

Catalyzing HVAC Market Change:  
**INVESTING FOR MAXIMUM IMPACT**



# HVAC Market Intelligence Report

APRIL 2016



## About This Report

The Bonneville Power Administration (BPA) recently completed research on the Heating, Ventilation and Air Conditioning (HVAC) market. This report highlights how the market works, what the industry is excited about, efficiency trends in equipment sales, and provides insights into opportunities for our programs to boost efficiency in the market.

## Who Should Read This?

BPA seeks to catalyze the market for high-efficiency residential and commercial electric HVAC in the Northwest. This report provides information to support strategic decision-making by the full range of energy-efficiency program planners in the Northwest, including utilities, the Northwest Energy Efficiency Alliance (NEEA), the Energy Trust of Oregon (ETO), and BPA.

# What Data Does the Report Present?

Researchers went straight to the best data sources available for the Northwest residential and commercial HVAC markets. This report reflects findings from:



### HVAC distributor sales data.

The distributor sales data comprises sales of all types of equipment—nearly 100,000 unit sales in total—from five HVAC distributors in the Northwest. Depending on the product, the sales data collected accounts for 35% to 90% of product sales in the Northwest HVAC market.



### Interviews with key players in the HVAC industry supply chain.

The research team interviewed 11 individuals active in the Northwest HVAC market, including wholesale distributors, manufacturer representatives, large mechanical or HVAC contractors, and HVAC engineers.



**Discussions with BPA program staff.** BPA staff shared valuable background information and helped frame the research questions.



### Secondary data sources.

The research team analyzed secondary data from a number of reports and sources including but not limited to the Northwest Power and Conservation Council's Sixth Regional Power Plan, sales data from the Air-Conditioning, Heating, and Refrigeration Institute (AHRI), the 2011 Single Family and Manufactured Homes Residential Building Stock Assessments (RBSA) and the 2014 Commercial Building Stock Assessment (CBSA).

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## IN THIS REPORT

The following key findings and market trends paint the HVAC market picture for program planners to use when deciding where to direct program investments.

### ● **The Industry Is Excited About Ductless**

The HVAC industry is excited about ductless, and it's creating changes in the structure of the U.S. HVAC market. Manufacturers are strategically positioning themselves to gain market share in the United States. Distributors report strong growth in sales of this equipment in the Northwest, but sales have a way to go before they surpass the sales of ducted equipment.

### ● **High-Efficiency HVAC Sales May Need a Boost**

Northwest sales data in 2013 and 2014 show a fairly stagnant market for high-efficiency HVAC equipment. This market may need help to jump-start the shift to today's world of high-efficiency HVAC products.

### ● **How the HVAC Market Works**

An understanding of HVAC purchase decision-making and the flow of products through the supply chain sheds light on why high-efficiency equipment sales are hitting barriers.

### ● **Market Intelligence for HVAC Programs**

The research indicates that sales of high-efficiency HVAC equipment are not taking off on their own, especially sales of high-efficiency ducted HVAC equipment. However, in this slow-moving market, there exists a significant strategic opportunity for efficiency programs.

# HVAC in the Northwest

**FIGURE 1**

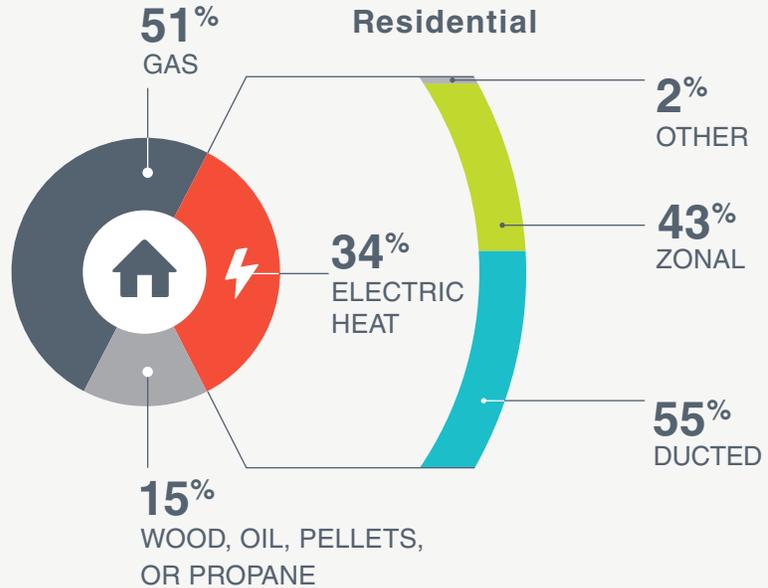
**SOURCE**  
2011 Single-Family Residential Building  
Stock Assessment (RBSA)

Primary heating fuel for single-family  
homes and HVAC distribution type for  
single-family electrically-heated homes  
in the Pacific Northwest

Research on the existing residential and commercial building stock conducted in 2011 and 2014 by the Northwest Energy Efficiency Alliance (NEEA) helps provide the lay of the land for the HVAC market in the Northwest. This information has an important bearing on information presented later in this report about the market potential for ducted and ductless HVAC systems.

As Figure 1 shows, half of single-family homes heat with gas, one-third use electric heat, and the remainder heat with wood, oil, pellets, or propane. Of the electrically-heated homes, over half distribute conditioned air through ductwork, while 43% have zonal heating systems.<sup>1</sup>

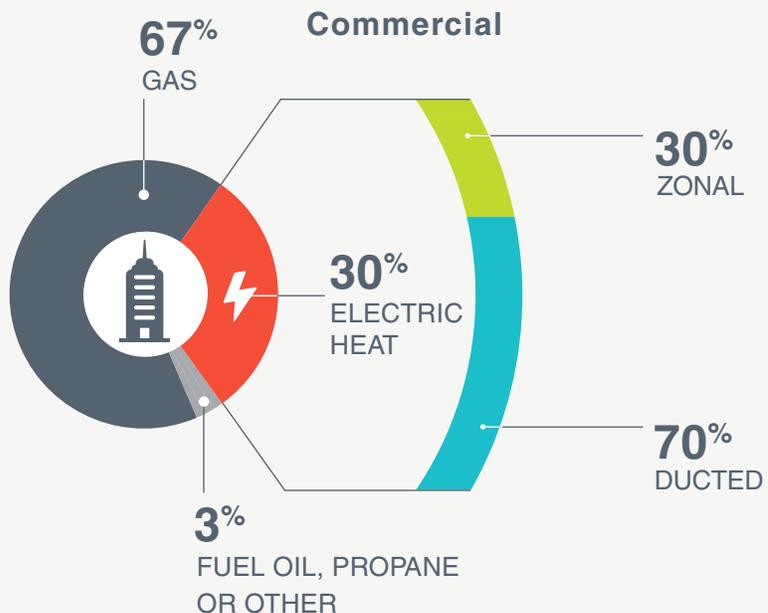
As Figure 2 shows, 67% of commercial buildings heat with natural gas and one-third heat with electricity. Of the electrically-heated buildings, 70% distribute conditioned air via ducted systems. The remainder of electrically-heated buildings have zonal systems.<sup>2</sup>



**FIGURE 2**

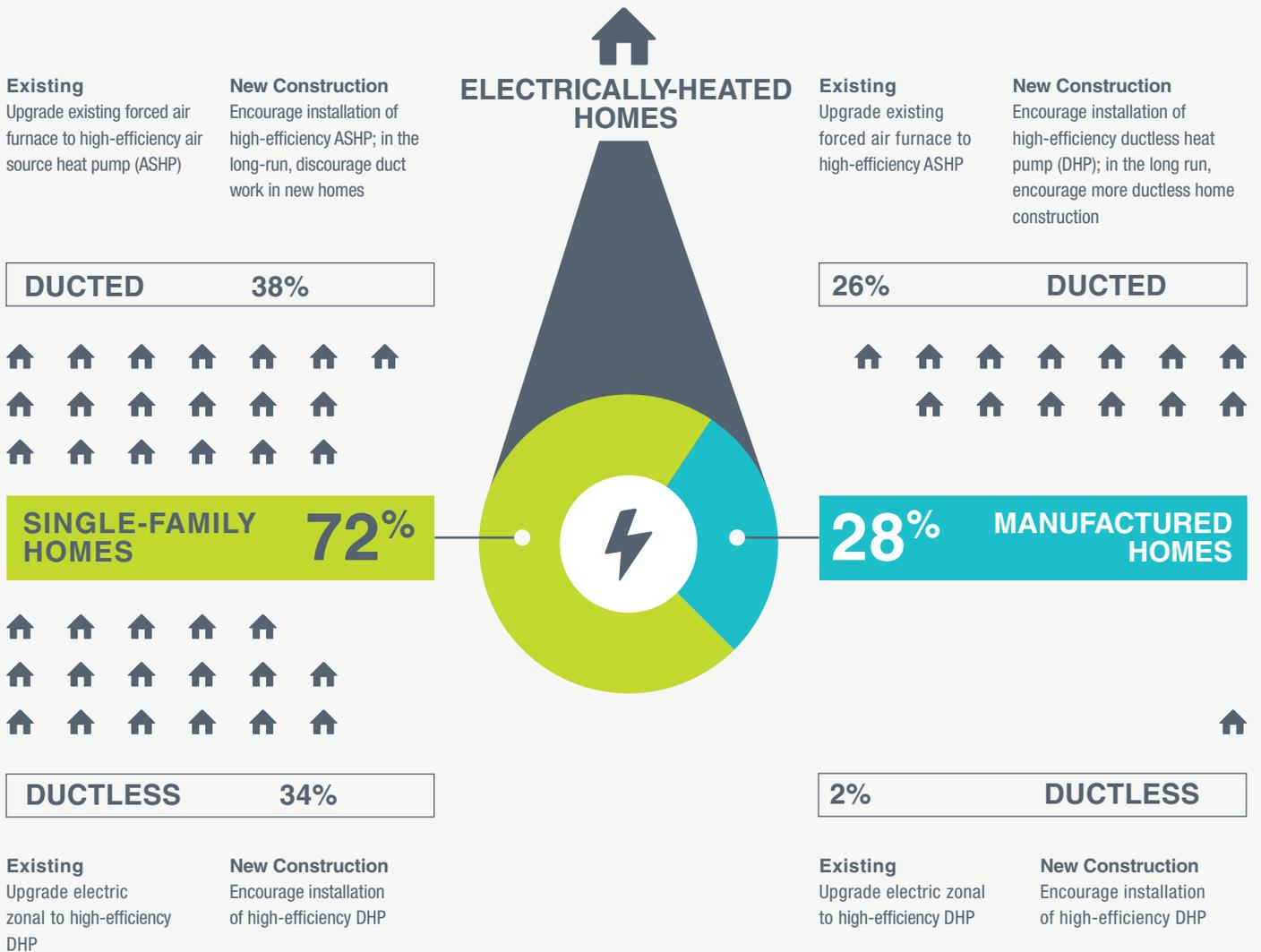
**SOURCE**  
2014 Commercial Building Stock  
Assessment (CBSA)

Primary heating fuel for commercial  
buildings and HVAC distribution type for  
electrically-heated commercial buildings  
in the Pacific Northwest



# Opportunities for Efficient HVAC Technologies

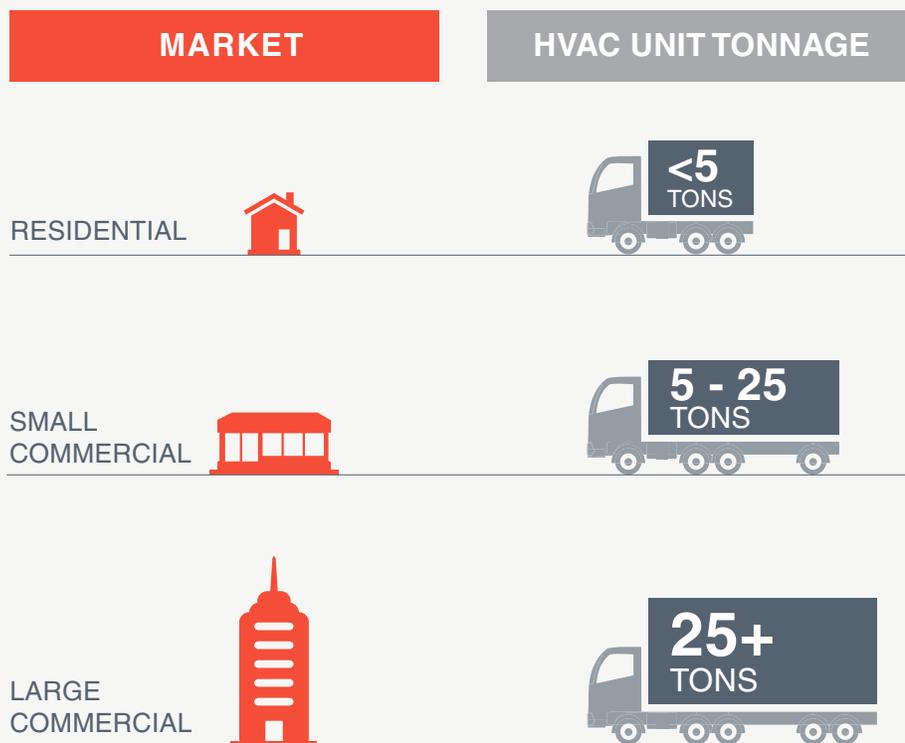
In Residential Housing Stock for Electrically-Heated Homes



**FIGURE 3**  
Opportunities for HVAC technologies in electrically-heated homes

**SOURCE**  
2011 Single-Family RBSA

# HVAC Market Segments



**FIGURE 4**

Typical HVAC unit sizes by market segment

**SOURCE**  
HVAC distributor interviews

The HVAC industry does not segment the market the way those in the energy-efficiency world do. Rather than having a clear delineation between the residential and commercial sectors based on the site of installation, distributors track sales by product line, size (tonnage), and technology type. Many distributors participate in both the residential and small commercial sides of the market but tend to focus more strongly on one side or another. Distributors who serve the large commercial market tend to do so exclusively.

# The HVAC Technologies Discussed in This Report



**FIGURE 5**

Residential and commercial heating and cooling systems discussed in this report

**Note:**

Higher-efficiency heat pumps (both ductless and ducted heat pumps) are likely to have variable speed compressors and could also be considered variable speed heat pumps (VSHPs).

## What Does It Mean to Be Ductless?

A ductless heat pump (DHP) heats and cools your home similarly to an air source heat pump (ASHP), but without ducts. The outdoor unit of a DHP system transfers heat from the outside into your home. Inside, a register on the wall silently and efficiently warms or cools the room. Larger areas may require separate registers. A ductless heat pump also provides air conditioning. Benefits of ductless technology include zonal heating and cooling and avoidance of the energy losses that result from leaky ductwork. The U.S. Department of Energy (DOE) estimates that leaky ducts waste as much as 30% of the energy used to run a typical HVAC system.<sup>3</sup>



# The Industry Is Excited About Ductless

Ductless HVAC technology has led sales in Europe and Asia for many years. Distributors report strong growth in sales of this equipment in the United States, particularly in the Northwest, but sales have a way to go before they surpass the sales of ducted equipment. It is difficult to make a compelling case for conversion to ductless equipment in buildings with existing ductwork, but ductless technology is rapidly growing in popularity for new construction and existing buildings that do not currently use air ducts to distribute heating and cooling.<sup>4</sup> Several Asian firms are partnering with U.S. firms to take advantage of existing brand awareness and distribution channels to boost sales in the U.S. market.

## GOOD CANDIDATES FOR DHPs

# 40%

OF ELECTRICALLY-HEATED HOMES  
IN THE NORTHWEST DO NOT HAVE  
DUCTS OR A DUCTLESS HEAT  
PUMP

# DUCTLESS

**\$1 B**

U.S. VRF MARKET COULD REACH \$1 BILLION IN SALES BY 2017, ACCORDING TO A LEADING HVAC MANUFACTURER

# The Next Billion-Dollar Technology: VRF

A sophisticated cousin of standard ductless systems, variable refrigerant flow (VRF) systems are taking the commercial HVAC world by storm. VRF systems (Figure 7) are complex and the added sophistication of those systems currently makes most sense in large commercial buildings with high operating costs and energy loads. A niche for VRF also exists in the residential market for high-end homes. VRF has experienced rapid growth during the past couple of years, and the technology is one of the main drivers behind partnerships between U.S. and Asian manufacturers (Figure 6).

Technical features that distinguish VRF systems from standard ductless equipment include their ability to support a much greater number of indoor evaporator units per outdoor condensing unit,<sup>5</sup> their streamlined piping configuration, the capacity for heat recovery, and their use of advanced controls.

These technical features deliver a number of valuable benefits. VRF systems can simultaneously heat and cool different parts of a building using the same refrigerant. They can also ramp up and down to meet the specific needs of a space instead of operating exclusively in conventional “on/off” modes. VRF’s flexible configuration also offers nearly endless opportunities for zoning, making spaces more comfortable and easier to control.

VRF systems work well in new buildings where builders save cost, materials, and space by not needing an expansive duct system. VRF systems can also be installed as retrofits with minimal disruption to building operations. However, the same limitation applies to VRF as applies to the market for ductless technology in general: owners of buildings with existing ductwork may opt for the lower upfront cost of using the existing infrastructure. The added features of VRF systems may cause some owners with ducted buildings to look past the higher upfront cost of VRF, though the extent to which this may be occurring is not clear based on the recent research.

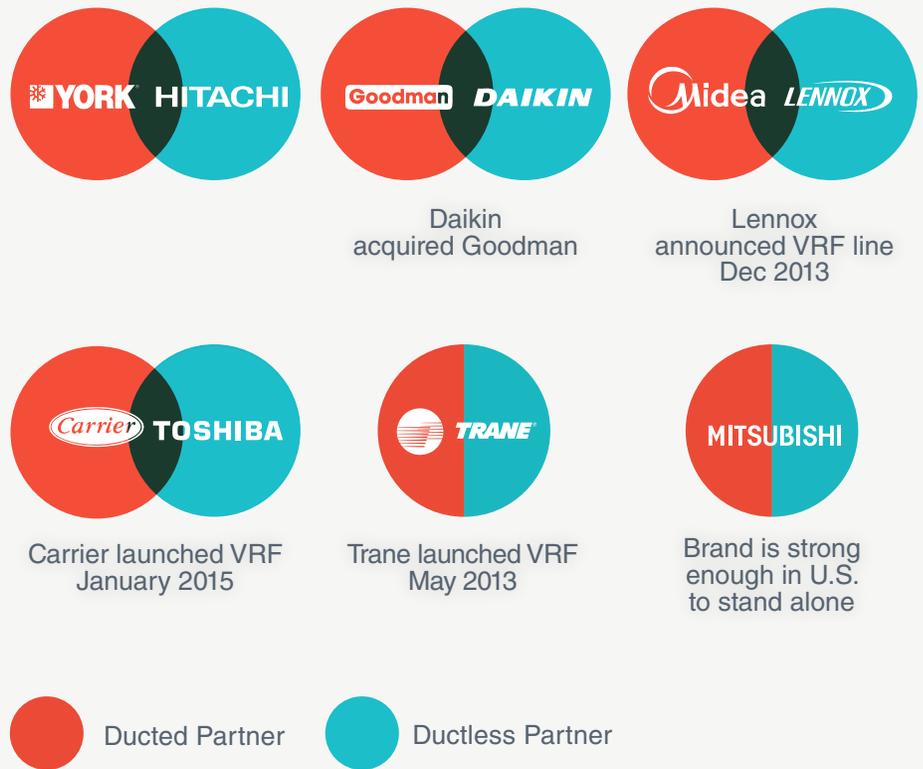
Manufacturers and distributors work to educate potential buyers about the economic and other benefits of VRF. However, the energy-efficiency community needs more proof of savings before embracing this technology.

Despite current skepticism about energy savings among the energy-efficiency community, sales of VRF systems are poised for significant growth due to the appeal of their numerous features and benefits. Interviews with HVAC market players indicate that sales of VRF technology could surpass those of traditional ducted unitary equipment within the next decade.

# Ductless Global Manufacturer Partnerships Since 2012

Asian manufacturers led the development of ductless technology. Firms such as Daikin, Mitsubishi, and Toshiba established clear technological leadership in the ductless category while American manufacturers continued to focus on the ducted systems that dominated the U.S. market. Growing interest in ductless technology in the U.S.—and the opportunity it represents—drove U.S. and Asian manufacturers to partner via merger, acquisition, or joint venture (Figure 6). These partnerships provide U.S. manufacturers access to ductless technology while their Asian partners benefit from the recognizable brands and established distribution channels of American HVAC giants such as York, Carrier, and Trane. This global corporate maneuvering illustrates the magnitude of the ductless opportunity in the United States.

**FIGURE 6**  
Manufacturing partnerships in the ductless market



**SOURCE**  
Synthesis of market actor interviews and various media press publications

# Where Does Ductless Make Sense?

## What Does It Mean to Be Ductless?

Ductless technology as a whole is a good fit for both residential and commercial buildings, especially in new construction where buildings can avoid the equipment and labor costs of installing new ductwork. Ductless technology is also well-suited for existing buildings with zonal electric heat or forced hot water because they lack existing ductwork. Roughly 43% of the existing housing stock of electrically-heated single-family homes have zonal heating.

Figure 3 on page 5 illustrates the full opportunity for HVAC technologies in both existing buildings and the new construction market.

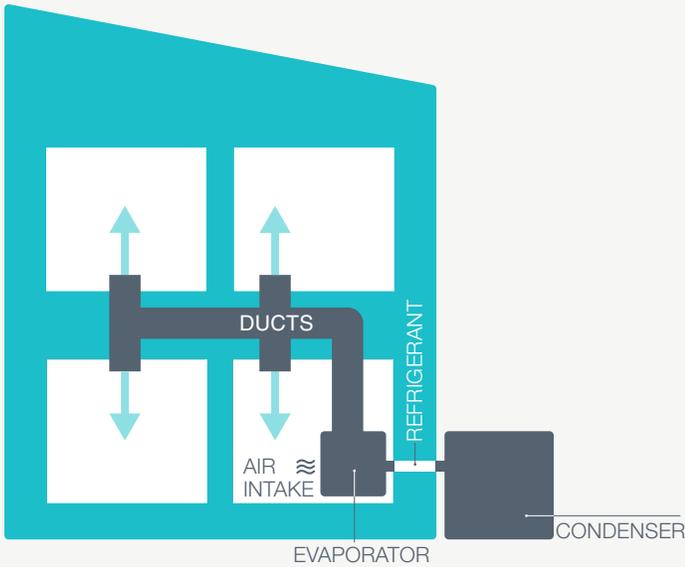
Conversion from ducted to ductless systems appears to be a rare occurrence based on a recent NEEA report. Installers interviewed for that study reported that they most often recommend ductless for additions or spaces that were previously unheated, homes with zonal electric heat, homes with wood heat, and commercial spaces. The report noted that wood, wall heaters, and baseboards were the most common heating sources used prior to installing a DHP.<sup>6</sup>

### FIGURE 7

Ducted, ductless, and VRF systems

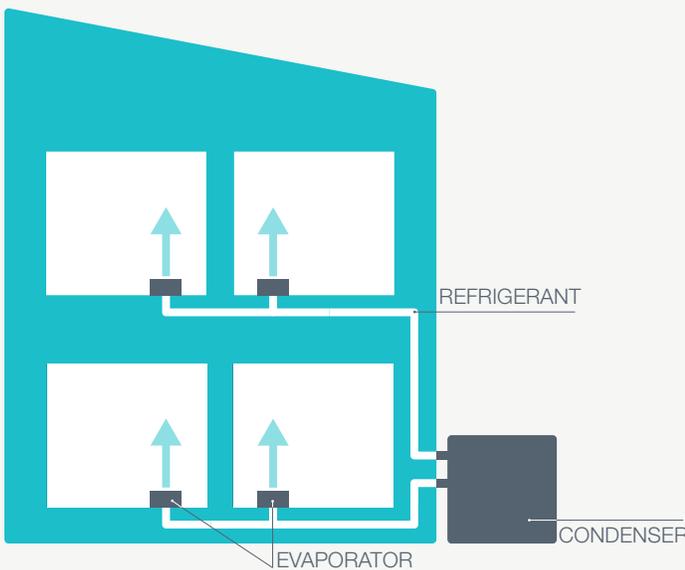
#### SOURCE

Adapted from Amarnath, Ammi and Morton Blatt, Variable Refrigerant Flow: An Emerging Air Conditioner and Heat Pump Technology, 2008 ACEEE Summer Study on Energy Efficiency in Buildings



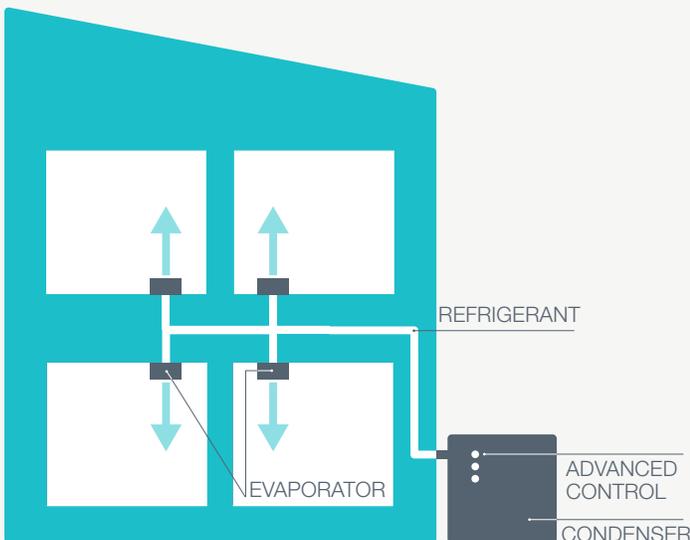
## Ducted systems

Include a single outdoor compressor and indoor evaporator. Refrigerant lines are short, but a large amount of ducting is required to move heated air.



## Ductless systems

Include a single outdoor compressor but multiple evaporators in each of the indoor zones. Refrigerant lines are longer than those in the ducted system but require less space. Additionally, removing ducts allows systems to be more efficient.



## VRF systems

(more efficient ductless systems)

Use parallel refrigerant lines to serve the evaporators located in each indoor zone. VRF systems require more advanced controls, but the parallel refrigerant lines further reduce the space needed for distribution. These VRF systems can provide simultaneous heating, cooling, and heat recovery.

*The average efficiency levels of equipment sold since 2013 indicates that the market is not moving to higher-efficiency equipment on its own.*

**PROGRAM REACH**

**12%**

OF RESIDENTIAL AIR SOURCE  
HEAT PUMPS SOLD IN THE  
NORTHWEST ARE INCENTED BY  
EFFICIENCY PROGRAMS

**EFFICIENCY REACH**

**50%**

OF ALL EFFICIENT AIR SOURCE  
HEAT PUMPS SOLD ARE  
INCENTED BY PROGRAMS

# High-Efficiency HVAC Sales Need A Boost

The research team collected sales data from five regional HVAC distributors. Sales data covering the period from 2013 and 2014 show that:

- 1) The majority of ducted residential and commercial heat pumps and air conditioners are sold at or not greatly above the federal minimum-efficiency levels.<sup>7</sup>
- 2) The average efficiency of units sold in 2013 and 2014 increased only slightly over that time frame.
- 3) Ductless technology is driving the market for high-efficiency units in both the residential and commercial markets.

## Data We Collected

The distributor sales data comprises sales of all types of equipment— nearly 100,000 unit sales in total— from five HVAC distributors in the Northwest. Depending on the product, the sales data collected accounts for 35% to 90% of product sales in the Northwest HVAC market.

A few notes about the data we collected include:

- The research team collected HVAC unit efficiency levels as ranges as opposed to discrete values. In some cases, more granular efficiency data would have allowed more in-depth analysis of efficiency trends.
- Sales data on VSHPs is included in the higher-efficiency tiers of the sales data for ASHP and DHP.
- The research team was not able to collect all data for all equipment types in the entire region, however we did gather information on additional types of equipment not presented in this report (e.g., gas furnaces). Visit our website to see the full sales data report: [www.bpa.gov/goto/MomentumSavings](http://www.bpa.gov/goto/MomentumSavings)

# SALES

# Sales Trends in the Residential Market

Our research indicates that for residential ducted ASHP, the top tiers of efficient equipment represent less than one-quarter of total sales as of 2014.<sup>8</sup>

In contrast, residential DHPs tend to be more efficient. Ducted ASHPs with a Heating Seasonal Performance Factor (HSPF) greater than 9.0 were about 20% of sales in 2013 and 2014.

Equipment in the 8.2 - 8.99 HSPF range made up about 50% of sales, and about 30% of sales were attributed to equipment below the federal standard of 8.2 HSPF. This suggests there are opportunities for efficiency programs to work to move this part of the HVAC market to more efficient units (see Market Intelligence for Programs beginning on page 30).

High efficiency dominates within the residential ductless mini-split heat pump category, in contrast to the

trend in other residential equipment categories. More than half of DHP sales had an HSPF of 10 or greater in 2013 through 2015.

Most distributors expect sales of ductless systems to grow rapidly during the next several years. Recent NEEA research supports this finding and concludes that sales will increase due to “increased customer knowledge and awareness, increased acceptance and popularity of DHPs, and increased marketing.”<sup>9</sup>

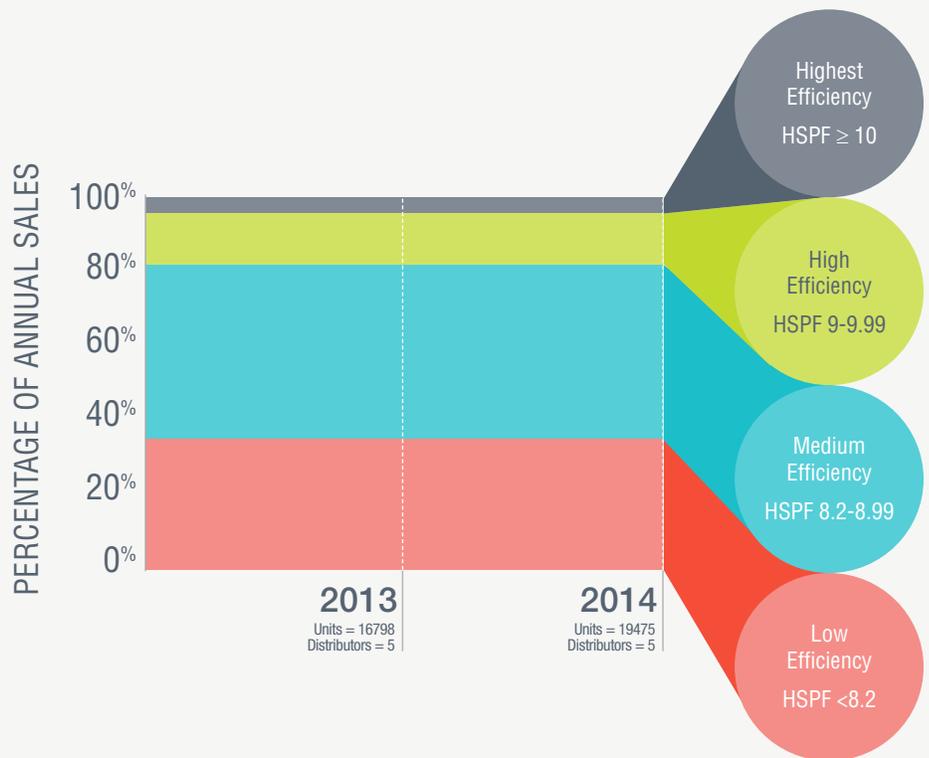
## Split System Heat Pump Efficiency Standards

# 7.7

FEDERAL MINIMUM EFFICIENCY THROUGH 2014

# 8.2

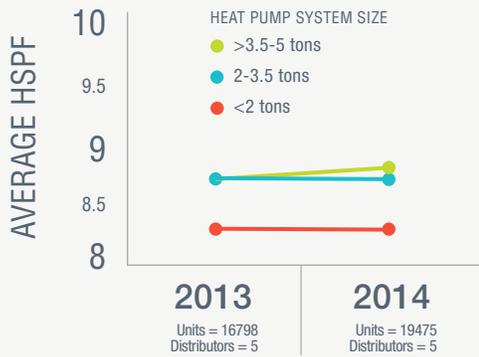
FEDERAL MINIMUM EFFICIENCY STARTING JANUARY 1, 2015



**FIGURE 8**

Residential split system air source heat pump sales by HSPF category

**SOURCE**  
HVAC distributor sales data

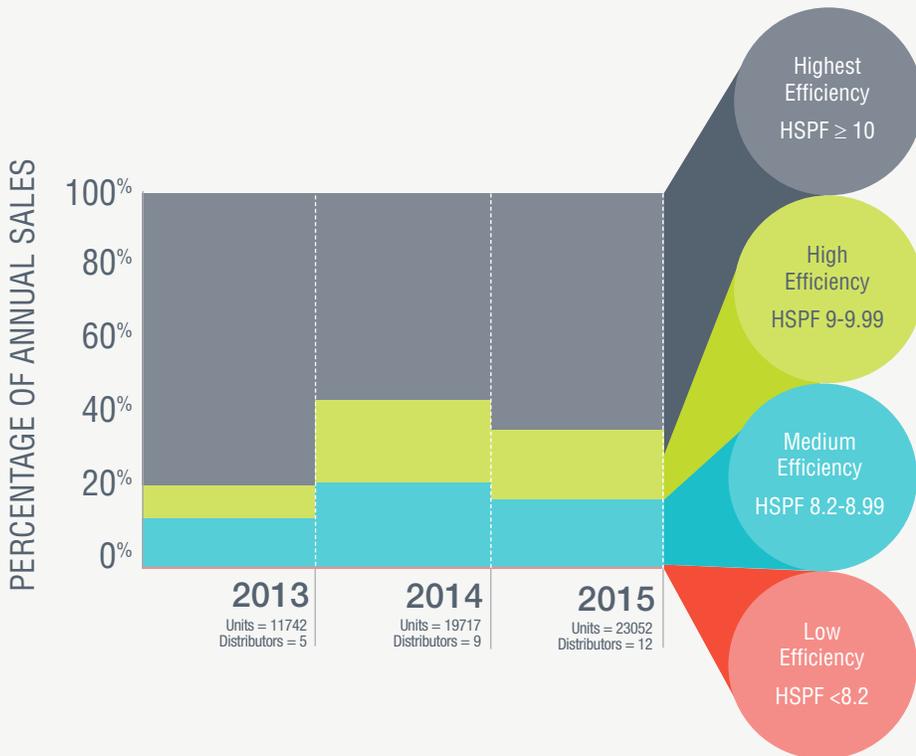


**FIGURE 9**

Average heating efficiency (HSPF) of residential split system heat pumps

**SOURCE**  
 HVAC distributor sales data

However, it is important to put the market for ductless equipment into context. Recall that ductless heat pumps are typically installed only in homes without existing ductwork. Fifty-five percent of existing homes that heat with electricity already have ducted systems, and 88% of homes with gas heat have ducted systems.<sup>10</sup> This restricts the size of the market for ductless systems among existing buildings. An analysis of data from the AHRI shows that ductless mini-split technology (heat pumps and air conditioners) accounted for roughly 25% of the combined residential/commercial HVAC equipment sales in the Northwest in 2013.<sup>11, 12</sup>



**FIGURE 10**

Efficiency distribution (HSPF) of ductless mini-split heat pumps

**SOURCE**  
 HVAC distributor sales data collected by the research team for 2013, collected by NEEA for 2014 and 2015  
 Note: NEEA does not track HSPF < 8.2

## Annual Residential Sales

### NEW CONSTRUCTION

**44%**

OF NEW AIR SOURCE HEAT PUMPS SOLD IN THE NORTHWEST GO INTO NEW CONSTRUCTION

### REPLACE UPON FAILURE

**56%**

OF NEW AIR SOURCE HEAT PUMPS SOLD GO TO REPLACE FAILED EQUIPMENT IN EXISTING HOMES

### DUCTLESS MINI-SPLIT SYSTEM

**25%**

OF THE COMBINED RESIDENTIAL/COMMERCIAL HVAC EQUIPMENT SALES IN THE NORTHWEST IN 2013

#### VARIABLE SPEED SAVINGS

# 30%

VSHP SAVE ABOUT 30% MORE THAN EFFICIENT SINGLE-SPEED ASHPs

## Variable Speed Heat Pumps

Although ductless technology is an exciting new trend, it's not suited for every application. Given that 55% of existing electrically-heated homes in the Northwest already have ducts, there is a significant opportunity to gain additional savings with VSHP in the ducted homes market. Efficient VSHP save about 30% more than efficient single-speed ASHP.<sup>13</sup> There is a growing trend of variable speed heat pumps in efficiency programs: in 2015, about 20% of heat pumps in BPA's Performance Tested Comfort Systems (PTCS) program were variable speed. Additionally, the research indicates that regional sales of high-efficiency ASHP are not taking off on their own. This provides an opportunity for energy-efficiency programs to help generate excitement about variable speed technology with key players in the supply and decision chains. While the research team did not collect sales data explicitly for VSHP in this first round of data collection (the sales are included in higher-efficiency tiers for ducted and DHP sales data), BPA plans to explore this technology in further detail in future research and sales data collection efforts.

#### STANDARD EFFICIENCY

# 97%

OF COMMERCIAL SPLIT SYSTEM AIR SOURCE HEAT PUMPS SOLD IN THE NORTHWEST (HSPF 8.0)

## Sales Trends in the Commercial Market

Growth in sales of high-efficiency equipment is slower in the commercial market than in the residential market. The research team estimates that the sample of sales data included in this analysis represents about 50% to 75% of the market for commercial ASHP and 20% to 35% of the market for commercial air conditioners.

#### HIGHER EFFICIENCY

# 3%

OF COMMERCIAL SPLIT SYSTEM AIR SOURCE HEAT PUMP UNITS SOLD IN THE NORTHWEST (>HSPF 8.0)

Only one distributor provided data for VRF equipment sales. Confidentiality is important to preserving trust and relationships with our data sources. As such, this report does not present a detailed distribution of sales for VRF. However, the team is able to report that the data show a trend of VRFs becoming more efficient over time. The research team hopes to collect more sales data for VRF in future research efforts.

### Commercial Split System Heat Pumps

About 97% of commercial split system air source heat pump units sold were standard efficiency, meaning that they had a Seasonal Energy Efficiency Ratio (SEER) 13 and HSPF 8.0. The remaining 3% were higher efficiency. Sales of systems with a capacity less than 8.5 tons dominate among commercial split system heat pumps.

# Commercial Packaged Air Conditioners

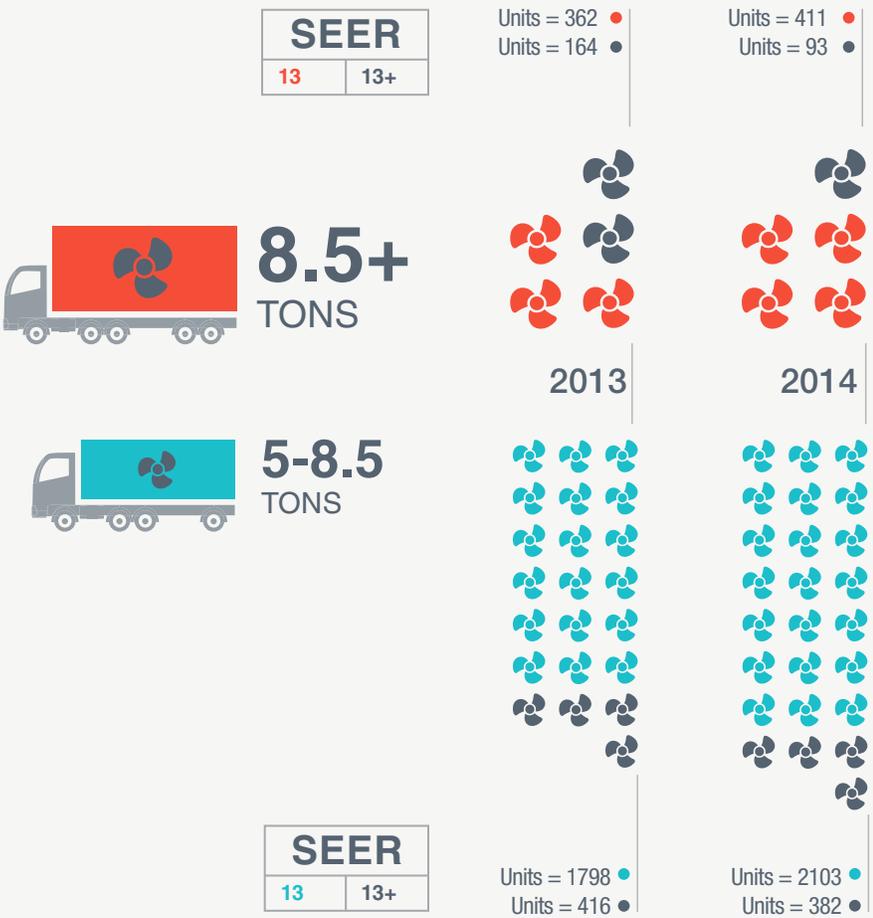


Figure 11 illustrates that for packaged commercial air conditioners sold in 2013 and 2014:

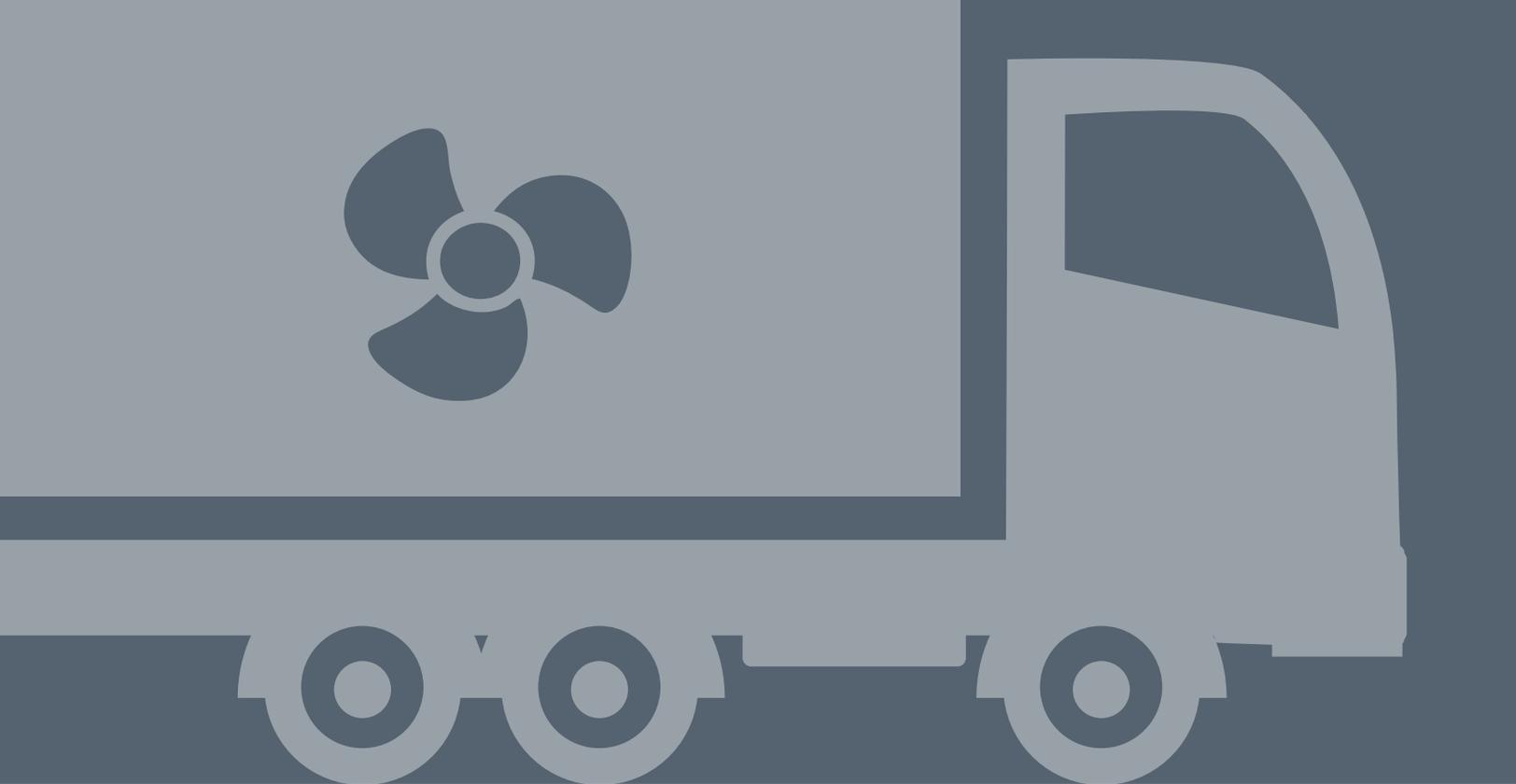
- Nearly all of the units represented by the sales data were low efficiency, just meeting the minimum federal standard
- Sales data did not show any units sold with a SEER greater than 14.49
- A majority of units sold were less than 8.5 tons capacity

Figure 11 presents data for packaged commercial air conditioners because they account for the majority of commercial air conditioners sold in the Northwest. The trend is similar for split commercial air conditioners, though high-efficiency equipment has made an even smaller entry into the market for split systems.

**FIGURE 11**

Size and efficiency distribution of commercial packaged air conditioners

**SOURCE**  
HVAC distributor sales data



MAR

# How the HVAC Market Works

*An understanding of HVAC purchase decision-making and the flow of products through the supply chain sheds light on why high-efficiency equipment sales are hitting barriers.*

## Residential

The residential market is fairly straightforward compared to the commercial market. There aren't many players crowding the supply chain, and the decision-making framework is predictable. The supply chain is consolidated at manufacturing and distribution. In contrast, the contractors and builders are very fragmented.

## Commercial

The commercial market is complex with many moving parts, many players influencing decisions, and longer sales cycles. The best intentions for efficiency can easily fall by the wayside in this process unless multiple champions stand behind the commitment to efficiency, and efficient equipment is readily available and familiar.

## Residential Decision-Making

When equipment fails, the homeowner's choice is likely to be greatly influenced by their contractor, what equipment is readily available, and price.<sup>14</sup> Builders may have similar experiences in the new construction market when making choices about what equipment to install in new homes.

The challenge for efficiency programs is to influence residential decision making at various levels of the supply chain. The supply chain is consolidated at manufacturing and distribution. Most equipment sold in the region is sold through only a few key distributors. In contrast, the contractors and builders are very fragmented, with hundreds of different contractors installing equipment across the region. End users are the most fragmented, with millions of homes in the Northwest.

Currently, our programs target contractors and end-users. There is an opportunity for our programs to engage with distributors and manufacturers where the supply chain is the most consolidated (see Market Intelligence for Program Planners and Managers beginning on page 30).

# PTCS

Performance Tested  
Comfort Systems

# Residential Program Barriers

Interviews with market actors revealed that primary barriers to participation in residential energy-efficiency incentive programs include:

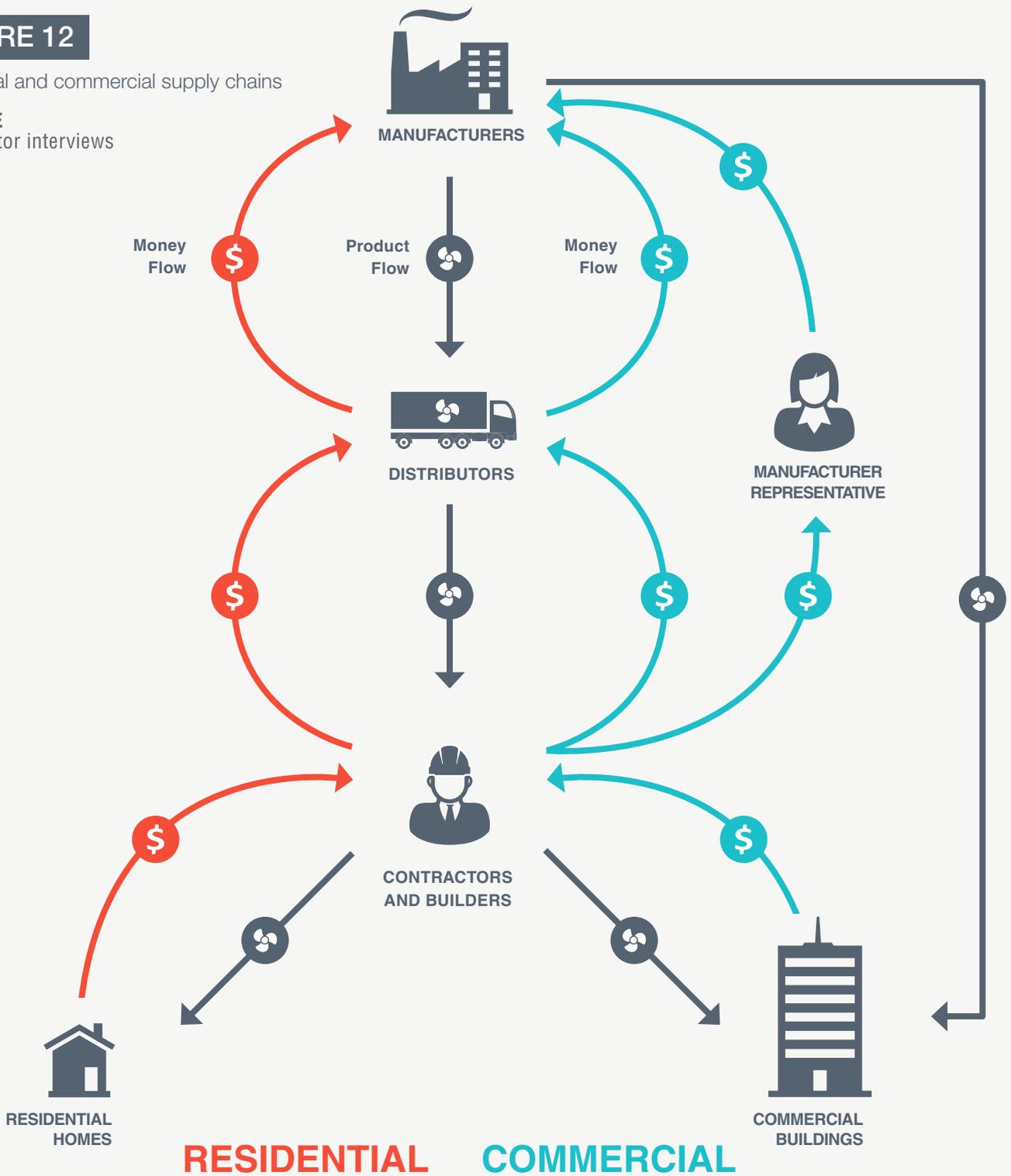
- **Upfront costs.** Residential and small commercial consumers are sensitive to the upfront costs of higher-efficiency HVAC options.
- **Consumer education.** Contractors may not have the resources or time to educate consumers on the benefits of a more efficient system. In addition to low energy costs, efficient HVAC systems have many non-energy benefits such as reducing indoor pollutants, maintaining air humidity and reducing HVAC noise. Educating consumers is not an area that contractors or builders may feel is worth the time and effort.
- **Distributor stocking practices.** Distributors will not stock what they cannot frequently sell. If consumers and their contractors are not requesting high-efficiency equipment, distributors are not likely to keep it in stock, which causes longer lead times.

*The BPA Performance Tested Comfort Systems (PTCS) Program launched in 2006 and promotes contractor training for quality installation of high-efficiency air source and variable speed heat pumps and duct sealing. BPA offers trainings, workshops, and online webinars for contractors to perform work in this program. Since 2006, BPA has certified more than 4,000 technicians and approved 88,500 equipment installations.*

**FIGURE 12**

Residential and commercial supply chains

**SOURCE**  
Market actor interviews



The flow of equipment for residential HVAC products follows a relatively straightforward path. The manufacturer ships products to a regional distribution center and then on to each distributor's branch location. An HVAC contractor then picks up the HVAC equipment on an "as-needed" basis.

Many contractors serve the residential HVAC market, but they are served by only a few distributors. Because of the size, the contractor market is very fragmented, whereas the distributor market is more consolidated. Distributors work closely with both contractors and manufacturers.

The flow of equipment for commercial HVAC products follows a path that is not all that different from the residential market.

However, in some cases, commercial HVAC equipment is transferred straight from the manufacturer to the commercial facility manager. Additionally, the manufacturer representative often influences the final decisions of the contractor.

# Commercial Decision-Making

A number of factors make the commercial HVAC decision-making process more complex and sales cycles longer than in the residential market. The best opportunities to support the commercial market also differ depending on the design and construction approach used.

## What makes large commercial decisions complex?



### Budget

The complexity and size of a commercial system often requires capital funding budgets and longer planning lead times.



### Technology Complexity

Many larger commercial HVAC systems require facilities and maintenance staff to operate and monitor them around the clock because of their complexity.



### Sales Cycle

The sales cycle in the commercial market is often much longer than in the residential market. Facilities staff are better prepared to anticipate equipment replacement needs, and the amount of capital required for large commercial systems warrants a careful review of options. Even in the case of emergency replacements, temporary heating/cooling solutions provide time for buyers to evaluate their technology options.



### Technology Options

The commercial HVAC market has far more technology options available than does the residential market, both in terms of systems and controls. As a result, many building owners need experts and unbiased information to help them evaluate the many options available.



### Decision-Makers

Multiple entities—contractors, distributors, manufacturer representatives, architects, and mechanical engineers—all have a hand in influencing the business owner's decision. Furthermore, the large capital expenses involved in commercial HVAC upgrades or replacements require stakeholder and often committee agreement.

# Commercial Program Barriers

Interviews indicate that the same barriers that apply to the residential market apply in this market, with the complexity of commercial incentives adding another layer of difficulty. The research indicates that:

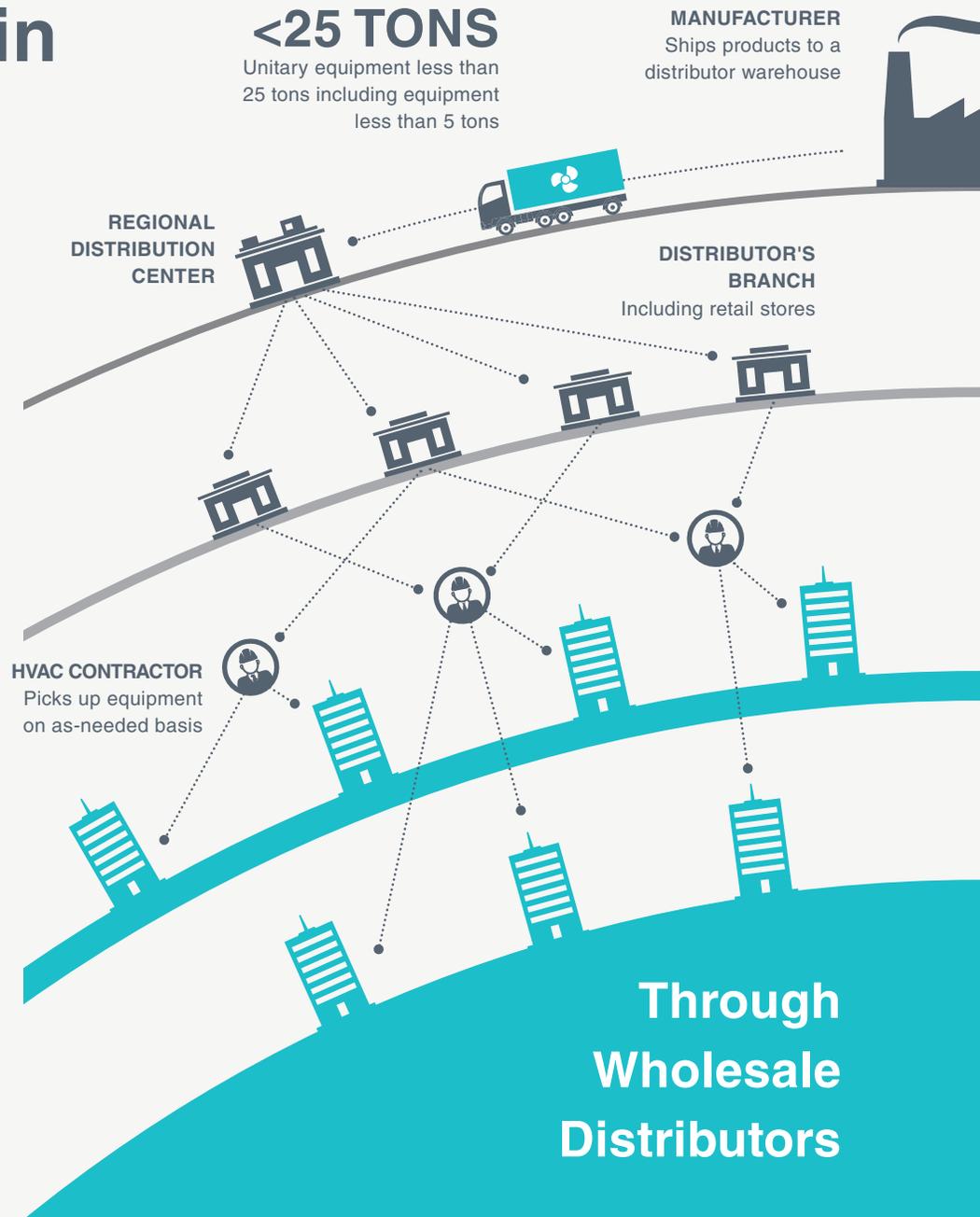
- **Contractors feel overburdened by paperwork.** Contractors often get frustrated with the long process of securing rebates. Interviews with distributors indicate that steps as simple as confirming a utility account can be a long process.
- **Commercial influencers lack information.** Influential players in the commercial HVAC supply chain—building owners, architects, mechanical engineers, and contractors—tend to recommend equipment that is well proven and familiar. They need targeted information early in the design process to increase the chances that higher-efficiency options will be considered.



The BPA Air Northwest Trade Ally Network launched in mid-2015 and is already making progress toward addressing barriers in the HVAC market. The network is in a good position to address the market's need for information and peer exchange. Air Northwest provides technical support, workshops, information about best practices and other resources. The network helps promote awareness about the benefits of energy-efficient options, as well as ease the process of identifying and understanding incentives.

# Two Main Supply Chain Pathways

*The flow of HVAC products in the commercial market follows two primary supply chain paths beginning with the manufacturer. The main difference between the two paths is who handles the equipment once it leaves the manufacturer.*



The wholesale distributor pathway uses a hub-and-spoke model. Wholesale distributors ship manufactured products to a distributor warehouse, the “hub” at the center (typically a regional distribution center), then on to the distributor’s branch, or the “spokes,” including retail outlets.

An HVAC contractor then picks it up on an as-needed basis. Wholesale distributors are in the business of logistics. The hub-and-spoke model helps balance short-term supply and demand fluctuations, getting product where it is needed most.

This supply chain path typically covers unitary equipment less than 25 tons, including equipment less than 5 tons sold to the residential sector. Larger capacity equipment of greater than 25 tons can use this path if the system is not customized for a particular customer.

**FIGURE 13**

Comparison of the two main commercial supply chain pathways: wholesale distributor pathway and manufacturer representative pathway

**SOURCE**  
Market actor interviews



In the manufacturer representative pathway, the manufacturers ship products directly to the builder or contractor's site. This pathway is for large (greater than 25 tons), customized, and complex equipment.

Knowledgeable manufacturer representatives help contractors identify the right equipment for each customer, and coordinate logistics for this supply chain pathway. Manufacturer representatives also focus on customer education,

sales, and increasing brand awareness among critical market players such as architects, engineers, and contractors. For manufacturers without their own representatives, specialized firms fill this role.

# Design and Installation Approaches

Decision-making processes vary depending on whether a commercial HVAC project follows a plan and spec or a design-build approach for system design and installation.

## Plan and Spec Approach



**LARGE HVAC SYSTEMS**  
25 tons+



**MANY DECISION-MAKERS**



**CONTRACTOR AND DISTRIBUTOR ARE FAR REMOVED**



**TAKES MORE TIME**



**ARCHITECTS, MECHANICAL ENGINEERS, AND BUILDING OWNERS**  
Main decision-makers

In plan and spec projects, the owner (or owner's representative) hires an architect or engineering firm to develop specifications for the building's HVAC system. The specifications indicate the equipment types, minimum performance requirements, and system controls suitable for use in the building. The completed "spec" goes out for competitive bid, and mechanical contractors submit quotes to supply equipment and installation services.

Plan and spec jobs typically involve large, complex HVAC systems, often for new construction or major renovations. These jobs require a significant number of decision-makers to collaborate on the plan of action and agree on final project specifications.

In the plan and spec model, the contractor and distributor are far removed from the owner of the HVAC equipment and therefore have relatively little influence over purchasing decisions. The mechanical engineers and architects, along with the building owner, are the market actors more involved in deciding what equipment to buy.

Distributors explained that plan and spec projects are common in the government sector in which price is often the driving decision factor. The lowest bid wins in most cases, adding another layer of difficulty for higher-efficiency equipment that comes at a cost premium.

### **OWNER/ OWNER'S REPRESENTATIVE**

Hires the architect and/or mechanical engineer



### **ARCHITECT/ ENGINEERING FIRM**

Develops specs and requirements for HVAC system

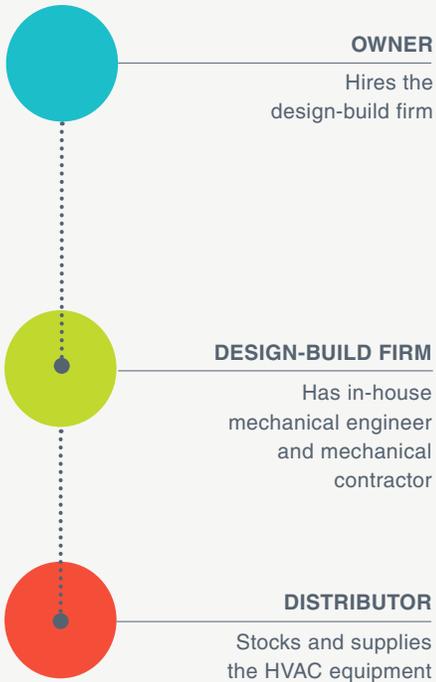


### **MECHANICAL CONTRACTOR**

Submits bid for equipment delivery and services



# Design-Build Approach



Design-build projects are more streamlined than those following a plan and spec model. Design-build projects have shorter sales cycles, no bidding process, and fewer parties involved in the final decision-making. Design-build projects generally involve smaller HVAC systems—less than 25 tons—and decisions are typically more relationship-based (i.e., the transaction is based on which distributor the mechanical contractor has a relationship with.)

A building owner typically hires a design-build firm that has both a mechanical engineer and mechanical contractor in-house. This setup simplifies project management and provides more opportunity for the contractor and distributor to influence the HVAC equipment purchasing decision. Without the constraints of detailed bid specifications, contractors and distributors have more freedom to propose the solution they think is right for the situation.

**SMALLER HVAC SYSTEMS**  
Less than 25 tons



**FEWER PARTIES INVOLVED**



**RELATIONSHIP-BASED DECISIONS**



**TAKES LESS TIME**



**DISTRIBUTOR AND CONTRACTOR**  
Main decision-makers



# Pulling It All Together: Market Intelligence for Program Planners and Managers

## Intelligence for the Residential and Commercial Sectors

### 1 Consider opportunities to expand the target audience to include distributors.

Distributors play a very important role in both the residential and commercial HVAC decision and supply chains. Engaging distributors is a good way to make a big impact on the HVAC market while only touching a few market actors, as the distributor network is more consolidated than contractors and end-users.

### 2 Look into the best ways to support distributors in promoting and stocking efficient equipment.

This approach could include education, training, spiffs for salespeople, or incentives to reduce the cost of higher-efficiency equipment.

For both residential and small commercial, encouraging distributors to stock efficient units is especially important to help the failed equipment market become more efficient. When end-users experience a sudden HVAC failure, they need a quick replacement and may settle for what is in stock and readily available. Because of the long life and high cost of HVAC equipment, most end-users do not replace their equipment until it fails or is near the end of its life. Therefore, the opportunity for efficiency programs to influence customers in their decision to install efficient equipment is rare. Encouraging distributors to stock more efficient equipment is critical to leveraging the failed equipment decision opportunity.

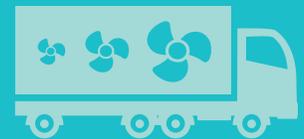
### 3 Support distributors in disseminating the message about efficiency to contractors.

Distributors have close relationships with their contractor customers. Determine what distributors need from efficiency programs to sell more efficient equipment to contractors, and educate contractors on how to sell it to builders and end-users. This could include training for contractors and marketing collateral for contractors to provide end-users.

INCLUDE  
DISTRIBUTORS



PROMOTE  
EFFICIENT  
EQUIPMENT



SUPPORT DISTRIBUTORS  
THROUGH EDUCATION



# SU

# Based on the research findings, we propose the following strategic opportunities to help boost efficiency in the HVAC market.

MOTIVATE BUILDERS

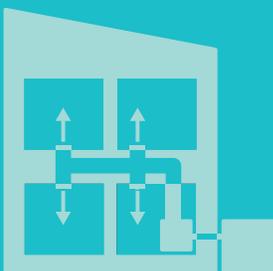


## 4 Identify how to influence the new construction market.

In addition to distributors, builders play an important role in changing the efficiency mix of sales in the new construction market. Efficiency programs should learn more about their path to purchase new equipment, how to better engage with builders, and what will motivate them to install more efficient equipment.

## 5 Embrace ductless but don't forget about the majority of the market with ducted systems.

ENCOURAGE THE USE OF VARIABLE SPEED TECHNOLOGY IN EXISTING BUILDINGS



Ductless HVAC is an optimal, efficient technology for new construction and a variety of existing building applications. Targeted marketing to buildings that fit into these categories (e.g., manufactured homes, homes with wood stoves or electric resistance heat) could expedite the growth of the ductless market. But what about all those buildings that already have air ducts and don't want to go ductless?

The research indicates that sales of high-efficiency air source heat pumps are not taking off on their own. A concerted effort to improve the efficiency of ducted heat pumps in existing buildings could help capture a large volume of potential savings and complement the growing buzz around ductless equipment. This is an opportunity for energy-efficiency programs to help generate excitement about variable speed heat pumps with key players in the supply and decision chains.

# Pulling It All Together: Market Intelligence for Program Planners and Managers

## Intelligence for the Commercial Sector

### 6 Education and technical support may help address information gaps in the commercial sector.

Those influencing decisions tend to recommend equipment that is well proven and familiar. Providing targeted information to the most influential players in the commercial HVAC supply chain—architects, mechanical engineers, and contractors—may help move the market forward. Additionally, providing information to building owners and Chief Financial Officers early in the design process will support more efficient choices.

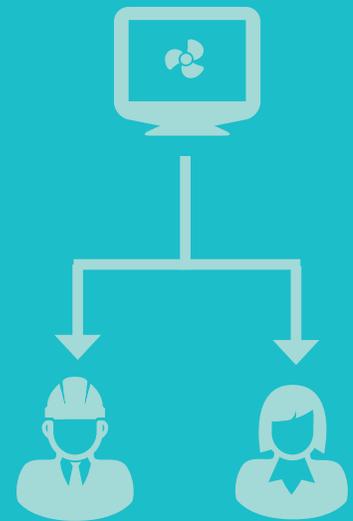
Ongoing efforts to educate market players will help prepare them to go into projects ready to recommend high-efficiency equipment. Education is especially important given skepticism in the market around the new focus on ductless and VRF technology. BPA's recently launched Air Northwest Trade Ally Network provides an excellent channel for delivering educational content and fostering peer exchange among HVAC market players.

#### Beneficial educational activities may include:

- Providing trainings, newsletters, and technical materials geared to the building community
- Supplying Northwest-specific cases studies, tailoring some for a more technical audience and some to financial decision makers

In addition, providing supplemental engineering and technical support to building owners, architects, contractors, and engineers may give them the extra resources and encouragement they need to think outside the box and run the numbers on advanced HVAC equipment. Information from an independent and credible source is often helpful to decision makers who are less familiar with the technical nuances of energy-saving equipment.

EDUCATE AND TRAIN KEY  
MARKET ACTORS



DEMONSTRATE THE ENERGY SAVINGS



## 7 Show me the VRF savings!

Manufacturers sing the praises of ductless VRF technology, but a solid record of evidence for the savings and other benefits is lacking within the Northwest market. This roadblock is a challenge for efficiency programs and others who want to "sell" the technology. Now is the time to collect, analyze, and share data to build the case for VRF technology. Demonstration projects, pilots and case studies highlighting the monetary and intangible benefits of ductless may help build trust in newer technology.

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3. U.S. Department of Energy. Ductless Mini-Split Heat Pumps, <http://energy.gov/energysaver/ductless-mini-split-heat-pumps>.
4. Sara Conzemius, "Northwest Ductless Heat Pump Initiative: Market Progress Evaluation Report #4" Prepared for NEEA by Illume Advising, LLC. July 23, 2015.
5. According to the U.S. DOE, an outdoor condensing unit for a VRF system can support as many as 60 indoor evaporator units.
6. Sara Conzemius, "Northwest Ductless Heat Pump Initiative: Market Progress Evaluation Report #4" Prepared for NEEA by Illume Advising, LLC. July 23, 2015.
7. As of January 1 2015, the federal standard efficiency level for split system heat pumps is 8.2 HSPF. Therefore, consumers can no longer purchase systems with an HSPF below 8.2, but that equipment was available in the market during the period covered by the sales data presented here. American Standard. "2015 Federal Standards for Heating and Cooling Products." May 2014. <http://www.sgtorrice.com/files/Pages/News/2015-Regional-Standards-Cooling-Heating%20Products-rev1.pdf>.
8. Market actors do not define the market by residential or commercial sectors and provide sales data only by HVAC equipment size and type. The research team used the sector/equipment size assumptions shown in the market segmentation in Figure 4 to differentiate sales between the residential and commercial sectors.
9. The most recent NEEA Market Progress Evaluation Report for ductless heat pumps notes that 14 percent of installers say that ductless heat pumps account for more than half of their revenue, and values are higher among most highly trained installers. More than one-third of installers expect sales of ductless heat pumps to grow significantly during the next two years due largely to increased consumer awareness and acceptance of the technology. Sara Conzemius, "Northwest Ductless Heat Pump Initiative: Market Progress Evaluation Report #4" Prepared for NEEA by Illume Advising, LLC. July 23, 2015.
10. 2011 Residential Building Stock Assessment. NEEA, September 18, 2012.
11. The research team cannot provide specifics about a trend toward increased sales over time for other years due to limited data from distributors and a lack of full market data from AHRI for years other than 2013.
12. The estimated market share for ductless mini-splits accounts for only compressor bearing units and does not include the accompanying number of indoor heads. As noted previously, ductless equipment applications are somewhat limited in retrofit applications because those homes that already have ducted systems are not likely to convert to ductless equipment.
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