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VHE DOAS Commercial Building Decision Makers Market Research

Prepared For NEEA:
Lauren Bates, Sr. MRE Scientist

Prepared by:
Molly McCabe, President and Founder

Hayden + Tanner
178 Wolf Creek Ranch Road, Suite 100
Bigfork, MT 59911

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

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Executive Summary

Overview

The Northwest Energy Efficiency Alliance (NEEA) sought to better understand how small to mid-size private and public sector building owners make decisions around High-Performance Heating, Ventilation, and Air Conditioning (HP HVAC) and what interventions NEEA's HP HVAC program could use to overcome identified barriers. NEEA's program is currently centered on the use of a very high efficiency Dedicated Outside Air System (very high efficiency DOAS). Unlike traditional HVAC equipment, very high efficiency DOAS requires several key pieces of equipment functioning together. This includes a heating and cooling system to condition the air and a separate ("decoupled") ventilation system. The decoupled very high efficiency DOAS allows for optimal control of each of these critical building functions and downsized mechanical systems resulting in greatly reduced energy use. However, given the system's complexity and upfront cost, NEEA assumes very high efficiency DOAS is generally most practical for new construction or buildings undergoing a major renovation and/or planned HVAC retrofit.

From past NEEA research on commercial real estate and deep energy retrofits, the HP HVAC team has identified three major barriers facing the program:

1. High first costs of very high efficiency DOAS relative to traditional and other systems.
2. Return-on-investment requirements for commercial buildings rarely include possible benefits provided by very high efficiency DOAS such as superior indoor air quality (IAQ).
3. Value engineering, a common cost-cutting process which frequently occurs during building or HVAC system design, and often results in a reduction in the efficiency of high-performance systems, and/or a replacement with a more conventional HVAC system entirely.

The two overarching research objectives for this study were as follows:

1) Learn how to overcome the overwhelming influences of first cost, rigid return-on-investment requirements and value engineering used by private sector commercial building owners.
2) Identify key decision makers for public sector owners of government buildings and their processes to inform program engagement and marketing strategies.

The research focused on private sector commercial building owners - including commercial real estate developers, investors, and owner/users - and public sector agencies such as municipal and state governments, K-12 schools, and universities. Building size was targeted at less than 50,000 square feet and no more than four stories.

Key findings were derived through several research activities, including literature and webinar review, and in-depth interviews with 19 building owners in the private and public sectors. Interviews occurred between December 2, 2021, and January 19, 2022, and revealed building owners' perceptions of the challenges, benefits, and possible applications of very high efficiency DOAS.

Top Line Findings

While HVAC related factors impact traditional heating/cooling needs (energy use, efficiency, ventilation, occupant comfort, heating/cooling loads), market actors also report they may impact economic drivers (operating cost, tenant retention, rent performance); health outcomes (air quality, airborne viruses, COVID, productivity, cognitive performance); environmental factors (carbon use, greenhouse gas emissions, resiliency); and even provide a link to social factors (contractor availability and performance) and education/training for small, diverse contractors.

Research Objective 1: Learn how to overcome the overwhelming influences of first cost, rigid return-on-investment requirements and value engineering used by private sector commercial building owners.

Findings for Private Sector Commercial Building Owners

- Every investment decision or major capital expenditure flows up to the partner, owner, or CEO level for ultimate approval.
- Economics, first and foremost, drives the decision.
- Sustainability attributes are often considered in silos. Siloed design, analysis and messaging can lead to siloed decision making (such as in "value-engineering").
- Existing buildings hold opportunity if the investment makes the asset more competitive or valuable in the marketplace.
- Building codes that impact new construction could drive adoption in the existing building market.
- Having a single tenant or owner/user building makes implementation easier. There is a single point of interaction for decision making and the installation disrupts only one business versus many.
- Smaller HVAC equipment may provide aesthetic value, additional usable (leasable) space, and opportunities for increased returns.
- Owners are unclear on technical aspects of very high efficiency DOAS, are concerned about contractor capacity to install and service, and are skeptical of economic claims.
- IAQ matters to owners but its full impact on building occupants is not yet a key driver in investment decisions.
- COVID and wildfires raised awareness and resulted in increased interest in incorporating high performance HVAC.
- The changing climate offers a lever to adoption.

- Owner/Users have a broader decision-making framework than Investor/Owners. Their focus is on their primary business first and foremost – space needs and comfort are driven by their business needs.
- Operator preference for legacy systems create an impediment to adoption.
- The smaller size of very high efficiency DOAS equipment may provide opportunities to expand the vendor and contractor pool to smaller or mid-size companies, potentially resulting in increased numbers of HP HVAC providers and the inclusion of diverse, minority and women owned contractor companies, who are more likely to operate smaller firms.
- Some large national accounts or big box retailers rely on outside energy efficiency consultants for recommendations and prefer individual system solutions (as opposed to integrated systems) that meet their targeted financial return requirements.

Research Objective 2: Identify the key decision makers for public sector building owners (administrative office, K-12 schools, and universities), understand their processes, and how this understanding might inform program engagement and marketing strategies.

Data around this objective is limited as it is based on two interviews. However, responses concur with information that can be inferred from public records in terms of how decision making is made and how capital expenditures are allocated in the public sector.

Findings for Public Sector Government/Education Facility Owners

- Topline decisions for capital allocation are made through governing bodies such as the legislature, county commissioners, city council, and school boards.
    - Elected officials must be responsive to the needs of their community, therefore taxpayer and constituent priorities are top-of-mind.
- There is limited capital availability and competing resource needs, thus government entities must prioritize and triage.
- It often takes a skilled third-party contractor, maintenance provider or an Energy Services Company (ESCO) to recognize performance problems, identify solutions, and provide alternative funding recommendations.
    - Occupants don't necessarily recognize when an HVAC problem exists if heating and cooling works, and often lack awareness of HVAC opportunities for upgrade.
- IAQ is increasingly important to decisionmakers due to COVID; priorities differ from city to city and state to state.
    - In schools, instructional technology often wins out over facilities upgrades.
- New public buildings are especially good candidates for high performance HVAC.
- Operator preference for legacy systems creates an impediment to adoption.

Top Line Recommendations

Recommendations for Private Sector Commercial Building Owners

- Research and explore potential partnerships with organizations whom commercial building owners – both owner/investor and owner/user - trust and rely on for advice, education, training, and referrals. (e.g., ESCOs, energy efficiency consultants, BOMA, ULI)
- Create an interdisciplinary NEEA program team to pilot a unified and integrated value proposition for energy efficiency in the built environment.
- Create a series of case studies which specifically highlight HP HVAC solutions and integrated energy efficiency solutions, initial costs, ongoing savings, and occupant outcomes across a variety of property types. Clearly articulate the difference in upfront costs vs. conventional HVAC and potential energy cost savings.
- Review education and marketing materials and reframe those targeted at demand side actors (owners, investors) in common, as opposed to technical language. Produce a FAQ "one-pager" responding to technical questions and concerns.
- Link HVAC performance to occupant outcomes in messaging, such as improved IAQ promoting higher cognitive functioning, reduced number of sick days, and improved employee productivity.
- Research the potential to partner with economic development agencies, professional engineering organizations, and small business enterprises to provide training and capacity building for small to mid-size, diverse HVAC contractors.

Recommendations for Public Sector Government/School Facility Owners

- Identify potential champions in government, universities, and K-12 schools, such as facilities managers, project managers, or construction and development managers.
- Explore opportunities to present and speak about HP HVAC at professional meetings of state or regional school superintendents, principals, and building engineering staff.
- Frame messaging around the benefits and positive outcomes for primary operational goals (e.g., educating students), being sure to use data and metrics that back up these claims.
- Identify and leverage sustainability mandates and funding opportunities to create pilot projects in public buildings.
- Explore opportunities to expand work with ESCOs to educate schools and government agencies.
    - As they perform building condition assessments of existing school and government buildings advise them on options to integrate HP HVAC into solutions.
- Explore potential partnership opportunities with organizations promoting sustainability in schools, such as the U.S. Green Building Council's (USGBC) Green Schools Initiative.
- Identify key staff within universities who are already designing and building to sustainable standards.

Introduction

Context

The Northwest Energy Efficiency Alliance (NEEA) sought to better understand how small to mid-size private and public sector building owners make decisions around High-Performance Heating, Ventilation, and Air Conditioning (HP HVAC) and what interventions NEEA's HP HVAC program could use to overcome identified barriers. NEEA's program is currently centered on the use of very high efficiency Dedicated Outside Air System (very high efficiency DOAS). Unlike traditional HVAC equipment, very high efficiency DOAS requires several key pieces of equipment functioning together. This includes a heating and cooling system to condition the air and a separate ("decoupled") ventilation system. The decoupled very high efficiency DOAS allows for optimal control of each of these critical building functions and downsized mechanical systems resulting in greatly reduced energy use. However, given the system's complexity and upfront cost, NEEA assumes very high efficiency DOAS is generally most practical for new construction or buildings undergoing a major renovation and/or planned HVAC retrofit.

From past NEEA research on commercial real estate and deep energy retrofits, the HP HVAC team has identified three major barriers facing the program:

1. High first costs of very high efficiency DOAS relative to traditional and other relatively energy efficient systems.
2. Return-on-investment requirements for commercial buildings rarely include possible benefits provided by very high efficiency DOAS such as superior indoor air quality (IAQ).
3. Value engineering, a common cost-cutting process which frequently occurs during building or HVAC system design, and often results in a reduction in the efficiency of high-performance systems, and/or a replacement with a more conventional HVAC system entirely.

The two research objectives of the current study are to:

1. Learn how to overcome the overwhelming influences of first cost, rigid return-on-investment requirements and value engineering used by private sector commercial building owners.
2. Identify key decision makers for public sector owners of government buildings and their processes to inform program engagement and marketing strategies.

The research focused on private sector commercial building owners - including commercial real estate developers, investors, and owner/users, and public sector agencies such as municipal and state governments, K-12 schools, and universities. Building size was targeted at less than 50,000 square feet and no more than four stories.

Sample Frame and Recruiting

Real estate demand side actors (property owners) may be generally segmented by certain characteristics including asset size, sophistication, and access to capital. These factors and economic opportunities shape decision-making by property owners and provide a broad theoretical framework for understanding each market actor's characteristics and process.

Several years ago, James Finlay, Commercial Appraiser and Managing Partner, Soundview Risk Advisors, broke down energy efficiency risk as viewed by the seven primary real estate asset classes ("tribes" in his "7 Tribes of Real Estate"[1]) characterized primarily by size, sophistication, hold period, and access to capital (see Appendix A). HaydenTanner used Finlay's classification to inform selection of the study sample, and targeted four of the classes for inclusion in the study:

i. Owner/Investor (including single tenant, multi-tenant, and small to medium size commercial & industrial)
ii. Owner/user (small business retail or office)
iii. Government
iv. Education

The sample frame focused on property owners holding assets of 50,000 square feet (s.f.) or less, and generally under 4 stories. To give readers context for the variety of building types which fit these parameters, examples include: a "box store" such as a TJ Maxx, with an average size of 30,000 s.f.; an REI retail store at 24,000 s.f.; a 4-story multi-tenant office building with approximately 10,000 s.f. floor plates (with perhaps 16 – 20 tenants); a 29,000 s.f. public library; a 16,000 s.f., 2-story single tenant flex space; a government office building, which currently averages 19,000 s.f.; a 5,000 s.f. single occupant owner/user space; or, a small 34,000 s.f. elementary education building.

Primary property types owned by study interviewees included single tenant retail, medical office, single tenant flex space, multi-tenant office, government office buildings, K-12 schools, and university buildings. Some property owners interviewed also own or have developed multi-family buildings.

To capture insights from a representative, yet diverse audience of the four target building owner types, the team recruited interview participants through a variety of sources. Between mid-November and late December 2021, HaydenTanner posted notices through social media (Twitter and LinkedIn), and reached out to several professional organizations, including The Urban Land Institute (ULI), Building Owners and Managers Association (BOMA), US Green Building Council (USGBC) Mountain/PNW region(s), and Main Street America. These entities

[1] https://www.slideshare.net/JamesFF/7-tribes-of-real-estate-investmt-risk-behavior-garr-inst-cbb-05-24-2012-finlay5; Mr. Finlay also co-authored *Valuation Advisory 9: Valuation of Green and High-Performance Property: Commercial, Multi-Family, and Institutional Properties*, March 7, 2018 for The Appraisal Foundation: https://drive.google.com/file/d/1yBTQpOR5S5w1m0kIHDPN2t00zoScK3L_/view

sent out inquiries to their membership within the four-state area and directed members to contact the research team. HaydenTanner also directly contacted 40 building owners with primary, secondary, and tertiary connections with the lead researcher, who has decades of experience in the commercial building field, including sustainable building and investment. This is notable, as those interviewed may represent a cohort predisposed to integrating sustainability into their buildings.

Methodology

On November 17, 2021, HaydenTanner delivered a primer presentation and guide to NEEA HP HVAC staff and others about commercial real estate analysis and valuation, including the aforementioned framework for understanding different types of building owners, investment drivers, and the decision-making process.

Next, HaydenTanner completed secondary and primary data collection and analysis via literature and webinar review, and virtual in-depth interviews with building owners in the private and public sectors. Interviews occurred between December 2, 2021, and January 19, 2022. Interviews were semi-structured, utilizing a pool of interview questions developed collaboratively with NEEA but also freely exploring topics and ideas introduced by research participants (see Appendix B for the interview discussion guide). At the beginning of each interview, HaydenTanner provided a brief orientation to very high efficiency DOAS using slides about the system provided by NEEA. Interview questions delved into participants' knowledge about HP HVAC and very high efficiency DOAS, its possible applications in commercial or government buildings, potential benefits and value propositions of the system, and challenges to system use or adoption. HaydenTanner completed thematic analysis of interviews to arrive at key findings. Copies of anonymized interview transcripts and notes were provided to the NEEA HP HVAC team. Direct quotes from these interviews are included in this report.

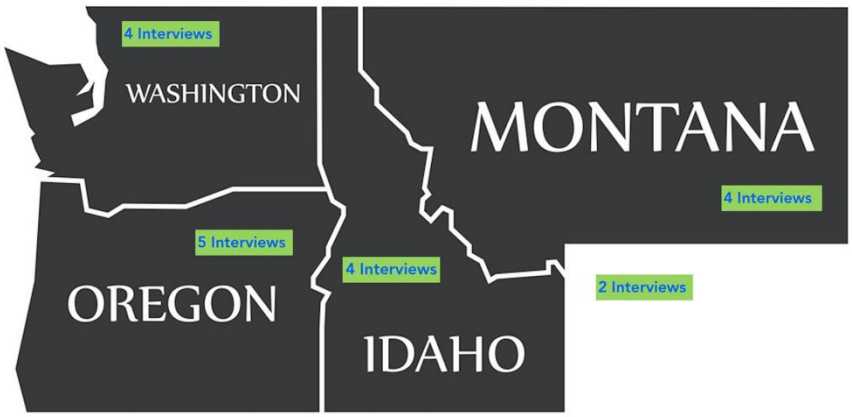
Sample

Nineteen (19) people were interviewed, either one-on-one or in pairs. The interviewees were equally spread among the target region (4-5 per state, see Figure 1). There were two interviewees with familiarity and/or experience in the Northwest, but who do not currently own or develop in the region; their detailed expertise and insights were deemed sufficiently relevant and important to include in the data. Of the social media and professional organization outreach, two contacts came through LinkedIn, eleven through the professional organizations, four were referrals from initial contacts and two through direct contact and personal relationships.

Table 1. Sample

Classification and Number of Participants	
Owner/Investor Developer	13
Real Estate Advisor	2
School/Government Representative	2
Owner/User	1
Professional Organization	1

Figure 1. Interview sample by state



Study Limitations

This qualitative study relies on a small, non-random sample of participants. After a brief introduction to the system, participants provided their perceptions of how HP HVAC could be applied to commercial and governmental buildings. Participants' views provide a directional snapshot of the potential uses and values of HP HVAC that warrant additional exploration.

Research Objective 1 Findings and Recommendations

The first research objective contained two parts. First, identify what barriers exist in the minds of private sector commercial building owners (both investor/owners and owner/users) that would keep them from investing in high-performance HVAC systems, either in new construction project or when doing a major rehab or renovation. And second, learn what participants believe can be done to overcome these constraints.

Private Sector Commercial Building Owners

Private sector property owners essentially fall into two categories: investors or users. Investor/owners purchase property and lease it out to tenants to generate income, while owner/users utilize the building, or a space within the building, for their own business purposes. Each has a slightly different perspective when evaluating investment in and capital expenditures (cap ex) for the building. Investor/owners look primarily at the financial returns derived from the net operating income (NOI) of the property and its desirability to potential tenants. Investors will take into consideration current market conditions, the competitive landscape, lease rates, capital expenditures necessary to lease the space, rentable square footage, and the yield of the investment as compared to alternatives. An owner/user considers the building in terms of how well it meets their current and future needs. Does the building have the amenities, the utilities, proximity to clients and staff? Owner/Users typically take the long view as they intend to hold the property until it no longer meets their needs, typically 10 years or more. Investor/Owners may hold the property for a much shorter period – perhaps 3-5 years, or they may view the asset as a long-term hold as well. Unless specifically called out for one or the other, the top line findings apply to both types of owners.

Findings

Every investment decision or major capital expenditure flows up to the partner/owner/CEO level for ultimate approval.
In every organization, the final decision is made by the individual who has responsibility for the budget and who must justify returns to investors or owners (e.g., CEO, "C Suite," Partner(s), Project Manager, Owner, or Board). In the end, they must be able to both articulate and show how High-Performance HVAC adds sufficient value to a property to make the investment decision. To justify the added upfront cost of high-performance system, the "C-Suite" must be convinced.

"Everything flows up to the partner/CEO level."
-Owner/Investor (Washington)

Economics, first and foremost, drives the decision.
Each owner identifies the determinants most relevant to their goals for profit, long term returns and asset value. The building owner's typical objective is to utilize the most cost-effective means of achieving these goals. For a private sector owner/investor, this goal is to increase the overall value of the building, through reduced risk and increased net operating income (which is a combination of revenue and expense). However, every project is different, as is each owner's definition of value.

Confirming NEEA's hypothesis, owner investment decisions are based on timing, cost, and value:

- Timing – Typically, investments are considered when owners are developing a new project, planning a major rehab, or due to a tenant request or tenant turnover. One interviewee noted, however, approximately 30-40% of their national retail clients do portfolio wide changes to their HVAC systems, sometimes retiring the systems early to gain economies of scale across their asset holdings.

- Cost – Owners evaluate the full suite of financial metrics including upfront costs (capital expenditures – "cap-ex") and savings over time (operating expenses - "op-ex"). The questions asked by owners with regards to upgrades and mechanical systems in general and HVAC specifically, include:
    - Is it possible to modify the existing system and make it work without major effort or expense?
    - Will the tenant pay for the improvements in their lease payments?
    - What kind of operating savings can be expected?

- Value – Improvements add value to the building by making it more aesthetically pleasing, increasing rentable space, making it easier to lease, or by modernizing it to remain competitive in the market.

"We invest in high- performance HVAC and envelope upgrades.
We only do things that add economic value to the building"
-Owner/Investor (National)

Participants noted many possible economic value drivers:

- Increased revenue
- Decreased expenses
- Increased leasable space
- Improved aesthetics
- Improved market perception (e.g., building prestige, quality of management)
- Decreased vacancies
- Increased leasing velocity
- Decreased occupant turnover ("churn")
- Decreased risk

- Improved IAQ/occupant health
- Improved resiliency[2] (e.g., dedicated outdoor air, enhanced filtration, and reduced energy consumption)

Despite citing this array of economic drivers, participants acknowledge few building owners give adequate thought to the interrelation of these factors. Owners generally limit their analysis to first costs, rent and expenses, rather than incorporating things like avoided costs, occupant health, and improved resiliency. Further, few engineers, contractors or HVAC vendors are versed in real estate value drivers. Consequently, they are unable to provide building owners with the full range of inputs to consider. This narrows the possible economic drivers under consideration, and in effect, limits the benefits that could be captured by better HVAC.

"[From the engineers], all the owner [sees is] a table of 'good and better,' that just shows costs going up with fuzzy estimates of potential savings down the road."
-Owner Advisor (Idaho)

Interviewees suggested it's not hard to include high performance HVAC in a new, high-end building, especially for owners targeting regional and national tenants who often have their own environmental, health, and social equity goals. Further, these investor/owners tend to be larger, with solid balance sheets, proven financial performance and strong credit quality which makes them easier to finance than small and mid-size owners.

Interviewees concurred that existing building owners will consider upgrading to high-performance HVAC if it adds perceived value and life to the building. There are opportunities if the investment makes the asset more competitive in the marketplace and consequently more valuable.

"I would consider doing it even if it were more expensive upfront if it benefited both me and the tenant. Anything I can do to modernize my [40-year-old] building is worth doing because I need to stay competitive with the market."
-Owner/Investor (Oregon)

However, smaller owners find it more difficult to find capital to upgrade their buildings. Owners operating on tight budgets may not have the ability to fund high-performance systems and will do what they can to keep the building operating and as comfortable as possible. For small to medium sized owners in particular, financing remains a gap to be addressed.

"Smaller building owners and developers are almost always running into real cost constraints and have to cut budget to fit the project into their loan maximums. They almost always prioritize costs they think will help them get higher occupancy, higher rents, or flip [sell] the

[2]https://www.researchgate.net/publication/335082811_HOW_HVAC_SYSTEMS_CAN_IMPROVE_RESILIENCE_OF_THE_BUILT_ENVIRONMENT_KAKO_SISTEMI_ZA_KGH_MOGU_POVECATI_OTPORNOST_IZGRADENOG_OKRUZENJA

property for more money. Again, the long-term benefits of higher performance systems are nice, but they need that building leased or flipped ASAP, so they don't go broke or break their budget."

-Owner Advisor (Idaho)

Contrary to common assumptions, participants noted that "green" incentives don't factor as much into the upfront decision making as might be expected. While investors are getting more comfortable with integrating efficiency measures in new construction and rehab, the decision to include these measures depend primarily on whether they make financial sense from the outset. The incentives are not core to the financial analysis. They help sell the idea, but typically are considered the "icing on the cake" as opposed to the driver. Participants noted two reasons for this. First, because the incentives are paid on actual performance, success (and consequently the incentive payment) is not guaranteed until the building has a proven operational history, which may be a substantial lag time and is reliant on operator and occupant compliance. Secondly, the incentives are often treated as a bonus and passed through to the contractor or vendor, so not reflected in owner profit.

"What I see actually is incentives are not necessarily figured into the hard calculations of the financial metrics. They're usually looked at as nice to have, but that has been shifting over the years as incentive programs have been maturing and have been becoming more reliable."

-Owner advisor (Oregon)

Tenants are also driven by economics. Typically, location and rental rate are the primary decision drivers. According to interviewees, only the most sophisticated tenants think through the total cost of their space, including utilities, operating costs, or the impact of the indoor air quality on the health or experience of their staff (e.g., sick days, higher productivity). If the common area maintenance (CAM) charges are within expected norms, they pay little to no attention to the HVAC system. They generally rely on trusted advisors such as their real estate brokers to identify potential space for lease within their budget and don't ask about ventilation or heating and cooling.

"The benefits are not readily apparent – tenants can't easily see, touch or even feel."

-Owner/Investor (Montana)

It was noted that leasing brokers also lack familiarity with high-performance HVAC solutions and the benefits to occupants of dedicated outside ventilation. They primarily look at rent as the competitive driver in the market. It is crucial to understand what the market will bear and the range of potential rents. In a strong market, a high-performance building, well marketed, will attract top tier tenants who are willing to pay a premium rent. In a down market, it allows the building to compete against its peer group more effectively for the same tenant at market rents – keeping the building leased, when others go vacant. However, if the leasing agent doesn't have the data or experience to share the value of HP HVAC, they don't market the building that way. That can be costly to an owner.

"Any time a tenant leaves it is costly to the landlord. You can put a value on avoided tenant turnover costs ("churn") – paint, carpet, tenant improvements, downtime, leasing fees, etc. What's 5% cap rate on the avoided churn worth?"
- Developer/Owner (Washington)

Siloed design, analysis and messaging can lead to siloed decision making (AKA "value-engineering").
Owners often parse economic metrics into silos using simple payback instead of evaluating a broad range of impacts. The conversation must be broadened to include operating costs, tenant turnover, leasing velocity, risk mitigation, and occupant health.

One interviewee, an experienced developer, owner, and investor who has successfully applied these concepts across multiple renovation projects, suggested integrated design is key to making the economics work. It is far easier to eliminate individual elements through value engineering if you design and analyze each component in isolation.

"You must do the building envelope first – otherwise you're leaving all the value on the table. You're still not sizing the system properly, because it's being designed as if nothing is done to the envelope, and it is costing you a ton a money – more than it needs to. Do the envelope first and then design the mechanical system to address the temperature swings after the envelope redesign."
-Developer/Owner/Investor (National)

Value engineering *as defined by the United States Federal General Services Administration (GSA) is* ***an organized effort directed at analyzing designed building features, systems, equipment, and material selections for the purpose of achieving essential functions at the lowest life cycle cost consistent with required performance, quality, reliability, and safety*** *.*[1]

Years of experience by the consulting team has shown every project is different, and that **improving its value does not mean cutting costs. It means optimizing the elements of the project through an analysis of all factors–cost, upkeep, wear-and-tear, aesthetic value, and long-term objectives.** To truly provide advantageous value engineering, the owner, contractor, and design team need to first understand the project as a whole and the vision and goals for the project. Every project is distinct, distinguishable by the elements that make up its location, design, and use. How do the systems work together? How long will the materials last? What type of maintenance will be needed? Will they work more efficiently and cost less to operate? The approach is one of value enhancement for the project – rather than sweeping cost-cutting measures that may not be the best fit for owner or property's needs or goals. Three criteria drive decision: cost reduction, added quality, and life cycle/maintenance. The critical time to integrate these conversations is at the beginning of the planning/design process.

"The whole energy model gets done together. That's HVAC, lighting, insulation, windows."
-Developer/Owner (Washington)

One example shared by an interviewee illustrates the value of an integrated approach:

> "An existing tenant was expanding and needed a new HVAC unit at a cost of approximately $140,000. The tenant did not have the capital to fund this improvement, and so requested the landlord to cover the cost and amortize the improvements in the lease over a 10-year term. The landlord proposed spending an additional $140,000 for other energy efficiency measures, specifically improvements to the envelope – glazing and insulation, and proposed both be amortized into the lease. As a result of the additional measures, the mechanical HVAC system was downsized.
>
> In the end, the landlord saw an annual increase in rent of $48,000 and the tenant recognized annual energy savings from the efficiency measures of $49,000 - so, no net economic impact to the tenant, but they received new equipment that meets their needs and provides greater comfort and efficiency. From the landlord's perspective, they recognize an annual increase in net operating income of $48,000. At a 6% cap rate, this equates to an $800,000 value increase in exchange for an upfront investment of $280,000. "

Existing buildings hold opportunity if the investment makes the asset more competitive or valuable in the marketplace.

It is simplest to integrate very high-performance DOAS into the design from the beginning. Many organizations have sustainability objectives in place which lead them to design with resource efficiency, health, and wellness in mind. Further, building codes and energy regulations in some jurisdictions, particularly in Washington and Oregon, are becoming increasingly stringent, requiring new construction meet more efficient design standards. Consequently, the incremental cost, as compared to conventional HVAC, is much smaller, and easier to justify.

"From scratch – vs. rehab - it's just a little easier - it's a no brainer."
-Developer/Owner (Oregon)

"We believe in high-performance HVAC and in indoor air quality – and believe they add value to our tenants and as a result, our property values. In new construction we've incorporated high-performance attributes [e.g. outdoor air, chilled beams and ionization] in all our buildings. We just spec it that way – and so far, everyone [investors] has been comfortable."
-Developer/Owner (Oregon)

Building codes that impact new construction could drive adoption in the existing building market.

Interviewees noted the changing requirements for larger buildings are likely to incentivize owners of smaller and existing (legacy) buildings to follow suit voluntarily to remain competitive. In Washington, the Commercial Clean Building Performance Standard[3] subjects buildings over 50,000 s.f. to new energy regulations. The standard requires that all covered commercial buildings must comply with the Energy Management provisions of ASHRAE Standard 100-2018, including meeting an energy performance standard or Energy Use Intensity (EUI) target based on building type and end uses. This new standard phases in over the next seven years. Interviewees note that the new standard combined with electrification requirements in cities like Seattle, WA, and Eugene, OR,[4] make it even more important for legacy buildings to renovate to stay competitive in the marketplace – even for those buildings smaller than 50,000 s.f.

"[T]his new code [requires] higher performance systems…. I think owners of those legacy buildings are going to have to solve for these kinds of issues….air conditioning, indoor air quality. I think they'll need to do renovations in order to compete on a leasing front"
-Developer/Owner (Washington)

Having a single tenant or owner/user building makes implementation easier.

Because there are fewer players to negotiate with and fewer people to educate on system operation, single occupant buildings (tenant or owner/user) make implementation of high-performance HVAC easier. The installation disrupts only one business versus many. Further, as it relates to investment property, leases are typically Net-Net-Net (NNN or "Triple Net"), which means the tenant pays for all capital expenditures and benefits from all savings, avoiding what is traditionally known as the "split incentive." (Split incentives happen when the owner is obligated to pay for improvements and the tenant receives the savings value.)

If the investor/owner is willing and able to fund the capital improvements, the investment can be capitalized into the lease payments. As a result, the owner's financial statement reflects an increase to net operating income, which in turn drives increased property value (increased NOI/investment or capitalization rate leads to a value increase). The energy savings go directly to the tenant, allowing them to 1) benefit from the improved indoor air quality and high-performance HVAC system and 2) offset the increased rental expense through reduced operating (utility) expenses.

"I choose to invest in single tenant buildings. I don't want to be managing tenants. I want the tenant to understand that anything I do to the building is for their benefit. I'm willing to work with them on things that benefit both of us. For them during the term of their lease

[3] https://www.commerce.wa.gov/growing-the-economy/energy/buildings/clean-buildings-standards/ https://www.commerce.wa.gov/growing-the-economy/energy/buildings/how-to-comply/
[4] https://rmi.org/washington-state-could-lead-the-nation-on-building-electrification-codes/

(e.g., lower utility bills) and for me, something that enhances the value of the building over time and is beneficial to future tenants."
-Owner/Investor (Oregon)

"If I had a long-term tenant, who had bought into the concept of refurbishing the HVAC and was willing to pay for it by amortizing the cost in the lease payments, I'd be willing to invest money to put the system in upfront. But that needs the collaboration of the tenant."
-Owner/Investor (Oregon)

Smaller HVAC equipment may provide aesthetic value, additional usable (leasable) space, and opportunities for increased returns.
Owners noted that anything that has an aesthetic impact, adds leasable square footage or common area value (such as a roof top garden or space for solar panels), or reduces need for enhanced roof strengthening positively impacts returns.
For example:

- Smaller mechanical equipment (as compared to conventional systems) may add "usable or rentable space" on the roof.
- Smaller ducts may result in better interior aesthetics.

"Space matters. Anything that can be rented out, or creates additional amenities, adds value"
-Developer/Owner (National)

In the context of long-term maintenance or replacement, the number and size of equipment makes a difference. Fewer units equate to lower CapEx reserve requirements, thereby reducing annual operating costs and increasing net operating income. Further, equipment sizing has a direct correlation with roof structure/reinforcement, again, smaller, and lighter potentially reducing need for additional buttressing. It may also be easier to repair and replace smaller units – for example, interviewees noted that instead of a crane, a lift might be used. Two interviewees suggested smaller equipment may also provide opportunity to expand the vendor market, by allowing smaller general contractors to participate:

"In the context of long-term maintenance or replacement, the size of equipment makes such a difference. Once you put a big roof top unit (RTU) [in place], what [does] it take to remove or service it? If the size of the high-performance HVAC equipment is significantly smaller, you can use a lift [instead of a] crane. You couldn't put a traditional RTU on a lift, but you can put those VRFs on one. It's a dramatically different sort of future proofing. If your massive RTU fails, and has to be swapped, you've got a much higher expense just due to the logistics of closing down a street and craning down the failed unit and putting a new one up again."
-Developer/Owner (Washington)

Owners are unclear on the technical aspects of very high efficiency DOAS; are concerned about contractor capacity to install and service; and are skeptical of economic claims.
In each of the interviews, a brief overview of very high efficiency DOAS was shared. Owners understood the concept initially but had difficulty understanding how the system worked in practice. The concept of pre-conditioning air raised skepticism, especially in regions with significant temperature differential. This may be due to a lack of inclusion of a supplemental heat source on the very high efficiency DOAS diagram.

"It's pretty difficult to dump that air straight into a building out of an ERV. There must be some supplemental conditioning. Otherwise, if it's minus 20 out and you're still pulling in a minimum outside air, you're talking about a temperature [differential] somewhere between 70 and minus 20. So, you're probably going to get maybe 35- or 40-degree air out of that system, which feels like air conditioning and from a comfort standpoint is not real acceptable."
-Owner Advisor (Montana)

Further concerning owners is the belief the high-performance HVAC will be more complex to install, maintain, and operate than a conventional system. Many shared the perception "the greater the complexity, the greater the likelihood of 'operator' error and poor results." One interviewee noted, "If my tenants don't know how to use the system, I get all sorts of 'repair calls'– which is costly – it takes up my property manager's time and makes my tenant unhappy, which in turn means I may get a bad review for being an unresponsive landlord."

Vendor capacity and "new" technology are also concerns. Owners shared concerns that the technology would be new to local HVAC contractors. Several owners mentioned they would be unlikely to use a system that only had a handful of experienced vendors with the capacity, depth, longevity, and skill to install and maintain. In the smaller markets, (e.g., outside of the major Portland and Seattle metros) a lack of skilled vendors was raised as a significant concern by interviewees. Fears over equipment reliability and availability if repairs or replacement were needed further exacerbated their concerns.

"I wouldn't want to use someone who hasn't demonstrated quality or experience in the past."
-Owner/Investor (Oregon)

"You're really relying on third party maintenance - a set of contractors coming back to provide repair and maintenance of systems. If you can package the installation and maintenance, then [the property owner] has security. That's where people have a big fear factor. What am I going to do when you walk away? What happens when I can't find the guy to fix it? What happens when I don't trust that anybody in this entire state knows what you put on my building?"
-Developer/Owner (Washington)

Owners lack enough background on the economic claims to trust them. The financial data and metrics provided in NEEA's very high efficiency DOAS materials lack sufficient detail and substantiation. The range of upfront capital expenditures is not clearly articulated, nor understood by owners, and potential energy cost savings can't be validated by historic

operations. Interest in installing very high-performance DOAS is stymied by a lack of clarity on both the up-front costs and the estimated operating savings as compared to conventional HVAC systems. Finally, interviewees noted NEEA's claimed savings are contingent upon future events that may or may not occur—savings depend on installer's skills, occupant or tenant behavior, proper operation, weather, and maintenance.

IAQ matters to owners but its full impact on building occupants is not yet a key driver in investment decisions.

IAQ is more important in some regions, but not others. In locales where air quality is particularly bad due to inversion layers and stagnant air (e.g., Boise and Missoula), the importance of air quality is broadly recognized and could be a driver for HP HVAC. COVID and wildfires have raised awareness around ventilation; however, how this plays out in new HVAC systems remains to be seen. Interviewees noted, IAQ is something tenants are beginning to ask about, and owners view high quality ventilation as a potential driver for tenant recruitment and retention, viewing "healthy buildings as a risk mitigant strategy" and differentiator in the marketplace.

"I think it I has become a check mark that everybody asks as you start your design process on a new building. How are we going to address this issue? Because tenants are highly sensitive to it [COVID] right now, it is an issue that is brought up early and is becoming a decision-making factor. However, it's too early to tell whether tenants will pay more and if so, how much more. It's also really hard to break this out as a deciding factor in a decision to lease something – it's a piece of the pie, but how do I isolate and weight that?"

-Developer/Owner (Washington)

Indoor Air Quality, Health and Cognition.

Recent studies from the Healthy Buildings program at Harvard's public-health school focus on how indoor air affects cognition and other aspects of human well-being. In a startling statistic, they note that American's spend 90% of their time indoors[1], making indoor air quality a key factor in long-term health. In 2017, Harvard researchers published the results of highly controlled lab study of 24 knowledge workers in differing air quality conditions.

The result of the study showed that improved ventilation positively affects cognitive function, an indicator of worker productivity. Accordingly, better air positively correlates with an occupant's ability to process information, make strategic decisions, and respond to crises. A follow on one-year study, which included participants in offices across six countries working in a variety of fields, including engineering, real estate investment, architecture, and technology, found that increased concentrations of fine particulate matter and lower ventilation were associated with slower response times and reduced accuracy on a series of cognitive tests.[1] Researchers estimate that doubling ventilation rates would cost of about $40/person/year, but that productivity could be increased by $6,500/person/year.[1] Integrating health and productivity analysis into the analysis further bolsters the argument for HP HVAC.

https://pubmed.ncbi.nlm.nih.gov/26593933/; https://hbr.org/2017/03/research-stale-office-air-is-making-you-less-productive

"The one thing I can convince other Idahoans of is that we need better ventilation, and our indoor air is the one thing that I can get other people on board that it's worth the extra dollars."
-Developer/Owner (Idaho)

COVID and wildfires have raised awareness and as result there is increased interest in incorporating high performance HVAC into buildings.
Interviewees suggested this is more prevalent in locations where public awareness is high and/or municipal or state regulations are driving building requirements.

"Wildfire smoke is a bigger issue."
-Owner/User (Montana)

Owners have little understanding of the actual impacts of air quality/ventilation on human health and performance nor do they understand the real business risks/liability for failing to implement very high efficiency DOAS ventilation, much less the demonstrated positive human and economic impacts (see sidebar above). However, the interviews show that there is an opportunity to increase interest in very high efficiency DOAS by clearly linking ventilation, IAQ, and occupant health.

"We have terrible air quality here in the winters. I think this is like such a nice application just for folks who have severe allergies and need the extra filtration. "
-Developer/Owner (Idaho)

"Oh, I know [owners and tenants will pay more for better HVAC.]. If it brings them better indoor air quality, so they're not having asthma and [other] issues, and it saves them energy on their energy bills, then it's a pretty easy sell. They just need to have someone present it to them in the right way."
-Developer/Owner (Idaho)

The changing climate offers a lever to adoption.
Two interviewees (from Washington and Montana) brought up climate and increasing heat as a driver for doing HP HVAC retrofits in their buildings. The increased number of "heat days" and higher overall average temperatures has received some attention from owners and was specifically cited as a reason for upgrades to their HVAC systems.

"When the remodel was done, the weather was different – it didn't get this hot. Things have changed."
-Owner/User (Montana)

Owner/users have a broader decision-making framework than investor/owners.
Owner/users focus primarily on their business first and foremost – how they choose their space, and the investments made, are derived from business needs. Investments can both benefit the business and have long term impact on comfort and operations. Capital is limited and property capital expenditures vie with business needs for funding. Property ownership longer than 10-years is common. Owners typically upgrade their buildings to support long term business growth and future operational needs. Decision-making also includes calculus around employee recruitment/staff retention.

"As a business owner – I am in a position to constantly upgrade, make things better – for my staff, for my clients, for my business."
-Owner/User (Montana)

[T]he utility bills and the energy piece…are very small comparatively to their operations. And, so, most building owners are trying to focus on their business."
-Owner Advisor (Montana)

"I was really tired of being uncomfortable. I didn't change the HVAC during a remodel, or at the end of its 'natural life' – I did it several years after a remodel. We were using baseboards for heat, and portable air conditioners for cooling. It was just stupid, expensive, loud, and inadequate."
-Owner/User (Montana)

Operator preference for legacy systems create an impediment to adoption.
Legacy systems are simple, made of durable materials with few moving parts, are currently working, and when they are not, can be serviced by most any vendor, maintenance person, or even janitor. Building owners, particularly smaller ones, typically rely on their local trusted HVAC contractor to advise them on new systems. The legacy systems are generally easy to maintain, the repairs are simple to execute and replacement parts easy to get. Contractors who understand how to fix them are in every market. As noted by one owner, the physical system may outlast the lifecycle of the technology embedded in the hardware – but, if it works, there's no reason to change it.

"[E]nergy use is lower as compared to an old building, [but] newer controls require more effort and expertise. We really don't have anyone on staff, or anyone with the skill set or time to properly manage the building. Before the retrofit, it was a simple system which didn't take a lot of hands-on management. But these new building systems do.
They're finicky and usually delicate. They don't have the robustness of the old systems (which were built to last 50-100 years). And they're made with lighter/cheaper metals, which also detracts from robustness."
-Owner (Montana)

The smaller size of very high efficiency DOAS equipment may provide opportunities to expand the vendor and contractor pool to smaller or mid-size companies.
This results in the twin benefit of increased HP HVAC providers (reducing owners concern over long-term servicing) and the inclusion of diverse, minority and women owned contractor companies, who are more likely to be smaller firms.

Interviewees also noted there is a middle market of developers and builders that this system seems well suited toward. These smaller buildings for which very high efficiency DOAS is ideally suited (under 50,000 s.f.) are more likely to be owned by smaller, local owners and developers. Many of these owners have long standing relationships with smaller, local HVAC vendors and contractors. However, most of the education and training around high-performance systems is done for the large companies.

One additional finding associated with downsized and separated systems relates to the potential of furthering equity and inclusion in the vendor pool. Two interviewees made the connection between the sizing of very high efficiency DOAS equipment and social equity. If very high efficiency DOAS equipment is in fact smaller, lighter, and less bulky, it may not require a crane to install, and instead, perhaps could be done via a lower cost lift, which could make it easier for smaller contractors to manage and install these units, including diverse, minority and women owned businesses. There exists an opportunity to target instruction and training on the installation, repair, and maintenance of this new technology for these smaller providers.

"The training becomes the tool that allows smaller groups, smaller contractors, smaller maintenance shops to better understand the newer technology, and have a competitive edge to go out and bid that work."
-Developer/Owner (Washington)

Some large national accounts or big box retailers rely on outside energy efficiency consultants for recommendations.
One interviewee noted large "national accounts" or "big box" retailers sometimes indicate a preference for individual system solutions (as opposed to integrated systems) that meet targeted financial hurdles. As noted previously, one interviewee noted approximately 30-40% of their national retail clients do portfolio wide changes to their HVAC systems, sometimes retiring the systems early to gain economies of scale across their asset holdings.

"If a retailer finds a project that meets their financial metric threshold, they move forward with it. In the [retail] space, the margins are relatively low. While they still have to meet their financial hurdles (11-13%) and prove it to their 'higher ups,' it is definitely an interesting talking point."
-Owner Advisor (Oregon)

Recommendations

Research and explore potential partnerships with organizations whom commercial building owners – both owner/investor and owner/user - trust and rely on for advice, education, training, and connections.

Owners rely on trusted advisors within their industry – these may be real estate brokers or professional organizations such as the Urban Land Institute, the Building Owners and Managers Association, American Institute of Architects, property management associations, local business organizations such as the Chamber of Commerce, Rotary, Economic Development Agency, or even a junior college or university. The objective is to educate owners directly and through their advisors and peer networks:

- Educate the leasing community by providing brokers educational opportunities such as one-hour introductory presentations that NEEA could host and longer term (2-4 session) continuing education qualified course work through the state realtor licensing organizations.[5]
- Educate through professional organizations by partnering on presentations, white papers, and case studies. The role of advisor is to educate their clients or members on systems, methods or technology that brings heightened value to their property or occupancy. Since the benefits from HP HVAC are not readily apparent, - it's hard to see airflow, easily discern temperature swings or even health benefits resulting from outside air - a clear and compelling narrative of the co-benefits needs to be articulated.
- Partner with local junior colleges and universities to offer a HP HVAC module as part of their engineering, architectural or sustainability programs. As an example, in Oregon Chemeketa, Lane, Linn-Benton and Portland Community Colleges all have HVAC programs.

Create an interdisciplinary NEEA program team to pilot a unified and integrated value proposition for energy efficiency in the built environment.

In addition to pursuing the avenues that will enable very high efficiency DOAS in the market, add a pilot program which pursues innovative transformation across sectors. In the pilot, instead of leading with HP HVAC, lead with integrated design and messaging from the beginning. Design, analyze and describe high-performance systems in totality, including building envelope, HVAC, lighting, etc.

[5] Such as those offered through The Energy Trust of Oregon or Earth Advantage. https://energytrust.org/commercial/tools-resources/; https://www.earthadvantage.org/initiatives/training.html or more broadly through the National Association of Realtors. https://www.nar.realtor/commercial/courses-designations-and-events

Create a series of case studies which specifically highlight HP HVAC solutions and integrated energy efficiency solutions, initial costs, ongoing savings, and occupant outcomes across a variety of property types. Clearly articulate the difference in upfront costs vs. conventional HVAC and potential energy cost savings.
Interviewees expressed skepticism over the economic returns NEEA claimed in its materials. Owners cannot consider upgrading to a very high-performance DOAS if they have no economic basis for analysis.

Illustrate the solution through two types of case studies clearly articulating cost and performance differentials. Focus one set of case studies on very high efficiency DOAS exclusively. Focus a second set utilizing an integrated approach of measures (envelope, HVAC, lighting, etc.). Segment by asset type (office, big-box retail, strip center retail). In both series of case studies, integrate total upfront cost (cap-ex) and ongoing performance returns as compared to conventional design. Highlight the resulting lower risk profile, IAQ benefits, and reflect budget tradeoffs and financial outcomes for both owner and tenant.

Owners recognize these are examples, not specific to their buildings. As designers are often the first point of contact with the owner, encourage them to bracket the potential costs and potential savings based on asset type or provide some estimate of the relative degree of difference from a conventional system in percentage terms. Include a full complement of the expenses (upfront engineering, commissioning, avoided energy costs, annual and periodic maintenance) and energy savings (including a statement of any pending or known energy price increases.)

Review education/marketing materials and reframe those targeted at demand side actors (owners, investors) in common, as opposed to technical, language.
Produce a FAQ "one-pager" for decision-makers responding to technical questions and concerns on very high efficiency DOAS.

Link HVAC performance to occupant outcomes in messaging.
Articulate health and wellness outcomes, such as: when compared to a conventional "baseline" building, reduction in volatile organic compounds (VOC) levels and increased ventilation reflect a 101% improvement in occupant cognitive scores.[6] This provides owner/investors with key figures and data to share with potential tenants. It provides owner/users with information to recruit and retain staff.

[6] The impact of Green Buildings on Cognitive Function, October 26, 2015. The COGfx Study - a joint study conducted by Harvard and Syracuse University. Economic, Environmental and Health Implications of Enhanced Ventilation in Office Buildings, International Journal of Environmental Research and Public Health. November 18, 2015. https://thecogfxstudy.com/study-1/view-the-reports/

Research the potential to partner with economic development agencies, professional engineering organizations and small business enterprises to provide training and capacity building for small to mid-size diverse contractors.

One of the interesting opportunities raised by the interviews was the potential to build capacity by educating and training small to medium size diverse contractors. Evaluate the potential for federal and state funding to launch training that could address diversity and inclusion and support local small businesses, while also providing needed comfort to owners on contractor capacity. Reach out to economic development agencies in local regions with a focus on diversity and equity such as Prosper Portland. There may be grants available for pilot projects and/or training.

Research Objective 2 Findings and Recommendations

The second research objective was to identify the key decision makers for public sector building owners (administrative office, K-12 schools, and universities), understand their processes, and how this understanding might inform program engagement and marketing strategies. Data around this objective is limited as it is based on 2 interviews. To protect interviewee confidentiality, when quoting them, we identify only their role (not their state).

Public Sector Owners – Government/Schools

Findings

Topline capital decisions are made through governing bodies such as the legislature, city council, county commissioners, city council, and school boards.
Funding needs for new capital projects are referred up to the governing body through a formalized hierarchy – from the local school or department, through a budget request, and then approved (or not) through a formal public process. [7] Elected officials must be responsive to the needs of their community; therefore, taxpayer and constituent priorities are top-of-mind. Department heads have authority to administer funds within their budget allocation (subject to delegated authority).

"…Most building owners are trying to focus on their business and for schools, that's educating kids. That's what they're good at. In Montana, maybe the top 20 schools actually have a facility person, but it is a very limited role where they are also a janitor or a cleaner. "
-Government/Education Interviewee

There is limited capital availability and competing resource needs, thus government entities must prioritize and triage.
Government entities prioritize and triage capital needs for rehab or upgrade in a multi-step process:

1) The users/staff must recognize there is a problem or a need.
2) The problem must be prioritized and triaged as compared to other needs.
3) The problem must be raised to a higher authority (e.g., department head/legislature/school board)
4) The funding source must be identified and secured.

[7] The Capital Budget is the portion of the state budget dedicated to acquiring and maintain state buildings, public schools, higher education facilities, public lands, parks, and other assets. In Washington, for example, the Office of Superintendent of Public Instruction submits a biennial budget request for the School Construction Assistance Program and several specialized programs.

"We are proactive with both schools and government. Typically, we do a building walkthrough. You can see the age of a system and look at the utility bills and compare the two to determine if there is an opportunity or not. This is all on us – we cover the initial costs. If we think they need a new system, we let them know. Then, if they decide it's a go – they typically go through the process of an RFQ and RFP, and we end up competing on everyone.
But it's also relationship driven."
-Third party advisor Interviewee

Capital expenditures are reliant on allocation from the governing body. Budgetary pressures often restrain the investment of time and funds to maintain the assets to a level that will ensure its full life cycle expectancy. Funding is limited by tax revenues, bonding capacity, grants, and incentives.[8] Initial funds are allocated at the legislative level, then drop to each department for further prioritization. Within a department, prior documented savings from HVAC or other efficiency investments, where the savings can be carried forward in the budgetary line item, may provide capital for future projects.

"You can blend saving from different factors and focus on higher payback items harvesting savings from lower payback throughout the [district]."
-Third party advisor Interviewee

State and local governments face a constant challenge to keep up with both operations and maintenance, the need to upgrade HVAC systems as well as instructional needs, and classroom capacity. Facilities repair, maintenance, or improvements compete with funding needs for staff, materials, and curriculum. Typically rehab or refurbishment of schools and government buildings are prioritized based on most immediate need.

"We prefer to do our projects with "in house" funds – but these are usually sparse. Discretionary monies typically go to educational programs, professors, etc."
-Government/Education Interviewee

It often takes a skilled third-party contractor, maintenance provider or Energy Services Company (ESCO) to recognize performance problems, identify solutions and provide alternative funding recommendations.
Interviewees reported that unless it is particularly egregious, building occupants don't recognize when a problem exists with their HVAC system. "As long as the lights turn on and the heat goes on, few staff, students, or administrators recognize they aren't getting good ventilation, or that the system is inefficient or failing." People are focused on doing their day-to-day work (e.g., educating children, serving their DMV patrons), and less so on building operations.

[8] Example: Washington State Organization and Financing of Schools, November 2020 https://www.k12.wa.us/sites/default/files/public/safs/pub/org/20/2020_Organization_and_Financing_of_Schools.pdf , pages 133-138

"[M]any schools don't even know they have a problem, they just pay the bills, and systems that were installed in the fifties, sixties, seventies that are running and still 60% efficient. Steam systems that are somewhat bulletproof, still run. And they heat the space, and they don't know they're not getting ventilation."
-Third party advisor interviewee

As noted by one third-party advisor:

"I can't think of a [energy efficiency/HVAC] project that has come from either a school district or local government official to us. I just can't even think of one."
-Third party advisor interviewee

IAQ is increasingly important to decision makers due to COVID.
As noted above, interviewees commented that until COVID, there was scant attention paid to IAQ. In the last 18-24 months, concerns over health and safety have raised awareness and attention. As noted above, research compiled by Harvard's Healthy Buildings program [9] has also raised awareness in the public sector. Funds allocated by the Federal and State governments have provided the opportunity for some improvements to be made since the start of the pandemic. But there are competing needs for capital. Priorities and level of concern differ from city to city and state to state and more commonly, instructional technology for remote learning (laptops, tablets, etc.) has won out over facilities upgrades.

"We were specifically focused on very-high-energy stuff when COVID came along, and we shifted gears – picking up enhanced ventilation."
-Third-party advisor Interviewee

New public buildings are especially good candidates for high performance HVAC.
As in the private sector, it is easiest to integrate high-performance HVAC into the design of new construction from the beginning. Due to government mandates, especially in Oregon and Washington, most new construction projects are already focused on some level of energy efficiency and sustainability. Many universities, and almost all public ones, in the four-state region have sustainability mandates (such as meeting USGBC LEED standards) for new construction. At the university level, many new buildings are funded by a benefactor who supports innovative technologies and sustainability, making integration of high-performance HVAC an easier sell. For major rehab, often combining hard to see items such as high-performance HVAC along with some visually compelling construction projects provides the "curb-appeal" that allows funding to be garnered.

"We're 'specing' [specifying] high performance in all new buildings. All buildings on campus must meet a minimum LEED silver. All new construction – is focused on energy conservation, and high-performance HVAC."
-Government/Education interviewee

[9] https://pubmed.ncbi.nlm.nih.gov/26593933/; https://hbr.org/2017/03/research-stale-office-air-is-making-you-less-productive

"It's much sexier to build a new building or an addition or renovation that looks great than it is to replace a boiler that nobody sees. In that case we often combine some things to build curb appeal into our projects to help sell to the voters, school board, or whomever else is making the decision."

-Third-party advisor interviewee

Operator preference for legacy systems create an impediment to adoption.

As with private sector owner/investors and owner/users, legacy systems present a tremendous challenge to public sector owners when implementing new technology. Many buildings are served by building engineers with long-standing experience with the existing system. Some school districts rely primarily on custodians to also provide maintenance. There is little capacity to integrate new high-performance HVAC systems easily and maintain them over the long term**.**

"Training the facilities staff is a huge issue. We are adding complexity to everyone's life. New and more complex systems. Change management is a huge piece – people don't know what they don't know. Engineering/maintenance staff must have ownership and buy-in."

-Education/Government interviewee

Recommendations

Identify potential champions in government, universities, and K-12 schools.
Identify key building sustainability leads in targeted municipalities or state, university, school districts, such as facilities managers, project managers or construction and development managers.[10]

Explore opportunities to present and speak about HP HVAC at professional meetings of state or regional school superintendents, principals, and building engineering staff.
One interviewee noted that superintendents change school districts every few years. When they move to another school district, they take their learnings and apply them to the next district. The greater the number of touch points, the greater likelihood of informing their decision-making process.

"You need to have some sort of champion…in the administration somewhere. It can come from the superintendent, or in one school district – the business manager. The school district failed several bonds in a row. They had deteriorating schools. We had to think about how we could fund a project without having an impact on taxpayers."
-Third-party advisor Interviewee

Frame messaging around the benefits and positive outcomes for primary operational goals (e.g., educating students), being sure to use data and metrics that back up these claims.
The economic value of better energy efficiency (lower costs) and better air quality (better health leading to fewer sick days) is a public benefit. The costs and value all roll up to the highest level, whether that is the governor's office, the mayor's office, the university president, or school district superintendent, and ultimately the taxpayer. Frame the benefits analysis in terms of specific value propositions related to each entity's primary operational goals – such as the goal of educating children. For example, the number of teachers hired; number of books/laptops/tablets purchased; number of materials purchased; number of scholarships funded; list of extra-curricular activities enabled, etc.[11]

Identify and leverage sustainability mandates and funding opportunities to create pilot projects in public buildings (including universities and K-12 schools).
At the Federal level, the 2021 Federal Infrastructure Investment and Jobs Act (IIJA)[12] includes elements which support more sustainable schools and communities (see Appendix D). The legislation includes U.S. Department of Energy grants to support energy efficiency and renewable energy at public school facilities. And there are Energy Efficiency and Conservation

[10] Responsibility for many government owned facilities will fall under the State Division or University Department of Facilities or Facility Services.
[11] https://www.eia.gov/todayinenergy/detail.php?id=21152
https://spaces4learning.com/articles/2015/07/01/school-costs.aspx - :~:text=The median elementary school reported,173.4 square feet per student.
[12] https://www.whitehouse.gov/briefing-room/statements-releases/2021/11/06/fact-sheet-the-bipartisan-infrastructure-deal/

Block Grants (originally funded through the 2009 American Recovery and Reinvestment Act). At the state level, a review of state policies (see Appendix E) suggest that Washington and Oregon have the most likely potential given existing regulations and funding sources.

Explore opportunities to expand work with Energy Performance Contractors and ESCOs to educate schools and government agencies.
The U.S. Department of Energy has identified a list of qualified ESCOs[13]. Several that are active in the four state NEEA region include McKinstry, AMERESCO, and Pacific Energy Concepts. While ESCO enabled projects typically need to be sizable, there is the potential to adopt programs that can be deployed across portfolios of buildings.

Explore potential partnership opportunities with organizations promoting sustainability in schools.
The U.S. Green Building Council (USGBC) has a Green Schools Initiative[14] - The Center for Green Schools - that would provide a useful source of contacts and ideas.

Identify key staff within universities who are already designing and building to sustainable standards.
Leverage existing NEEA relationships with the Integrated Design Labs at University of Washington (Seattle), Montana State University (Bozeman) and the University of Idaho (Boise) and the Energy Studies Building Lab (EBSL) at the University of Oregon (Eugene and Portland). NEEA has a longstanding relationship with the IDLs and individuals who currently or previously worked in each. Use these relationships to identify key building sustainability leads at each university. As new construction often is the easiest driver for integrating new technologies, determine if there are opportunities to integrate very high efficiency DOAS into these new developments. Additional benefit, education and training can be harvested by engaging students in the design, analysis, and construction of these high-performance HVAC elements.

[13] https://www.energy.gov/eere/femp/articles/doe-qualified-list-energy-service-companies
[14] https://www.centerforgreenschools.org/

Overall Conclusions and Recommendations

This study builds on NEEA's prior research on HVAC market characterization and the process around High-Performance HVAC design decisions. The study seeks to understand how decisions are made from the perspective of public and private sector owners of small to medium size commercial property. Who drives the decision to invest in HP HVAC, what real or perceived barriers exist which constrain owners from deploying this technology, and what interventions can NEEA's High Performance HVAC program could use to overcome these barriers?

During the interviews, the research team shared a high-level explanation of very high efficiency DOAS. Unlike traditional HVAC equipment, very high efficiency DOAS requires several key pieces of equipment functioning together. This includes a heating and cooling system to condition the air and a separate ("decoupled") ventilation system. The decoupled very high efficiency DOAS allows for optimal control of each of these critical building functions and downsized mechanical systems, resulting in greatly reduced energy use. However, given the system's complexity, need for skilled engineering and upfront cost, very high efficiency DOAS is generally most practical for new construction or buildings undergoing a major renovation and/or planned HVAC retrofit.

The hypothesis going into the research was that the high first costs of very high efficiency DOAS relative to conventional systems and return-on-investment requirements often made it difficult to implement high-performance HVAC. Based on the interviews, private sector owners and public sector owners recognize there are secondary and tertiary drivers to value, however, most commercial property owners have not been educated on how these attributes directly create value. These include anything that increases leasing velocity or reduces tenant turnover. Investments that enhance a building's longevity and competitiveness in the marketplace. It includes superior IAQ. It includes occupant comfort and health.

In understanding the dynamics and mechanisms to reach commercial building owners, it is crucial, as taught by leadership expert Simon Sinek to "Start with Why"[15] and create a compelling value proposition. As noted by Sinek, people need to understand the "Why" behind a new idea, such as very high efficiency DOAS, before they will truly buy into it.

[15] Simon Sinek, 2009 TED Talk – Start with Why – How Great Leaders Inspire Action
https://www.ted.com/talks/simon_sinek_how_great_leaders_inspire_action?language=en

[16]

Tell a simple story.
The benefits are not readily apparent – occupants can't easily see, touch, or even feel them. You must describe them and place a specific economic framework around them. Reduce the fear that this is "something new." Bringing in outside air to heat and cool a building, or ventilate a space is age old. The solutions are proven. They are not high-tech, they are simple, have few moving parts and the marketplace has experience with these individual components.

Link the value to the economic, health, productivity, and social outcomes.
To change how we design, build, and operate buildings, we have to change the narrative. Moving from binary, siloed choices to integrated design, analysis, and messaging. Articulate a clear narrative between upfront cost and potential savings. And translate the value into a dollar number, and organizational sustainability goals. Building owners are wise to incorporate health impacts into their cost-benefit calculations and be prepared to articulate these for their occupants or tenants. When health is accounted for the costs for enhancing the indoor environment can be properly evaluated against the full range of benefits, including productivity and wellness.

"This is an opportunity in which you're going to save a boat load of money and look like heroes. And you are doing something unique, smart."
-Montana Interviewee

[16] Graphic from Outsource.be https://www.outsource.be/en/communications/why-start-with-why-by-simon-sinek-offers-added-value-for-your-communication-and-pr/

Finally, education is key.
The lead time for any major rehab or construction is long. Educating early in the process, in various venues, and through a multitude of partners is key. Utilize a wide net to partner with a range of players – professional organizations, the business community (including chambers of commerce), the brokerage community, and owners. And partner with economic development agencies to educate and support capacity building and development of small, diverse contractors.

Existing Gaps and Further Areas for Study

Interviews with study participants identified gaps in the information provided on very high efficiency DOAS and further areas of study that NEEA consider.

- **Upfront costs of very high efficiency DOAS.** The very high efficiency DOAS materials state the upfront costs of installing HP HVAC are greater than a conventional system, but that ongoing operational costs are lower. Interviewees collectively noted a greater need to understand the difference in upfront costs of very high efficiency DOAS as compared to the conventional alternative (or at a minimum the percentage (or order of magnitude) delta).
- **Reasoned estimate of ongoing energy use post installation of very high efficiency DOAS.** To adequately compare a conventional system to a HP HVAC system, property owners noted the need to accurately estimate the ongoing energy use and cost savings. A systematic assessment of upfront costs combined with a reasoned estimate of energy use will help owners effectively evaluate the tradeoff between up-front costs and ongoing savings, enabling a more accurate assessment of the value premise engendered by the new technology.
- **Maintenance and commissioning requirements of very high efficiency DOAS equipment.** With regards to technical skepticism, interviewees requested more information on the maintenance and commissioning requirements of very high efficiency DOAS. This will provide property owners with ability to evaluate 1) whether existing vendors and maintenance staff have the capability to maintain the systems and 2) what additional costs should be included in operational expenses for commissioning.
- **Identify existing or potential contractors and their training needs.** Research on the availability of skilled contractors in each of the NEEA regions, would help alleviate property owner concern as well as provide a starting point to identify vendor education and training needs.
- **Research into available Federal and State grants and funding** (such as the 2021 Federal Infrastructure Investment and Jobs Act[17]) to support HP HVAC or other energy efficiency measures would identify specific capital sources and help NEEA target their efforts to use resources most efficiently and productively.

[17] https://www.whitehouse.gov/briefing-room/statements-releases/2021/11/06/fact-sheet-the-bipartisan-infrastructure-deal/

Appendix A – The 7 Tribes of Real Estate

James Finlay – The 7 Tribes – Investment Risk Cultures, Clusters, 2012

https://www.slideshare.net/JamesFF/7-tribes-of-real-estate-investmt-risk-behavior-garr-inst-cbb-05-24-2012-finlay5

1. SFR/ 1-4 Units
    a. Generally owner-occupied
2. Small C&I (Commercial and Industrial)
    a. SBA mom & pop/owner-user < $2 million
3. Medium C&I
    a. Larger owner-user/part owner-user, local investor
    b. $2 million - $10 million
4. Large C&I
    a. Multi-tenant, leased investment
    b. > $10 million
5. Multi-Family
    a. Medium/large, Affordable, market, investor grade apartments/condos
6. Special Purpose
    a. Gas station, fast food, hotel/motel, theater, data center
7. MUSH
    a. Municipal, Universities, Schools, Hospitals

In the very high efficiency DOAS study, we updated the estimated investment size from those in 2012 to 2021 and did a further breakdown on the four categories studied, as shown below.

Primary Real Estate Owner Characteristics of the very high efficiency DOAS Demand Side Market Actor Study				
Investment Influence	**Small Commercial/Industrial Owner/User**	**Middle Market Owner/Investor**	**Large C&I**	**Public Sector/Government MUSH (Municipal, University, Schools, Hospital)**
Holding period	≥ 8-10 years	varies	short or long	long
Typical Occupant	Owner User/single tenant	Single to multi-tenant	Multi-tenant	Single tenant – multiple uses
Decision Maker	CEO/Owner/Partner	CEO/Owner/Partner	Asset Manager/Project Manager/ Division president/"C-Suite"-Board	Department Head Legislature/Governing Body
Additional Actors	HVAC contractor	Third party engineer or consultant	Dedicated Building Engineer	Government contracting, Building maintenance, Janitor
Equity available for development	limited Tied to owner and/or operating business	Varies tied to tenant/NOI	good tied to tenant/NOI	Tied to public process Competition for limited resources
Debt avail (size, cost & access)	Tied to operating business and/or traditional mortgage	Varies Tied to tenant/NOI	good, but balance sheet issues	Typically bonding
Investment analysis sophistication	very limited in real estate	limited to good	very good	varies
Risk Appetite	adverse	mixed	sophisticated	mixed
Influences to act	economic, branding, reputation, employee recruitment/retention, health	economic, social/reputational, tenant driven	economic (cash flow/value), tenant driven, social, corporate ethos/stated sustainability goals, regulation	mandated, equipment failure, economic, pilot or demonstration project, health, and wellness
Influencers to act	peers, friends, vendors/engineers	Engineer/advisors	C-suite, asset managers	advisors, constituents
Regulation as influencer	low impact	Medium impact	high impact	High impact
Primary hesitation	capital constraints	market value, payback	market value, payback	capital constraints

Appendix B - Recruiting Language

Recruiting Language used on social media

Are you interested in building or renovating to high-performance, carbon-neutral/net zero standards? Better indoor air quality? state-of-the-art technology quantifiably more profitable and cost effective than conventional construction/rehab?

We want to hear from YOU. We're seeking decision makers - qualifying commercial building property owners (including local/state/federal government and schools), portfolio managers, occupants/tenants, investors, lenders and appraisers in Oregon, Washington, Idaho and Montana.

You can earn $250 by participating in virtual focus groups or one-on-one interviews during December 2021. Interview participants will learn about state-of-the-art HVAC technology and will have the option of receiving additional free training about high-performance HVAC for indoor air quality and energy efficiency.

To qualify, the following building attributes are preferred:

· Office, retail, school, or government building
· 50,000 sq. ft. or less
· Owner/user or multi-tenanted, for-lease buildings
· Have previously undergone and/or are planning a new construction or major retrofit

If you think you are qualified and would like to learn more, please send me a direct message.

#netzerocarbon
#CarbonNeutral
#HighPerformanceBuilding
#Oregon #Washington #Idaho #Montana

Appendix C – Interview Discussion Guide and Presentation

Interview Discussion Guide and Slide Presentation

VHE DOAS Interview Discussion Guideline – Commercial Decision Makers

This project seeks to understand how decisions on new and replacement HVAC systems are made by demand side market actors/commercial building stakeholders (e.g., owners, investors, occupants, tenants, appraisers, financiers) – those, that have a financial interest in building ownership, investment, and operations. To understand this, we want to get some insights on the key criteria you consider when deciding on a new or replacement HVAC system and what influences your thought process and ultimate determination?

Housekeeping items:

- With your permission, we will be recording and ultimately transcribing this session for our research. If you do not want us to record, we will take notes.
- We will not attribute any answers or comments specifically to an individual or firm
- We will be compiling answers and may group responses into decision-maker categories (e.g., owner/occupant; small business; investor/owner; government agency; education facility; appraiser; investor and/or banker)
- We will provide a summary of our research to you when it is completed.
- This discussion will take +/- 60 minutes.
- We will provide you with a $250 online gift card to thank you for your time. We'll confirm your contact information for the card at the end of the interview

Agenda:

- 10-minute overview of the VHE DOAS system
- Brief Q&A to answer clarifying questions
- Interview Questions
- Close/summation

Interview Discussion Framework:

1. For a new or existing building [Clarify with interviewee which they are speaking about initially, then do follow up on the remaining typology]
    a. when would a choice to change or upgrade the HVAC equipment come into play?
    b. With an existing building, what is the trigger?
2. Who do you rely on in determining which HVAC equipment to choose?
3. What factors or key drivers are relevant?
    a. [If not mentioned]: Are sustainability, energy efficiency or net zero construction, important factors in your decision making? Why or why not?

4. What benefits do you want to get from a new HVAC system? What do you want it to do for you, your building, and the people in the building?
    a. [If not mentioned] Do you consider indoor air quality? (Especially as it pertains to the health and wellness of building occupants?)
5. To what extent do you think COVID will impact or influence your decision-making on new systems? How so?
6. We've just gone through a series of consecutive wildfire seasons, and are likely to see more, would the prospect of continued poor air quality influence your decisions around your HVAC system? How so?
7. Has this changed in the past couple of years?
8. Have tenants/occupants/staff/students/parents expressed interest or concern about indoor air quality?
9. To what extent do you think better indoor air quality would translate into giving your building an edge in comparison to a competing building? If so, how?
    a. [If not mentioned]: If yes, could it translate into slightly higher rent? a longer-term lease? Lower turnover? a higher quality tenant?
10. To what extent would having better indoor air quality benefit staff or students? If so, how?
    a. [If not mentioned:] Better staff retention? Higher quality work product? Better student cognition and learning?
11. How would you analyze an investment in a new HVAC system?
    a. How do you evaluate the cost/benefit of a particular HVAC system?
    b. Do you consider it individually or as part of a whole design package? (e.g., insulation; unit number/size; fans; operable windows, etc.)
    c. How do you weigh first costs vs. operating costs?
    d. What is an appropriate investment horizon? Do you have a particular return requirement?
12. If first costs on a VHE DOAS system were higher than a conventional system, what factors would you consider in making your decision? What, if anything, would the VHE DOAS have to do to justify the higher expense?
13. [If not mentioned]: If a VHE DOAS system were shown to reduce both energy use and energy cost volatility, could this overcome higher first costs?
14. How does regulation or the risk of regulation come into play?
15. Have you ever had a discussion with your banker, investor, or an appraiser about getting a "green" appraisal for one of your properties? Why or why not?
16. Have you ever had a discussion with your banker, investor, or an appraiser about a high-performance HVAC system? If so, how did they integrate higher performance/lower operating costs into the valuation?
17. What overall concerns would you have about choosing VHE DOAS?
    a. To what extent are these unique to VHE DOAS vs. for any HVAC system?
18. What overall benefits, if any, do you see in VHE DOAS?

Appraisal/Financing

19. If you are an appraiser, how would you value a very-high-performance HVAC system?

20. Would data points would you be looking to confirm?
21. Are there experts you would look to for confirmation of results/outcomes?
22. What financing tools are you aware of, or might be useful?
    a. [If not mentioned]: Could C-PACE work?
    b. Are there specific funders you are familiar with who specialize in or are interested in funding "green" buildings? And what types of incentives do they offer?

Government/Education

23. Who makes the decision on what HVAC systems to put into a new building or retrofit?
    a. What is their decision-making process? To what extent is the process different for new construction vs. major renovation vs. HVAC system retrofit?
    b. How the decision makers learn about new HVAC systems or technologies?
    c. What's the best way to introduce a new HVAC system to these decision makers?
24. What are the key factors that go into this decision?
    a. [If not mentioned] What data or information is needed to select an HVAC system?
25. How are these types [new construction/major renovation] of construction projects typically financed?
26. Could a financing structure that minimized first costs, but allowed capture of lower operating costs work?
27. Do you have any mandates or goals coming from local, state, or federal agencies that would drive you towards or away from a VHE DOAS system?

Final Questions

28. How can we help you? What would be most useful? (e.g., education, training, capacity building, financing, articulation of business case, etc.?)

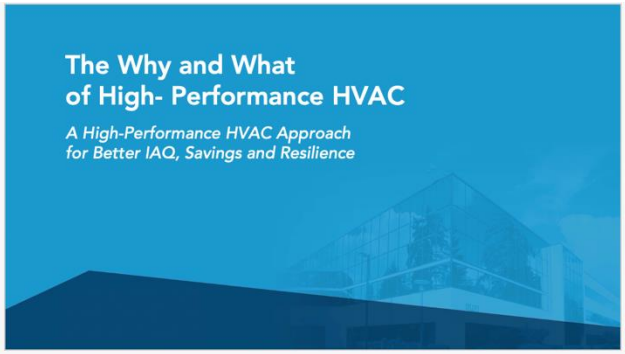
29. Are you interested in participating in a pilot program?

Thank you so much for your time. This has been tremendously useful.

Potential Follow up Questions

30. VHE DOAS systems typically require different smaller ducts and registers, is this something you would consider in the event you were just replacing or upgrading the building's HVAC, or would you only consider it in the context of a planned building renovation/refresh
31. Have you ever had a discussion with a tenant about "green leasing," in which both owners and tenants agree to "green" practices? Why or why not? If yes, can you share some specifics?

Interview Slide Presentation



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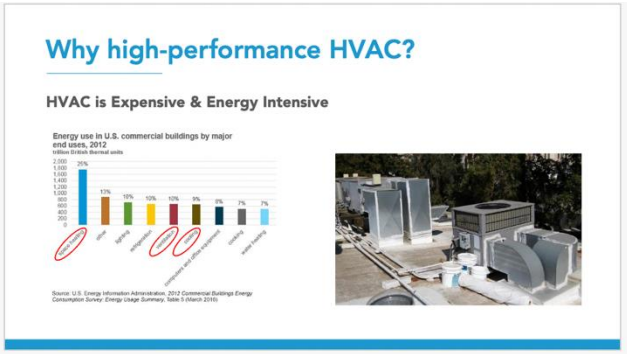

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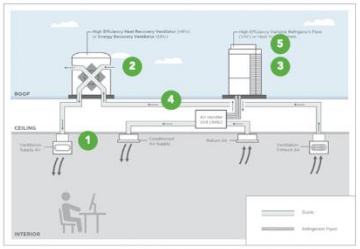
4

Example High-Performance HVAC Design

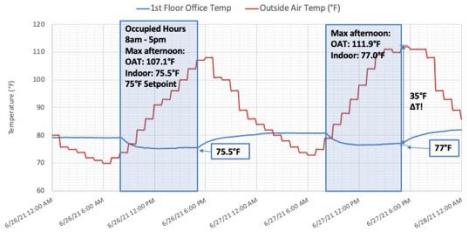


Key Components:

1. Decouple ventilation from heating and cooling
2. Use a high-efficiency heat recovery ventilator
3. Select a high-efficiency heating/cooling system
4. Use high-performance ventilation fan energy
5. Right-size the heating / cooling system

5

Hot or Cold Weather Resilience

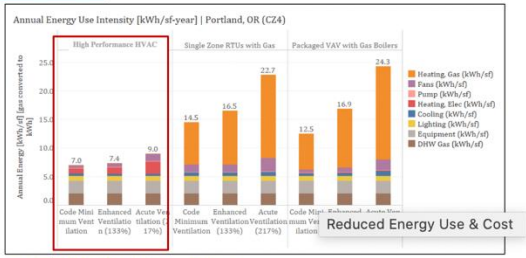


6

System Benefits

7

Reduced Energy Use & Cost



Source: Covid-19 Risk Reduction Strategies and HVAC System Energy Impact

8

Why Upgrade Your HVAC?

Save energy & money
by reducing building energy use by an average of 36%, and HVAC energy use by an average of 65% (compared to a code-minimum system).

Better indoor air quality
due to filtered 100% outside air being brought into the space, with little to no recirculation

Increased occupant comfort
through improved temperature stability and the ability to create zones with unique temperature controls

Meets/Exceeds all Energy Codes in the Northwest

9

Results from NW Projects

10

CASE STUDY:
PNW Preschool

LOCATION: Portland, OR
SQ. FT.: 2,900
COST/SQ. FT.: $22.80

EXISTING SYSTEM:
Constant volume 5-ton packaged heat pump RTU

NEW SYSTEM:
2x 1.5-ton ductless heat pumps
1x 2-ton ducted mini-split heat pump
1x Ventacity Systems 1000RT HRV

58%
reduction in total HVAC energy use

50%
reduction in total building energy use

"The drastic difference in air quality is amazing! Before the renovation, our building was hot, stuffy and humid, and we had lots of odor issues in the classroom. Now the classroom air is fresh and odor-free. The air really does feel fresh and clean.

With air quality such a major topic of discussion during the pandemic, it has been comforting to know we are having a constant exchange of fresh air in our buildings at all times."

—School administrator

PNW Preschool

"I think very high efficiency system is a great choice for preschools to ensure high air quality at the developmental phase of a child's growth when their bodies are developing, their lungs are growing, and fresh air is so vital to their health.

Teachers and staff feel safer in a building with a high standard of air filtration and flow. Knowing that stagnant air is moved out of the building and the incoming air is fresh and filtered makes everyone feel much safer."

—School administrator

CASE STUDY:
Seattle Office Building [5,911 sq. ft.]

EXISTING SYSTEM:
VAV system: combined heating capacity, incl. re-heat coils in VAV distribution units
(16.4 tons heating, 14 tons cooling)

NEW SYSTEM:
(1) VRF Heat Pump System
(1) 1000 cfm HRV
(15.6 tons heating, 14 tons cooling)

51.3
Existing EUI

29.7
New System EUI

PEAK CHANGE:
-30 kW
Winter
-6 kW
Summer

69%
reduction in total HVAC energy use

42%
reduction in total building energy use

CASE STUDY:
Portland Office Building [12,000 sq. ft.]

EXISTING SYSTEM:
(9) RTUs
(43 tons heating, 35 tons cooling)

NEW SYSTEM:
(1) VRF System
(4) 1000 cfm HRVs
(18 tons heating, 16 tons cooling)

51.4
Existing EUI

19.1
New System EUI

Total Project Cost:
$15.61/sf

71%
reduction in total HVAC energy use

61%
reduction in total building energy use

Appendix D - Funding Opportunities

There is an opportunity for additional research on how the funding mechanisms below and other financing mechanisms might support NEEA's work on very high efficiency DOAS and other energy efficiency efforts.

Funding Opportunities

Small Business Administration (SBA) 504 loan program.[18] The 504 Loan Program provides long-term, fixed rate financing of up to $5 million for major fixed assets. SBA 504 loans are provided in partnership between certified development companies, or CDCs, and banks, to small business owners at below-market, fixed interest rates for terms of 10 and 20 years. Loans can be used for the purchase of new buildings or the improvement of existing buildings. Owners can take advantage of a "green" provision offered through the SBA Grow 504 Loan Program [19] which allows higher lending amounts for small business owners who want to buy or improve commercial or industrial buildings to make them more energy efficient. To qualify for the green provision, small business owners need to demonstrate a projected 10 percent reduction in energy costs by implementing one or more energy-saving improvements (e.g., insulation, energy-efficient lighting, more efficient heating/air conditioning, etc.)

Small Business Administration 7(a) loan program.[20] The 7(a) program is the most common loan product provided through the SBA. In addition to uses such as working capital, it can also be used to purchase real estate - land and buildings; the construction a new building; or renovation an existing one.

Commercial Property Assessed Clean Energy (CPACE). Commercial property-assessed clean energy (CPACE) is a financing structure in which building owners borrow money for energy efficiency, renewable energy, and resiliency improvements and make repayments via an assessment on their property tax bill. The financing arrangement then remains with the property even if it is sold, facilitating long-term investments in building performance. CPACE may be funded by private investors or government programs, but it is only available in states with enabling legislation and active programs.[21] Oregon, Washington and Montana have passed CPACE enabling legislation, and the first two states have active programs. Montana only passed legislation in 2021 and no active programs have been reported at this point. Idaho has no CPACE enabling legislation.

[18] https://www.sba.gov/funding-programs/loans/504-loans
[19] https://www.nrel.gov/docs/gen/fy17/66878.pdf
[20] https://www.sba.gov/funding-programs/loans/7a-loans
[21] https://betterbuildingssolutioncenter.energy.gov/financing-navigator/option/cpace; https://www.pacenation.org/pace-programs/

The Infrastructure Investment and Jobs Act (IIJA), passed November 2021
(Summaries below provided by the US Green Building Council (USGBC)
https://www.usgbc.org/sites/default/files/2022-02/Infrastructure-Investment-Jobs-Act-Highlight-Slides_FINAL2.pdf

Private Sector Building Provisions in the IIJA

Nonprofit Energy Efficiency Materials Pilot Program (Sec. 40542) $50M through 2026 for Department of Energy (DOE) pilot program providing nonprofits with grants of up to $200k for building energy improvements, including windows, HVAC, lighting, insulation, etc. Various grant criteria, including "an effective plan for evaluation, measurement, and verification of energy savings." Program to be established within one year of enactment, or by 11/15/22.

Codes Implementation (Sec. 40511) $225M through 2026 in competitive grants through DOE's Building Technology Office to states and partner organizations to assist with the implementation of modern building energy codes. Partner organizations include local code agencies, associations of building and design professionals, local energy efficiency programs and efficiency advocacy organizations.

Energy Efficiency Revolving Loan Fund (Sec. 40502) Through State Energy Program, $250M in FY22 to create a new program providing grants to states to establish revolving loan programs – along with grants and technical assistance – for residential and commercial building energy audits and resulting energy efficiency improvements. Eligible recipients of loans and other assistance include building owners/operators and homeowners. Program to be established within one year of enactment, or by 11/15/22. Funding to remain available until spent.

Public Buildings Provisions in the IIJA

Federal Buildings (Sec. 40554) $250M in FY22 for FEMP's Assisting Federal Facilities with Energy Conservation Technologies (AFFECT) grant program for federal building improvements, remaining available until spent.

EECBG Grants (Sec. 40552) $550M in FY22 for grants to states, local governments, etc. under the Energy Efficiency and Conservation Block Grant Program, remaining available until spent.

School Buildings Provisions in the IIJA

Public School Facilities Grants (Sec. 40541) $500M in Department of Energy competitive grants through 2026 for clean energy improvements at K-12 schools, with priority for schools with renovation/repair needs, lower-income schools, and schools using energy-related performance contracting. Schools and partner organizations (nonprofit and for-profit) are eligible for grants. Those receiving grants must report how funding was used, including estimated cost savings and use of performance tracking such as ENERGY STAR or LEED.

Workforce Provisions in the IIJA

Building, training, and assessment centers (Sec. 40512) $10M in FY22 available until spent for DOE grants for institutions of higher education to establish building training and assessment centers to educate and train building technicians and engineers in modern building technologies.

Career skills training (Sec. 40513) $10 million in FY22 available until spent for DOE grants to support career skill training programs for classroom and on-the-job training for obtaining industry certification to install energy efficient building technologies.

Washington State Funding Opportunities

Washington State Department of Commerce: The **Energy Retrofits for Public Buildings Program**[22] provides grant funding for public entities such as towns, cities, Tribes, and public agencies to make energy updates to public buildings and facilities. These retrofits save money and reduce pollution for schools, hospitals, community centers, and other public buildings. The program includes grants for energy efficiency and solar for state and local governments, as well as the State Project Improvement grants to help state agencies invest in energy efficiency while making other improvements.

The most recent grants were awarded in November 2020. The next set are slated for 2022. Priority considerations in the 2020 allocation were: access for small towns and cities, demonstrated need, and alignment with the 2021 State Energy Strategy [23]which includes helping to fund energy efficiency improvements in rural public buildings, with particular support for schools and hospitals.

[22] https://www.commerce.wa.gov/growing-the-economy/energy/energy-retrofits-for-public-buildings/
[23] https://www.commerce.wa.gov/growing-the-economy/energy/2021-state-energy-strategy/

Appendix E - State Policy Requirements for Public Facilities

Existing Energy Efficiency/Carbon Policies in the PNW
https://www.nwcouncil.org/2021powerplan_existing-policies-clean-electricity-policies

Washington

As required by Chapter 39.35 RCW-High Performance Public Buildings, all major facility projects of public agencies receiving any funding in a state capital budget, or projects financed through a financing contract as defined in RCW 39.94.020, must be designed, constructed, and certified to at least the LEED silver standard. All major facility projects of any entity other than a public agency or public school district receiving any funding in a state capital budget must be designed, constructed, and certified to at least LEED silver standard.

Per the State-funded school construction projects greater than 5,000 square feet are required by Chapter 39.35 RCW - High Performance Public Buildings (link is external) to incorporate high-performance features into their school design and construction. Schools must meet either a minimum of LEED Silver or the Washington sustainable school design protocol standards. The Washington State School Construction Assistance Program (SCAP) provides funding assistance to school districts that are undertaking a major new construction or modernization project https://www.k12.wa.us/policy-funding/school-buildings-facilities/school-facilities-programs/high-performance-school-buildings-program

Under the Clean Energy Transformation Act (CETA), signed by Washington Governor Jay Inslee in 2019 it is mandated that by 2045, Washington must have a 100% non-emitting, clean electricity supply. As an interim step, by 2030, the electricity supply must be 100% greenhouse gas neutral, with at least 80% from non-emitting and/or renewable resources.

Utilities and organizations across the region and nation are grappling with understanding and incorporating diversity, equity, and inclusion within their work and the immediate effects within their communities. Washington utilities are now mandated per CETA to consider the "equitable distribution of energy benefits and reduction of burdens to vulnerable populations and highly impacted communities." This includes – but is not limited to – consideration of public health, economics, environmental impacts, and the equitable distribution of energy and non-energy benefits.

Oregon

In July 2021, Oregon Governor Kate Brown signed a bill that mandated 100% clean electricity supply by 2040 for independent owned utilities (IOUs) and electricity service providers.

Idaho

Idaho does not have any state-level clean policy or greenhouse-gas reduction initiative currently.

Montana

As part of the State of Montana High Performance Building Standard Goals, all State projects with a project budget of $5,000,000 or more must achieve a LEED Certification level of at least Silver.

In 2019 then Montana Governor Steve Bullock, created the Montana Climate Solutions Council to develop strategies and recommendations to address and adapt to climate change in the state over the next three decades. Amongst the priorities is a goal to achieve net-zero greenhouse gas emissions for average annual electric load state-wide by 2035 and economy-wide by 2050. The Montana Climate Solutions Plan completed in August 2020 includes a roadmap with recommendations around community solar installations; exploration of new energy storage technologies and microgrid opportunities.

The future of the Climate Solutions Plan is unclear after a change in the Administration.