 minutes.

   The focus group is for market research purposes only. In order to participate you will need a desktop or laptop computer with a reliable internet connection, camera, and microphone. For this research, the focus group may be audio and/or video-taped for analysis purposes, but your responses and personal details will remain strictly confidential.

   We will provide an electronic gift card for $350 in appreciation of your time and input, plus an additional $25 if you complete the questionnaire. Would you be interested in joining us for this type of discussion? **(CHECK ONE ANSWER.)**

Yes	❒1
No	**TERMINATE**

- IF "**Yes**" CHECKED: Continue screening with Q.2

OTHERWISE: Terminate

2. In which state is your office located? **(ENTER ANSWER.)**

State:

- IF "**Washington, Oregon, Idaho, or Montana": Continue screening with Q.2b**
- **OTHERWISE: Terminate and tally**

2b. And in which states do you personally work or have projects that you work on? **(ENTER ANSWER.)**

State:

- IF "**Washington, Oregon, Idaho, or Montana": Continue screening with Q.3**
- **OTHERWISE: Terminate and tally**

IF "FAMILAIR WITH VHE DOAS" (BASED ON Q. S – Sample), ASK Q. 3a. OTHERWISE SKIP TO Q. 4

3a. Have you ever heard of a VHE DOAS HVAC system or worked on a pilot project in conjunction with NEEA that involved the VHE DOAS system? **(READ LIST AND CHECK ONE ANSWER.)**

Heard of/Familiar with VHE DOAS	❒1
Worked on a VHE DOAS pilot project with NEEA	❒2
Never heard of or worked on a VHE DOAS System	❒3

- IF "**Heard of" / "Worked on" VHE DOAS**": Respondent is verified as being "Familiar" and remains in the "Familiar" cell. Continue with Q. 4.
- IF "**Never Heard of"**: Continue with Q. 3b.

IF "NEVER HEARD OF/WORKED ON VHE DOAS SYSTEM" (Q. 3a), ASK Q. 3B. OTHERWISE SKIP TO Q. 4.

3b. Just to clarify, have you ever worked on an HVAC system that included a Ventacity heat recovery ventilator (HRV)? **(CHECK ONE ANSWER.)**

Yes	❒1
No	❒2
Not Sure	❒3

- IF "**Yes**": Respondent is verified as being "Familiar" and remains in the "Familiar" cell. Continue with Q. 4.
- IF "**No"**: Switch respondent to the "Unfamiliar" cell. Continue with Q. 4.

ALL CONTINUE FROM HERE:

4. Which of the following best describes your job title/role? **(READ LIST AND CHECK ONE ANSWER.)**

Architect	❒1
Mechanical Engineer	❒2
General Contractor	❒3
Distributor	❒4
HVAC contractor/installer	❒5
HVAC Vendor (including manufacturer representatives)	❒6
Manufacturers Product Manager	❒7
Manufacturers Account Manager	❒8
Distributor Branch Manager	❒9
Distributor Sales Staff	❒10
General Contractor	❒11
Other (Specify)	❒12

AIM FOR MIX (BUT TRY TO HAVE ONE ENGINEER PER GROUP)

5. What proportion of the buildings that you work on are represented by the following three types? The total must add to 100%. **(RECORD PERCENTAGES – MUST ADD TO 100%.)**

Residential Buildings

Commercial buildings with less than 50,000 square feet

Commercial buildings with 50,000 or more square feet

TOTAL ---------- 100%

- IF 100% FOR **"Residential":** Terminate
- IF 100% FOR **"Commercial Buildings with 50,000 or more":** Terminate
- IF less than 20% for "**Commercial with less than 50,000 sq ft**": Terminate
- OTHERWISE: Continue to Q.6a

IF "GENERAL CONTRACTOR" IN Q. 4, ASK Q. 6a NEXT. OTHERWISE SKIP TO Q. 6b.

6a. Which of the following best describes the type of projects your firm works on? **(READ LIST AND CHECK ONE ANSWER.)**

Exclusively "Design/Build" projects	❒1
Primarily "Design/Build" projects	❒2
Exclusively "Plan and Specify" projects	❒3
Primarily "Plan and Specify" projects	❒4
A mix of different types of projects	❒5
OTHER (Specify)	❒6

- Must Include **1** General Contractor that works either **Exclusively or Primarily on 'Design and Build' projects**
- All others can work on any type of project

IF "ENGINEER" IN Q. 4, ASK Q. 6b NEXT. OTHERWISE SKIP TO Q. 7.

6b. Which of the following best describes the type of firm your currently work for? **(READ LIST AND CHECK ONE ANSWER.)**

Architectural Firm	❒1
Mechanical Engineering Firm	❒2
Mechanical, Electrical, and Plumbing (MEP) Firm	❒3
Mechanical, Electrical, and Plumbing (MEP) Design Build Firm	❒4
Distributors	❒5
Manufacturers	❒6
Other (Specify)	❒7

ALL CONTINUE FROM HERE:

7. How are you typically involved in small-to-medium commercial projects (specifically those building that are under 50,000 square feet)? Are you involved in: **(READ LIST AND CHECK MULTIPLE ANSWERS.)**

Designing the building	❒1
Designing the HVAC system	❒2
Advising on or recommending HVAC equipment types	❒3
Installing HVAC equipment	❒4
None of the above	❒6

- IF "None of the above" CHECKED: Continue with Q.8
- OTHERWISE: Continue Q.9

IF "NONE OF THE ABOVE", ASK Q. 8 NEXT. OTHERWISE SKIP TO Q. 9.

8. We would really like to speak with people who are more closely involved in decisions around which types of HVAC equipment are installed in commercial projects and how that equipment is installed. Is there someone else in your company involved in the design, sales or installation for small-to-medium commercial projects that might be able to participate in our discussion? (**CHECK ONE ANSWER.)**

Yes	❒1
No	❒2

- IF "**Yes**" CHECKED: Ask to speak with that person and return to introduction; if not available, leave message and record contact information
- OTHERWISE: Terminate

ALL QUALIFIED RESPONDENTS CONTINUE FROM HERE:

9. In which of the following types of areas are the **commercial buildings** your company works with located or do you work in? **(READ LIST AND CHECK MULTIPLE ANSWERS.)**

Urban (i.e. Portland, Seattle, Boise)	❒1
Rural (anything outside of Portland, Seattle Boise)	❒2

- **INVITATION:**

Congratulations, you have qualified to participate in our focus group discussion and to complete the short 15

minute survey prior to participating in the focus group. This focus group would be conducted online. We would email you the link you would need to join the meeting beforehand.

Just as a reminder the discussion group would last about approximately an hour and 15 minutes. minutes, requires a desktop or laptop computer with a reliable internet connection, camera, and microphone. The dates of the group that you are eligible to participate in will be held on < **ENTER DATE AND TIME – see tentative schedule on next page** > and for your participation, you would be rewarded with an electronic gift card for $350 and an additional $25 if you complete the 15 minute questionnaire.

The discussion is for market research purposes only and no sales of any kind will take place. It may be audio/video-recorded, but your answers will only be used in combination with answers from other respondents.

Would you be willing to participate?

Yes	❒1
No	TERMINATE

- IF "**YES**" CHECKED: Collect respondent information.
- IF "**NO**" CHECKED: Terminate and tally

Great, thanks for agreeing to participate! Let's schedule a time (see schedule **). Please make sure to have a pen and paper handy when you are participating in the focus group discussion.

** **When scheduling with respondent try wherever possible to have 1 engineer in each group and the other members of the group should be a mix of other job titles.**

Please provide the following information so we can contact you. Please be sure to provide your correct email, as this is how we will send you the link and information to join the video meeting.

NAME: PHONE: (AC -)

E-MAIL:

Thank you very much for your help!

READ FOR ANYONE BEING TERMINATED (NOT QUALIFIED):

Thank you very much for taking the time to speak with me today. Unfortunately, we're limiting the study to people who work in specific places and roles in HVAC installation. We regret that our current study is not a good match for you.

QUESTIONNAIRE

NEEA VHE DOAS PRE-GROUP QUESTIONNAIRE

[INTRO COPY]
Thank you for taking the time to complete our survey. Answering the following questions should take no more than 15 minutes of your time. Your responses will be kept anonymous.

Upon completing this survey, you will receive an electronic gift card for $25 from Focus Crossroads.

[SECTION ONE/DEMOGRAPHICS INTRO COPY]
To get started, we have a few questions about your profession, your specialization, and where you work.

Demographics

From the following list, select the option that best describes your profession. If your profession isn't listed, please write in your title using "Other."

- ❑ Architect
- ❑ Design Engineer
- ❑ Distributor Branch Manager
- ❑ Distributor Sales
- ❑ Engineering Manager
- ❑ General Contractor
- ❑ HVAC Contractor
- ❑ Manufacturer Representative
- ❑ Vendor
- ❑ Other _____

When it comes to selecting and designing HVAC systems, do you or your firm specialize in those that are highly energy efficient?

- ❑ Yes
- ❑ No

In which state are the majority of your commercial HVAC projects completed?

- ❑ Idaho
- ❑ Montana
- ❑ Oregon
- ❑ Washington

[SKIP PATTERN: Idaho]
Do you primarily work in Boise?

- ❑ Yes
- ❑ No

[SKIP PATTERN: Oregon]
Do you primarily work in Portland?

- ❑ Yes
- ❑ No

[SKIP PATTERN: Washington]
Do you primarily work in Seattle?

- ❑ Yes
- ❑ No

[SECTION TWO INTRO COPY]
Next up, we'd like to learn more about your experience in the design, selection, and procurement of HVAC systems.

[INTRO COPY]
HVAC system design projects—whether they're renovations, retrofits, or new construction—typically follow one of the following models:

Plan & Specify	Design-Build	Progressive Design-Build	General Contractor Construction Management
The classic design approach, where the owner hires an architect and engineer to develop design documents and then selects a contractor to install the system through a bidding process.	In classic design-build, the owner hires a design-build contractor which includes a team that delivers the entire project including design and construction.	Progressive design-build is similar to classic design-build, with the slight difference that the entire design team (instead of just the design builder) is selected by the owner.	General contractor construction management (gccm) is a hybrid approach in which the owner hires both the general contractor and the architect directly.

[Objective 1, iii] Thinking back to your past HVAC projects, which of the following models have you had experience with? Please check all that apply.

- ❑ Plan & Specify
- ❑ Design-Build
- ❑ Progressive Design-Build
- ❑ General Contractor Construction Management (GCCM)

[Objective 1, iii] Thinking back to your past HVAC projects, what made them successful when it came to overall project success and ongoing decision making?
[OPEN RESPONSE]

[FOLLOW UP]
[Objective 1, iii] Thinking back to your past HVAC projects, was there anything standing in the way of overall project success and ongoing decision making?

- ❑ Yes
- ❑ No

[SKIP PATTERN: Yes]
[Objective 1, iii] During your previous HVAC projects, what was standing in the way of overall project success and ongoing decision making?
[OPEN RESPONSE]

[MATRIX QUESTION; RANDOMIZE ANSWER ORDER]
[Objective 1, i] Please indicate how important each of the following factors are to you in the design, selection, and/or procurement of an HVAC system.
[SCALE: Not Important 1 2 3 4 5 Very Important]

- ❑ Completing the project at or under budget
- ❑ Completing the project on time
- ❑ Ease of maintenance
- ❑ Energy efficiency
- ❑ Equipment capacity
- ❑ Equipment manufacturer reputation
- ❑ Equipment manufacturer technical support/warranty
- ❑ Initial cost
- ❑ Life-cycle cost
- ❑ Overall project profitability
- ❑ Project aesthetics
- ❑ System reliability
- ❑ Prior familiarity with the system
- ❑ OTHER:_____

[Objective 1, i or ii] From your experience, what is the number one biggest problem or barrier you encounter during the design, selection, and/or procurement of an HVAC system?
[OPEN RESPONSE]

[Objective 1, i] How influential are your professional relationships to the design, selection, and/or procurement of an HVAC system, and/or the ultimate success of that HVAC project?

- ❑ Not influential
- ❑ Somewhat influential
- ❑ Very influential

- ❑ I'm not sure

[SKIP PATTERN: Not influential] Please explain why professional relationships are not influential to the design, selection, and/or procurement of an HVAC system, and/or the ultimate success of an HVAC project.
[OPEN RESPONSE]

[SKIP PATTERN: Somewhat influential] Please explain why professional relationships are somewhat influential to the design, selection, and/or procurement of an HVAC system, and/or the ultimate success of an HVAC project.
[OPEN RESPONSE]

[SKIP PATTERN: Very influential] Please explain why professional relationships are very influential to the design, selection, and/or procurement of an HVAC system, and/or the ultimate success of an HVAC project.
[OPEN RESPONSE]

[Objective 1, i] Thinking about your work in general, what excites you the most about what you do?
[OPEN RESPONSE]

[Objective 1, i] Thinking about your work in general, what excites you the least about what you do?
[OPEN RESPONSE]

[SECTION THREE INTRO COPY]
You're almost finished!

Next up, we're going to ask you several questions about the people you work with, HVAC design team dynamics, and your ongoing learning about emerging HVAC technologies and design principles.

[MATRIX QUESTION]
[Objective 1, iii] During a typical HVAC project, how often do you work with each member of the design team?
[SCALE: Never 1 2 3 4 5 Always]

- ❑ Architect
- ❑ Design Engineer
- ❑ Distributor Branch Manager
- ❑ Distributor Sales
- ❑ Engineering Manager
- ❑ General Contractor
- ❑ HVAC Contractor
- ❑ Manufacturer Representative
- ❑ Vendor
- ❑ Other _____

[Objective 1, iii] During the last HVAC project you worked on, which member(s) of the overall project team had the most influence over decisions about HVAC system type and efficiency?
Please indicate the level of influence held by each team member in the following two questions.
[SCALE: Not Influential 1 2 3 4 5 Very Influential]

Which team members did you influence?

- ❑ Architect
- ❑ Design Engineer
- ❑ Distributor Branch Manager
- ❑ Distributor Sales
- ❑ Engineering Manager
- ❑ General Contractor
- ❑ HVAC Contractor
- ❑ Manufacturer Representative
- ❑ Vendor
- ❑ OTHER:_____

Now the reverse: which team members influenced you?

- ❑ Architect
- ❑ Design Engineer
- ❑ Distributor Branch Manager

- ❑ Distributor Sales
- ❑ Engineering Manager
- ❑ General Contractor
- ❑ HVAC Contractor
- ❑ Manufacturer Representative
- ❑ Vendor
- ❑ OTHER:_____

[Objective 1, iii] In your experience, who typically manages the overall HVAC project from start to finish? Please check all that apply.

- ❑ Architects
- ❑ General Contractors
- ❑ Mechanical Contractors
- ❑ Owners/Clients
- ❑ OTHER:_____

[Objective 1, iii] How do you and/or your firm primarily generate revenue?
[OPEN RESPONSE]

[Objective 1, iii] How do you ensure that your HVAC system design, sales, and/or installs will be profitable for you and/or your firm?
[OPEN RESPONSE]

[Objective 1, iii] What are the major costs you and/or your firm need to manage to remain profitable?
[OPEN RESPONSE]

[Objective 1, iii] Who are your most important and/or profitable customers, and why?
[OPEN RESPONSE]

[Objective 1, i] Please select the statement that most accurately applies to you.

- ❑ Among my peers, I'm known as always being knowledgeable about emerging HVAC technologies and/or design principles.
- ❑ I'm curious about emerging HVAC technologies and/or design principles, but I don't always keep myself up to date.
- ❑ When it comes to emerging HVAC technologies and/or design principles, I typically rely on my peers being up to date.

[CLOSING COPY]
That's it! Thank you for taking the time to answer our questions. To thank you for your responses, you will be receiving an electronic gift card for $25 from Focus Crossroads.

We look forward to meeting you soon, and talking more about emerging technologies in commercial HVAC.

DISCUSSION GUIDE

NEEA VHE DOAS DISCUSSION GUIDE

GUIDE SECTIONS

1. **Introductions/Hello/Tech Check -** ***10 minutes***

2. **Objective 2 + 3 (vii) -** ***25 minutes***
   Learn how specifiers think (perceptions and misconceptions) about VHE DOAS.
   (Use the context of DOAS and NEEA developed stimulus materials -"VHE DOAS description" and "Diagram" to gauge current awareness, understanding and attitudes regarding the Very High Efficiency DOAS approach.)

3. **Objective 3 -** ***30 minutes***
   Gain feedback on the VHE DOAS "selling points" and naming options.

   (Use NEEA developed stimulus material to gain feedback on how to communicate the Very High Efficiency DOAS approach in a way that will positively shift attitudes and behaviors)

4. **Wrap Up/Thank You -** ***10 minutes***

1. INTRODUCTIONS - 10/65 MINS

- Hello, my name is ____. I'm a researcher. I usually go around the country talking to people about different topics. Today, we are gathered here, online, to talk about HVAC systems for the next 75 minutes.
- I am recording and transcribing this. I have a few team members listening in and a tech expert on hand to help if needed.
- We'll have a mix of topics to talk about, and activities to do. There are no right answers, and no wrong answers, just your opinion and feedback.
- We will be moving fairly quickly and toggling between ZOOM and MURAL - an online collaboration tool.
- There is a link to the MURAL board in the ZOOM chat box—will everyone click on that?

Moderator "summons" participants to WELCOME TO MURAL (1)

- Now using Mural, please add where you live and your role at your company/job.

Moderator "summons" participants to MURAL ACTIVITY: HELLO (2)

- Do any of you know each other? By the end you will and you will also be very familiar with MURAL. And your specific MURAL color (e.g. Tim is pink, Mary is green). Any tech questions before we move on?
- Let's go back to ZOOM - your other window or tab. Everybody here? Thumbs up?

2. OBJECTIVE 2 + 3 (VII) - 25/45 MINS

Learn how specifiers think (perceptions and misconceptions) about VHE DOAS
(Use the context of DOAS and NEEA developed stimulus materials -"VHE DOAS description" and "Diagram" to gauge current awareness, understanding and attitudes regarding the Very High Efficiency DOAS approach.)

Obj 2 iv. What is clear or unclear about VHE DOAS?

- As I mentioned, we are here to talk about HVAC systems—specifically, DOAS
- What does DOAS mean to you? (Prompt: Dedicated Outside Air System?)
- What types of equipment might be included when using a DOAS approach?

  Listen for:
  - *DOAS can be a single piece of equipment (an ERV/HRV, called a DOAS unit) or a system that separates ventilation from heating/cooling*
  - *DOAS includes the unit that provides ventilation in addition to ductwork, diffusers, controls, post-heat*
- There are several types of DOAS: Conventional DOAS, High Performance DOAS; any other DOAS you know of?

- Show of hands:
    - Who has heard of the Very High Efficiency DOAS approach?
    - Anyone worked with or installed?
- Take a moment and think of an adjective that describes the Very High Efficiency DOAS approach? Whatever comes to mind.

Moderator "summons" participants to MURAL ACTIVITY: ADJECTIVES (3)

SHARE OUT

- Pre/First impression words. (*Moderator records in MURAL)*

Obj 3 (vii): How do specifiers react to the NEEA prototype description and diagram of VHE DOAS?

- Moving on, some of you are familiar with the Very High Efficiency DOAS approach and some are not. I'm going to use MURAL to share a description of the Very High Efficiency DOAS approach. I want to know what are the MOST COMPELLING aspects of the description.

Moderator "summons" participants to MURAL ACTIVITY: DESCRIPTION (4)

PROTOTYPE SYSTEM DESCRIPTION MARKUP

- So, here's the description. Each of you has 5 circles, in your color. You can move and stretch the circles to indicate what you think are the most compelling aspects of this description.

STIMULUS: PROTOTYPE SYSTEM DESCRIPTION - NEEA FINAL - 7/17

A dedicated outside air system (DOAS) approach that minimizes energy consumption by recovering heat with high efficiency heat recovery (>82% sensible recovery) and a high efficiency heating/cooling system. To maximize performance, this approach completely de-couples ventilation air from primary heating and cooling air, downsizes the heating/cooling equipment, and minimizes fan power by minimizing pressure drop and operating ventilation fans at optimal conditions.

SHARE OUT

- *Moderator briefly summarizes what they found compelling.*
- How does this add to your understanding of the Very High Efficiency DOAS approach?

- Now, let's take a look at a diagram of the Very High Efficiency DOAS approach for additional information.

Moderator "summons" participants to MURAL ACTIVITY: GRAPHIC (5)

STIMULUS: PROTOTYPE DIAGRAM - NEEA FINAL - 7/17

- Anything else that you find compelling (if you had more circles, you would have circled it!)
- Let's go back to ZOOM - your other window or tab. Everybody here? Thumbs up?
- Now that you've read the description and seen the diagram, do you have any questions? *(Listen for confusion and/ or key information gaps)*

DEPENDING ON TIME AND IF NEEDED CALL ON JORDAN EXPERTISE - LIMIT TO A FEW MINUTES, AUDIO ONLY. POSSIBLY ANSWER THE QUESTIONS BY EXPLAINING HOW THE VERY HIGH EFFICIENCY DOAS APPROACH IS DIFFERENT FROM/EVOLVES CURRENT HVAC APPROACHES. *NOTE:* JORDAN WILL BE AVAILABLE IN THE FIRST TWO GROUPS; WE WILL BE SHARING MORE INFORMATION THAT WILL FURTHER ELUCIDATE THE APPROACH.

UNFAMILIAR GROUPS ONLY

- Let's pause for a moment to think about your work and your HVAC options. This approach is another option. What are some of the pros and cons of this Very High Efficiency DOAS approach? Get at least one of each.

Obj 2 v. What features, benefits, and drawbacks do they ascribe to VHE DOAS?

Obj 2 vi. What challenges do they anticipate in designing and/or installing using the system approach that is unique to VHE DOAS?

- Thanks for those pros and cons, this next activity involves quickly sorting a list of consideration factors into one of three piles.

Moderator "summons" participants to MURAL ACTIVITY: CARD SORT (6)

STIMULUS: "POST-IT NOTES" OF PROs and CONs (MOTIVATORS & BARRIERS/CHALLENGES) Identified during Immersion - NEAA FINAL - 7/17
(Potential to iterate based on input from challenges activity from previous groups)

CARD SORT

- INSTRUCTIONS: Capture the pros and cons of why you & your peers would consider the Very High Efficiency DOAS approach a realistic option. Quickly sort the "cards" below into the 3 columns. Pro, Con, Neither Pro or Con. Each person should sort one row of cards. I'm going to give you a minute (or two) to do this first sort.
- Review the sort, agree/disagree? Any changes you'd make?
- Please divide and conquer, within each pile, quickly rank order cards, you can have a tie or two.
- Explain the top two in each pile - why placed in each category?

  (Note: Participants are likely to reveal their reasons while doing the exercise. Moderator can follow up with specific and relevant probes).

FAMILIAR GROUPS ONLY

- Let's pause for a moment to think about your knowledge of and experiences working with the Very High Efficiency DOAS approach. What are some of its pros and cons? Get only one of each.

DEBATE

- Was anybody on the debate team in High School? Well, now's your chance. We will now debate the Pros and Cons of the Very High Efficiency DOAS approach:
  - You (Name) will argue the pros - all the pluses of this approach
  - You (Name) will argue the cons - all the negatives/challenges
  - You (Name) get to add pros and cons to either side
- You have a few minutes to develop your case and one minute each to present.
- DEBATE *(Listen to arguments, move on, no probing until after the card sort)*
- Well done, I have a few more consideration factors to share with you, let's go back to MURAL

Moderator "summons" participants to MURAL ACTIVITY: CARD SORT (6)

STIMULUS: "POST-IT NOTES" OF PROs and CONs (MOTIVATORS & BARRIERS/CHALLENGES) Identified during Immersion - NEAA FINAL - 7/17
(Potential to iterate based on input from challenges activity from previous groups).

CARD SORT

- INSTRUCTIONS: Capture the pros and cons of why you & your peers would consider the Very High Efficiency DOAS approach a realistic option. Quickly sort the "cards" below into the 3 columns. Pro, Con, Neither Pro or Con. Each person should sort one row of cards. I'm going to give you a minute (or two) to do this first sort.
- Review the sort, agree/disagree? Any changes you'd make?
- Please divide and conquer, within each pile, quickly rank order cards, you can have a tie or two.
- Explain the top two in each pile - why placed in each category?
- Any key pros or cons that you included during the debate that are not listed here? What are they? *(If not revealed earlier)* Why important?

  (Note: Participants are likely to reveal their reasons while doing the exercise, Moderator can follow up with specific and relevant probes)

3. OBJECTIVE 3 - 35/10 MINS

Obj 3. Explore feedback to VHE DOAS "selling points" and naming options.

vii. How effective are NEEA prototypes at convincing specifiers to seriously consider VHE DOAS?)
viii. What questions do HVAC system designers have about the prototypes?
ix. What changes do HVAC system designers recommend to the prototypes, and why?

- Let's go back to ZOOM - your other window or tab. Everybody here? Thumbs up?

"SELLING POINTS"

- As you have uncovered, there are some real advantages and some real challenges facing the adoption of the Very High Efficiency DOAS approach.

- Let's look at some "selling points" created to stimulate consideration and adoption of the Very High Efficiency DOAS approach.

Moderator "summons" participants to MURAL ACTIVITY: SELLING POINTS (7) PROTOTYPE SELLING POINTS MARKUP

STIMULUS: Vhe Doas Prototype Materials: Selling Points - Neaa Final - 7/17 *(Rotate Order Across Groups.)*

- INSTRUCTIONS: Use your "thumbs up" icons to indicate the THREE selling points that you think are especially convincing. Then, use your 1 "star" icon to vote on the ONE selling point that you think is the MOST convincing.

- *Moderator identifies and leads a brief discussion of 'hot spots:'* How/why is that convincing?

- Looking over the list again, is there anything confusing or unclear? Any selling point that is weak? What could make it better? What changes would you make?

IF NEEDED CALL ON JORDAN EXPERTISE - ELUCIDATION OF THE FEATURES AND BENEFITS; LIMIT TO A FEW MINUTES, AUDIO ONLY (FIRST TWO GROUPS).

NAMING

- During this discussion, we've been talking about the Very High Efficiency DOAS approach. It doesn't have a name yet. Let's look at some possible naming options.

Moderator "summons" participants to MURAL ACTIVITY: NAMES (8)

STIMULUS: VHE DOAS NAMING OPTIONS - NEAA FINAL - 7/17

- INSTRUCTIONS: Read these potential names. Use your "star" icon to indicate the ONE name that you think is most compelling.

- Which is most compelling? Why?

- What do you think of this list - like/dislikes; do's/don'ts (Probe: short name, description, acronym etc.)

- Anyone have any other suggestions: another name to add to the list for the next group?

- Let's go back to ZOOM - your other window or tab. Everybody here? Thumbs up?

Objective 3 (In totality)

- In this session, we have uncovered some real advantages and some real challenges facing the adoption of the Very High Efficiency DOAS approach.
- Of everything that you've heard so far today, what is the ONE most convincing thing/piece of information that makes you consider the Very High Efficiency DOAS approach a realistic option?

SHARE OUT: Everyone's "most convincing thing/piece of information."

- Work together for a few minutes to create a SALES PITCH for the Very High Efficiency DOAS approach. Please choose a note taker, you will need to refer back to this in our next and last activity. *(Up to 3 minutes of conversation, moderator will gauge when to summon them to MURAL.)*
- Our last activity is called "Convince a Peer" You will be using anything discussed or created today, to work together to build a "sales pitch" that will convince a peer to seriously consider the Very High Efficiency DOAS approach.

Moderator "summons" participants to MURAL ACTIVITY: CONVINCE A PEER (9)

- INSTRUCTIONS: Working together, finalize the SALES PITCH that will convince a peer to consider this Very High Efficiency DOAS approach.
- You must Include SELLING POINTS to back up your Sales Pitch (peers might be skeptical, you have to convince them!).
- Lastly, you need to have a name for what you are selling. What's the best NAME for this approach?

STIMULUS: Everything we have shared previously: pros and cons, prototypes (system description, diagram, selling points) naming.

- The notes you just jotted down.
- You can zoom out to see all of the activities you completed or go to the OUTLINE to locate one of them - click on the icon that looks like a list at the top right

- You have 7 minutes to work together to develop a convincing pitch. At least one person will need to capture your ideas on mural—copy/paste from stimulus or write from scratch. You will then have a few minutes to pitch!

- Let's go back to ZOOM - your other window or tab. Everybody here? Thumbs up?
  (Note: one participant may choose to stay on the MURAL board)

SHARE OUT: Presentation of the pitch (1 to 3 minutes)

- What is the most powerful element of your pitch?
- How/why will this approach work?
- Which challenge(s)/barrier(s) does this take on?
- Which motivator(s) are you leveraging? How/why will that work?

4. Wrap Up/Thank You - 10/0 mins

- Almost done, please give me an adjective to describe the Very High Efficiency DOAS approach.

Moderator "summons" participants to MURAL ACTIVITY: ADJECTIVES (3)

SHARE OUT: "Final/most informed impression" words. (*Moderator records in MURAL)*

- *Moderator shares the PRE - three words and POST - three words*
- What changes do you see? What caused the shift in your perception/understanding?

- Address any client questions (shared with moderator via chat; Lauren to prioritize).
- *IF TIME:* Looking forward (5-10 years), what do you think the future holds for the Very High Efficiency DOAS approach?

- Thank you for sharing your time and thoughts with me today. Your help today is greatly appreciated by NEEA *(the Northwest Energy Efficiency Alliance).* In the next few years, you will be hearing more about the Very High Efficiency DOAS approach, so stay tuned!
- Next week you will be receiving your compensation via an email from Focus Crossroads.

MURAL ACTIVITY OVERVIEW

Welcome to MURAL

Before we get started:

Instructions
Close the outline in the upper right corner—MURAL will bring you where you need to be

Change your zoom settings in the lower right corner to mouse or trackpad mode

Tips
Double click to enter text in the post-it notes and text boxes

Click and drag to move icons around

Fix mistakes with undo/redo at the top left—keyboard shortcuts work too!

Hello!

Name, City, Job Role

Name, City, Job Role

Name, City, Job Role

Description

Instructions: Use your circles to indicate what you think are the most compelling aspects of this description.

A dedicated outside air system (DOAS) approach that minimizes energy consumption by recovering heat with high efficiency heat recovery (>82% sensible recovery) and a high efficiency heating/cooling system. To maximize performance, this approach completely decouples ventilation air from primary heating and cooling air, downsizes the heating/cooling equipment, and minimizes fan power by minimizing pressure drop and operating ventilation fans at optimal conditions.

Names

Instructions: Read these potential names. Use your "star" icon to indicate the ONE name that you think is most compelling.

Advanced Decoupled HVAC Application

DOAS+

Fresh System HVAC

HealthVAC

High-efficiency Dedicated & Decoupled (HEDD)

NextAIR

Optimal Air System

SmartVent

Adjectives

Instructions: Jot down one adjective that describes the Very High Efficiency DOAS approach.

Adjective 1

Adjective 2

Selling Points

Instructions:
Use your "thumbs up" icons to indicate the THREE selling points that you think are especially convincing.
Then, use your 1 "star" icon to vote on the ONE selling point that you think is the MOST convincing.

Improves indoor air quality by using filtered 100% outside air

Decreases risk of contaminant and airborne illness spread by recirculation

Assures indoor air quality and thermal comfort by better ventilation control

Increases occupant comfort by improved temperature stability and the ability to create zones with unique temperature controls

Supports occupant health and productivity by improved indoor air quality and comfort

Improves acoustic comfort by reduced fan noise

Reduces maintenance costs and lifetime cost of system

Increases design flexibility by system downsizing, reduced ductwork and shaft size, and saved roof space

Substantially lowers energy use in commercial buildings

Significantly reduces energy costs with the same upfront cost as other high-performance systems

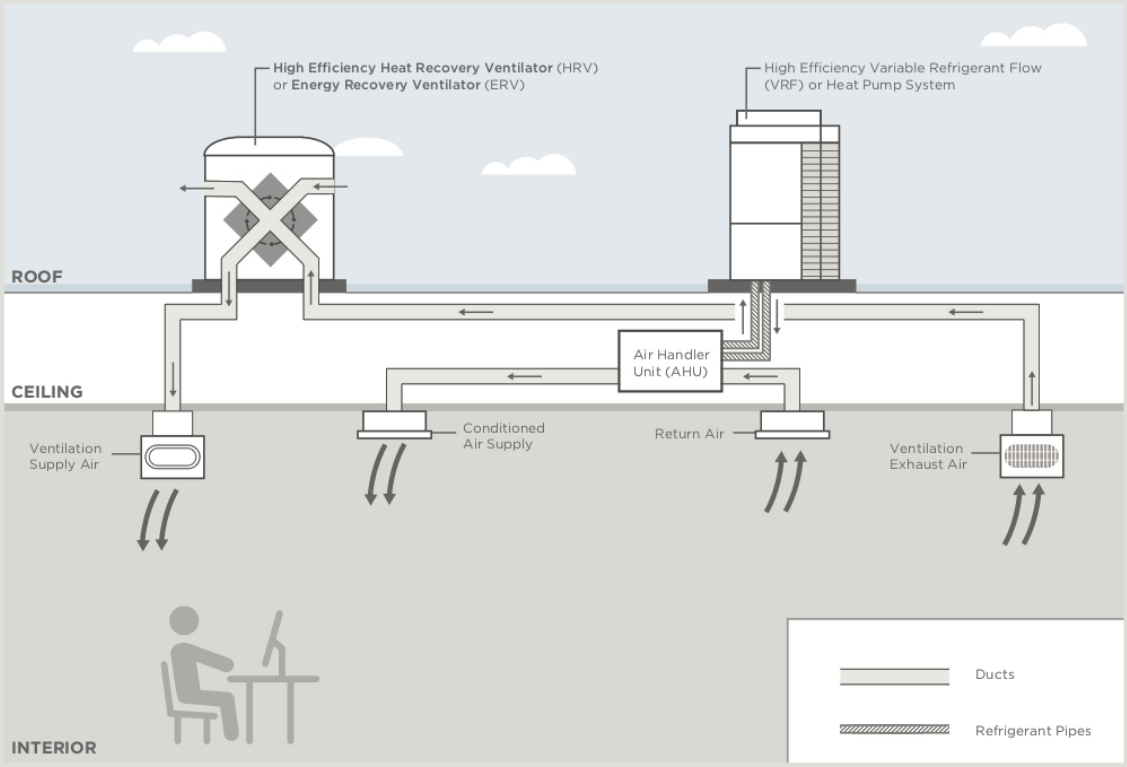
An ideal HVAC system for customers who value sustainability

Meets 2018 Washington code requirements for new construction or retrofit HVAC installations *(to be shared with WA groups only)*

Card Sort

Instructions: Capture the pros and cons of why you & your peers would consider the Very High Efficiency DOAS approach. Quickly sort the "cards" below into the 3 columns. Each person should sort one row of cards.

PROS	CONS	NEITHER PRO NOR CON
Building aesthetics	Professional relationships	Changing established business practices	Few high efficiency equipment manufacturers	Lack of experience with a manufacturer	Vendor relationships
Functionality	Meeting code	Durability	Time	Professional reputation	
Owner/client expectations	Team communication	Lack of experience with a very high efficiency DOAS approach	Cost	Physical site limitations	



Convince a Peer

SALES PITCH

Instructions: Create a SALES PITCH that will convince a peer to consider this Very High Efficiency DOAS approach.

[Put your Sales Pitch here]

SELLING POINTS

Instructions: Include SELLING POINTS to back up your Sales Pitch (peers might be skeptical!).

[Put your Selling Points here]

NAME

What's the best NAME for this approach?

[Put your Name here]