



Energy Efficiency

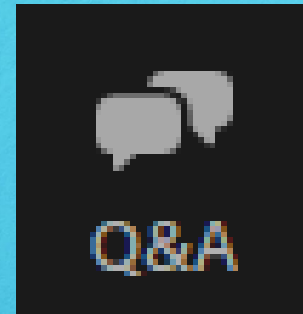
February 15, 2024

# Replacing air conditioners with air source heat pumps (ASHPs)

Contractor Heat Pump Training Initiative | Zak Paine

# Housekeeping

- Recordings of this webinar will be available within the ComEd Training Workspace
- All attendees should be admitted with microphone **muted**
- Ask questions in the Q&A
  - Questions can be submitted anonymously
  - When a question is answered, all attendees will be able to see the question, who asked it (if provided), and the answer
  - Depending on time, some questions might not be answered. In that case we will do our best to follow up with everyone after the webinar ends



# Agenda

- 1. Why focus on air conditioner (AC) replacements?**
  - Consumers
  - Contractors
- 2. AC replacement product definitions**
- 3. Technical considerations**
  - System Design
  - Installation

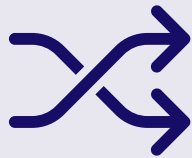
# Key takeaways for contractors



ASHPs as AC replacements represent a growing business opportunity.



AC replacement technologies are available for a variety of applications and scenarios.



AC replacements will have nuances in considerations differing from standard ASHP installations.

# Zak Paine

- HVAC Installation Advisor
- ComEd training team
- Former contractor
- 15 years experience with heat pumps
- ICC Master Mechanical License





Homeowner perception of heat pumps increases after installs.



Homeowners with new heat pumps recommend them.



Homeowners feel comfortable in Northern Illinois with heat pumps.



Upfront cost is critical to customers; leverage rebates, tax credits, and financing.



Homeowners see savings on average.



Not all customers want to replace their heating and cooling at the same time; be prepared to offer solutions to these customers.

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What is the market?

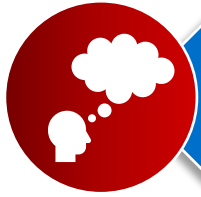
# Variable Speed Heat Pumps (VSHPs) as AC Replacement Study

- Engaged contractors, distributors, and manufacturers to learn about the coil-only VSHP market segment
- Monitored 30 coil-only, variable speed heat pumps (VSHPs) and 3 single speed heat pumps (SSHPs) installed as AC replacements in northern Illinois
- Gathered continuous operational and performance data for about half a year, late 2022 to summer 2023
- Surveyed participating homeowners about their experiences





# Goals of market research



## Uncover homeowner perceptions

- What do customers value?
- What drives system replacement?
- Where are current awareness levels?



## Understand opportunities and barriers

- What do these look like for contractors?
- ...Distributors?
- ...Manufacturers?

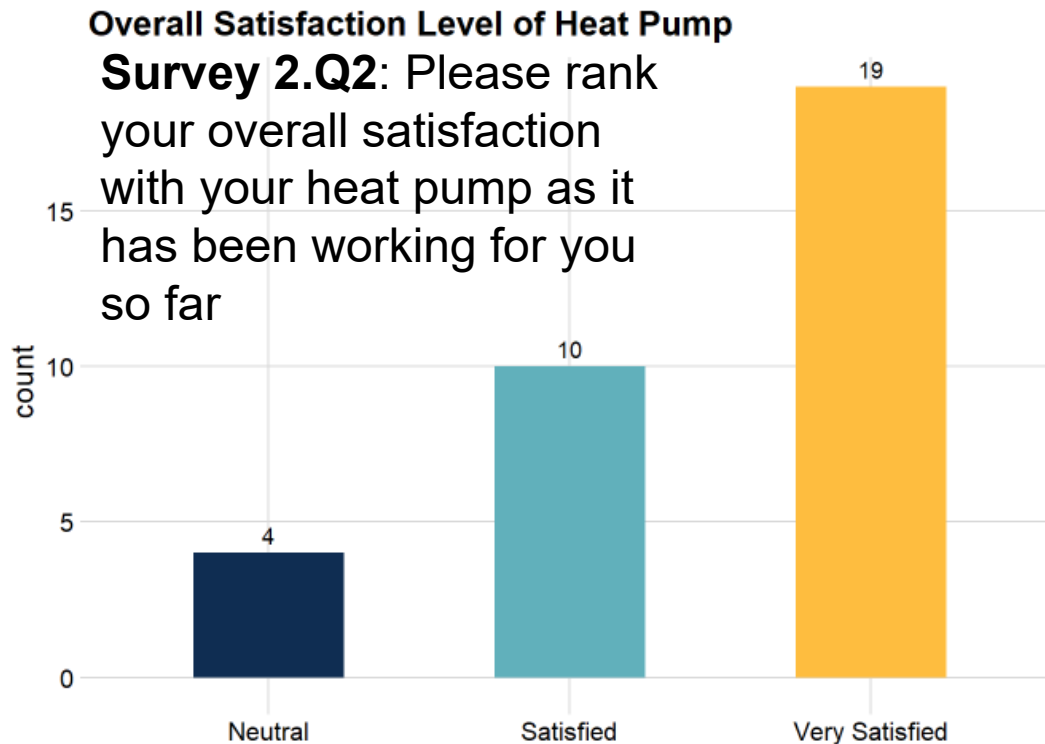


## Activate growing business opportunity

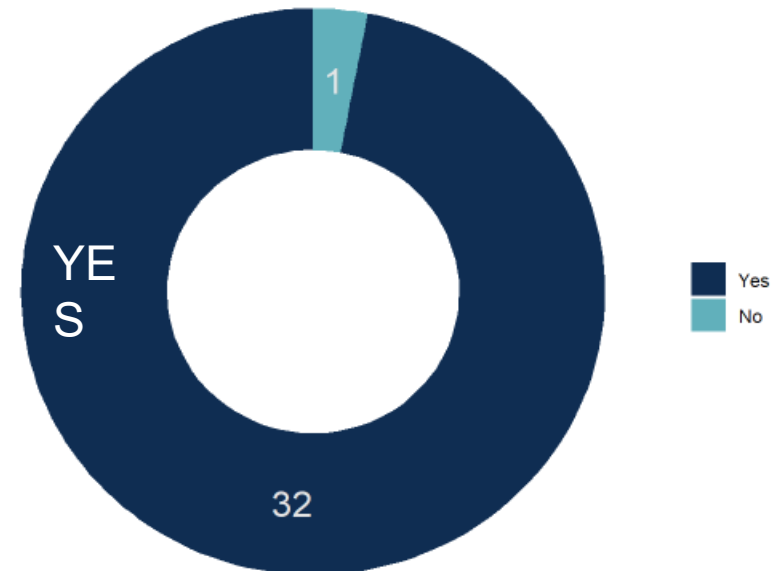
- ASHPs as AC replacements present a clear business opportunity.
- While homeowners are beginning to hear more about heat pumps, there is an opportunity to close the knowledge gap
- Learn how to communicate both benefits and costs in ways that are easiest for homeowners to understand

# Homeowner Sentiments are Positive After HP Installs

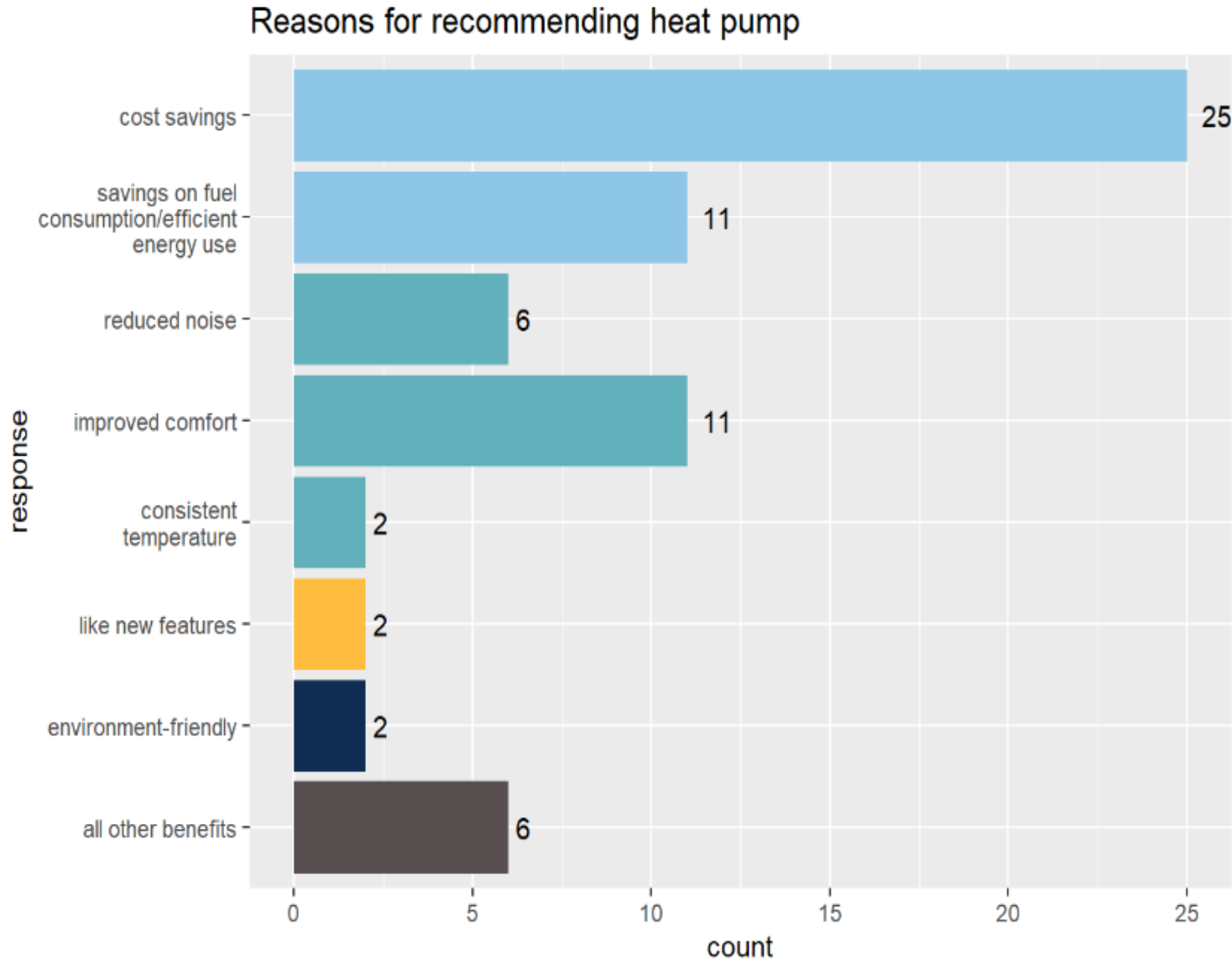
- No participants reported overall dissatisfaction; more than half very satisfied
- 96% would recommend a HP for AC replacement
  - “No” respondent said they “didn’t see the difference to recommend it” (C320)



**Survey 2.Q4:** Would you recommend a heat pump to other homeowners in IL?



# Why would homeowners recommend VSHPs?

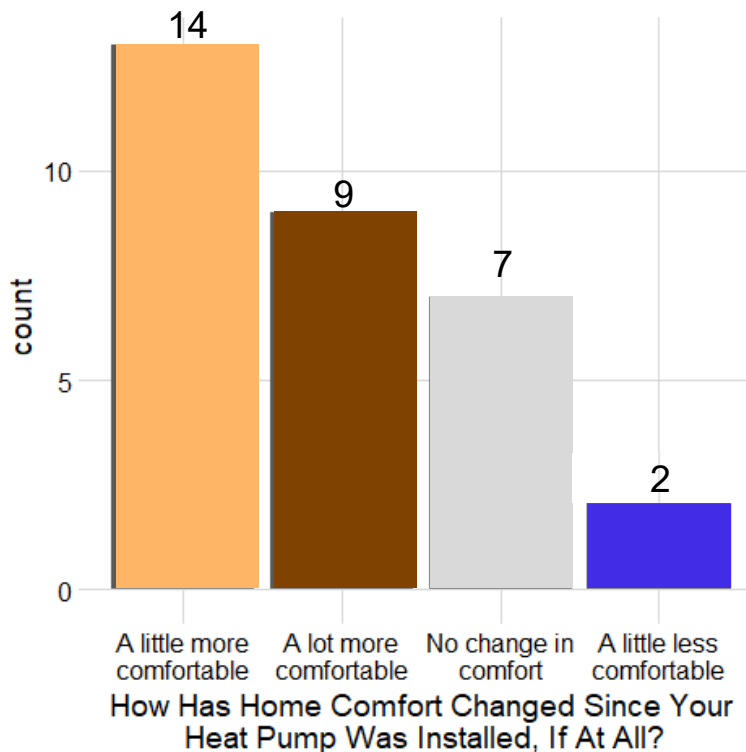


- 25 participants stated that they felt their VSHP **saved costs**
  - 11 participants mentioned savings on **energy/fuel**
- 11 participants mentioned **improvement in comfort**
- 6 said the HP **reduced noise**

# VSHPs Usually Delivered Improved Comfort

## Most Common Positive Sentiment Mentions:

Consistent temperatures  
Better cooling



Comments from homeowners who felt **a lot more** comfortable:

- “The whole house is **even temperature.**”
- “More **Even and consistent heating and cooling**”
- “Heat was so much **more even** throughout the house”
- “**more even and consistent** cooling and heating when the heat pump is operating”
- “Humidity control has been much **better in the summer**”
- “**Cools better** in the summer”
- “It's so much better overall! The **cooling is amazing** and the heat is great above 40F”
- “Heating was not appreciably changed but the temperature in the house is far **more stable.** **Cooling was a pleasant** experience. Although it did not seem to keep the air as dry as would have been comfortable”
- “We were more cautious about using the AC with he heat pump we keep the house a bit cooler.”

# Customer insights

- Before being explained, 40-55% of interviewed homeowners are aware of how heat pumps differ from air conditioners
- After heat pump benefits were explained, about half of interviewed homeowners said “saving money” was a motivation and almost a third said “hearing good things about heat pumps” motivated them.
- After heat pump benefits were explained, almost 80% of homeowners said that they would pay up to 20% more for a heat pump that delivered on performance claims.
- For those that purchased heat pumps, homeowners recommended heat pumps due to saving money, better efficiency, reduced emissions, and better cooling performance.

BUSINESS  
OPPORTUNITY

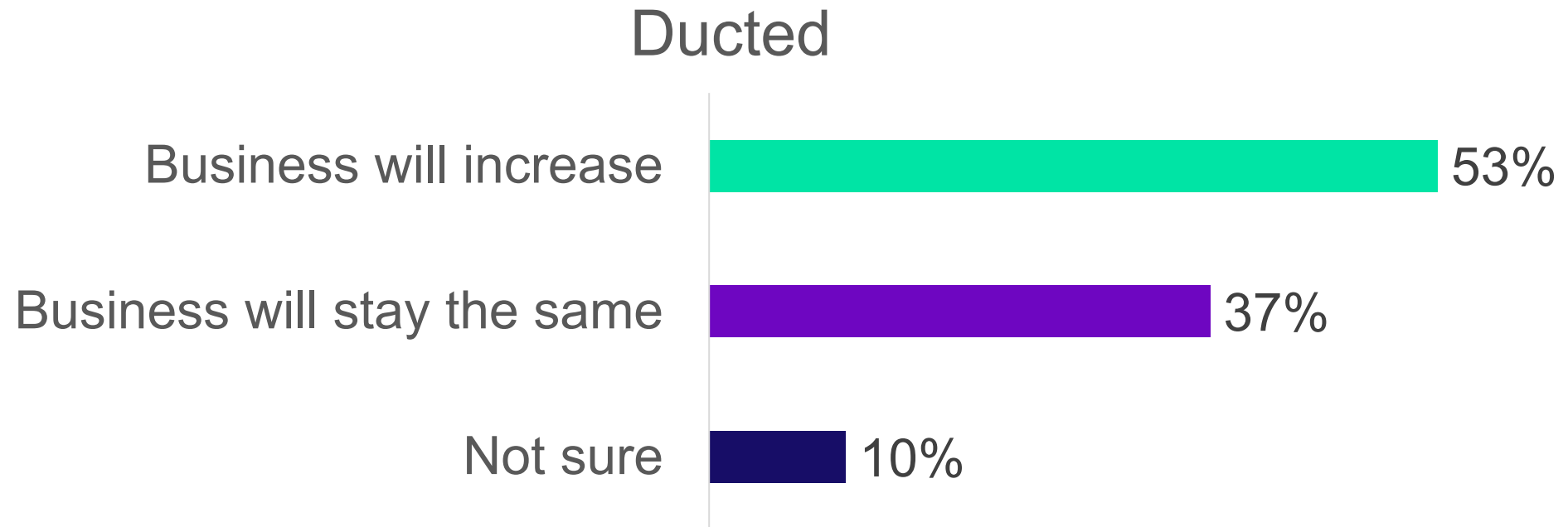


# **Contractor opportunities and perceptions**



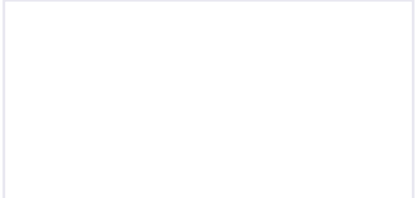
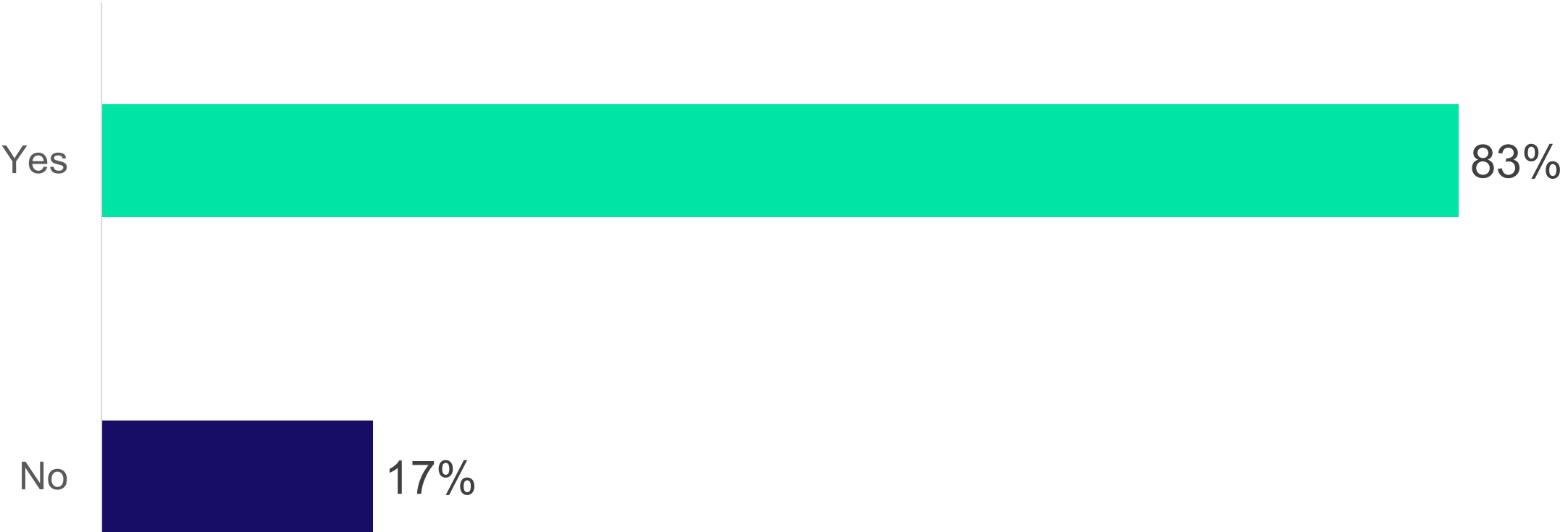
# Do you think you will be selling more ASHP's in the future or the same amount as now?

*Contractor perceptions*



# Do you ever recommend a ducted ASHP when replacing a furnace or AC?

*Contractor perceptions*







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Upfront cost is critical to customers; leverage rebates, tax credits, and financing.



Homeowners see savings on average.

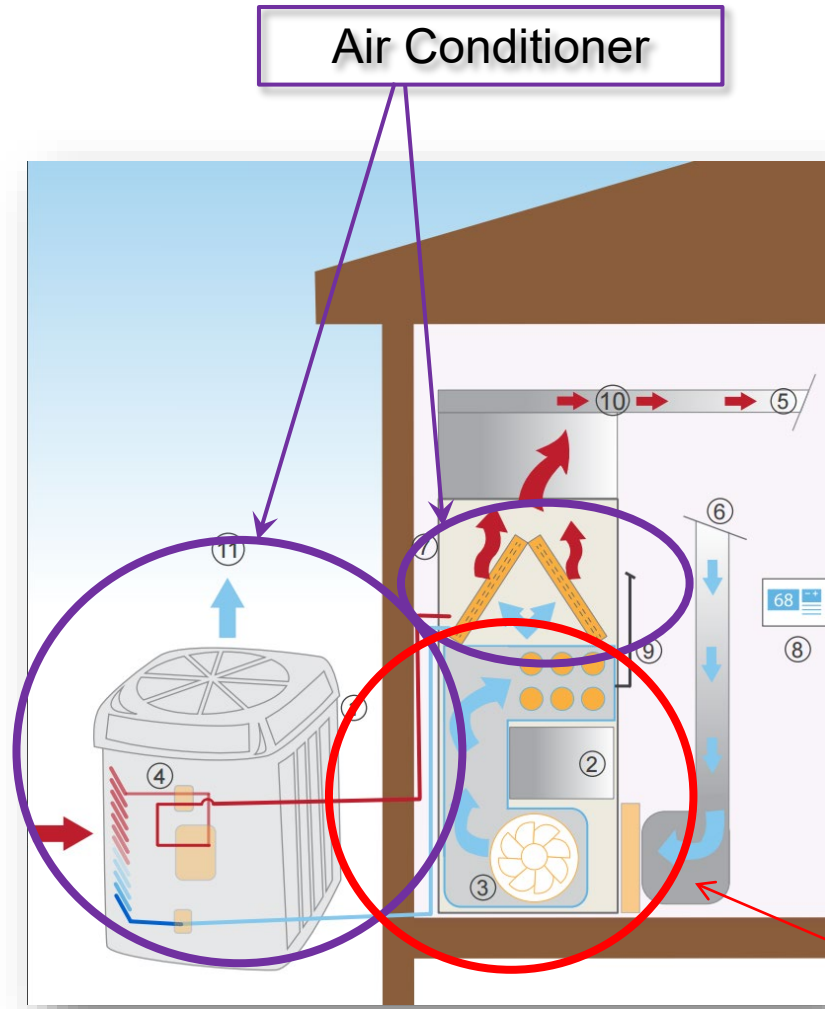


Not all customers want to replace their heating and cooling at the same time; be prepared to offer solutions to these customers.



# AC replacement product definitions

# Furnace plus AC systems



Dual fuel, centrally ducted air-source heat pumps (ASHPs) are a direct analogue to furnace-AC pairs

Most ASHP products available have required simultaneous AC and furnace replacement

A limitation created due to rating standards and communicating system controls

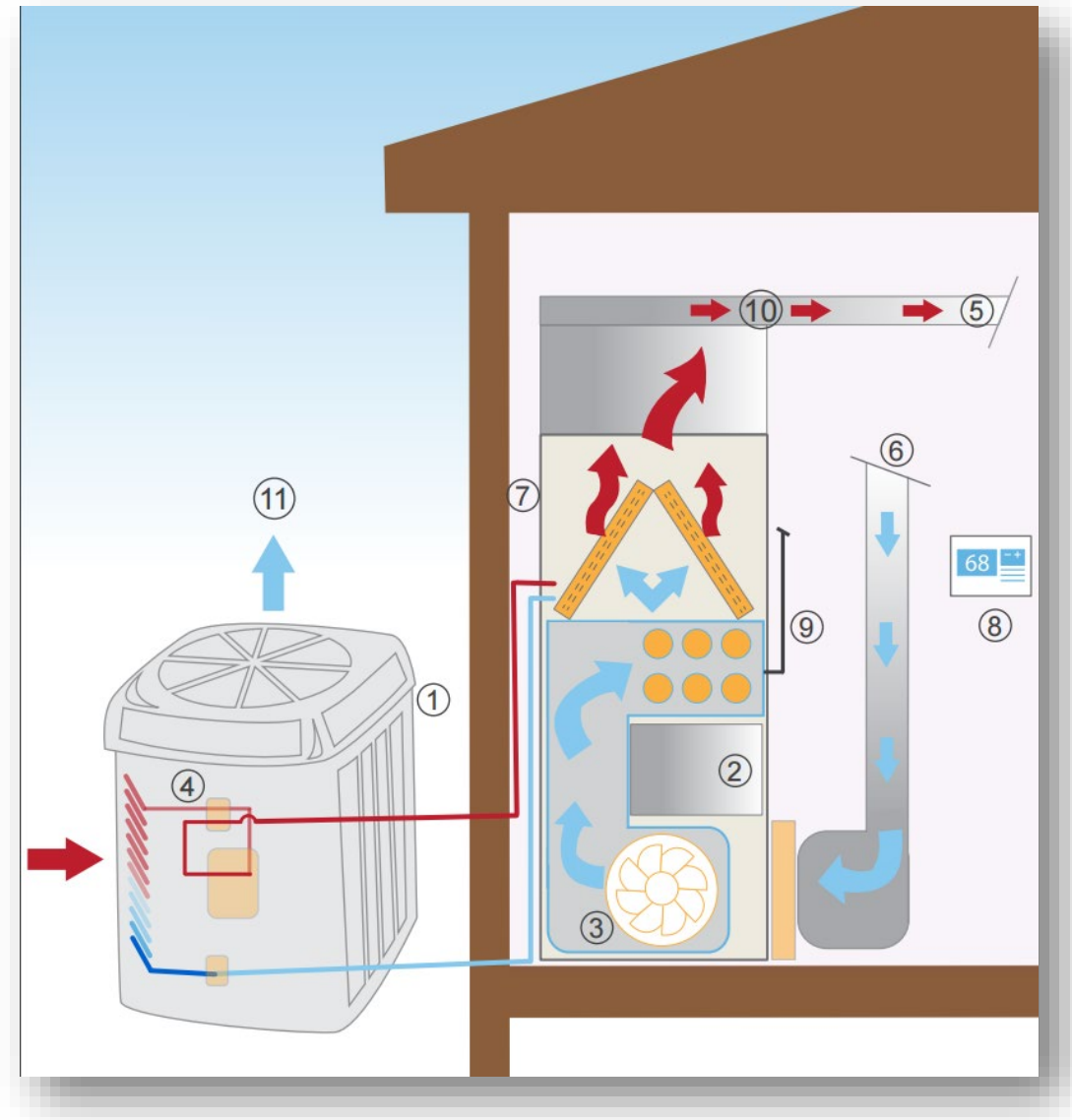
**Coil-only ASHPs are a new product class that can install on pre-existing furnaces and air handlers**

Coil-only ASHPs have different controls compared to matched furnace-ASHP pairs with communicating controls

Gas/Propane furnace

# Definition of AC replacement application type

- Historical VSHP applications require all component package
  - Full replacement
  - New construction
- Full control and communication between all components
  - Optimal performance
  - High cost





# Product definition for ASHP AC replacement

- Available product options:
  - Baseline options
    - Air conditioner – majority are min. efficiency (SEER 13) and single stage
  - Upgrade 1
    - Single stage or two stage heat pump
  - Upgrade 2
    - Variable speed heat pump



Any ASHP



VSHP



ccASHP



DOE Challenge

# Considering single stage – entry level

- Single (or two stage) heat pumps cannot increase compressor speed at cold temperatures\*
  - Their capacity decreases quicker as it gets colder outside
  - Leads to less operating hours for the HP
- Lower up-front costs
- Good performance at shoulder season air temperatures

*\*Cold temperatures: ~0° - 17° F*



Any ASHP

# VSHP as AC replacement

- System capacity is more consistent across cold winter temps
- Capable of displacing most of the heating load
- Less expensive than first gen ccASHPs, but more costly than single stage heat pumps
- Increasingly most VSHPs are now on the [NEEP Cold Climate Air Source Heat Pump product list](#)



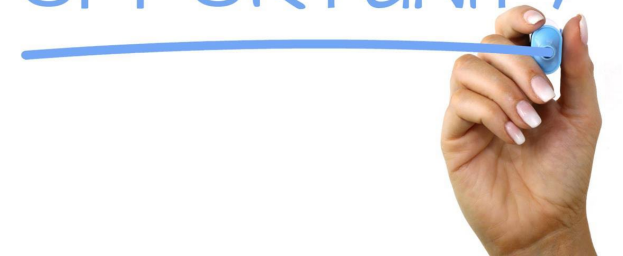
VSHP



# Potential overall benefits

- Decarbonization
- Cooling savings benefits through higher SEER/SEER2 ratings
- Increased comfort
- Operational Cost savings for some scenarios
- Protection against price volatility

BUSINESS  
OPPORTUNITY



# Technical considerations

*System design considerations &  
Installation considerations*



# Goals



Look at coil only match trends



Asking if the home application and fuel type will matter in your selection



Considering proper controls and strategies for this approach.



Considering single speed vs variable speed heat pumps and which is potentially the best choice with available incentives, rebates, and tax credits



Operational cost matters, considering when they favor air source heat pumps over ACs



Considerations for the most affordable heat pump that can do the job

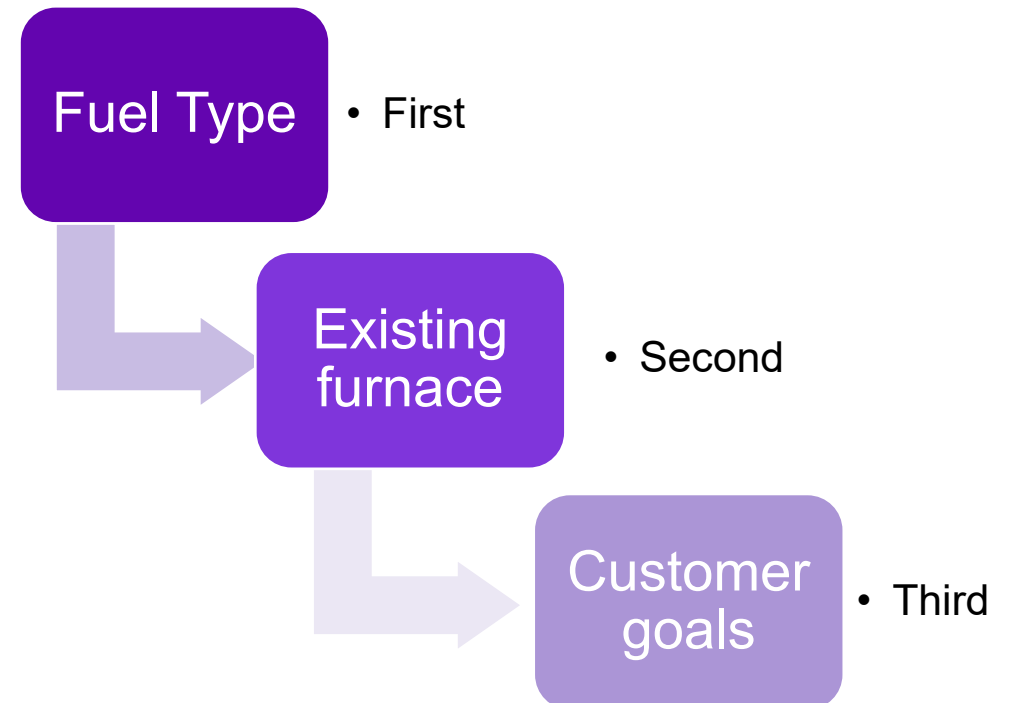


# System design considerations

*Technical Considerations*

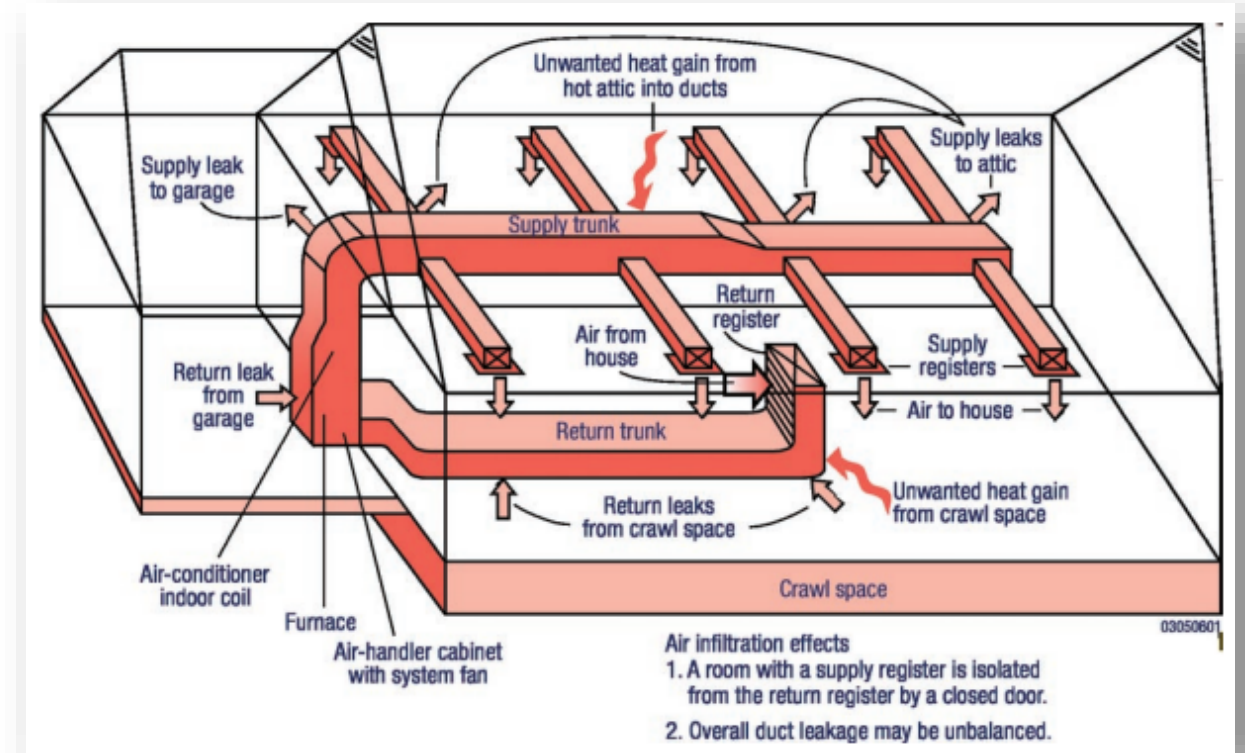
# AC replacement with an ASHP considerations

- What is the existing heating fuel type?
  - If electric resistance, go with ccASHP
  - If propane furnace, go with VSHP AC Replacement
  - If gas furnace, go with Single/Two speed or VSHP AC Replacement
- What is the furnace's usable lifetime and efficiency?
  - Likely keep furnace when
    - 12 years old or newer
    - 90% AFUE or higher
    - Recently tuned and working well
- What is the customer looking for?
  - Comfort
  - Cost savings
  - Emissions reductions
  - Efficiency



# Considering ductwork

- Ductwork systems must be evaluated for ability to handle heat pumps.
- VSHP typically have
  - Lower airflows
  - Lower air temperatures
- Comfort and energy impacts if not sized correctly
- Quality installation requirements
  - Look for unconditioned spaces
  - Look for existing issues



<https://www.nrel.gov/docs/fy05osti/30506.pdf>

**For more information see our Sizing Training Module!**

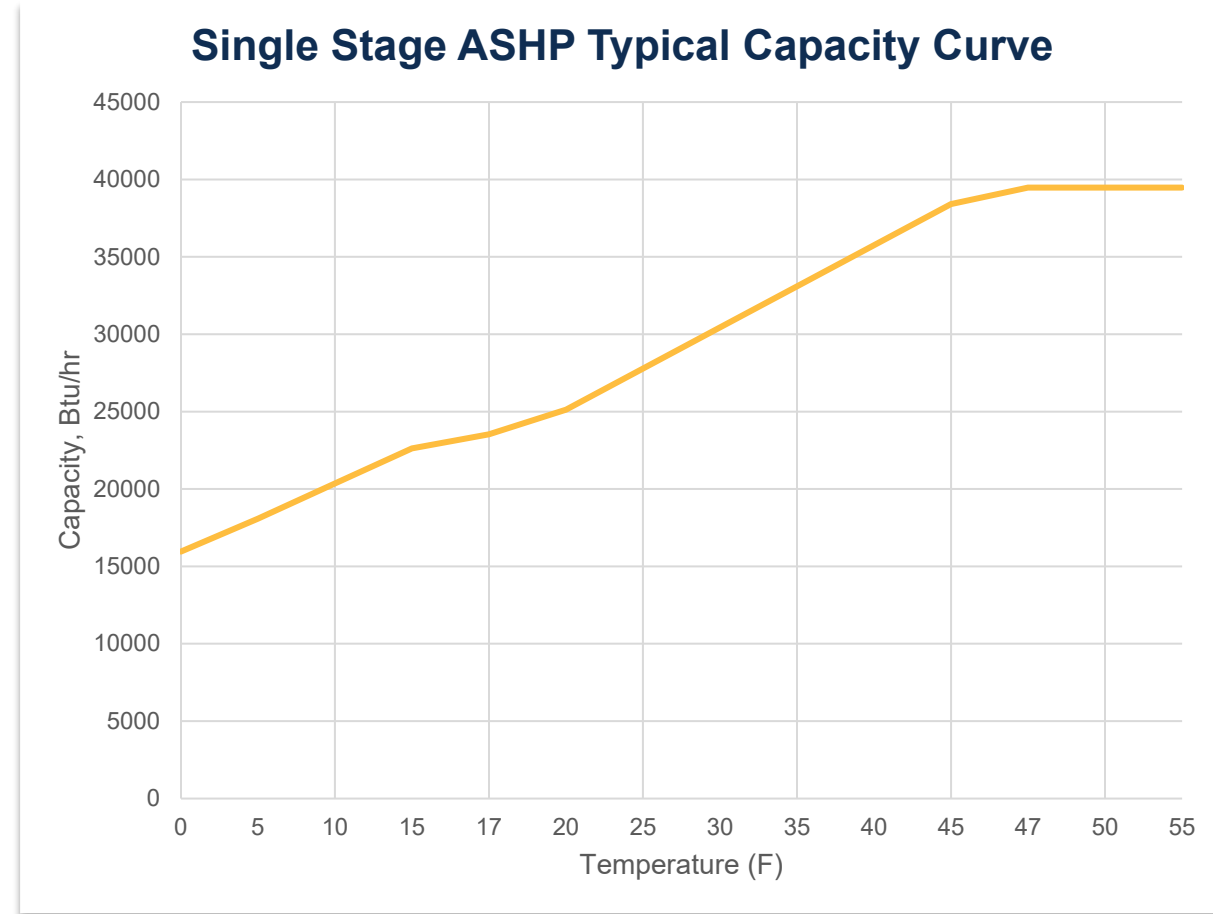


# Single Stage Heat Pumps (SSHP)



# SSHP: Cost conscious with natural gas

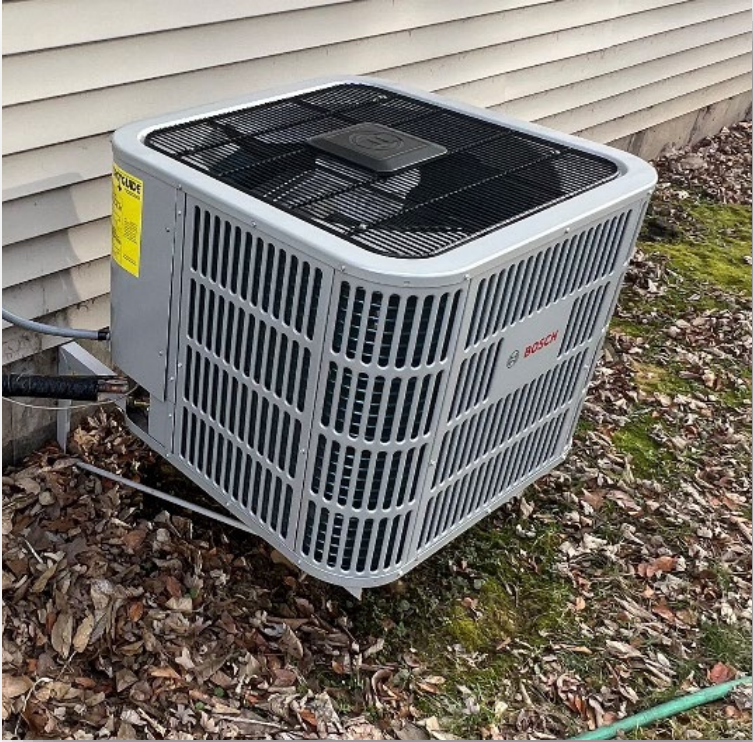
- **Aligns well with:**
  - Shoulder season heating only
  - Natural gas furnace backup
  - Low first costs
  - Initial HP market participation
- **Avoid for:**
  - Electric or delivered fuel applications
  - Electrification/Emissions related focus





# Coil-only / non-communicating

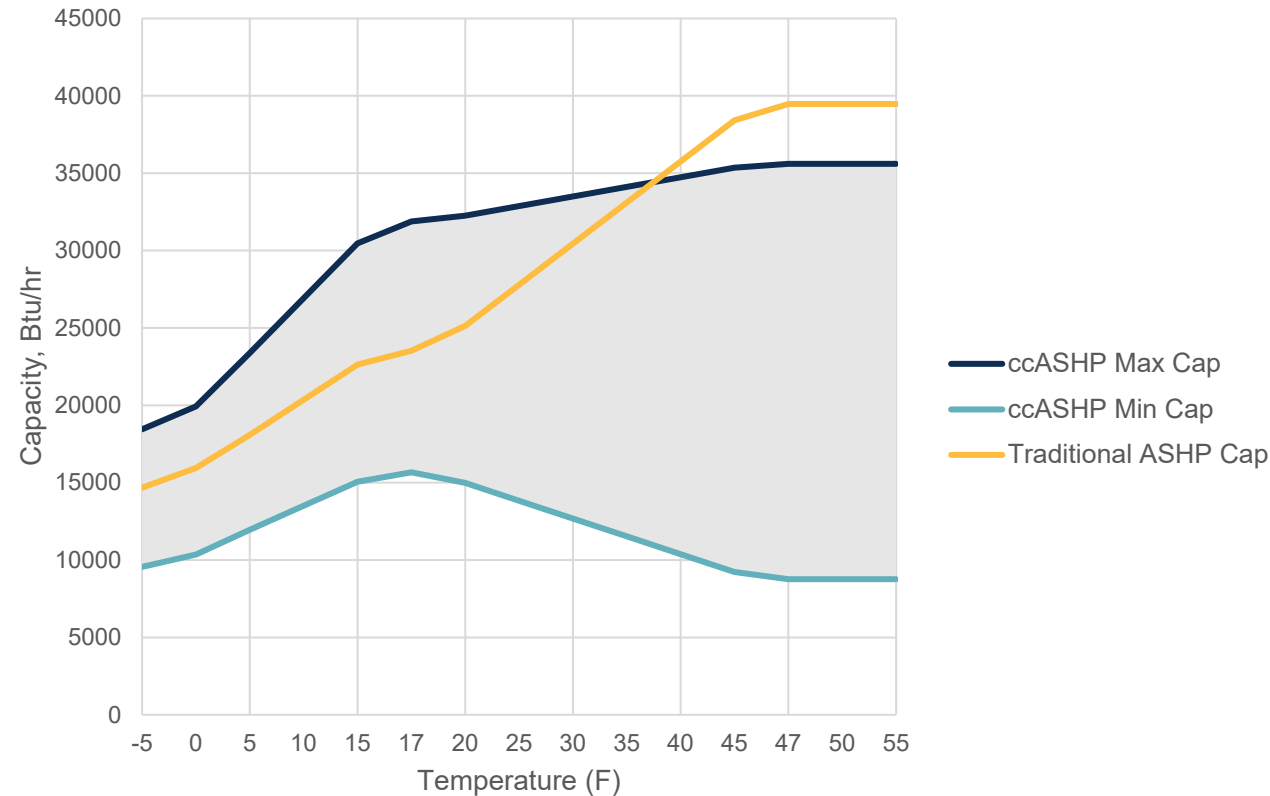
Variable Speed Heat Pumps (VSHP)



# VSHP: Displace expensive heating fuels, improve comfort, reduce emissions

- **Aligns well with:**
  - Electric resistance or delivered fuel heat displacement
  - Reducing fuel costs
  - Cooling season savings
  - Increased comfort
  - Electrification & emissions reduction goals
- **Avoid for:**
  - The most cost sensitive customers with natural gas and no dual fuel electric rates

**Air Source Heat Pump Capacity Comparison**



# Product performance and sizing for VSHPs

## Cold climate performance

- HSPF/HSPF2
- COP at 5°F
- Capacity maintenance at low temperatures
- QPLs: NEEP ccASHP product list
  - ***Most VSHPs are now on the NEEP list***



Ready to search the list?

Product Type <sup>i</sup> Ducting Configuration Brand AHRI, Model, Unit <sup>i</sup> Heating Capacity 47°F Rated Btu/h <sup>i</sup> Heating Capacity 5°F Max Btu/h <sup>i</sup>

All Product Typ  All Ducting Cor  All Brands  AHRI, Model or Ur

0 80000 0 80000

ENERGY STAR Certified <sup>i</sup> Eligible for Federal Tax Credit <sup>i</sup>

ENERGY STAR V6.1  North

ENERGY STAR V6.1 Cold Climate  South

SEARCH THE LIST

Advanced Search - Sizing for Heating

Advanced Search - Sizing for Heating User Guide <sup>i</sup>

Design Load Calculators

<https://ashp.neep.org/#!/>

# Coil-only matching in AHRI

Considerations for AC Replacement & keeping existing furnace:

Coil-only (Coil Mix-Match) ratings for AC replacement with heat pumps are derated to industry average air handler energy use.

If furnace is 5 years old or younger, try searching for the full compressor, coil, furnace match to get best rated efficiency.

May only be available in reduced tonnages.

Use Quick Search Criteria if manufacturer is known.

Export Search Results and filter for matches without furnaces when manufacturer is not set.

# MIX & MATCH





# Installation considerations

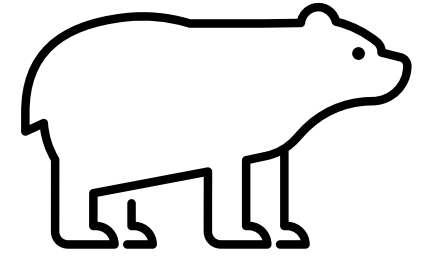
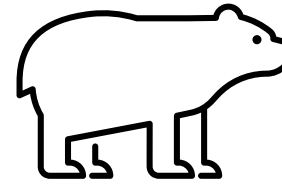
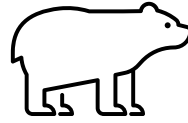
*Technical Considerations*

# Heat pumps vs. air conditioners: Key differences

- HPs operate in both heating and cooling seasons
- Sizing may be informed by cooling and/or heating loads
- Thermostat upgrades may be needed to control a HP
- Delivered air temperature may be lower than gas furnaces when HP running
- Typically, longer HP run times when overcoming thermostat setbacks



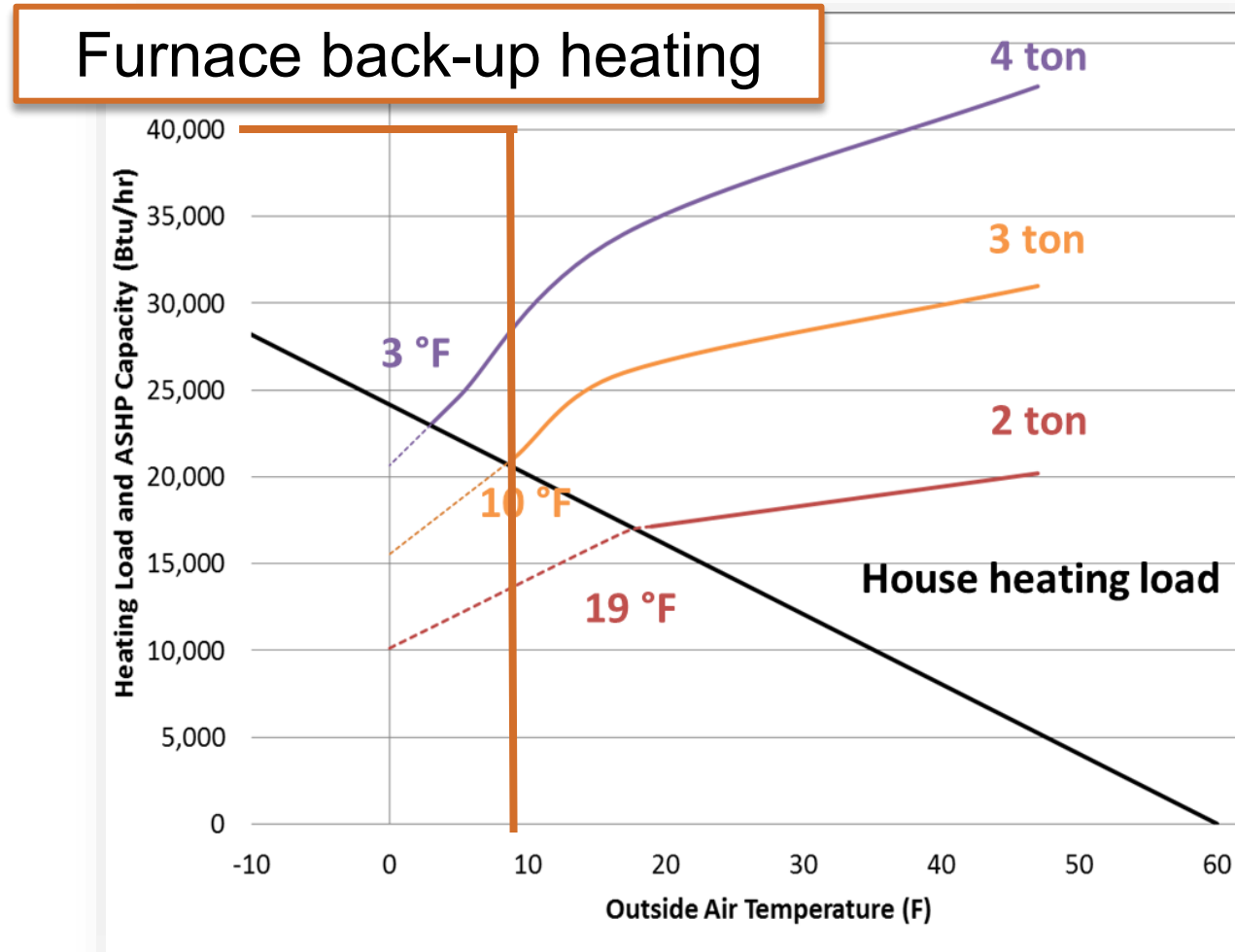
# Sizing matters



- Existing ACs and furnaces are often oversized
  - Load calculations are always recommended
- **SSHPs should be sized for cooling load**
- Coil-only matched VSHP models may have fewer offered condenser sizes
  - Sized for cooling if natural gas backup. Size for heating and cooling if propane backup.
  - Manufacturers may offer only 3- and 5-ton condensers
  - Paired coil size and condenser dipswitch settings can scale down the VSHP output for mid-size applications

# Sizing VSHPs for heating

- Recommended for electric resistance and propane heated homes only (unless homeowners are going “all electric”)
- Trade-offs between HP size and fraction of heating load met
- Percentage of heating load met by ASHP:
  - 4 ton ~ 86%,**
  - 3 ton ~ 77%**
  - 2 ton ~ 60%**





# Thermostat selection and configuration is a critical difference between HPs and ACs

**NOT ALL THERMOSTATS ARE DUAL FUEL COMPATIBLE**

Selecting a heat pump compatible thermostat is NOT enough



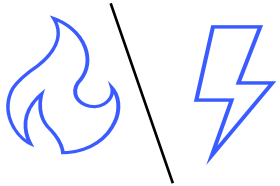
For more detailed information on controls, please check out the Controls module.

# Thermostat features to look for:



4 or more wires /  
wireless

- Must be able to control the HP reversing valve to operate both heating and cooling modes
- Wireless thermostat models exist



Dual fuel controls  
software

- Some thermostats can control a HP but not a HP with a backup heat source



Outdoor air  
temperature  
monitoring

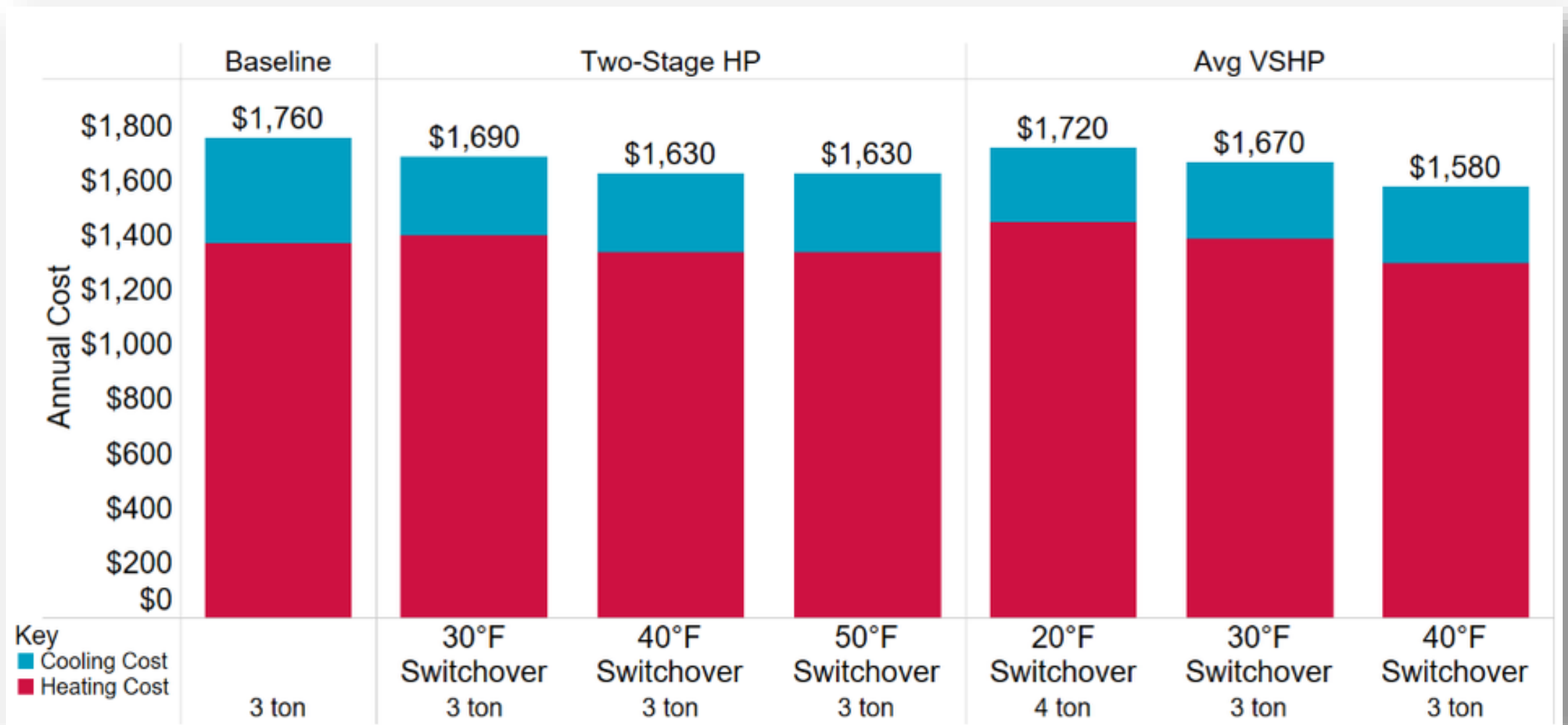
- Can be a hardwired sensor, wireless sensor, or WiFi connectivity to a local weather station
- Required to set a condenser lockout temperature



Multiple stage heating  
controls

- Optional, but may improve comfort or eliminate condenser lockout at low temperatures

# Economic switch over resources – Natural gas is current fuel



# What's new and what's next?

- Interactive operational cost tool and heat pump informational website
- Contractor resources and guidance on switchover temperatures
- Additional consumer programs operated by the State of Illinois

**NEW**





More coil only matches are hitting market every few months



Similar to other heat pump installations, the home application and fuel type will matter in your selection



Research is needed on proper controls and strategies for this approach. Please engage with your manufacturers



Not all scenarios require VSHPs, but they are increasingly becoming the best choice with available incentives, rebates, and tax credits



Operational cost matters and in many instances, savings are available

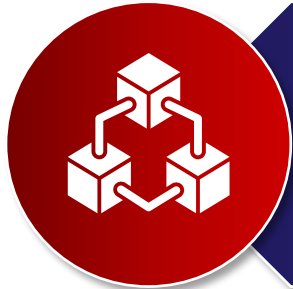


Load calcs lead to right sizing, which can ensure the smallest or most affordable heat pump can do the job

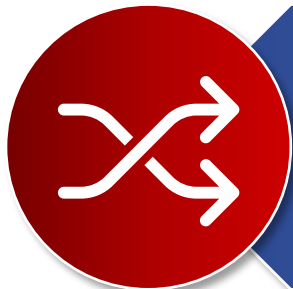
# Key takeaways for contractors - review



ASHPs as AC replacements represent a growing business opportunity.



AC replacement technologies are available for a variety of applications and scenarios.



AC replacements will have nuances in considerations differing from standard ASHP installations.

# Take the Knowledge Check

- [Knowledge Check](#)
  - You can find it in the chat
  - We'll send it out via a follow up email from [registration@slipstreaminc.org](mailto:registration@slipstreaminc.org)
- Complete it by **EOD Wednesday February 21** to check this course off your required trainings

# Thank you

For technical and training questions, please contact:

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