



October 15, 2020

REPORT #E20-411

HVAC Market Actor Profile Report

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

Prepared by:
Joe Van Clock, Associate

Apex Analytics, LLC
1717 Bluebell Ave.
Boulder, CO
80302

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

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Executive Summary

This report presents findings from research into the decision-making processes underlying small-to-medium (less than 25-tons) commercial HVAC installations from the perspective of HVAC contractors. NEEA contracted with Apex Analytics, LLC and its partner, EcoMetric Consulting (the research team) to investigate two key research objectives:

- › Understand the motivations, information sources, and decision-making processes of workers involved in commercial HVAC installations
- › Understand the “business side” of commercial HVAC installation companies (including market influences, profitability, and employee recruiting and retention).

The research team reviewed existing research on the HVAC market and conducted two primary data collection activities to address these objectives: four online focus groups with a total of 13 HVAC contractors and in-depth interviews with 26 HVAC contractors.

Key Findings

Motivations and Information Sources

HVAC contractors are motivated by the potential to achieve customer satisfaction: they receive gratification from knowing that they increased a customer’s comfort or allowed the customer to focus on their work without thinking about their HVAC system. HVAC contractors are also motivated by the opportunity to solve problems and overcome technical challenges.

Staying up to date on HVAC technologies and applications is important for HVAC contractors. It supports their ability to achieve two key sources of job satisfaction: achieving customer satisfaction and overcoming technical challenges, and it helps to ensure their projects are profitable. Better-trained installers require less time from supervisors and are less likely to need to address corrections from building inspectors.

HVAC contractors primarily turn to vendors (manufacturers, manufacturers’ representatives, and distributors) for information about HVAC technologies and applications. This information ranges from online videos and brown-bag lunches to more detailed continuing education. For example, HVAC contractors reported vendors typically provide in-person seminars three to four times a year either at the HVAC contractor’s location or hosted periodically by the vendor.

HVAC contractors also undergo training to maintain professional certifications.¹ Vendors provide training to support these efforts, and HVAC contractors also reported looking to professional organizations, unions, and state contractor boards for this type of training.

Decision-Making Processes

There are multiple potential paths to purchase and installation for small-to-medium commercial HVAC equipment. The contractor’s role in the path to purchase and installation is determined by the system design approach. As Figure 1 summarizes, HVAC contractors have the least influence in plan and specify projects, and the greatest influence in new construction or major renovation projects that take a design/build approach.

Figure 1: HVAC Contractor Influence by System Design Approach

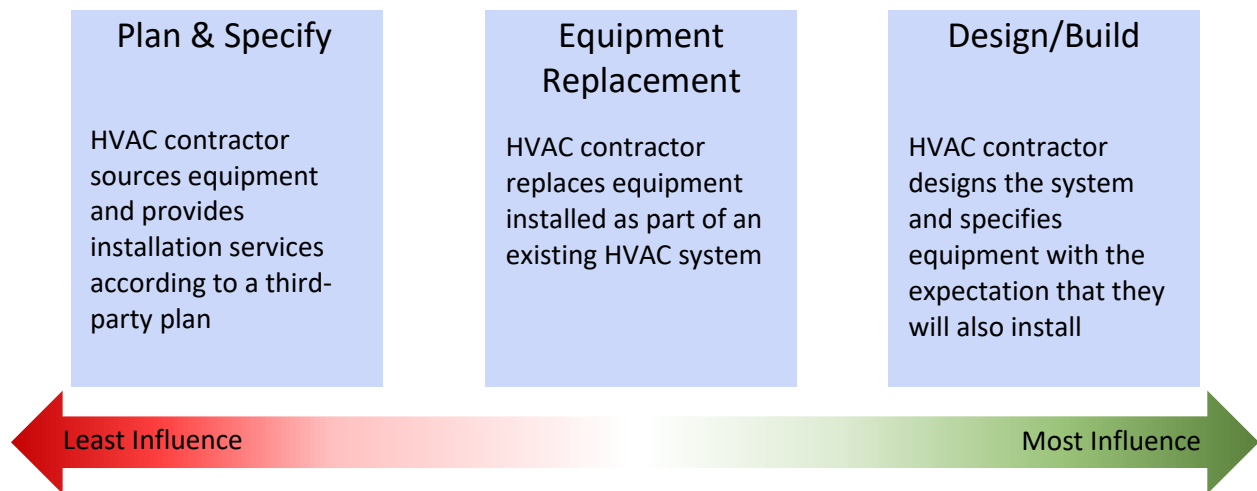


Table 1 provides additional detail on the contractor’s role in system design, their considerations around system design and equipment recommendations, and the limitations they face under each system design approach.

¹ Certifications cited include North American Technical Excellence (NATE), as well as electrical and refrigerant certifications.

Table 1: Contractor Experience in Key Project Types

	Plan and Specify	Equipment Replacement	Design/Build
HVAC Contractor Role in System Design	Limited. Third-party engineer designs system.	Selects equipment, may seek assistance from distributors	Designs system & selects equipment, may seek input from distributors and/or partner engineers
HVAC Contractor Design Considerations	<ul style="list-style-type: none"> • Value engineering • Opportunities to differentiate bid from competitors 	<ul style="list-style-type: none"> • Existing infrastructure (e.g. duct work, roof curbs) • Functionality of existing system 	<ul style="list-style-type: none"> • Characteristics of space • Use of space • Code • Customer priorities and budget
Limitations on Design	<ul style="list-style-type: none"> • Need to meet specified requirements 	<ul style="list-style-type: none"> • Equipment availability • Timing • Cost • Potential to trigger more stringent code review 	<ul style="list-style-type: none"> • Customer priorities and budget

HVAC contractors generally favor efficient equipment both because they believe it will increase customer satisfaction and because efficient equipment is generally more expensive and thus provides more revenue for the HVAC contractor. Despite these positive sentiments, HVAC contractors estimate that approximately 30% of small-to-medium commercial HVAC installations are more efficient than code requires. HVAC contractors described four factors that increase the likelihood they will install efficient equipment in a small-to-medium commercial building:

- › **Design/build projects:** As noted above, the HVAC contractor has the greatest opportunity to influence system design and equipment selection in design/build projects. Smaller commercial properties operated by independent, private sector businesses are most likely to take a design/build approach.
- › **Owner-occupied buildings:** HVAC contractors perceive that small-to-medium commercial customers are more likely to install efficient HVAC equipment in public and owner-occupied buildings, like doctor or dentist’s offices. HVAC contractors stated that owners and managers of leased properties more often prioritize cost and reliability over efficiency.
- › **Projects in which the contractor interacts directly with the customer decision-maker:** Communicating the value of efficient equipment can be challenging for HVAC contractors when they have to work through an intermediary like a general contractor. In addition to the challenges inherent in passing a

message through a third-party, the general contractor does not directly benefit from energy savings.

- › **Equipment replacements with opportunities to significantly ease installation or improve functionality:** Making significant changes to an HVAC system in an equipment replacement scenario has the potential to greatly increase the project cost and time requirements relative to a more limited, like-for-like replacement. As a result, HVAC contractors typically only recommend more comprehensive upgrades with potential to provide greater energy savings when there is an opportunity for a significant improvement in functionality, an opportunity to simplify the system and installation, or both.

Business Side of Commercial HVAC Installation

The business environment in which commercial HVAC contractors operate drives a tendency toward risk aversion. HVAC contractors generally “stay in their lane,” focusing on projects that fall within their area of expertise. Two key factors contribute to this tendency:

- › **Importance of relationships:** Building and maintaining relationships with end-use customers and general contractors is central to HVAC contractors’ business development approach. HVAC contractors develop these relationships by providing exceptional service to end-use customers and by reliably completing tasks on time and on budget for general contractors. HVAC contractors are reluctant to take risks that could result in systems that do not perform adequately, damaging these relationships.
- › **Cost of callbacks:** One HVAC contractor reported that a typical HVAC installation could yield a profit between 18% and 25%. However, contractors noted that the need to return to the business and address issues after the installation was complete could eliminate an installation’s profit. As a result, HVAC contractors are selective in the projects they pursue and the equipment they recommend in order to avoid installations they are not confident will meet the customer’s needs.

Consistent with their tendency toward risk aversion, HVAC contractors typically work with a limited set of partners in their small-to-medium commercial installations. Most contractors work with a small number of preferred distributors and manufacturers, with the level of service and technical support available a key consideration in HVAC contractors’ selection of these vendors. HVAC contractors often look to vendors for help in identifying specific equipment options for a given application. Distributors support equipment replacement projects by maintaining databases of existing equipment they can use to identify replacement options with a similar configuration. HVAC contractors also typically maintain relationships with a small group of engineers they call on for design support in projects that are outside their area of expertise or that require an engineer’s stamp for permitting.

Conclusions and Recommendations

Conclusion 1: Persuasive engagement with HVAC contractors will draw from their motivations for customer satisfaction and drive to solve technical problems.

Messaging focused on the energy and non-energy benefits that efficient systems provide to customers could resonate with contractors' motivation to achieve customer satisfaction. Messaging focused on the potential for efficient systems to provide solutions to common technical problems could speak to the motivation HVAC contractors find in resolving technical challenges.

- › **Recommendation 1: NEEA should develop case studies showcasing the energy and non-energy benefits to customers of efficient technologies and the potential for those technologies to overcome technical challenges.** Case studies provide an opportunity to develop a narrative around the benefits of efficient systems and illustrate those benefits in a specific, concrete situation. These case studies could primarily be directed toward an installer audience, although they could also be a tool that installers could share with their customers when relevant.

Conclusion 2: The business benefits of a well-trained workforce could motivate HVAC contractors to support training their staff to install efficient equipment. HVAC contractors perceive that installing efficient equipment requires a better-trained workforce. HVAC contractors also recognize that well-trained installers require fewer resources to supervise and reduce the risk of potentially costly installation errors. As a result of these benefits, contractors often support technical training for installers.

- › **Recommendation 2: NEEA should promote training on efficient equipment with an emphasis on the business benefits of a trained workforce.** Training is important in enabling contractors to install efficient equipment and giving them the confidence to promote efficient options. While existing industry training offerings may provide sufficient training on efficient options, NEEA could encourage contractors to participate in them. The potential cost savings in reduced management time and reduced risk of error may resonate with HVAC contractors.

Conclusion 3: Program strategies targeting contractors are likely to be most influential in new construction and major renovation installations in smaller, owner-occupied facilities. While contractors generally value energy efficiency, their opportunities to influence system design and promote efficiency are limited in plan and specify and equipment replacement scenarios. The facility types most likely to take a design/build approach, giving contractors the greatest opportunity to influence design, overlapped with the types most likely to install efficient

equipment: independent, private-sector businesses, in smaller, owner-occupied facilities. In some cases, specialized needs around temperature and humidity or greater concern about comfort or indoor air quality provide further motivation for these facilities to install more efficient systems.

- › **Recommendation 3: NEEA should pursue contractor-focused market intervention strategies for technologies likely to be installed in smaller, owner-occupied commercial buildings.** Doctors' and dentists' offices, indoor grow operations, and some restaurants and retail often meet the conditions that provide contractors the greatest opportunity to promote efficiency. Strategies that engage design teams and market actors further upstream, like distributors and manufacturers' reps, may be more effective than contractor outreach in influencing HVAC installations in other types of facilities.

Conclusion 4: Split incentives are an important barrier to efficiency in small-to-medium commercial HVAC installations. Contractors perceived that the owners and managers of leased buildings, who were not responsible for the energy costs, prioritized low upfront costs and reliability over efficiency. Split incentives, and other communication barriers, can also come into play when a general contractor acts as an intermediary between the HVAC contractor and the customer. A general contractor may have limited HVAC knowledge and may not see notable benefits from installation of a more efficient HVAC system. As a result, the general contractor may see the HVAC system as an opportunity to reduce costs through value engineering and may not effectively communicate the benefits of efficiency to the building owner.

- › **Recommendation 4: In designing small-to-medium commercial market interventions, NEEA should seek opportunities to facilitate direct interaction between building owners and HVAC contractors.** Contractors reported they can more effectively promote efficiency when they interact with building owner decision-makers directly. Program elements like the design charettes that are part of some new construction programs could facilitate direct interaction between HVAC contractors and building owners.

Conclusion 5: HVAC contractors tend to be risk averse, and installations yielding the greatest efficiency improvements are likely to pose risks from the contractor's perspective. An HVAC contractor's role in the system design, and thus the risk to their reputation if that design proves ineffective, is limited when they install equipment to a third-party's specification. Similarly, a like-for-like equipment replacement can be expected to provide similar functionality to the existing system, limiting the risk of customer dissatisfaction. The installations likely to provide the greatest opportunity for efficiency improvements – design/build new construction projects and equipment replacements involving larger changes to the system –

require that HVAC contractors take more responsibility for system design. As a result, the HVAC contractor takes on more risk that the design will not meet the customer's needs. Taking on those risks require that HVAC contractors have design capabilities and confidence in the designs they generate.

- › **Recommendation 5: Include strategies to mitigate the risk of proposing system designs including efficient equipment in market intervention efforts.** A variety of tools could help reduce the risk of efficient designs to HVAC contractors, from comprehensive technical support to communication tools to educate end-use customers about the benefits and operation of efficient systems. More intensive strategies could include program-provided commissioning and quality control, or even funds to offset the cost of callbacks on highly-efficient systems.

Conclusion 6: There may be an opportunity to classify HVAC contractors based on the share of their work that is equipment replacement. The share of an HVAC contractor's work that is equipment replacement appears to be correlated with both the distribution of the contractor's work between residential and commercial buildings and the types of new construction projects the HVAC contractor most often conducts. These divisions may overlap with more qualitative differences in their approach to the market, although the small sample sizes and qualitative nature of this research make it difficult to draw definitive conclusions. Table 2 summarizes these groups.

Table 2: Potential Contractor Classifications

Contractor Group	Equipment Replacement as Share of Installations	Distribution of Work by Sector	Primary Type of New Construction
Bid & Install: Business focused on winning competitive bids for installation, primarily based on price.	Low (1/3 or less)	Primarily Commercial	Plan & Specify
Full Service: Businesses providing a broad range of services, from maintenance and equipment replacement to new construction. Maintain a broad, in-house knowledge base, including in-house design capabilities, to support diverse project types.	Moderate (Between 1/3 and 2/3)	Mixed	Design/Build
Maintenance & Reliability: Primarily do high volumes of similar installations in the residential sector. Will take on commercial work when it is within their expertise, with a focus on getting the system up and running reliably.	High (More than 2/3)	Primarily Residential	Plan & Specify

If the distinctions between contractors' business approaches hypothesized in Table 2 are accurate, HVAC contractors falling into the Full Service group would likely be the most receptive to efficiency interventions. These HVAC contractors are likely to have the greatest technology knowledge and design capabilities, and most likely to propose more innovative system designs.

- › **Recommendation 6: NEEA should conduct further research to assess the validity of the contractor groupings proposed in Table 2.** In addition to clarifying differences in business approach associated with the share of work comprised of replacement installations, this research should explore ways to identify full-service contractors in the market to support program targeting efforts.

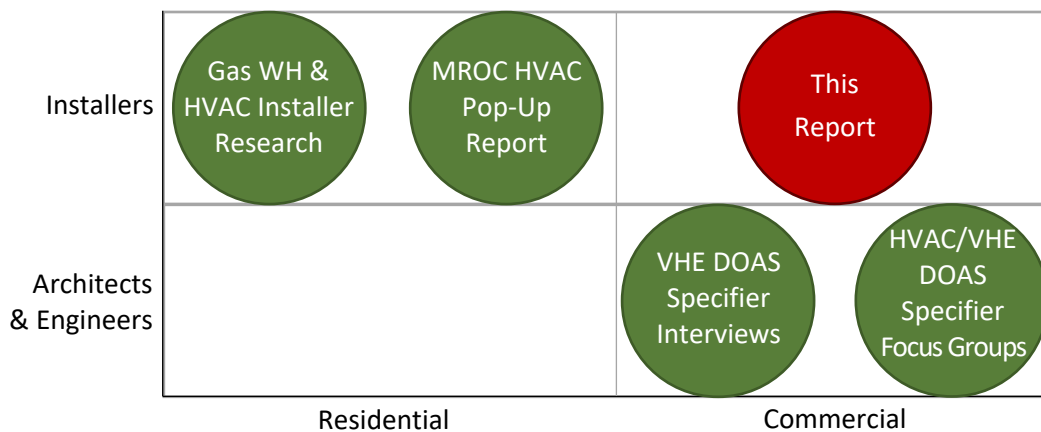
1. Introduction

This report presents findings from research into the decision-making processes underlying small-to-medium (less than 25 tons) commercial HVAC installations, from the perspective of HVAC contractors.² NEEA contracted with Apex Analytics, LLC and its partner, EcoMetric Consulting (the research team) to conduct this research.

NEEA's HVAC Product Group is considering the energy savings and market potential of a variety of HVAC technologies for commercial buildings as well as the most effective market interventions to address that potential. This research supports those efforts by providing background information on the structure and decision-making processes behind small commercial HVAC installations. This research also assessed how installers' approach to key aspects of the HVAC business might affect their decision-making. NEEA will use this information to identify value propositions that resonate with HVAC installers, develop effective messaging, and identify the best channels to communicate with HVAC installers.

This research builds on prior research NEEA conducted into the HVAC market. It adds to existing research efforts through its targeted focus on installers and small-to-medium commercial projects, specifically. As Figure 2 illustrates, NEEA's recent research into HVAC installer decision-making focused on the residential market,³ while research on commercial systems primarily drew on the perspectives of architects and engineers.⁴

Figure 2: Recent NEEA HVAC Research Efforts



² NEEA uses the threshold of less than 25 tons to differentiate small-to-medium commercial HVAC systems that are more likely to use packaged rooftop units or similar equipment rather than large, customized commercial systems.

³ The 2019 Natural Gas Water Heater and HVAC Installer Research Report, by Illume Advising, and the 2019 MROC HVAC Pop-Up Report by MarketVision Research.

⁴ The 2020 HVAC/Very High Efficiency Dedicated Outside Air System (VHE DOAS) Specifier Interviews Research by the Cadeo Group.

1.1 Research Objectives

NEEA has defined two broad objectives for this research, as well as several, more specific research questions within each objective. Table 3 lists these objectives and the associated research questions.

Table 3: Research Objectives

Objective	Research Questions
<i>Objective 1: To understand the motivations, information sources, and decision-making processes of workers involved in HVAC installations</i>	
Motivations	1. What motivates installers?
	2. What are their pain points?
Information Sources	3. Where do installers get information?
	4. Are employees required to get continuing education credits? If so, where do they find these opportunities?
Decision Making	5. What is the path to purchase and installation? How are employees in different roles involved in the path to purchase?
	6. Who makes decisions about what throughout the entire path to purchase and installation? Are there differences in the approach or decision-making process based on building type (new construction vs. retrofit, medium vs. small, etc.)?
	7. Do they select projects? If so, how do they select them?
	8. When would an HVAC installation be likely to be “above code” and why? What are the up and downsides of working above code by individual and role?
<i>Objective 2: To understand the “business side” of HVAC installation companies</i>	
Business Model	1. What sells, and why?
	2. What influences in the market place inform their decisions (e.g., what their competitors are doing)?
	3. Why do installers sell particular products/manufacturers? What is the history of their manufacturer relationships?
	4. Do they partner with other firms for some jobs? If so, what do the partners contribute? Why those particular partners?
	5. How do firms structure a deal/install so that they make money? What are essential rules they must follow to be profitable?
Staffing and Talent Pipeline	6. To what extent are installation firms experiencing a shortage of skilled workers? What are drivers of any such shortage? What are firms doing in response?
	7. To what extent are workers “poached” between firms? How are firms responding?

The data collection period for this research took place early in the COVID-19 pandemic, as stay at home orders were first coming into effect in Northwest states and as restrictions began to be lifted. In addition to addressing the research objectives and research questions NEEA defined, the research team also explored the effect of the pandemic on HVAC contractors' business and the anticipated effect of the pandemic on the HVAC workforce.

2. Research Approach

The research team reviewed existing literature to ensure this study built on that foundation of research. This review included studies from the Northwest and other jurisdictions as well as online HVAC industry publications.⁵ The research team conducted two primary data collection activities to address NEEA's research objectives, focus groups and interviews.

2.1 List Development, Sampling, and Recruiting

The research team sought to base this research on a representative sample of HVAC firms active in small-to-medium commercial facilities in the Northwest. The team began with a business database export of all firms classified as working in plumbing, heating, and air conditioning. The team merged this list with trade ally lists from program administrators across the region and used these trade ally lists to identify characteristics of contractors working in commercial HVAC, which could further narrow the industry list. This process resulted in a recruiting sample frame of 8,297 companies distributed across Idaho, Montana, Oregon, and Washington.

The research team screened focus group and interview participants to ensure they met certain key criteria:

⁵ A full bibliography of sources for this review is included in Appendix A: Literature Review Sources.

Table 4: Respondent Screening Criteria

Criteria	Metric
Ability to reasonably identify trends and characterize what is typical in small-to-medium commercial HVAC installations	At least 20% of all installations are commercial systems 25 tons or less ¹
Exposure to small-to-medium commercial installation decision-making	Involved in sales, recommending equipment types, or installation
Installation (as opposed to maintenance and repair service) makes up a significant share of business ²	Equipment installation is at least 20% of small commercial HVAC work

¹ Researchers used their discretion, considering the full range of screening responses, to accept four interview respondents and one focus group participant with a lower share of commercial installations. These HVAC contractors operated in rural areas where fewer commercial opportunities were available.

² Included in interview screening only.

Recruiting efforts coincided with stay at home orders associated with the COVID-19 pandemic, and later the lifting of those orders. As a result, HVAC contractor availability and response varied widely over the course of the data collection period. Ultimately, the research team achieved a combined response rate of 5.2% across focus groups and interviews. Additional detail is available in Appendix B: Sampling and Recruiting Approach Detail.

2.2 Online Focus Groups

The research team conducted four online focus groups with contractors involved in small commercial HVAC sales and installation. As Table 5 shows, the research team segmented the focus groups by company size and geographic location. In total, 13 HVAC contractors participated in the focus groups, which took place on April 23 and April 30, 2020, and lasted 90 minutes each.

Table 5: Number of Participants by Focus Group

Company Location	Small Firms (<10 employees)	Large Firms (≥10 employees)
West of Cascades	3	4
East of Cascades	4	2
Total	7	6

2.3 In-Depth Telephone Interviews

The research team conducted in-depth telephone interviews with 26 HVAC contractors. As with focus groups, the research team segmented interviews by company size and geographic location (Table 6). The research team conducted interviews between May 19 and July 2, 2020. Interviews typically lasted between 45 minutes and one hour.

Table 6: Number of In-Depth Interview Respondents by Geography and Size

State	Small Firms (<10 Employees)	Large Firms (≥10 Employees)
Idaho	0	2
Montana	2	3
Oregon	5	6
Washington	3	5
Total	10	16

3. Small Commercial HVAC Contractor Characterization

While NEEA did not explicitly define research objectives related to characterizing the HVAC contractors installing small-to-medium commercial HVAC systems, the research resulted in findings on HVAC contractor characteristics that provide valuable background information in support of NEEA’s research objectives.

3.1 Company Characteristics

Contractors working in commercial HVAC are generally larger companies than those working exclusively in residential HVAC. Interview recruiting efforts identified 31 companies that regularly conduct HVAC installations in small-to-medium commercial buildings.⁶ These companies were both larger, on average, and more likely to have more than 10 employees than the 57 identified companies that do not regularly conduct small-to-medium commercial HVAC installations (Table 7).

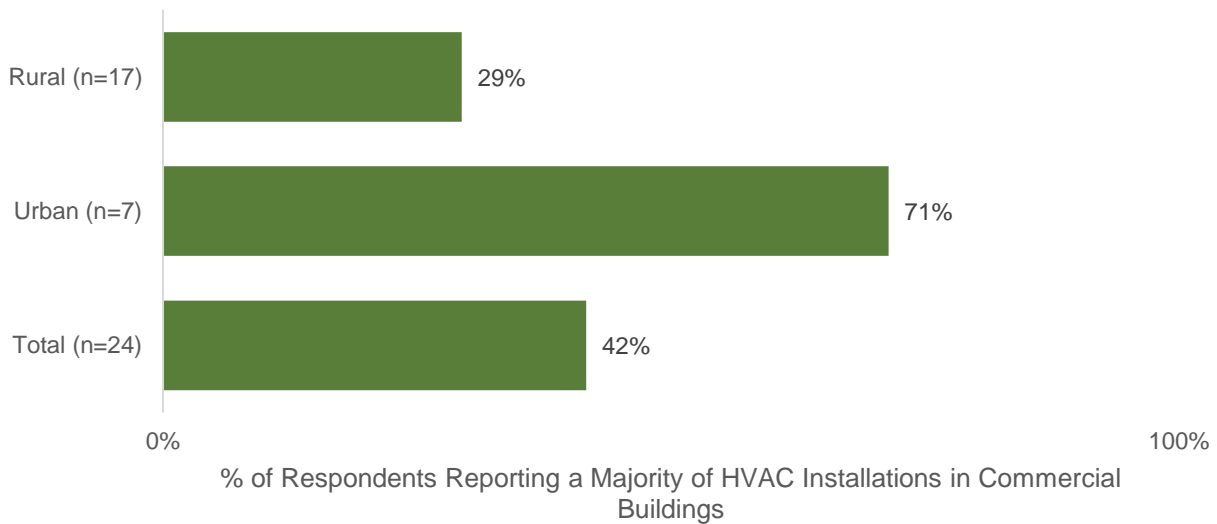
⁶ As described above, the research team set 20% as an initial threshold for small-to-medium commercial installations, but allowed some exceptions for companies conducting as few as 10% of installations in small-to-medium commercial buildings based on an assessment of other screener responses.

Table 7: Size of Commercial HVAC Installers Relative to Residential Installers

	Regularly Conduct Small/Medium Commercial Installations (n=31)	Do Not Regularly Conduct Small/Medium Commercial Installations (n=57)
Average Number of Employees	19.4	8.2
Share with More than 10 Employees	52%	25%

Most HVAC contractors that do small/medium commercial installations do not primarily work on commercial projects. Overall, 58% of interviewed HVAC contractors reported that fewer than half of their installations were in commercial buildings. HVAC contractors in urban areas were considerably more likely to report completing a majority of their installations in commercial buildings than rural HVAC contractors (Figure 3). There was not a notable difference in the share of commercial installations between larger and smaller HVAC contractors.

Figure 3: Share of HVAC Contractors’ Primarily Working in Commercial Buildings



The minority of HVAC contractors who primarily install systems in commercial buildings appear to specialize in commercial work. Most of these HVAC contractors reported that more than three-fourths of their installations were in commercial buildings.

Few HVAC contractors specialize in new construction and major renovation. Most HVAC contractors (58%) reported that maintenance, repairs, and equipment

replacement made up at least half of their small-to-medium commercial HVAC work. An additional 30% reported that more than two-thirds of their small-to-medium commercial installations were new construction.

HVAC contractors installing small-to-medium commercial equipment fall into three groups, defined by the share of their installations that replace existing equipment. Members of each group share common characteristics related to the types of new construction installations they complete and the share of their work that is in commercial buildings.

Table 8: HVAC Contractor Grouping by Share of Equipment Replacement Installations

Equipment Replacement as Share of Installations	Number of Interview Respondents (n=24)	Sector Accounting for Majority of Work	Primary Type of New Construction Installations Completed
Low (0-33%)	7	Commercial (5 of 7)	Plan and Specify (5 of 7)
Moderate (34-66%)	12	Mixed: Residential (7 of 12) and Commercial (5 of 12)	Design/Build (8 of 12)
High (67-100%)	5	Residential (5 of 5)	Plan and Specify (3 of 5)

There were not clear differences between these groups in company size (all three include a mix of small and large firms) and location (all include firms in both urban and rural areas). Qualitative findings also provided limited insights into differences in the way firms within each group approach the market. Nonetheless, these differences may be a topic for future research.

4. Motivations and Decision-Making Processes

4.1 Motivations and Pain Points

4.1.1 HVAC Contractor Motivations

› *What motivates installers?*

HVAC contractors described three key sources of satisfaction in their work:

› **Achieving customer satisfaction:** HVAC contractors reported they were motivated by feedback that they had improved a customer’s comfort or

otherwise solved a problem for the customer. As one HVAC contractor stated, “helping someone work through those challenges and get them to a win at the end of something that seems too daunting...at first is rewarding, getting all those pieces to fit together.” A few interviewed HVAC contractors described their work as “a service to the community” in the sense that they can help businesses meet their heating and cooling needs.

- › **Solving technical problems:** HVAC contractors also reported satisfaction in applying their knowledge to address technical challenges for their customers. According to one, “I really love being able to help people find solutions. When people call me and have questions, I have expertise. I can help them get comfortable.” Another HVAC contractor reported gaining satisfaction from developing the expertise to solve these technical problems, saying “there is a lot of science that goes into what we do, if you actually do it right, and really getting to learn more about that is pretty fun.”
- › **Building relationships within the industry:** Finally, some HVAC contractors reported finding satisfaction in the relationships they had built within the industry and the opportunity to help less experienced staff develop professionally. One HVAC contractor said, “one of the most rewarding things is to go out on a job and see one of my past apprentices working independently and knowing I’ve had an impact on him.”

4.1.2 HVAC contractor Pain Points

- › *What are [installers’] pain points?*

Mundane, day-to-day aspects of running a business are a source of frustration.

Ensuring staff are available to carry out a project and managing those staff were among the most common frustrations that HVAC contractors described. While two contractors reported that lack of staff availability was a frustration, respondents more often expressed frustration with the reliability and need for supervision of their staff.

HVAC contractors also expressed frustration with administrative tasks that could be time-consuming or complex. These tasks include coordinating schedules to ensure equipment delivery, cranes, and installation staff are all available when needed to keep a project on schedule. One HVAC contractor explained, “say something doesn’t get shipped when it’s supposed to be...You have a timeline, but it doesn’t happen because of some error in the supply chain...then you get pressure from the customer.” The administrative and bureaucratic aspects of obtaining permits were also a source of frustration for HVAC contractors, who reported the process could be time consuming. One HVAC contractor said, “there are so many [code officials] that...are great and want what’s best for me and the end customer, but there are people...that are not that way. They get very frustrating to me.” Finally, HVAC

contractors expressed frustration with unhappy customers or customers whose decision-making processes were particularly long and complicated.

4.2 HVAC Contractor Education and Information Sources

- › *Where do installers get information?*
- › *Are employees required to get continuing education credits? If so, where do they find these opportunities?*

HVAC vendors (distributors, manufacturer’s reps, and manufacturers) are a primary source of information about new HVAC technologies for HVAC contractors. HVAC contractors reported receiving information from distributors, manufacturers’ reps, and manufacturers in a variety of ways, ranging from in-person seminars, to brown-bag lunches, to online videos. As one HVAC contractor stated, “I can go to my suppliers and they really do well in keeping me up to date on any changes they may have, because they stay up to date.” Similarly, another HVAC contractor reported that “vendors do a good job of creating value by offering seminars, classes, information on new products. There is a lot out there through the vendors.” HVAC contractors also mentioned that vendors provide information on local codes as well as technical support to resolve installation issues.

HVAC contractors also reported receiving information about the HVAC industry from industry organizations,⁷ and trade publications,⁸ although HVAC contractors indicated they rely on these sources less than vendors.

While some HVAC contractors reported using some online sources and social media to gather information about the HVAC industry, these were not primary information sources for most. YouTube and manufacturers’ websites were the most common online information sources that HVAC contractors reported using. Six HVAC contractors reported using social media sites, including Facebook, LinkedIn, and Instagram. HVAC contractors noted that there are Facebook groups for HVAC business owners and women in HVAC. These are closed groups, and the research team was unable to access and review the contents of posts.

HVAC contractors described two primary types of continuing education: education to learn about new technologies and education to maintain professional certifications. As Table 9 shows, manufacturers are a key source of continuing education focused on technologies. Some manufacturers also require HVAC

⁷ Organizations listed include: Air Conditioning Contractors of America (ACCA), Air Conditioning, Heating, and Refrigeration Institute (AHRI), the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE), the Building Operators and Managers Association (BOMA), NEXSTAR Network, and Plumbing-Heating-Cooling Contractors Association (PHCC).

⁸ Trade publications listed include: *Contractor Magazine*, *Contracting Business*, *Plumbing & Mechanical*, and *ACHR News*.

contractors to maintain certain certifications to be authorized dealers for their products. Distributors and manufacturers provide training to help HVAC contractors maintain these certifications. HVAC contractors also reported looking to professional organizations, unions, and the state for this type of training.

Table 9: Continuing Education Topics and Sources

Continuing Education Purpose	Source of Training	Frequency and Duration
Learn about new technologies and product applications	Manufacturers Manufacturers Representatives Distributors	Onsite training provided at HVAC contractor location 3-4 times per year Some staff attend 1-2 week training events held annually
Maintain professional certifications (e.g. North American Technical Excellence (NATE), refrigerant, electrical)	Distributors Professional Organizations Unions State	As required to maintain certification (e.g. NATE requires 16 credit hours every 2 years)

HVAC contractors reported encouraging employees to attend trainings and some provided support for training including paying the cost of training for their employees and allowing employees to attend training on paid time. Two large HVAC contractors reported they had in-house training programs. These HVAC contractors provided limited detail about their in-house training programs. One noted that their in-house training involved pairing less experienced staff with senior or specialized staff and gradually increasing the level of independence with which the new staff would complete tasks. A third HVAC contractor reported hosting brief, online training sessions focused on new products, product application, or service at least twice a week, with a mix of in-house content and content provided by distributors or manufacturers.

4.3 HVAC Project Decision-Making

4.3.1 Path to Purchase and Installation

- › *What is the path to purchase and installation? How are employees in different roles involved in the path to purchase?*
- › *Who makes decisions about what throughout the entire path to purchase and installation? Are there differences in the approach or decision-making process*

based on building type (new construction vs. retrofit, medium vs. small, etc.)?

There are multiple potential paths to purchase and installation for small-to-medium commercial HVAC equipment. Focus group and interview findings suggest four key factors that define the path to purchase and thus can impact the decision-making processes for HVAC installations. Figure 4 illustrates these factors.

Figure 4: Factors Determining HVAC Contractor Role in System Design

Installation Type	System Design Approach	Contractor Management	Contractor Selection
Equipment Replacement	Like-for-Like Replacement	Direct Hire	Maintenance Relationship
New Construction/ Major Renovation	Plan and Specify	Through GC or Architect	Preferred Vendor
	Design/Build		Competitive Bid

Table 10 provides additional detail on the elements within each factor.

Table 10: Factors Influencing the Path to Purchase and Installation

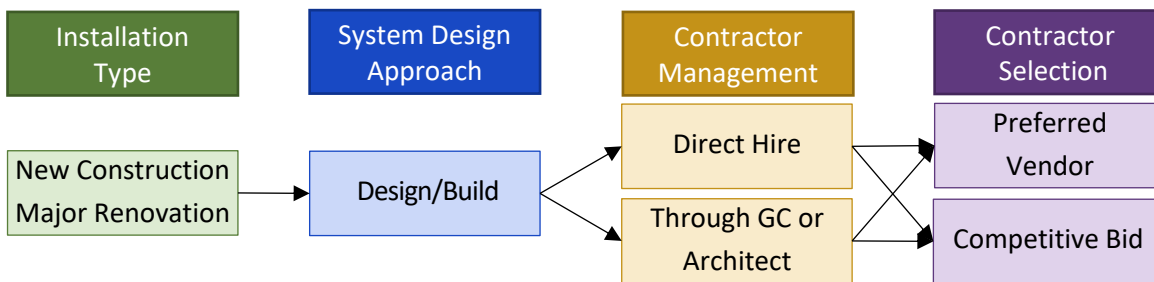
Key Factors		Definition
Installation Type	Equipment Replacement	Installations replacing existing equipment, typically when that equipment has failed or needs significant repairs.
	New Construction/ Major Renovation	Installations of equipment in new buildings or spaces where existing HVAC systems have been removed as part of a larger renovation project.
System Design Approach	Like-for-Like Replacement	Replacement of existing equipment with equipment of the same type. Replacement equipment could be high efficiency or just meet code requirements.
	Plan and Specify	An architect or another HVAC contractor designs the system and specifies equipment. The building owner/manager or general contractor solicits bids for installation of the specified system.
	Design/Build	The building owner/manager or general contractor selects an HVAC contractor to design the system and specify equipment with the understanding that HVAC contractor will also install the equipment.
Contractor Management	Direct Hire	The building owner/manager selects the HVAC contractor and oversees their work.
	Through GC or Architect	An architect or general contractor, under contract to the building owner/manager, selects the HVAC contractor and oversees their work.
Contractor Selection	Maintenance Relationship	Many HVAC contractors offer maintenance contracts to building owners and managers. In addition to establishing ongoing relationships with their clients, these contracts provide HVAC contractors with an opportunity to identify and recommend equipment replacements.
	Preferred Contractor	HVAC contractors build relationships with building owner/managers and general contractors, whether through maintenance contracts or previous installation projects. Building owner/managers and general contractors may offer work directly to HVAC contractors with whom they have a relationship.
	Competitive Bid	Building owner/managers and general contractors may solicit bids from multiple HVAC contractors for an installation. The building owner/manager or general contractor may select a small group of HVAC contractors to bid or post the bid publicly for any interested HVAC contractor.

The system design approach is a particularly important factor in determining the role an HVAC contractor will play in system design and installation and the opportunities and constraints on their ability to influence system design and equipment selection.

4.3.1.1 Design/Build New Construction or Renovation

HVAC contractors have the greatest flexibility around system design and equipment selection in design/build new construction or renovation projects, in which the HVAC contractor who installs the system also designs the system. As Figure 5 indicates, design/build projects occur in new construction and major renovation situations. While the HVAC contractor makes equipment selection decisions in equipment replacement projects, aspects of the existing system impose constraints on those decisions that do not apply to design/build new construction or major renovation projects (see section 4.3.1.2 for additional details). As one HVAC contractor said, “[design/build new construction] allows us to have more control and utilize in-house design capabilities.”

Figure 5: Design/Build Path to Purchase



The contractor management and contractor selection approaches can vary for design/build projects. The general contractor managing the construction or renovation project may hire an HVAC contractor to design and install the HVAC system, or the property owner or manager may hire the HVAC contractor directly. HVAC contractors reported greater opportunity to sell efficient systems when they interact directly with the building owner or manager.

While building owners or general contractors may seek competitive bids for a design/build project, HVAC contractors more often reported winning these projects through their relationships with building owners and general contractors. As one HVAC contractor said, “We have some customers come to us and say, ‘We know you guys design stuff, and we have this place that needs equipment. Here is a vague idea of what we want.’” Another HVAC contractor similarly reported that relationships with general contractors could lead to design/build opportunities, saying, “We have had general contractors that we do a lot of plan and specify with, and they will call up with a project and say...‘I want you to design this and just take

care of it.” Interview findings suggest that HVAC contractors may also take on difficult or complex design/build projects for customers or general contractors with whom they have relationships that they may not otherwise pursue.

Design/build projects make up a minority of small commercial HVAC installations.

Only two of the 26 interviewed HVAC contractors indicated that design/build projects made up half of their installations or more. On average, design/build projects make up approximately one-fourth of the interviewed HVAC contractors’ work.

Consistent with findings from prior studies, interview findings confirmed that design/build projects tend to be in smaller commercial properties operated by independent, private-sector businesses. One HVAC contractor gave an example of a restaurant or small retail business in a 2,000 square-foot space in a strip mall as a customer likely to take a design/build approach.

4.3.1.1.1 HVAC Contractor Role in System Design

HVAC contractor sales staff, estimators, and project managers generally lead the process of designing the HVAC system in design/build projects. Four large HVAC contractors reported their companies have internal engineering staff, while two additional companies reported having internal staff with computer-assisted design (CAD) capabilities.

HVAC contractors may seek assistance from external engineers on larger or more complicated projects. HVAC contractors typically maintain relationships with a small group of engineers who they call on for support.⁹ One HVAC contractor stated, “There are a couple of engineers we will bring in if the job is very complicated or larger than I can handle.” HVAC contractors also reported drawing on their relationships with distributors for engineering support to assist with system design.¹⁰ As one HVAC contractor explained, “if I have any issues with code requirements, or if I am getting into something above my expertise level, I turn to manufacturers or distributors for engineering.”

In addition to complex projects, HVAC contractors work with engineers on projects in which local jurisdictions require plans with an engineer’s stamp. While requirements vary by jurisdiction, HVAC contractors stated the projects requiring an engineer’s stamp typically included larger projects (based on square footage of conditioned space – one HVAC contractor cited 4,000 square feet as a threshold), more complex projects, and any project requiring roof load calculations. An engineer’s stamp is less likely to be required for equipment replacement projects, particularly like-for-like replacements.

⁹ See section 5.4.1 for additional information on contractors’ partnerships with engineers.

¹⁰ See section 5.3 for additional information on contractors’ relationships with distributors.

A few HVAC contractors reported they list stamping as an exclusion, an item that their contracts specifically list as outside the scope of their projects. These HVAC contractors reported they generally do not pursue projects requiring an engineer's stamp and, if needed, obtaining a stamp would be the customer's responsibility.

Engineers typically play an active role in system design when HVAC contractors bring them onto a project. As one HVAC contractor explained, "We don't want them to be just the stamper. We want them to be part of it. They have a lot of information and knowledge." Two HVAC contractors reported that the engineers they work with typically have a more limited role, of reviewing a design the HVAC contractor had already developed.

HVAC contractors may look to manufacturers' representatives for advice in selecting equipment when the project is outside the HVAC contractor's area of expertise. According to one HVAC contractor, "if...we are not quite sure what will be the best fit...for the application that we are looking at, we will get...the distribution channel of the manufacturer involved to get their advice and input." In addition to selecting equipment, manufacturers' representatives will help with commissioning on larger projects. One HVAC contractor specified that a manufacturer's representative would typically be involved in commissioning on projects larger than five tons.

4.3.1.1.2 **Design Considerations and Constraints**

HVAC contractors described five broad considerations in designing systems as part of design/build projects:

- › **Customer needs and constraints:** HVAC contractors reported assessing their customers' budgetary constraints, the extent to which the customer prioritizes efficiency, and the importance of non-energy benefits like aesthetics, noise reduction, and comfort when designing HVAC systems. Describing these considerations, one HVAC contractor said, "It comes down to people and what they want. And you've got to be pretty open to a lot of different concepts or ideas and design to not only make it work right, be reliable, but also make them happy." HVAC contractors emphasized that it was important for them to interact directly with the customer to effectively consider these items and noted that it could be difficult to have that direct contact with building owners in some cases when they were working with a general contractor.
- › **Use of space:** HVAC contractors reported that understanding the configuration and use of the space an HVAC system was going to condition was an important consideration for system design. HVAC contractors gave examples ranging from dentists' offices where surgeries needed to be cooler than waiting rooms to grow operations or florists with very specific temperature and humidity needs. One HVAC contractor said, "We're not just

going to throw a system on the roof and say it's good to go, and they're in there making windows with fire. You have to take into account what the building is going to be used for, how many people are going to be in it, what kind of BTUs it's going to have." Some HVAC contractors further reported designing systems to accommodate any future planned expansion, including potentially oversizing systems.

- › **Physical characteristics of space:** HVAC contractors reported that the size of the building, its orientation, and characteristics of the building envelope like insulation levels and the size and location of windows are all inputs into their system design. HVAC contractors also reported considering how the characteristics of the space may impact the logistics of completing the installation, including the potential to bring in a crane and the need for additional roof support.
- › **Code:** HVAC contractors reported that meeting energy codes, mechanical codes, and structural codes was an important consideration in their equipment design decisions. As one HVAC contractor said, "Obviously, it's code, mechanical code as well as energy code, that's the biggest thing," another HVAC contractor stated "Energy efficiency code, in our area, runs everything." HVAC contractors reported that codes for commercial buildings could be complex. Codes can also motivate HVAC contractors to install certain types of equipment, for example, one HVAC contractor noted that meeting code requirements related to noise often led him to install higher-efficiency systems, and others noted a reduced need to engineer roof loads as a benefit of installing ductless systems.
- › **HVAC contractor experience and comfort with equipment:** Reliability is a key consideration for HVAC contractors in their system design and equipment selection decisions. Reliable equipment reduces the need for callbacks, which can reduce or eliminate an installation's profitability, and benefits HVAC contractors in building maintenance relationships with customers. As a result, some HVAC contractors reported working with equipment with which they were familiar. One HVAC contractor explained, "a lot of the design/build, after you do it for so long, you just know [what type of equipment] you want to use."

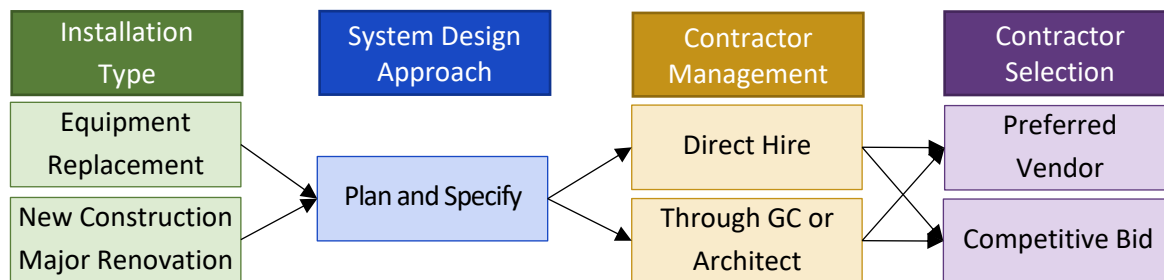
4.3.1.2 Plan and Specify New Construction or Renovation

HVAC contractors play the smallest role in system design and equipment selection in plan and specify projects. An engineer typically designs the system in plan and specify projects and the customer or general contractor solicits bids for installation. These designs may be project-specific or used across multiple, similar buildings in the building owner's portfolio. For example, HVAC contractors reported that some national chains use a common system design in all their locations, across the

country.¹¹ In other cases, HVAC contractors reported that a building owner or manager will ask an HVAC contractor to design a system and then seek bids for installation from that HVAC contractor and others.

While plan and specify projects are primarily new construction, HVAC contractors estimated that between 20% and 35% of plan and specify projects are equipment replacements. Figure 6 summarizes the path to purchase for plan and specify projects.

Figure 6: Plan and Specify Path to Purchase



While building owners or general contractors may offer plan and specify projects directly to a preferred HVAC contractor, HVAC contractors most often described these projects in the context of competitive bids. HVAC contractors reported variation in the approach building owners and general contractors use to solicit these bids, with some projects issued as an open solicitation to any interested HVAC contractor, while others will seek bids from a smaller, select group of HVAC contractors. HVAC contractors reported that projects soliciting a more limited set of bids were more desirable because they generally faced less intense price competition than open bid projects. According to one HVAC contractor, “We try to avoid [open-bid solicitations] because you could be bidding against six or seven sheet metal companies and that gets out of hand. Normally, what we deal with is a specified contractor inviting a select few.”

Most HVAC contractors reported doing both plan and specify and design/build projects, but there was considerable variation in the share of HVAC contractors’ work that plan and specify projects made up. Six HVAC contractors indicated that plan and specify projects made up a majority of their installations, while eight reported plan and specify projects were less than 10% of their installations. HVAC contractors reported that national chain retailers, publicly owned facilities, and larger or more complicated projects were more likely to take a plan and specify approach to equipment installation.

¹¹ One contractor noted that this approach can result in specifications for equipment that is not sized appropriately for the Pacific Northwest climate.

4.3.1.2.1 HVAC Contractor Role in System Design

HVAC contractors have limited opportunity to influence the system design in plan and specify projects. HVAC contractors reported that the client's investment in developing the design prior to seeking bids made them unlikely to agree to significant changes. As one HVAC contractor explained, "The client has already paid an engineer...I don't feel that it's my job to change it or make strong recommendations to do something different at that point." In addition, HVAC contractors noted that, to be competitive, their bids needed to reflect the specified design. One HVAC contractor said, "When you bid something, you try to stay close to how it's specified because everybody else is. If you are going to get the bid, you need to do that."

Nonetheless, HVAC contractors reported that some general contractors or engineers, particularly those with whom they had strong relationships, were more open to the HVAC contractors' suggestions on the plans than others. According to one, "If you're on really good terms with the engineer, almost like a friendship basis, a lot of times, they will work with you." Several HVAC contractors specified they would typically bring up any suggested changes to the plans after winning the project. HVAC contractors reported they typically finalize and gain the customer or general contractor's approval on all plans before installation.

The only changes HVAC contractors reported making during the installation process were adaptations to address any unexpected findings or conditions, like leaks or the need to route refrigerant lines around structural beams, that would prevent installation of the equipment as planned. As one HVAC contractor explained, "In the plan and specify, you are at the mercy of the prints, because if you deviate from those prints, then if anything goes wrong, the installer is on the hook...once you have your design, you are basically telling the customer this is what you are going to get, and if they don't get that, you are on the hook."

4.3.1.2.2 Design Considerations and Constraints

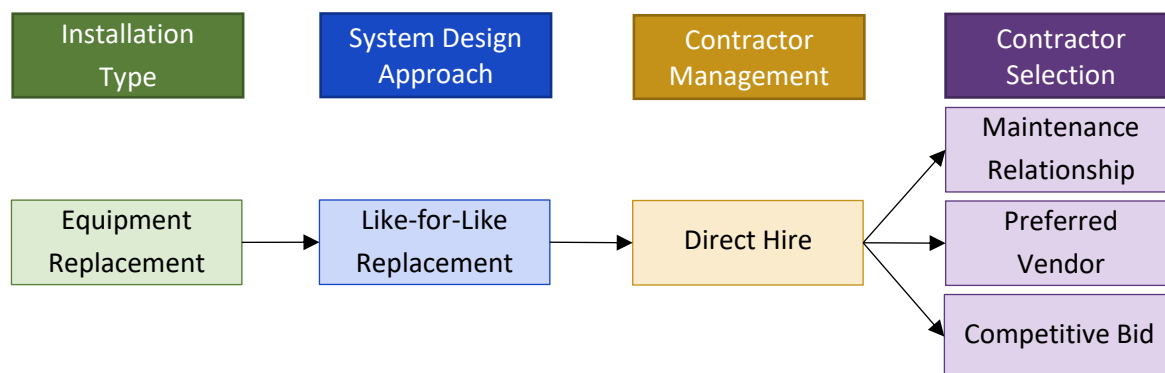
HVAC contractors seek opportunities to add unique value to differentiate themselves from competitors in plan and specify bids. HVAC contractors reported that, in some cases, they do this by offering options for value engineering, to meet the needs of the design at a lower cost. HVAC contractors noted that, on plan and specify projects, the cost of the specified design often exceeds the project's budget and general contractors will often ask the HVAC contractors for value engineering suggestions. One HVAC contractor said, "Engineers think they get paid by the page; the more they add, the more they make. They design these elaborate systems, which is fine as long as [clients] have the budget. Lots of people don't have the budget for it." Other strategies HVAC contractors described to differentiate themselves included demonstrating a high level of engagement with the project by asking lots of questions and seeking to build a relationship with the client or

providing additional lifecycle cost analysis and “outside the box” solutions in addition to the solicited bid.

4.3.1.3 Equipment Replacement

The existing infrastructure at the site and, potentially, the need to quickly replace failed equipment constrain HVAC contractors’ recommendations in equipment replacement installations. As Figure 7 suggests, a general contractor or architect would rarely be involved in an equipment replacement installation; instead, the HVAC contractor typically works directly with the building owner or manager. HVAC contractors often identify opportunities for equipment replacement through their maintenance relationships with customers. However, building owners or managers may also reach out to HVAC contractors they have worked with in the past or seek multiple bids for the replacement.

Figure 7: Equipment Replacement Path to Purchase



Equipment replacement makes up the majority of small-to-medium commercial installations for most (15 of 26 interviewed) HVAC contractors, with some reporting that more than 80% of their installations were replacements. This section focuses on equipment replacement projects in which the HVAC contractor is primarily responsible for selecting the equipment. Nonetheless, some equipment replacement projects take a plan and spec approach, with the customer hiring a third party to specify the equipment. HVAC contractors estimated that between 20% and 35% of plan and specify projects were equipment replacements.

4.3.1.3.1 HVAC contractor Role in System Design

HVAC contractors stock and install residential HVAC equipment for use in certain commercial situations and do not stock larger commercial equipment. As past studies have reported, HVAC contractors purchase larger commercial equipment on an as-needed basis.

HVAC contractors most often work with vendors (including distributors, manufacturers, and manufacturers' representatives) in selecting the specific equipment to recommend in replacement installations. HVAC contractors most often stated they would provide vendors with the general equipment type they planned to install and the project specifications and ask the vendor to recommend specific equipment options for the project. As one HVAC contractor explained, "we are telling them what we are working on...and they are helping us select the equipment that would work best for the application."

HVAC contractors reported that vendors maintain databases they can use to find technical details like the dimensions and location of the electrical disconnect on a customer's existing equipment. Vendors can use this information to identify the best replacement equipment and HVAC contractors can use it to estimate project costs.

One HVAC contractor noted that a vendor's ability to clearly explain the benefits and drawbacks of each option was one reason for their loyalty to that vendor. Vendors provide the information HVAC contractors present to their commercial customers. One said, "We will meet with [the vendor] before we meet with the owner to discuss the different options that are available."

A smaller number of HVAC contractors reported they generally select equipment to offer their customers based on their own experience; they do not look to vendors for this advice. One of these HVAC contractors said, "We usually only work with one manufacturer on the equipment side of things, so we know their product offerings really well."

4.3.1.3.2 **Design Considerations and Constraints**

Changing HVAC system type can significantly increase costs and time requirements relative to a like-for-like replacement. Larger changes to the system may require modifications to existing infrastructure at the site, like duct work and roof curbs. As a result, HVAC contractors can be reluctant to recommend changes to the system type in a replacement scenario. One HVAC contractor said, "To give options that will require a substantial amount of more work to convert something to a new type, that's going to be challenging for the customer to decide to go with."

In addition, HVAC contractors reported that code requirements are often less intensive in a like-for-like replacement than in larger system change. For example, changing the type of equipment may trigger the need to recalculate roof loads, adding cost to the project.

Finally, HVAC contractors noted that replacement installations often occurred when equipment had failed and returning the system to operation quickly was a priority. Interviewed HVAC contractors reported that it may take between half a day and two days to replace a piece of equipment, while a larger system redesign could take

weeks. One HVAC contractor explained that, “Most clients aren’t going to do a major modification to a system unless they are in the middle of a remodel...it’s more about getting them up and running so their tenant or their employees are comfortable.”

Given these constraints, HVAC contractors can be limited in their system design and equipment selection options when replacing an existing system. As one HVAC contractor said, “If you’re dealing with a change-out situation, where the selection of equipment size and efficiency level may be determined completely by the application, your hands may be tied in a lot of ways.”

HVAC contractors reported four considerations that could motivate them to recommend a more significant change to the HVAC system type in an equipment replacement scenario:

- › **Customer concerns** with their existing systems
- › **Flaws in the design of the existing system**, which may have caused its failure
- › **Modifications to the building or the duct work** since the existing equipment was installed
- › **Potential to reduce system complexity** and increase functionality.

Regarding system complexity considerations, one respondent reported replacing systems consisting of a water source heat pump, cooling tower, and large central air handler with a variable refrigerant flow (VRF) system. This HVAC contractor reported installing the VRF system was easier than trying to replace equipment in the existing system and provided additional benefits like zonal application and increased control.

4.3.2 Project Selection

- › *Do they select projects? If so, how do they select them?*

HVAC companies tend to “stay in their lane” when it comes to project selection. Interview respondents commonly look for a niche in the market where they feel comfortable and pursue bids primarily in that space. Half of the interview respondents mentioned a preferred niche or product (e.g. light commercial) they prefer to pursue.¹²

Several HVAC contractors mentioned intentionally not bidding on every available opportunity, if they feel the project is outside their core area of expertise. For example, one HVAC contractor said, “We’re a service-based company. We’re not

¹² The niches and products listed varied, but included contractors focused on service, contractors focused on installations in particular business types, like chain restaurants, contractors focused on installations of particular equipment types, like ductless heat pumps.

the best at everything in the business, but we rank very high in almost every area of the service business.” Scope, timing, and location of potential projects also factor into the decision of whether to bid on a project, as do economic conditions and the availability of work. One HVAC contractor said, “As the economy improves, you become a lot choosier.”

4.3.3 Energy Efficiency Considerations

- › *When would an HVAC installation be likely to be “above code” and why? What are the up and downsides of working above code by individual and role?*

Most small commercial HVAC systems do not significantly exceed code requirements for energy efficiency. On average, HVAC contractors estimated that approximately 30% of their small-to-medium commercial HVAC installations were more efficient than code required. None reported that more than half of their small commercial installations were more efficient than code, and three reported that less than 10% exceeded code. One HVAC contractor elaborated that, “With commercial, energy efficiency is up on the list, but not necessarily at the top.”

Higher upfront costs of efficient systems prevent more customers from selecting them, particularly in equipment replacement installations. HVAC contractors noted that installing more efficient systems could significantly increase the cost of the project. As one HVAC contractor said, “If, for the sake of energy efficiency, you have to change the entire system, it’s a huge change, huge cost, bigger headache. You will never convince the customer to go with a completely different system because it’s more efficient.”

HVAC contractors reported that incentives for energy efficient equipment could be an effective tool to help them sell efficient equipment. One HVAC contractor stated that, “There has to be energy incentives to even want to look at [converting to a ductless heat pump] as an option, otherwise cost is king.” HVAC contractors gave examples of rebates for economizers and variable frequency drives that had helped drive installation of these technologies. Some HVAC contractors noted, however, that commercial HVAC rebate programs were often complex, not well publicized, and program changes could be difficult to track. One HVAC contractor noted that manufacturers may also offer rebates on high efficiency systems, as a way to promote their higher-end products.

4.3.3.1 Customer and Project Types Adopting Efficient Systems

HVAC contractors described two key factors that increase the likelihood a project will include efficient equipment:

- › **Installations in owner-occupied buildings:** HVAC contractors stated that owners and managers of leased properties more often prioritized cost and

reliability over efficiency. According to one HVAC contractor, "If it's a property management company who's overseeing a building for a lot of tenants, they have other considerations and high efficiency isn't always the top of their list." Another HVAC contractor elaborated that "You need to be dealing with somebody who has more skin in the game" to sell an efficient system. As a result, owner-occupied buildings like doctor or dentist's offices, or publicly owned buildings are more likely to select efficient equipment.

- › **Installations in which the HVAC contractor interacts directly with the end customer:** HVAC contractors reported that interacting directly with the building owner can significantly improve the HVAC contractor's ability to promote efficient options. According to one HVAC contractor, "The common denominator [among customers installing efficient equipment] is the opportunity to meet with the buyer, the person in charge of making the decision. That is my goal, because, if I can meet with them, there is a greater chance they will exceed code." Communicating the value of efficient equipment can be challenging for HVAC contractors when they have to work through an intermediary like a general contractor. As one HVAC contractor said, "It's tough to sell efficiency to an architect or a project manager because it doesn't necessarily benefit them as it does the owner."

HVAC contractors reported that these two factors often overlap: it can be difficult to gain direct access to customer decision makers in leased buildings or when the building owner was a large corporation. Some HVAC contractors described strategies they used to get access to customer decision makers. For example, one HVAC contractor reported offering to explain the HVAC system's controls to the customer as part of the proposal process as a way to establish a direct connection with the building owner.

HVAC contractors are better able to promote efficiency in design/build projects. It is more difficult for HVAC contractors to interact directly with project decision-makers in leased building and large corporations, both of which are more likely to take a plan and specify approach. HVAC contractors further reported that plan and specify projects rarely called for efficient equipment. Instead, HVAC contractors often face price competition in plan and specify projects, and HVAC contractors are often asked to provide value engineering.

Previous research suggested that small commercial customers installing efficient equipment were typically motivated by rebates or environmental certifications, like LEED. HVAC contractors provide some support for this. Two HVAC contractors cited environmental certifications as a motivator for customers installing efficient equipment. According to one, "The customers that ask about efficiency are looking for what's sexy, 'Our building is LEED Platinum' or something. They are looking for the title. They are not looking for efficiency in the way you would think people are looking for energy efficiency."

More often, however, HVAC contractors noted more generally that some customers simply placed a higher priority on efficiency. HVAC contractors also noted that some types of businesses have specialized needs that might motivate them to invest in higher-end, and more efficient, equipment. For example, hospitals may be willing to invest in improved indoor air quality, retail or restaurant businesses may be focused on customer comfort, and florists or indoor grow operations may need greater control over humidity and temperature.

4.3.3.2 **Technical and Business Considerations**

HVAC contractors generally favor efficient equipment over standard equipment for two reasons: they believe efficient equipment will result in greater customer satisfaction, and efficient equipment is typically higher cost and thus generates more revenue and profit for their companies. One HVAC contractor said, “A higher efficiency system, that’s a value sell. And when we are able to sell on value, we are able to keep up higher margins. We are able to easily have a happier client at the end, as opposed to a quick-turn replacement.”

Installation of high efficiency systems can be more complex than standard systems, particularly if efficiency gains require larger changes to the existing system. Some HVAC contractors reported little additional effort was required to install a high efficiency system, with two specifically noting that the process of installing a high efficiency rooftop unit was largely the same as installing a standard efficiency unit.

Other HVAC contractors reported that higher efficiency systems were generally more complex, requiring additional controls and commissioning, and, depending on system type, different approaches to venting and condensate management. One HVAC contractor said, “The higher the efficiency, the more careful you have to be to install it. Another explained, “there’s more involved in the high efficiency system, a little more work on my part, a little more overseeing. It’s more rewarding when it’s done, but a little more headache.”

Given this complexity, HVAC contractors noted it was important to use trained installers for high efficiency systems. One elaborated that “The more efficient is going to be more complex, it requires a higher level of education and expertise on the equipment. It’s important to have educated, trained installers.”

Some rural participants reported that more efficient systems often had more complex components that could take longer and be more expensive to obtain in repair situations. Associating this complexity with a lack of reliability, these HVAC contractors stated they were reluctant to recommend the highest-efficiency equipment.

5. Business Model

5.1 Sales Approach and Technologies

› *What sells, and why?*

5.1.1 Sales Strategy and Approach

Client service and relationships are key to business differentiation. The most common theme HVAC contractors repeated during in-depth interviews was that excellence in client engagement is paramount to defining their business reputation. One HVAC contractor stated that “Our whole motto...has been, we take care of our clients, they come back and will take care of us. The biggest thing has been to provide great service.”

HVAC contractors repeatedly discussed the importance of building relationships based on honesty and trust. As one HVAC contractor said, “If I ever gave a seminar on how to have a successful business, it would be two minutes long: Keep in touch, be respectful, do what you say you’re going to do.” Respondents often cited return customers and ongoing maintenance contracts as being a key part of profitability and business success. As one HVAC contractor explained, “At the end of the day, you are the contractor who is going to be married to that system. Your warranty or your maintenance agreement...is going to carry through a lot longer than that general [contractor] is going to be talking about finish and paint and everything else at the end of his project.”

While some HVAC contractors primarily compete on price, others seek to win work through a reputation for value. A few respondents said that competitive pricing was their main approach to win work. According to one, “It’s price, basically, every job should take about the same hours.” One small firm reported they track and price their bids to be the same as their local competition. According to this respondent, “It’s important in a small area to not charge more or less than others. People will find out really fast.” Other firms emphasized selling value. One HVAC contractor explained that their approach was, “Don’t be the cheapest, sell value.” Another elaborated that “Our job is not to be the low bid, but to get the [general] contractor to say, ‘I want to use [company] on the project’ because of our reputation.”

While HVAC contractors seem to perceive maintaining a reputation as honest and reliable as necessary, a few of the larger HVAC contractors talked about going further to stand out from the competition. One large firm in a (large) rural town said they emphasize excellent quality, while another large urban firm said they sometimes offer additional options to their bids. HVAC firms that look to do high-end work mentioned medical and dental practices as key clients because those business types often look for air filtration in addition to consistent comfort.

HVAC contractors are divided in their approach to presenting efficient options to small commercial customers. Some routinely present efficient options, often as part of a “good, better, best” option set, while others seek to determine customer interest in efficiency before presenting options. Describing the later approach, one HVAC contractor explained that “You just have to drill down and understand: are they looking to do the bare minimum or something that will be of more value? Then...give them options, show them ‘Here is what you can get away with and here is what would address more of your concerns.’ It’s about communication and dialog.”

There were no clear patterns differentiating HVAC contractors taking each approach. HVAC contractors who do not routinely recommend efficient options reported they would do so if the client expresses interest in energy and environmental impacts or if the client views the building and equipment as a long-term investment. One HVAC contractor said, “In discussions with the customer, you find out: are you looking for just comfort, reliability, energy savings? What are you looking for? Then you develop your plan from there.”

HVAC contractors view their sales role as educating customers about the benefits and drawbacks of the various equipment options available. Customers would then use this knowledge to select an option that best balances their needs with their priorities and budget constraints. As one HVAC contractor explained, “Our job is to explain it well enough so they understand it and can make an informed decision. The biggest challenge is to do that as best we can.” HVAC contractors reported that, when discussing efficient options with customers, they broaden the conversation to include non-energy and financial benefits, rather than focusing more narrowly on upfront cost and ability to meet code. According to one HVAC contractor, “If you’re selling a high efficiency system...you’re talking about quality of life stuff as opposed to talking about budget or is this up to code?”

5.1.2 Popular Technologies

Ductless heat pumps are popular in the small commercial subsector. Several HVAC contractors mentioned ductless heat pumps as a technology they prefer to install, noting their popularity with customers. Other HVAC contractors noted that demand for cooling is increasing and providing cooling can make a property more appealing to tenants, increasing the appeal of ductless heat pumps. According to one HVAC contractor, “As global warming has been increasing, it’s been interesting to see how much we do need air conditioning in the summer. Our requests for air conditioning have skyrocketed.”

VRF and ductless heat pump systems were the most common technologies HVAC contractors mentioned as efficient options. HVAC contractors noted these systems provide both energy efficiency and non-energy benefits like noise reduction and improved zonal control. These systems can also provide benefits from the HVAC

contractor's perspective in that respondents reported they are relatively easy to install. One HVAC contractor explained the appeal of VRF and ductless systems, saying "We're trying to find a budget solution that forces us into a lot higher efficiency bracket in order to simplify the systems that we're installing so we can install them faster and be able to get approval quicker."

HVAC contractors reported that ductless systems may also more easily meet code requirements. For example, two HVAC contractors reported that installing a highly efficient ductless system allowed them to bypass codes requiring a dedicated outside air source. As a result, the system would not need an energy recovery ventilator, making the ductless system more cost-competitive with the alternative. As one of these HVAC contractors explained, "There are outside air codes that you can bypass a dedicated outside air source by going with a high efficiency ductless...it then becomes a price point because, to meet code, you have to put a different system in and run electrical to it, like an [energy recovery ventilator]."

HVAC contractors reported that rooftop unit installations were less likely to be high efficiency. HVAC contractors stated that, while the efficiency of rooftop units has improved, it still lags that of residential equipment and the options available for efficient rooftop units, particularly for heating, were considerably more limited than the efficient options available for residential equipment. As one HVAC contractor said, "Efficiency-wise, packaged units, or things like that, are pretty limited on options. Out of any specific brand, you only have one or two choices in the same tonnage."

5.2 Market Influences

- › *What influences in the marketplace inform their decisions (e.g., what their competitors are doing)?*

HVAC contractors usually track their competition. As one said, "We keep an eye on them, they keep an eye on us." HVAC contractors reported doing this primarily to better understand what the competition is doing, and how they are pricing their work. One HVAC contractor explained, "We also watch their pricing. We can tell if they're hungry. You'll see them get a lot of work, get buried." A few HVAC contractors also mentioned market positioning and continual company improvement as drivers for tracking the competition. The primary mechanism for learning about competitors was through word of mouth and customer feedback (e.g. sharing what other firms had bid).

5.3 Selection of Products and Manufacturers

- › *Why do they sell particular products/manufacturers? What is the history of their manufacturer relationships?*

HVAC contractors typically work with a limited set of preferred distributors and manufacturers. HVAC contractors most often reported working with their preferred vendor due to the level of customer service and technical support the vendor provides. As one HVAC contractor stated, “We have to recognize that all equipment we deal with is mechanical, and machines break down. I need to know, when I sell equipment, that I have support available.” Similarly, another HVAC contractor said, “The customer service [vendors] provide me is just as important as the customer service that I provide my clients.”

HVAC contractors also consider the availability of equipment and replacement parts in selecting distributors and manufacturers; ordering a part that is not in stock could increase the time needed to repair a customer’s system, decreasing the customer’s satisfaction. Some rural HVAC contractors work as much as two hours from the nearest distributor location. A few HVAC contractors reported working with multiple distributors and manufacturers to maintain the greatest flexibility in equipment for each situation.

5.4 Relationships with Other Market Actors

- › *Do they partner with other firms for some jobs? If so, what do the partners contribute? Why those particular partners?*

In addition to their close relationships with vendors, HVAC contractors reported partnering with engineers and general contractors on some HVAC installations.

5.4.1 Engineers

HVAC contractors most often call on a small group of engineers for advice or stamped plans. Most HVAC contractors reported they maintain relationships with a small number of engineering firms, who they work with regularly. As one HVAC contractor stated, “Most heating contractors will partner up with a group you know and trust.” Another HVAC contractor said, “We have great relationships with local engineers. We can pick who is best suited for a certain type of project and feel we have the best guy on the job every time.”

5.4.2 General Contractors

HVAC contractors maintain strong relationships with certain general contractors, which can provide them with work and allow increased input on system design. HVAC contractors reported developing these relationships through experience working with the general contractor, completing projects reliably and demonstrating their competence. As one HVAC contractor described, “We have done work together for so many years, we’re basically business partners, it feels like.” HVAC contractors noted that general contractors with whom they have relationships were more open to their input on system design, and in some cases asked them to

design the project directly. According to one HVAC contractor, “We built a relationship [with certain general contractors] and a lot of times, they won’t even deal with having a third-party complete the design because they know we can do it in-house.”

HVAC contractors avoid working with particular general contractors. HVAC contractors also reported being somewhat selective in the general contractors with whom they work. One HVAC contractor said, “If it’s a good company to work for, I’ll want to do more work for them...if it’s not a good job, I’ll want to get out of there.” HVAC contractors noted that working with poorly organized general contractors or those who make requests beyond the scope of the installation could make projects less profitable.

5.5 Profitability and Business Metrics

- › *How do firms structure a deal/install so that they make money? What are essential rules they must follow to be profitable?*

HVAC contractors adhere to two key principles to ensure profitability:

- › **Bid wisely:** Several HVAC contractors reported accurate and “wise” bidding was a vital skill. Whether through repetition, experience and “getting a feel” for a job’s requirements, or whether through detailed, careful post-job analysis of set metrics (e.g. hours, costs, mark-ups), bidding well was the most common factor respondents cited as a way to ensure profitability of their projects. A large HVAC contractor also reported that bidding projects to avoid unexpected, future expenses helps them build positive customer relationships that lead to follow-up work.
- › **Avoid callbacks:** Callbacks to address issues once an installation is complete can eliminate an installation’s profitability for the HVAC contractor. One HVAC contractor reported that HVAC contractors could typically earn a profit of between 18% and 25% on a commercial HVAC installation. However, unexpected labor costs, whether during the installation itself or to address issues after the installation was complete, could eliminate that profit.

HVAC contractors are selective in the projects they take on in order to ensure profitability. Smaller HVAC contractors in particular reported they would pass on jobs if they did not anticipate it would be possible to install a system that would meet the customer’s needs, either due to the conditions in the space or because the customer was not receptive to their advice. According to one HVAC contractor, “if [the customers] start hemming and hawing and want to keep this or keep that, or want to do things that I know are going to be a callback nightmare...I walk away.”

HVAC contractors see risk in proposing the lowest-cost equipment if that equipment will not as effectively meet the client’s needs, potentially resulting in callbacks. One

HVAC contractor noted that, as a smaller company with fewer overhead costs, they were typically able to offer relatively low bids. This HVAC contractor reported they were underbid in some cases but suspected the low bidders in those cases failed to recognize some aspect of the project that would increase the complexity of the installation. This HVAC contractor and another reported that failing to fully recognize the needs of an installation could result in callbacks. One said, “the worst thing you can do is go out there...and you put in the new system and they’re calling you back in a month saying...something’s going on.”

5.6 Employee Recruiting and Retention

- › *To what extent are installation firms experiencing a shortage of skilled workers? What are firms doing in response?*

HVAC companies often pride themselves on being a great place to work. Many HVAC contractors reported that their firms offer competitive salary and benefits in order to attract and retain top-quality employees. Several respondents also talked about creating a positive culture, with some smaller firms comparing the culture to a family.

The pandemic did not appear to significantly affect worker availability and/or recruiting. Although the COVID-19 pandemic appeared to produce some newly unemployed workers, overall, respondents reported a relatively steady flow of business throughout the spring, although the timing of routine maintenance, in many cases, was delayed by a month or more. The result has been a busy late spring/early summer for many HVAC contractors now looking to catch up on deferred maintenance work. Therefore, this study did not find a significant change in worker availability due to the pandemic.

Ensuring staff are trained in the commercial equipment they install can help HVAC contractors mitigate the risk a project will run over budget. Focus group participants noted that commercial installations can be complex, and installations of efficient equipment can be still more complex than standard installations. HVAC contractors reported that well-trained installers could help to keep a project on-budget by needing less support and by making fewer mistakes requiring follow-up work. As one HVAC contractor explained, “Any time you have to expend more resources to be able to advise those guys doing an install, it takes from the profitability. Because the longer they take on the jobs, that takes from profitability. The more the inspector writes you up because your guys don’t know what they’re doing, it’s going to cut into the profitability.”

6. Conclusions and Recommendations

Conclusion 1: Persuasive engagement with HVAC contractors will draw from their motivations for customer satisfaction and drive to solve technical problems.

Messaging focused on the energy and non-energy benefits that efficient systems provide to customers could resonate with contractors' motivation to achieve customer satisfaction. Messaging focused on the potential for efficient systems to provide solutions to common technical problems could speak to the motivation HVAC contractors find in resolving technical challenges.

- › **Recommendation 1: NEEA should develop case studies showcasing the energy and non-energy benefits to customers of efficient technologies and the potential for those technologies to overcome technical challenges.** Case studies provide an opportunity to develop a narrative around the benefits of efficient systems and illustrate those benefits in a specific, concrete situation. These case studies could primarily be directed toward an installer audience, although they could also be a tool that installers could share with their customers when relevant.

Conclusion 2: The business benefits of a well-trained workforce could motivate HVAC contractors to support training their staff to install efficient equipment. HVAC contractors perceive that installing efficient equipment requires a better-trained workforce. HVAC contractors also recognize that well-trained installers require fewer resources to supervise and reduce the risk of potentially costly installation errors. As a result of these benefits, contractors often support technical training for installers.

- › **Recommendation 2: NEEA should promote training on efficient equipment with an emphasis on the business benefits of a trained workforce.** Training is important in enabling contractors to install efficient equipment and giving them the confidence to promote efficient options. While existing industry training offerings may provide sufficient training on efficient options, NEEA could encourage contractors to participate in them. The potential cost savings in reduced management time and reduced risk of error may resonate with HVAC contractors.

Conclusion 3: Program strategies targeting contractors are likely to be most influential in new construction and major renovation installations in smaller, owner-occupied facilities. While contractors generally value energy efficiency, their opportunities to influence system design and promote efficiency are limited in plan and specify and equipment replacement scenarios. The facility types most likely to take a design/build approach, giving contractors the greatest opportunity to

influence design, overlapped with the types most likely to install efficient equipment: independent, private-sector businesses, in smaller, owner-occupied facilities. In some cases, specialized needs around temperature and humidity or greater concern about comfort or indoor air quality provide further motivation for these facilities to install more efficient systems.

- › **Recommendation 3: NEEA should pursue contractor-focused market intervention strategies for technologies likely to be installed in smaller, owner-occupied commercial buildings.** Doctors' and dentists' offices, indoor grow operations, and some restaurants and retail often meet the conditions that provide contractors the greatest opportunity to promote efficiency. Strategies that engage design teams and market actors further upstream, like distributors and manufacturers' reps, may be more effective than contractor outreach in influencing HVAC installations in other types of facilities.

Conclusion 4: Split incentives are an important barrier to efficiency in small-to-medium commercial HVAC installations. Contractors perceived that the owners and managers of leased buildings, who were not responsible for the energy costs, prioritized low upfront costs and reliability over efficiency. Split incentives, and other communication barriers, can also come into play when a general contractor acts as an intermediary between the HVAC contractor and the customer. A general contractor may have limited HVAC knowledge and may not see notable benefits from installation of a more efficient HVAC system. As a result, the general contractor may see the HVAC system as an opportunity to reduce costs through value engineering and may not effectively communicate the benefits of efficiency to the building owner.

- › **Recommendation 4: In designing small-to-medium commercial market interventions, NEEA should seek opportunities to facilitate direct interaction between building owners and HVAC contractors.** Contractors reported they can more effectively promote efficiency when they interact with building owner decision-makers directly. Program elements like the design charettes that are part of some new construction programs could facilitate direct interaction between HVAC contractors and building owners.

Conclusion 5: HVAC contractors tend to be risk averse, and installations yielding the greatest efficiency improvements are likely to pose risks from the contractor's perspective. An HVAC contractor's role in the system design, and thus the risk to their reputation if that design proves ineffective, is limited when they install equipment to a third-party's specification. Similarly, a like-for-like equipment replacement can be expected to provide similar functionality to the existing system, limiting the risk of customer dissatisfaction. The installations likely to provide the greatest opportunity for efficiency improvements – design/build new construction

projects and equipment replacements involving larger changes to the system – require that HVAC contractors take more responsibility for system design. As a result, the HVAC contractor takes on more risk that the design will not meet the customer’s needs. Taking on those risks require that HVAC contractors have design capabilities and confidence in the designs they generate.

- › **Recommendation 5: Include strategies to mitigate the risk of proposing system designs including efficient equipment in market intervention efforts.** A variety of tools could help reduce the risk of efficient designs to HVAC contractors, from comprehensive technical support to communication tools to educate end-use customers about the benefits and operation of efficient systems. More intensive strategies could include program-provided commissioning and quality control, or even funds to offset the cost of callbacks on highly-efficient systems.

Conclusion 5: There may be an opportunity to classify contractors based on the share of their work that is equipment replacement. The share of an HVAC contractor’s work that is equipment replacement appears to be correlated with both the distribution of the contractor’s work between residential and commercial buildings and the types of new construction projects the HVAC contractor most often conducts. These divisions may overlap with more qualitative differences in their approach to the market, although the small sample sizes and qualitative nature of this research make it difficult to draw definitive conclusions. Table 11 summarizes these groups.

Table 11: Potential Contractor Classifications

Contractor Group	Equipment Replacement as Share of Installations	Distribution of Work by Sector	Primary Type of New Construction
Bid & Install: Business focused on winning competitive bids for installation, primarily based on price.	Low (1/3 or less)	Primarily Commercial	Plan & Specify
Full Service: Businesses providing a broad range of services, from maintenance and equipment replacement to new construction. Maintain a broad, in-house knowledge base, including in-house design capabilities, to support diverse project types.	Moderate (Between 1/3 and 2/3)	Mixed	Design/Build
Maintenance & Reliability: Primarily do high volumes of similar installations in residential sector. Will take on commercial work when within their expertise, with a focus on getting the system up and running reliably.	High (More than 2/3)	Primarily Residential	Plan & Specify

If the distinctions between contractors’ business approaches hypothesized in **Error! Reference source not found.** are accurate, HVAC contractors falling into the Full Service group would likely be the most receptive to efficiency interventions. These HVAC contractors are likely to have the greatest technology knowledge and design capabilities, and most likely to be willing to propose more innovative system designs.

- › **Recommendation 6: NEEA should conduct further research to assess the validity of the contractor groupings proposed in Table 11.** In addition to clarifying differences in business approach associated with the share of work comprised of replacement installations, this research should explore ways to identify full service contractors in the market to support program targeting efforts.

Appendix A: Literature Review Sources

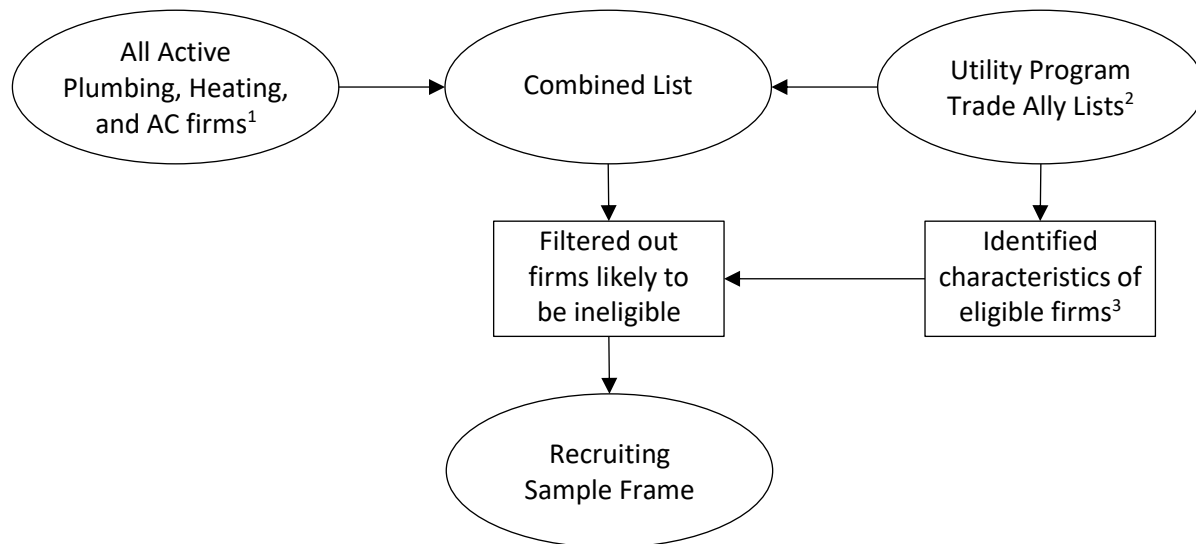
1. Bonneville Power Administration, *HVAC Market Intelligence Report*, April 2016
2. Bonneville Power Administration, *Commercial HVAC Market Characterization*, July 7, 2015
3. NEEA, *Commercial High-Performance HVAC Market Characterization*, June 1, 2019
4. NEEA, *Rooftop HVAC Market Characterization Study*, February 16, 2017
5. NEEA, *Commercial Code Enhancement Audience Research Study*, September 19, 2019
6. NEEA, *MROC Report HVAC Pop-Up*, January 17, 2019
7. NEEA, *Natural Gas Water Heater and HVAC Installer Research Report*, March 20, 2019
8. Personal communication with Terry Malloy, TMI Energy (Illinois-based HVAC contractor)
9. ACHRNews, Various articles and opinion pieces
10. HVAC Insider <https://hvacinsider.com/>
11. HVACR Business <http://www.hvacrbusiness.com/>
12. Supply House <https://www.supplyht.com/>
13. Engineered Systems Magazine <https://www.esmagazine.com/>
14. Contractor Magazine <https://www.contractormag.com/training>
15. Northwest HVACR Training <https://www.inwhvac.org/>

Appendix B: Sampling and Recruiting Approach Detail

Sample Development

The research team sought to develop a regionally representative sample of HVAC firms working in small-to-medium commercial facilities to support the primary research questions and objectives. The team applied a rigorous quantitative approach to ensure that all regional firms working in small-to-medium commercial facilities were given a chance to be selected. The team further sought to ensure that data collection activities would include respondents that were not regional trade ally firms with known utility program relationships. Figure 8 summarizes the research team’s sample frame development approach.

Figure 8: Sample Frame Development Approach



¹ Firms with North American Industry Classification System (NAICS) code 238220 (Plumbing, Heating, and Air Conditioning).

² List sources include Energy Trust of Oregon, Puget Sound Energy, Northwest Trade Ally Network, Northwestern Energy, Idaho Power, and Avista Utilities.

³ Characteristics include associated Standard Industry Classification (SIC) codes and presence or absence of key terms in company name.

The research team acquired a list from Mergent Intellect¹³ of all known active HVAC firms in zip codes served by NEEA’s funders, based on the businesses’ North

¹³ <https://www.mergentintellect.com/>

American Industry Classification System (NAICS) code.¹⁴ The data included geographic information, basic contact information, and firmographic fields including company size, recent annual sales, basic company structure, and additional Standard Industry Classification (SIC) code information. This list included 14,546 firms. The research team merged company leadership contact information with the final sample to facilitate recruiting.

The research team merged known commercial HVAC trade ally lists from six regional program administrators, representing the entire NEEA service area into the master Mergent Intellect list.¹⁵ Table 2 lists the regional trade ally sources and list sizes.

Table 12 HVAC Utility Program Trade Ally List Sources

Regional HVAC Utility Program Trade Ally List Source	# of records
Northwest Trade Ally Network (BPA, Tacoma Utilities, Clark PUD)	138
Puget Sound Energy	178
Northwestern Energy	134
Idaho Power	56
Energy Trust of Oregon	186
Avista Utilities	46
Total	745

The regional trade ally data both provided enhanced contact information and served as a basis for further screening of the master list, to identify firms unlikely to work in commercial HVAC installation (e.g., plumbing-only firms). The research team used combinations of Standard Industrial Classification (SIC) code and company name for this secondary screening. For example, SIC codes for fire alarms, sprinklers, solar, piping, and irrigation indicated likely non-HVAC firms. Further, there were very few known regional trade ally firms with the term “plumbing” in their name without the additional terms “Heating” and/or “Cooling.” The research team used this insight to further screen the master list. Similar screens were performed for sheet metal and refrigeration contractors. These SIC and name

¹⁴ This search included firms classified under the NAICS code for Plumbing, Heating, and Air Conditioning (238220).

¹⁵ Due to variations in company name between the master list and trade ally lists, the research team used fuzzy merging algorithms (Levenshtein distance values were calculated between all name combinations and name matches were assumed valid with a score ≥ 94) to provide valid company name matches while limiting the need for hand coding and manual inspection.

screens, and removal of duplicates, reduced the master list to 8,297 potential HVAC firms. Table 3 shows sample frame screens by state.

State	Master HVAC Industry List	Screened Non-HVAC Firms	Recruitment Sample Frame	Recruitment Eligibility Estimate*	Estimated Small-to-Medium Commercial HVAC Population*
Oregon	4,249	1,797	2,452	61%	1,503
Washington	6,622	2,841	3,781		2,318
Idaho	2,318	1,120	1,198		735
Montana	1,357	491	866		531
Total	14,546	6,249	8,297		5,087

*Estimated after combining eligibility focus group and interview recruiting rates averages

The combined post recruitment focus group and interview eligibility screening rate was 61% resulting in a final study estimated population of 5,087 regional companies conducting HVAC installations in small-to-medium commercial facilities.

Respondent Recruiting

The research team drew random samples from the overall sample frame for interview and focus group recruiting, supplementing initial samples with additional records, also drawn at random, as needed. Ultimately, focus group recruiting efforts included outreach to 599 companies, and in-depth interview recruiting efforts included outreach to an additional 616 companies.

Puget Sound Energy sent emails to its trade allies and NEEA sent emails to all additional sampled trade allies for whom email addresses were available on the research team’s behalf, introducing the project and encouraging their participation. The Bonneville Power Administration also included an item in its trade ally newsletter informing readers about the study. The research team made multiple attempts to reach each sampled firm by phone. For both focus group and interview recruiting, the research team worked with Consumer Opinion Services, whose staff conducted contractor outreach and administered the screener. Trained members of the research team moderated all focus groups and conducted all the interviews. The research team offered focus group participants an incentive of \$175. Interview respondents were initially offered a \$50 incentive, but the research team increased

that amount to \$75 due to lower than anticipated response to interview recruiting efforts.¹⁶

Table 13 provides combined response rates for the focus group and in-depth interview recruiting efforts. Due to overlap in recruiting efforts for the two data collection activities, the research team does not report response rates for each data collection effort individually.¹⁷

Table 13: Response Rates

Disposition		Number of Records
Complete	Focus Group Participants	13
	Interview Respondents	26
Contact Not Reached (left message, not available, etc.)		591
Refused		115
Not Eligible ¹		233
Bad Phone Number ²		237
Incidence Rate (share of records meeting sample requirements)		61%
Response Rate (share of eligible records participating in research)		5.2%

¹ Includes firms that do not conduct HVAC work, firms in the HVAC industry that do not install HVAC systems (e.g. duct cleaning), and HVAC installers that did not meet screening requirements.

² Where possible, recruiters used web searches to identify alternate contact information if the phone number provided did not work.

It is important to note that recruiting efforts for this study coincided with stay at home orders associated with the COVID-19 pandemic and, later, the lifting of those orders. As a result, HVAC contractor availability and response varied widely over the course of the data collection period. Specifically, focus group recruiting efforts, which occurred in March and April encountered a higher-than-usual number of closed businesses, but many contacted participants were willing to participate. Interview recruiting efforts occurred as businesses were reopening, and many contractors were very busy.

The contractors that participated in the research brought a wide range of perspectives, although the sample is not proportionally representative of the region in some key areas. As Table 14 shows, known trade allies are overrepresented among research participants, as are large firms and contractors from Oregon.

¹⁶ Seven interview respondents received \$50 incentives, while 18 respondents received \$75. One respondent declined the incentive.

¹⁷ Specifically, several interview respondents were recruited through follow-up outreach to companies selected for focus group recruiting who were unable to participate in focus groups.

Nonetheless, the sample includes views from both trade allies and non-trade allies, large and small firms, and from contractors operating across the region. Given the qualitative nature of this study, this diversity of viewpoints is sufficient to provide insights on HVAC contractor decision making.

Table 14: Comparison of Sample Characteristics to Region

Characteristic		Population	Sample
Share of Known Trade Allies		11%	28%
Company Size	Small (<10 employees)	60%	46%
	Large (≥10 employees)	40%	54%
Location	Idaho	30%	10%
	Montana	9%	15%
	Oregon	26%	44%
	Washington	35%	31%

Appendix C: Data Collection Instruments

Focus Group Screener

Introduction

My name is [NAME], calling from [COMPANY] on behalf of the Northwest Energy Efficiency Alliance, NEEA. I hope you are well, and I know these can be stressful times, but we would really appreciate your participation in some research we are conducting to help NEEA better work with HVAC contractors.

We are planning to hold online focus groups with commercial HVAC contractors to learn about your work. We value your experience and opinions about working in commercial HVAC and would really appreciate the chance to include you. We expect the focus group to take 90 minutes. We'll provide an electronic gift card for \$175 in appreciation for your time and input. Would you be interested in joining us for this type of discussion with other HVAC contractors?

[If concerned about legitimacy:] If you have questions about the study, you can reach out to Lauren Bates at NEEA at LBates@neea.org.

Screening

[If interested in participating:] Great, I'd like to ask just a few short questions to make sure you would be a good fit for a focus group.

[ASK ALL]

- S1. Roughly what proportion of the HVAC systems your company installs are each of the following types?
 - a. Residential
 - b. Commercial, 25 tons or less [IF LESS THAN 20%, GO TO TERMINATION SCRIPT]
 - c. Commercial, greater than 25 tons

[ASK ALL]

- S2. How are you typically involved in small-to-medium commercial HVAC projects? Are you involved in:
 - a. Sales
 - b. Advising on or recommending equipment types
 - c. Installation

- d. What other ways are you involved? [RECORD OPEN-ENDED RESPONSE]

[IF NOT INVOLVED IN SALES, RECOMMENDING EQUIPMENT TYPES, OR INSTALLATION]

S3. 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 sales or installation for small-to-medium commercial projects that might be able to participate in our discussion?

- a. Yes [*Ask to speak with that person and return to introduction; if not available, leave message and record contact information*]
- b. No [GO TO TERMINATION SCRIPT]

[IF INVOLVED IN SALES, RECOMMENDING EQUIPMENT TYPES, OR INSTALLATION]

S4. Great, I would like to gather a few details about your company. Does your company operate from more than one location?

- a. Yes
- b. No

[IF INVOLVED IN SALES, RECOMMENDING EQUIPMENT TYPES, OR INSTALLATION]

S5. How many employees does your company have at your location?

- a. [RECORD OPEN-ENDED RESPONSE – IF ≥ 10 ASSIGN TO LARGE COMPANY GROUP; IF < 10 AND SINGLE LOCATION ASSIGN TO SMALL COMPANY GROUP]

[IF MULTIPLE LOCATIONS]

S6. How many employees does your company have across all its locations?

- a. [RECORD OPEN-ENDED RESPONSE – IF ≥ 10 ASSIGN TO LARGE COMPANY GROUP; IF < 10 ASSIGN TO SMALL COMPANY GROUP]

[IF INVOLVED IN SALES, RECOMMENDING EQUIPMENT TYPES, OR INSTALLATION]

S7. Do you or your customers receive rebates or grants from utilities [*For respondents in Oregon and SW Washington: or organizations like the Energy Trust of Oregon*] for installing energy efficient HVAC systems in commercial buildings?

- a. Yes
- b. No

c. Don't know

[IF RECEIVE REBATES]

S8. What utilities or organizations provide those rebates or grants?

a. [RECORD OPEN-ENDED RESPONSE]

[IF RECEIVE REBATES]

S9. Roughly what proportion of the commercial HVAC systems you install that are smaller than 25 tons receive rebates?

a. [RECORD OPEN-ENDED RESPONSE]

[IF INVOLVED IN SALES, RECOMMENDING EQUIPMENT TYPES, OR INSTALLATION]

S10. In which geographic areas does your company sell or install commercial HVAC systems smaller than 25 tons? [If multiple states, ask for proportion in each state]

a. [RECORD OPEN-ENDED RESPONSE]

Closing

[IF PASS SCREENING CRITERIA]

S11. It sounds like you would be a great fit for our focus group. It will take place on [DATE] from [START TIME] to [END TIME]. As a reminder, you would receive \$175 in appreciation for your time and input. Are you available to participate?

a. Yes

b. No

S12. Do you have access to reliable internet and a web camera?

a. Yes [*Provide participation details and collect contact information for follow-up*]

b. No

[IF NOT AVAILABLE OR ABLE TO DO ONLINE FG]

S13. Is there someone else in your company involved in sales or installation for small-to-medium commercial projects that might be able to participate in a focus group?

a. Yes [*Ask to speak with that person and return to introduction; if not available, record contact information and leave message*]

b. No

[IF NOT AVAILABLE OR ABLE TO DO ONLINE FG]

S14. These discussions are part of a larger research project, and we will be reaching out to contractors to participate in phone interviews. Again, we would provide a monetary incentive for your participation. Would you be willing to participate in a phone interview?

- a. Yes
- b. No

[IF WILLING TO PARTICIPATE IN INTERVIEWS]

Thank you very much, someone from our team will reach out to you soon to discuss these additional research opportunities.

Termination

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. May NEEA contact you for other research in the future?

Focus Group Discussion Guide

Pre-Group Questionnaire

Thank you for participating tonight. To start with, we would like to learn a little bit about how the Covid-19 pandemic and stay-at-home orders have impacted your business.

1. Is your business still operating?
 - a. Yes, with full staff
 - b. Yes, with reduced staff
 - c. No
2. If your business is still operating, how has the amount of work you are doing changed?
 - a. Doing more work
 - b. Doing about the same amount of work
 - c. Doing less work
3. How has the type of work you are doing changed?

[OPEN-ENDED RESPONSE]

Introduction

Hello everyone, and thanks for joining us today. My name is [NAME]. As we mentioned when we reached out to you about joining this conversation, we are working with the Northwest Energy Efficiency Alliance, NEEA. The goal of our research, and this conversation, is to really understand what it is like to be a commercial HVAC contractor. We want to know about all the different steps that go into a commercial HVAC project, what decisions get made along the way, and what you are thinking about as you make those decisions. NEEA and other utilities in the region will use that information to design better energy efficiency programs.

Before we get started, there are a few housekeeping items I need to go over:

- I know there can be lots of distractions and it's tempting to multitask, but I want everyone to stay focused on the discussion, just like you would if we were in a room together.
- Also, I'd like to ask everyone to assume positive intent during our discussion. Conversations online can be a bit more awkward, and we don't know each other, so we'll need to give each other a little extra slack and patience.
- That said, it's OK to respectfully disagree with someone. Our goal isn't to arrive at a consensus, we want to learn about how things work differently as well as what is similar for each of you. We welcome different opinions.
- It is my job to make sure we hear from everyone, so if you haven't spoken up in a while, I might call on you. Or, if you have been talking a lot, I might ask you to give someone else a turn. I appreciate your understanding and cooperation in making sure everyone gets to speak.
- Our discussion will take 90 minutes. We will take a five-minute break partway through, but if you need to step away at any time that's OK. We understand you're at home and things come up with family members. We hope you'll come back as soon as you can.
- If there is background noise where you are, please mute yourself when you are not speaking.
- There are some people who will be observing our discussion today. Some of my colleagues, some NEEA staff members, and [*if applicable:*] some utility staff from around the region are on the line.
- As I mentioned, our goal is to learn from your experience and expertise, and we appreciate your honesty. Nothing you say tonight is going to have any impact on your trade ally relationships or anything like that.
- We will be video and audio recording the conversation today. We will share the recordings with our clients at NEEA, but we won't make them available publicly.

- Our report will not include any information that identifies individual respondents.

Any questions before we begin?

Warm-Up Questions

Q1. First, I would like to go around and have everyone tell us your name and one unexpected benefit or silver lining that you have experienced from all the changes in the past few months. This is one of the few times that I'm going to call on people and ask everyone to talk – most of the time we can let the conversation flow more naturally and you can pipe in if you have something to say, or not. Mine is that I find myself chatting much more with my neighbors. The 7:00 cheer for front-line workers that the Mayor of Portland encouraged us to do has turned into a six-feet-apart neighborhood happy hour. How about you [*First respondent*]?

[If a respondent brings up a serious, negative experience, express sympathy and understanding if they don't want to be there. Example: "I'm so sorry about that. I really appreciate that you chose to join us tonight. I'm impressed with your resilience. I completely understand, though, if you would rather not be here."]

Q2. Now, I'd like to look at the results of the poll you all completed a few minutes ago. It looks like most people's work has [*reference poll responses*]. Beyond those changes in the amount and type of work you are doing, what have been the biggest changes in the way you do your work during the Corona virus?

We'll talk more about the impact of the Corona virus and what you think the long-term effects might be at the end, but now I'd like to shift to talk about working in HVAC more broadly. [*Moderator will be conscious of time in asking Q3-Q7. We will seek to ask at least one question about benefits and one about drawbacks but may not ask all.*]

Q3. What is the most rewarding part of your job?

Q4. What are your favorite installations to do? Why do you say that?

Q5. What caution would you give someone who told you they wanted to be an HVAC technician - what would you want them to consider before committing to the career?

Q6. What is the most challenging part of your job?

Q7. What is the most frustrating part of your job?

Decision-Making

Q8. We're going to spend some time tonight filling in this table I have prepared [*Share screen to show table*]. As you can see, I've tried to lay out the key stages and decision-points for an HVAC installation. And this is the first place where I need your expertise. Please let me know if you have seen these things change in the current environment, but, in general, I'd like to talk about how things work in a more normal situation.

1. Did I hit all the key milestones and decision points?
2. Did I get them in the right order?
3. Does it vary for new construction projects as opposed to retrofit?
4. Do the milestones change if the project is plan & specify vs. design + build? If so, how so?
5. How about for projects procured by a General Contractor/Construction Manager (sometimes also called GCCM or CMGC) process?
6. What are the most common models on the small/medium commercial HVAC projects you work on? Why?

Q9. Now that we have this general timeline of project decisions, I'd like to talk about where you come in and what decisions you make. At what stage of the project do you typically learn about it?

Q10. Now I would like you to walk me through each stage of an HVAC installation project. First, tell me who all is involved? [*Repeat for each stage*]

1. What is their role? Do they make decisions? Provide input? What are their main concerns?
2. Let me know if there are differences between the project types we just talked about. We'll use different colors to note each type.

Q11. [*Walk through project steps:*] What decisions do you make?

1. What do you consider when you are making those decisions?
2. What information do you need to inform those decisions? Where do you get it?
3. Who needs to approve those decisions, if anyone?

Q12. [*Probe on contractor selection or selection of equipment type milestone, as appropriate:*] To what extent do you have an opportunity to influence the decisions that others have made when you come to a

commercial project if you think there is a better solution? How often do you propose alternate solutions?

Q13. [Probe on selection of equipment size & efficiency level milestone:] In what situations are you more likely to install a system that is more energy efficient than code? Are there certain types of businesses that are more likely to install above-code systems? Certain types of projects (e.g. new construction vs. retrofit)?

Q14. Who generally decides whether an HVAC system will be more efficient than the energy code requires?

Q15. How does your work change when you are installing a system that is above code relative to one that just meets code? What is more challenging about an above code system? What is easier?

Q16. What about the other people involved in the installation? Whose work is most impacted by the decision to install an above code system? Why?

Information Sources

Thanks everyone. Now I'd like to take a quick break to give everyone a chance to use the bathroom, get something to drink, or just look away from your screen for a little bit. We will start up again in five minutes, so please be back then.

Q17. As we start back in, I have another poll question. How up-to-date are you on the different types of HVAC equipment that are available?

1. Very up-to-date
2. Somewhat up-to-date
3. Not very up-to-date

Q18. [Reference poll results:] How do you learn about different types of HVAC equipment?

1. Do you actively seek out information on new systems? [If not addressed, probe for information sources]

Q19. What did you do the last time you were in the field and a question came up, for example troubleshooting a technical issue?

1. Is that what you would typically do in that situation?
2. How often does that kind of situation come up?

Q20. What kinds of continuing education opportunities do you find the most valuable? Why?

1. How easy or hard is it to find those types of opportunities?

Business Model

Q21. Now that we have talked about the general structure of an HVAC installation project, I'd like to learn a little bit about your day-to-day work.

1. Is there such a thing as a typical day?
2. How much does the structure of your day vary?
3. Who or what sets your schedule?

Q22. What is the first thing you typically do on a workday? What do you do after that? [*Probe for differences between respondents*]

Q23. I understand there is a shortage of skilled workers for HVAC installation. What, if anything, have your companies done to find and attract skilled workers?

1. How, if at all, do you think the Covid-19 situation will affect this?

Q24. Before we close, I'd like to get back to the Covid-19 situation. How do you think this will impact the HVAC business moving forward? So far, what are your thoughts about how HVAC businesses can succeed given the changes?

Closing: Those are all the questions I have for you. Thank you all for your time and thoughtful answers!

In-Depth Interview Screener

Introduction

Hello, my name is _____, calling from _____ on behalf of the Northwest Energy Efficiency Alliance, NEEA. I know these are stressful times and hope you and your loved ones are well. I value your time and HVAC expertise, and hope you can spare a few minutes to talk with me. Is now a good time?

[*If yes, continue. 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 is essential to be understanding and empathetic.*]

OK. We are interviewing commercial HVAC contractors to learn about your work. The information we gather will help NEEA and other energy efficiency program administrators in the Northwest design programs to more effectively work with HVAC contractors. We expect the interviews to take about 45 minutes, and we'll provide an electronic gift card for \$75 in appreciation of your time and input. Would you be interested in being part of that type of discussion?

[*If concerned about legitimacy:*] If you have questions about the study, you can reach out to Lauren Bates at NEEA at LBates@neea.org.

Background/Screeners

[*If interested in participating:*] Great, I'd like to ask just a few short questions to make sure you would be a good fit for our research and then we can schedule a time that would be convenient for you.

[ASK ALL]

- S1. Roughly what proportion of the HVAC systems your company installs are each of the following types?
- a. Residential
 - b. Commercial, 25 tons or less [IF LESS THAN 20%, GO TO TERMINATION SCRIPT]
 - c. Commercial, greater than 25 tons

[ASK ALL]

- S2. Thinking about your small commercial HVAC work, what proportion of it is...
- a. Maintenance
 - b. Repairs
 - c. Replacement of existing equipment
 - d. New construction or major renovations [IF REPLACEMENT + NEW CONSTRUCTION < 20%, GO TO TERMINATION SCRIPT]

[ASK ALL]

- S3. What role do you typically play in a small-to-medium, meaning 25 tons or less, commercial HVAC installation project?
- a. [OPEN-ENDED RESPONSE – *If needed, probe to determine if respondent is involved in sales, specifying equipment, installation, and/or other ways. Assess extent of respondent's involvement in decision-making*]

[IF NOT INVOLVED IN SMALL COMMERCIAL DECISION-MAKING]

- S4. 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 sales or installation for small-to-medium commercial projects that we could speak with?

- a. Yes [*Ask to speak with that person and return to introduction; if not available, leave message and record contact information*]
- b. No [GO TO TERMINATION SCRIPT]

[IF INVOLVED IN SMALL COMMERCIAL DECISION-MAKING]

- S5. How many employees does your company have across all its locations?
- a. [NUMERIC RESPONSE]

[IF INVOLVED IN SMALL COMMERCIAL DECISION-MAKING AND SIZE/GEOGRAPHY QUOTA NOT FILLED]

- S6. It sounds like you would be a great fit for our interviews. What would be a convenient time for a conversation? As a reminder, the questions generally take about 45 minutes.

[*Schedule a time convenient for the respondent and, if possible, send an electronic meeting invitation*]

- S7. What is the best phone number for me to reach you at that time? [*Ask for a direct line or cell number if possible*]

- S8. As I mentioned, our client, NEEA, is interested in learning about HVAC decision-making, including hearing directly from contractors. Would it be alright if one or more people from NEEA listened in on our conversation? I want you to know this is completely optional. If you would be more comfortable or would be willing to speak more freely, we can keep the conversation private. We won't include any information in our report that would identify an individual respondent.

- a. Yes – NEEA staff can attend
- b. No – NEEA staff cannot attend

Termination Script

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. May NEEA contact you for other research in the future?

In-Depth Interview Guide

Lead-in

Thanks for taking the time to talk with me. As I mentioned before, we are working to help the Northwest Energy Efficiency Alliance, NEEA, better understand the small commercial HVAC business so they, and other energy efficiency program

implementers, can more effectively work with contractors. I have some questions about the decisions that go into a typical small-to-medium commercial HVAC installation, and by small-to-medium, I mean systems less than 25 tons, as well as some questions about your business. Do you have any questions before we begin?

[*If NEEA staff are attending:*] [NUMBER] staff members from NEEA are on the line and they are going to be listening-in to our conversation. It can be helpful for them to hear your responses directly.

I'll be taking notes as we talk today. Do you mind if I also record our conversation? The recording is to help with my notetaking. We won't report any findings in our written report in a way that would identify individual respondents.

- Q1. First of all, how has the current situation with Covid-19 impacted your business? [*Note: Attempt to keep this section short and focused on current status*]
- a. [*If needed:*] Are you still operating?
 - b. [*If so:*] Has the type of projects you are working on changed? How?

HVAC Project Decision-Making

Thanks, now I would like to learn about how things work under more normal circumstances.

- Q2. First, please tell me about what a typical day is like for you.
- a. How much does the structure of your day vary?
 - b. Who or what sets your schedule?
 - c. What is the most rewarding thing you do on a day-to-day basis?
 - d. What aspects of your day-to-day work are the most challenging or frustrating?
- Q3. Please walk me through the path from purchase decision, to purchase, to installation for a small-to-medium commercial HVAC installation. When do you typically come into the project?
- Q4. On what proportion of the small commercial HVAC installations you work on is the system design already done by the time you come onto the project?
- a. Who designs the system in those cases?
 - b. What opportunity do you have to suggest changes to the system in those cases, if you feel there is a better solution? How frequently do you make suggestions?

- c. Are there certain types of customers or certain types of projects that are more likely to design the system before bringing in the installer?
 - d. [*If not addressed:*] Are these plan + spec new construction projects, or are there other projects where the system is designed before you are involved?
- Q5. On what proportion of the small commercial HVAC installations you work on are you in charge of designing the system?
- a. On what types of projects are you more likely to be designing the system? [*If multiple project types (e.g. design/build new construction and replacement), probe on each in follow-up questions*]
 - b. Who is involved in the system design in those cases? [*Probe for: Roles of staff within the respondent's company as well as distributors and others outside the installer's company*]
 - c. What do those people consider when they are designing a system – what would lead them to design the system one way rather than another? How is this different between new construction and equipment replacement?
- Q6. About what proportion of your small-to-medium commercial projects require “stamping” by an engineer?
- a. What determines whether a project will need stamping?
 - b. How do you find an engineer to stamp your plans when you need one?
 - c. What role, if any, does the engineer play in developing the design?
- Q7. What proportion of your installations meet code, what proportion exceed code, and for what proportion does code not apply?
- a. When does code not apply?
- Q8. In what situations are you more likely to install a small-to-medium commercial HVAC system that is more energy efficient than code?
- a. [*If needed:*] Are there certain types of businesses that are more likely to install above-code systems? Certain types of projects?
 - b. Who generally decides whether an HVAC system will be more efficient than energy code requires? What motivates them to choose an above code system?
 - c. How, if at all, does your work change when you are installing a system that is more efficient than energy code requires?

- d. How is this path different based on the size of HVAC system? What about new construction vs. replacement? [*Probe for if/how key decision makers are different for different size projects*]
- Q9. Once the system is designed, what would you say are the most important decisions you make in the course of installing a small-to-medium commercial HVAC project?
 - a. What information do you need to make those decisions?
 - b. Where do you get that information?
- Q10. What kinds of commissioning and QA/QC happen after the equipment is installed?
 - a. How, if at all, is this documented? Do you report it to anyone?
- Q11. Who is in charge of the final approval, confirming that the job is done?
- Q12. [*If not addressed:*] How, if at all, are manufacturers or distributors involved in the decisions that go into small-to-medium commercial HVAC projects? What information or advice to they provide, if any?
 - a. Are there particular distributors you typically work with? Why?
 - b. Are there particular manufacturers or brands of equipment that you prefer? Why?

Business Models

I'd like to shift a bit to talk about where you get information and the business side of HVAC installation.

- Q13. Where do you go to get up-to-date information on the HVAC industry?
 - a. What kind of information do you typically look for from those sources? [*Probe for information about new technologies, trends in the industry, practical "how-to" information for technical tasks, business or management advice, websites, online forums, etc.*]
- Q14. What kind of training or continuing education do you participate in? [*If needed, probe on: continuing education for licensing, distributor training, utility training*]
 - a. Where do you find those opportunities?
- Q15. What types of business metrics does your company track? Are there targets you try to hit, as a company?

- a. What about individual employees: How does your company evaluate installers' job performance? What metrics do you use? What about sales staff?
 - b. How does that performance structure impact the way people approach projects?
- Q16. Are there any types of small- to mid-size commercial solutions that are particularly popular with your customers? If so, what?
- a. Why do you think that is?
- Q17. Do you pay attention to what your competitors are doing?
- a. Why or why not?
 - b. [*If so:*] How do you learn about what your competitors are doing?
 - c. [*If so:*] How do you use that information?
- Q18. What, if anything, do you do to make sure your deals/installations will be profitable?
- a. Are there any rules of thumb you follow to help the profitability of a project? What are they?
- Q19. What does your company do to attract and retain workers?
- a. Do you try to hire skilled workers, or do you hire unskilled workers and train them? Why?
 - b. How, if at all, do you anticipate the current COVID situation will affect the talent pipeline going forward?

Closing

- Q20. Finally, getting back to the current situation with Covid-19, how, if at all, do you think your business will change going forward?

Those are all the questions I had prepared. Is there anything we haven't covered that you think it's important for NEEA and other program administrators to know about your work and how decisions are made on small-to-medium commercial HVAC installations?