Center for Energy and Environment

Why Front Range HVAC Contractors Should Care About Heat Pumps

2024

- Front Range Community College
- City of Fort Collins

Your Trainer

Dan Wildenhaus

Sr Technical Manager and Trainer–
Center for Energy and Environment

15 years as a contractor doing Home Energy Ratings, HVAC and Weatherization

15 years as a consultant and trainer for utilities and governments

Soon to be a Colorado resident!

We're a mission-driven non-profit that loves to partner!

Learn more about Center for Energy and Environment in CO

What type of work we do

Technical trainings

Pilot/Program Management

- Design/Implementation
- Equity/Income-Qualified
- Commercial/Multi-family/Residential
- Energy Advising/Customer Experience

Who we have worked for

City and County of Denver
Platte River Power Authority
Xcel Energy
Gunnison
BELCO

Who we are members of

SWEEP
EEBC

Where we can be found

www.mncee.org

Based in Minnesota with an expanding Colorado-focused team

Who is Center for Energy and Environment in CO?

Gabrielle Rinck

Program Implementation Manager- Colorado

Based in Colorado Springs, Gabrielle is responsible for the implementation and delivery of programs and pilots in Colorado

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Robin Osindele

Energy Advisor- Electrification

Based in Englewood, Robin works with equity priority commercial building owners, contractors, and community-based organizations to advance electrification

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Dan Wildenhaus

Senior Technical Manager- Training and Consulting Services

Soon to be a Colorado resident!

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And growing…

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Ideas move at the speed of revolution. People and programs move at the speed of evolution; until now… We are CEE

What we'll cover today

- Notes and comments from City of Fort Collins
- Level setting terminology
- Applications
- Homes that are ready for Heat Pumps
- Customers that are ready for Heat Pumps
- Contractors that are ready for Heat Pumps
- Selling Heat Pumps
- Quality Installation
- YOUR questions

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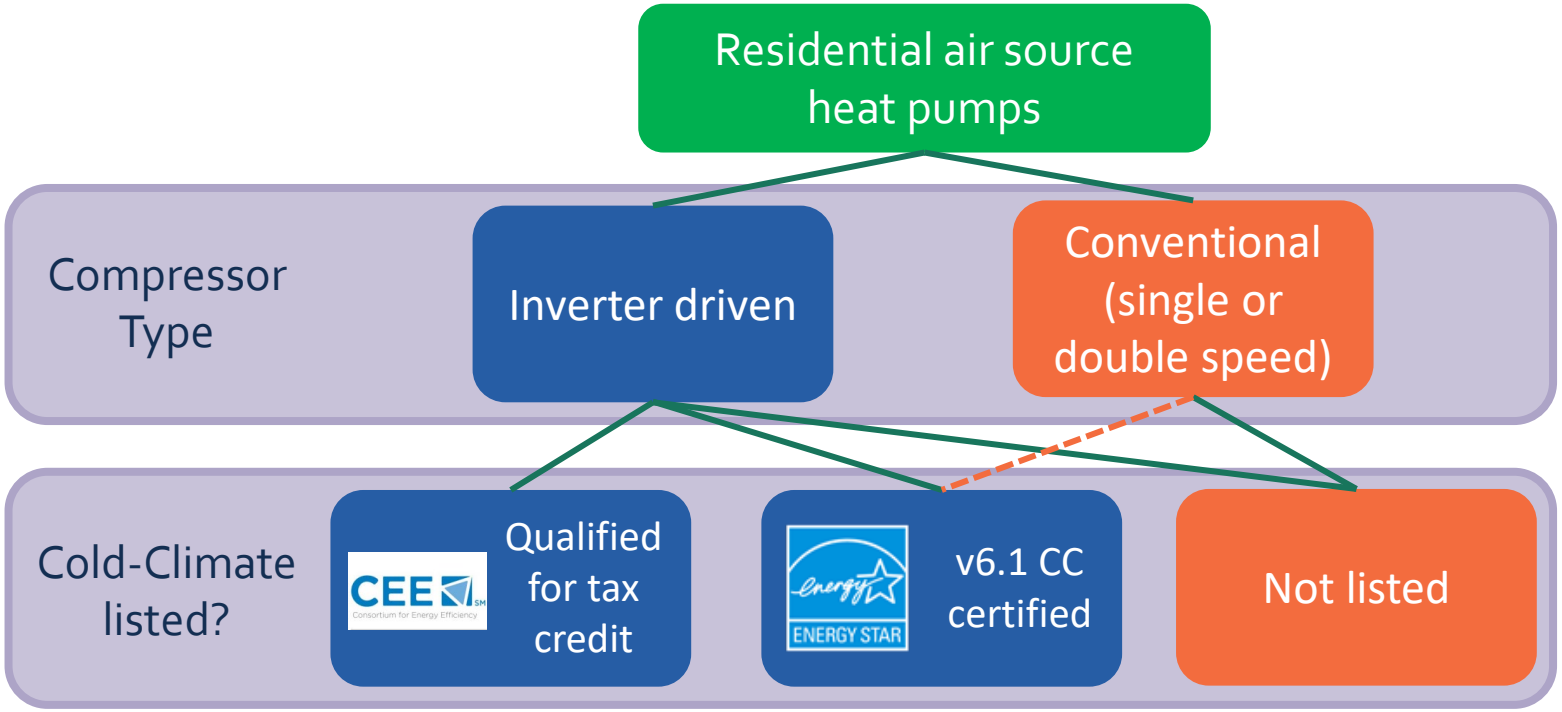
Level-setting terminology

Specific to Front Range climate

Level Setting Terminology



What qualifies as a "cold-climate" heat pump?

- Generally efficient at low ambient temperatures and can achieve capacity performance and maintenance

"Dual fuel" can mean many things

- Equipment compatibility
- Utility program description
- Always ask to fully understand the definition!

Local Design conditions

- **Design Temperature is not the coldest day or hottest day of the year**
- **Winter Design Conditions: It only gets colder than this <u>0.4 to 1%</u> of the time!**
- **Ft Collins:**
  - Winter Design Condition is 6°F
  - Summer Design 91°F with 62°F wet bulb
    - Summer: I don't care about what the design temp is, I want it cool now!

Note: Internal temps for sizing: ACCA presets

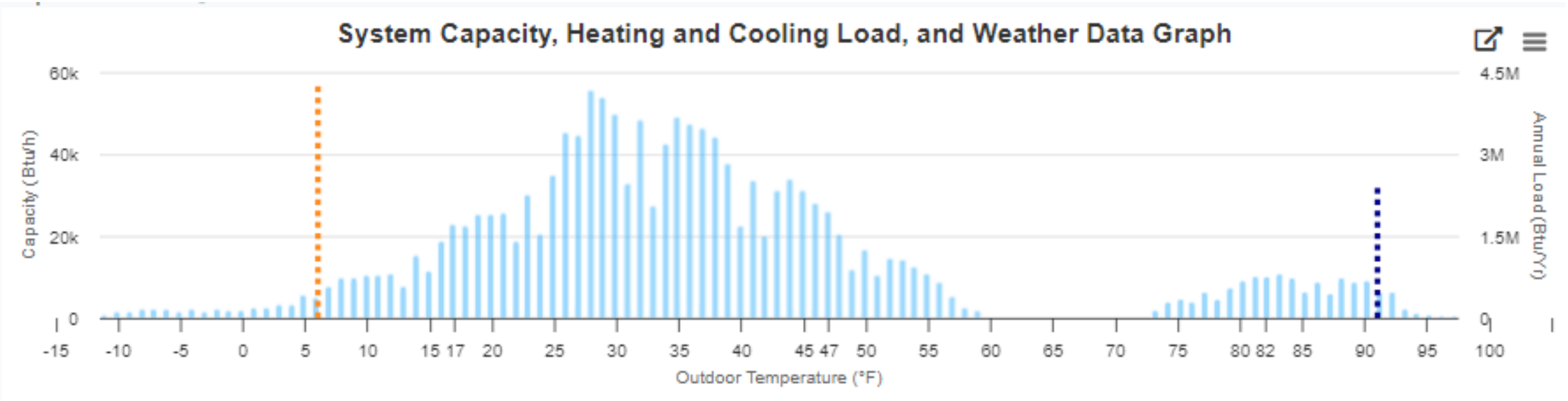
Summer/cooling – 75°F

Winter/heating - 72°F

https://www.fcgov.com/building/hvac-requirements

Annual Load x Hours for an existing home in Ft Collins

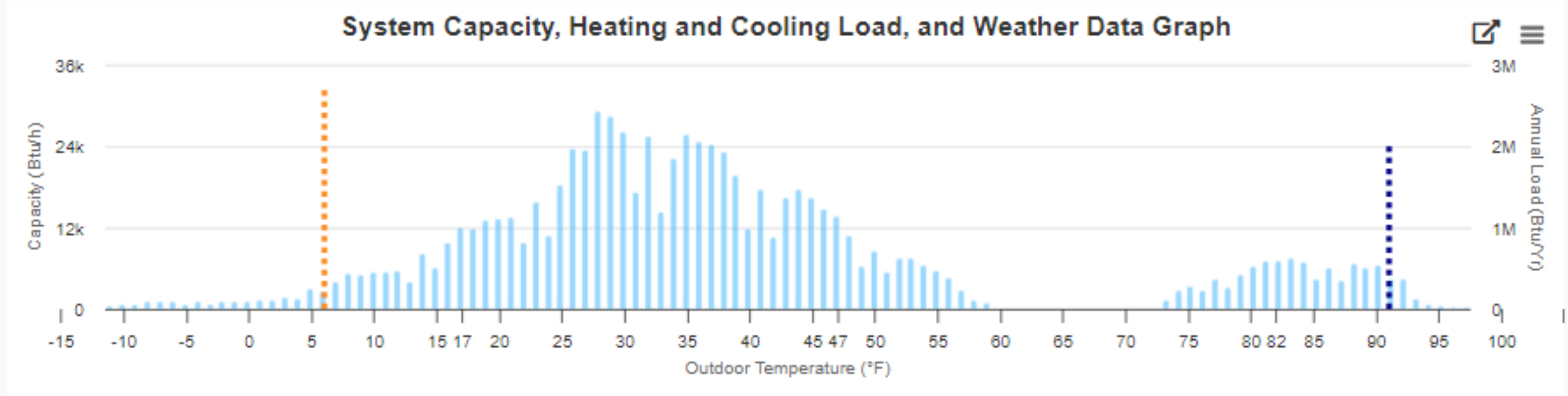
Demo House Fort Collins			
Site ID:	16531	Heating:	45,300 BTU/hr
Area:	2,200 ft²	Cooling:	25,400 BTU/hr
Climate:	Trinidad AP	Latent:	-2,400 BTU/hr



Load x Hours: On the graph, there is a faint bar chart in the background indicating the number of load-hours a home spends at each outdoor temperature range or "bin." For each bin, this is the home's load (in Btu/h) times the number of hours. It is an indication of how much heating energy is needed each year at various outdoor temperatures. This can help users understand relative impacts of short cycling and backup heating for a given heat pump and home heating load. Generally, the more this bar chart is covered by the modulating zone, the better the heat pump fits the heating load.

Annual Load x Hours for a New Home in Ft Collins

Demo House 2 Fort Collins			
Site ID:	16533	Heating:	26,400 BTU/hr
Area:	2,400 ft^2	Cooling:	19,700 BTU/hr
Climate:	Fort Collins	Latent:	-2,600 BTU/hr



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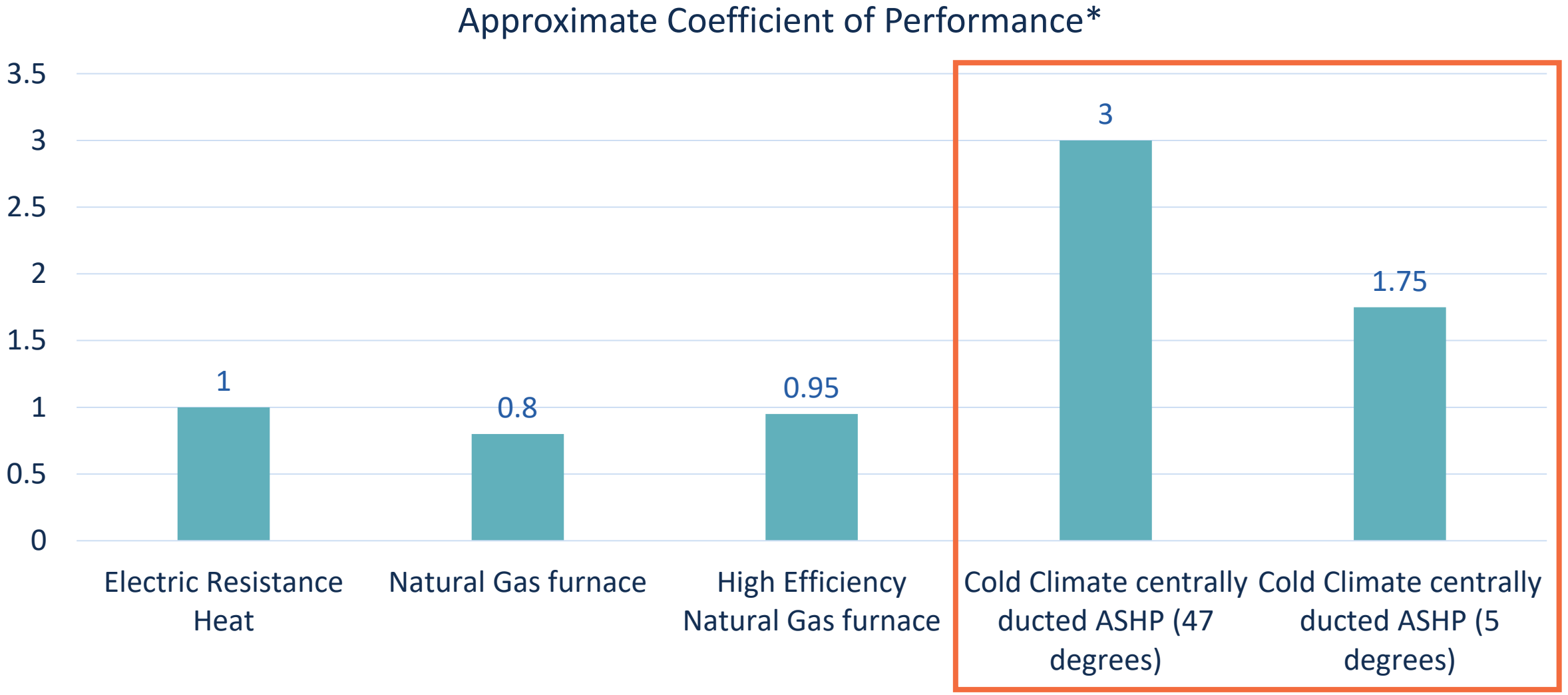
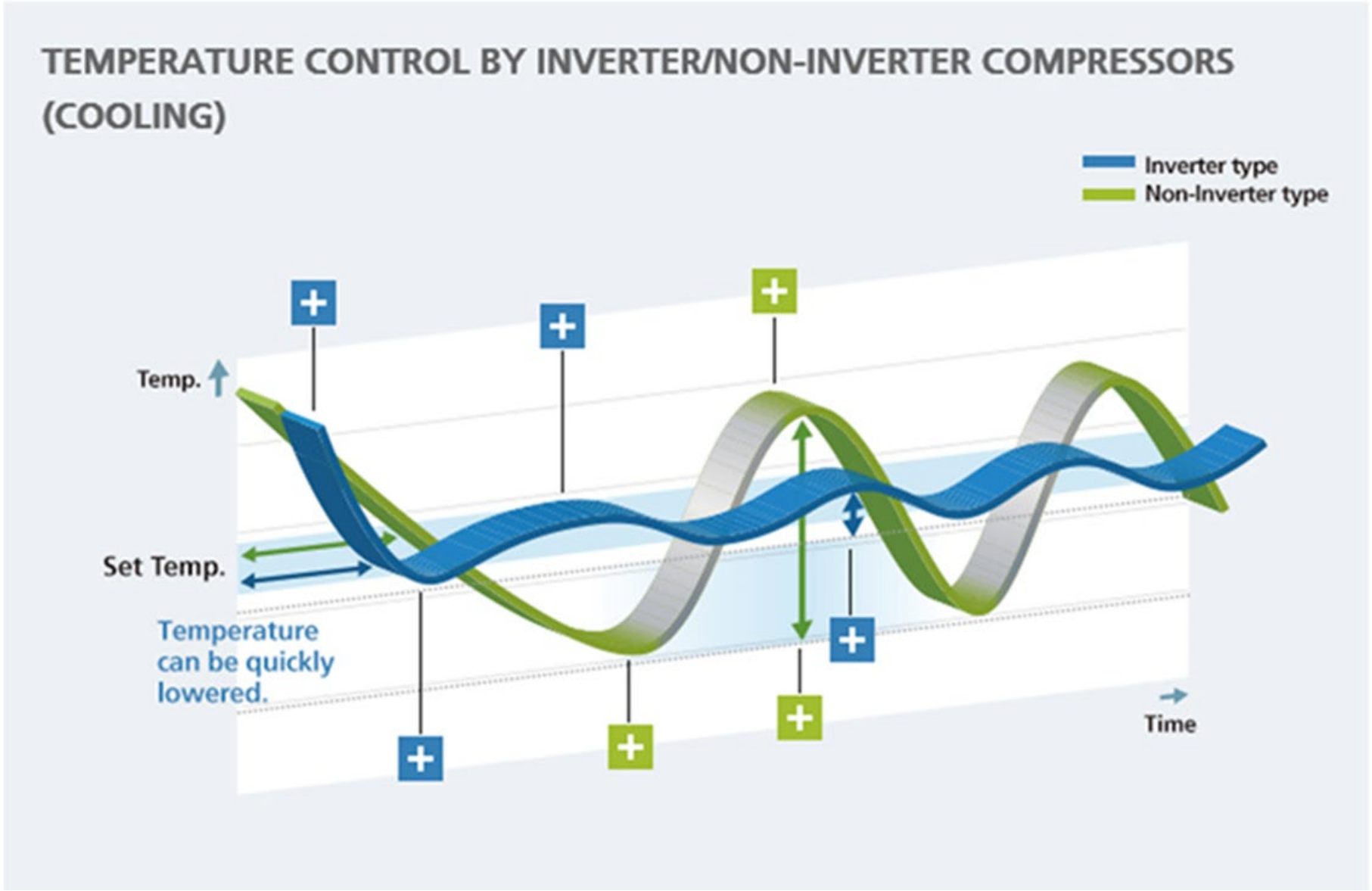
Level setting on COP by system type



**Note – Natural Gas appliances don't use COP like heat pumps. AFUE = COP * 100*

NEW GENERATION HEAT PUMPS – SYSTEM TYPES



How do cold climate heat pumps work?

- Higher compressor speeds
- Variable refrigerant flows
- Rerouting excess hot refrigerant back through indoor coil
- In some cases, indoor air flow is adjusted
- Variable capacity heat pumps typically use between 0.85 to 9.5 kWh/hr
- At low compressor speed, moderate refrigerant flow, and moderate air handler flow, they may use 1.5 to 3 kW
- At higher compressor speed, more intense refrigerant flow, and adjusted air handler flow, they may use 4 to 8 kW.
  - ***Heat pump is typically 2 to 3 times more efficient in cool, but not frigid climates***

REALLY…IN COLD CLIMATES?

- Variable capacity advancements have expanded cold climate performance
- Standardization of a cold climate performance specification
- Field research studies **observed systems delivering heat as cold as -25°F!**

WHAT IS CCASHP TECHNOLOGY?

Typical **Efficiency Requirements**

- Greater than ≥18 SEER2
- Greater than ≥11.7 EER2
- Greater than ≥8.1 HSPF2

Performance

- Max capacity at 5° F at least 70% of rated capacity at 47° F
- COP at 5°F of 1.75 or higher

Northeast Energy Efficiency Partnership (NEEP) cold climate product list

cee
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Applications

ASHP Application Types

Existing HVAC	ASHP Options	Considerations	Market Size?
AC replacement – with ductwork	Ducted ASHP	Sizing, energy costs, product cost, change over temperature	??
AC replacement – without ductwork	ccDHP	Sizing, comfort needs, product cost	??
Electric baseboard	ccDHP	Sizing, home configuration, number of heads	??
Propane/oil furnace	Ducted dual-fuel ccASHP	Sizing and change over temperature	??
New Construction	Ducted ccASHP	Sizing and electric plenum backup	??

ASHP Application Types

Existing HVAC	ASHP Options	Considerations	Market Size??
AC replacement – with ductwork	Ducted ASHP	Sizing, energy costs, product cost, change over temperature	??
Easy Sell – plenty of homes 15% - 50% energy savings			
Electric baseboard	ccDHP	Sizing, home configuration, number of heads	??
Propane/oil furnace	Ducted dual-fuel ccASHP	Sizing and change over temperature	??
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ASHP Application Types

Existing HVAC	ASHP Options	Considerations	Market Size
AC replacement – with ductwork	Ducted ASHP	Sizing, energy costs, product cost, change over temperature	??
		configuration, number of heads	??
Propane furnace	Ducted dual-fuel ccASHP	Sizing and change over temperature	??
Electric furnace	Ducted ccASHP	Sizing and electric plenum backup	??

Big Opportunity – A LOT of homes

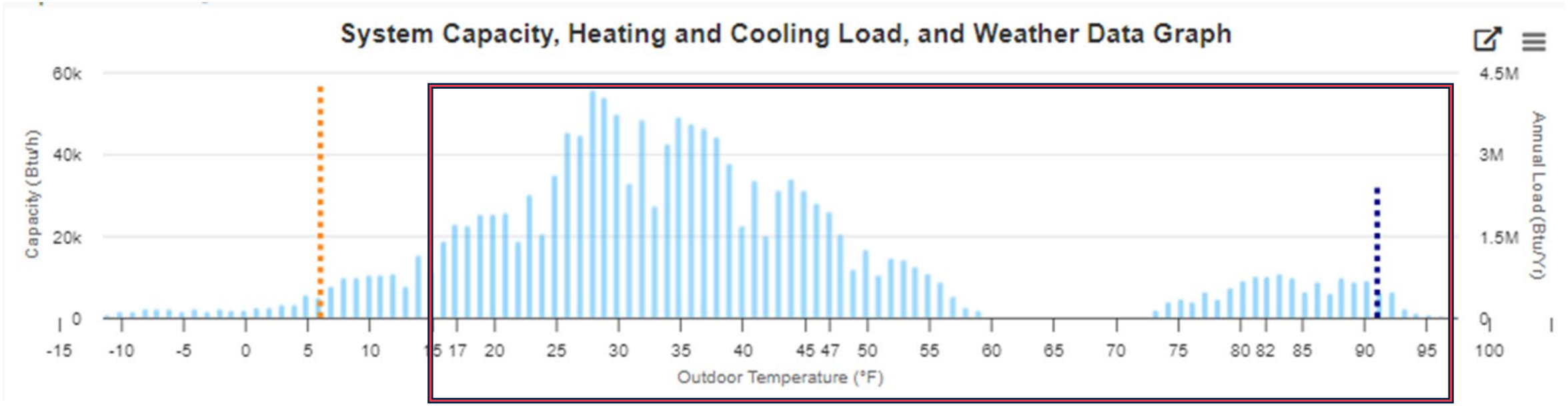
ASHP Use Case: Existing Furnace & AC

- **Typical home attributes**
  - 80% efficient furnace
  - 3-ton AC – ≤14 SEER
  - **Existing heating fuel natural gas or propane**
- **General existing conditions to consider**
  - Is existing furnace oversized?
  - Comfort complaints about uneven temperatures
  - Are ductwork modifications needed
  - How much time is spent at home vs away
  - **What condition is the house and existing ductwork in?**

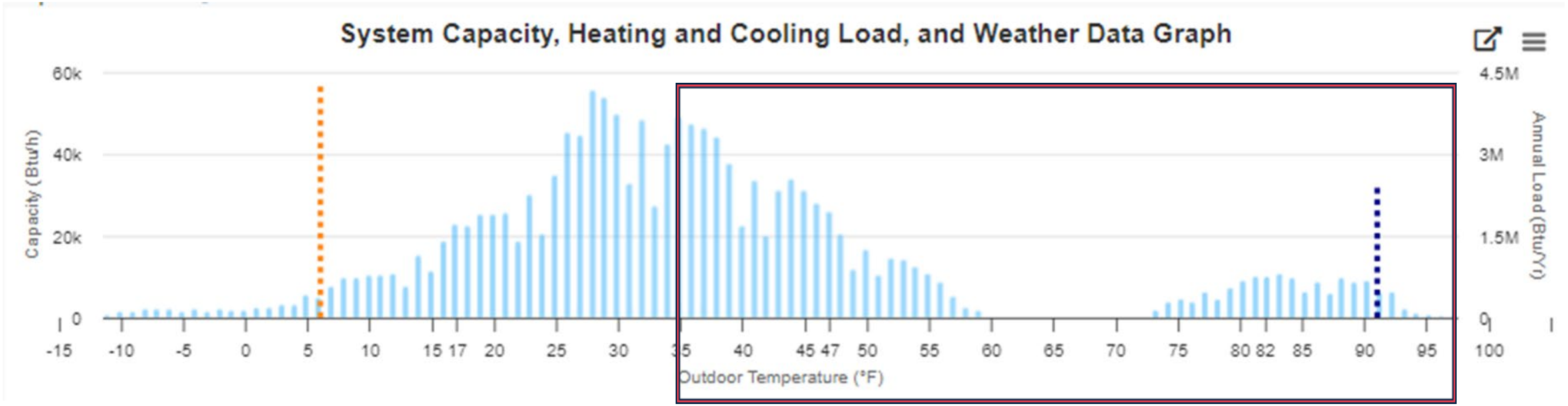
Dual-Fuel – non-cold-climate ASHP and Furnace

- **How to achieve best cost efficiency for inverter driven, but not cold climate systems.**
- **Size at the high end of the cooling load**
  - **Don’t significantly oversize only a ½-1 ton more than cooling need**
  - Use maximum capacity at 17 ° F
  - Look for ≥16 SEER
- **Furnace replacement or integrate with existing?**
  - Replace if near end of life or
  - If inefficient <92 AFUE without ECM blower
  - **Propane/oil furnace in last third of life**
- **Thermostat and other controls**
  - Wherever possible use the manufactures suggested thermostat
  - Enter a customized temperature-based switchover based on findings from customer discussion
- **Homeowner education**
  - No thermostat setback or very minimal setback no more than 4 degrees
  - Avoid the use of constant fan - utility bill penalty.

Choosing a switchover temperature of 15˚F allows HP to serve ~90% of annual heating load x hours



Choosing a switchover temperature of 35˚F allows HP to serve ~45% of annual heating load x hours



Dual Fuel - ccASHP and Furnace

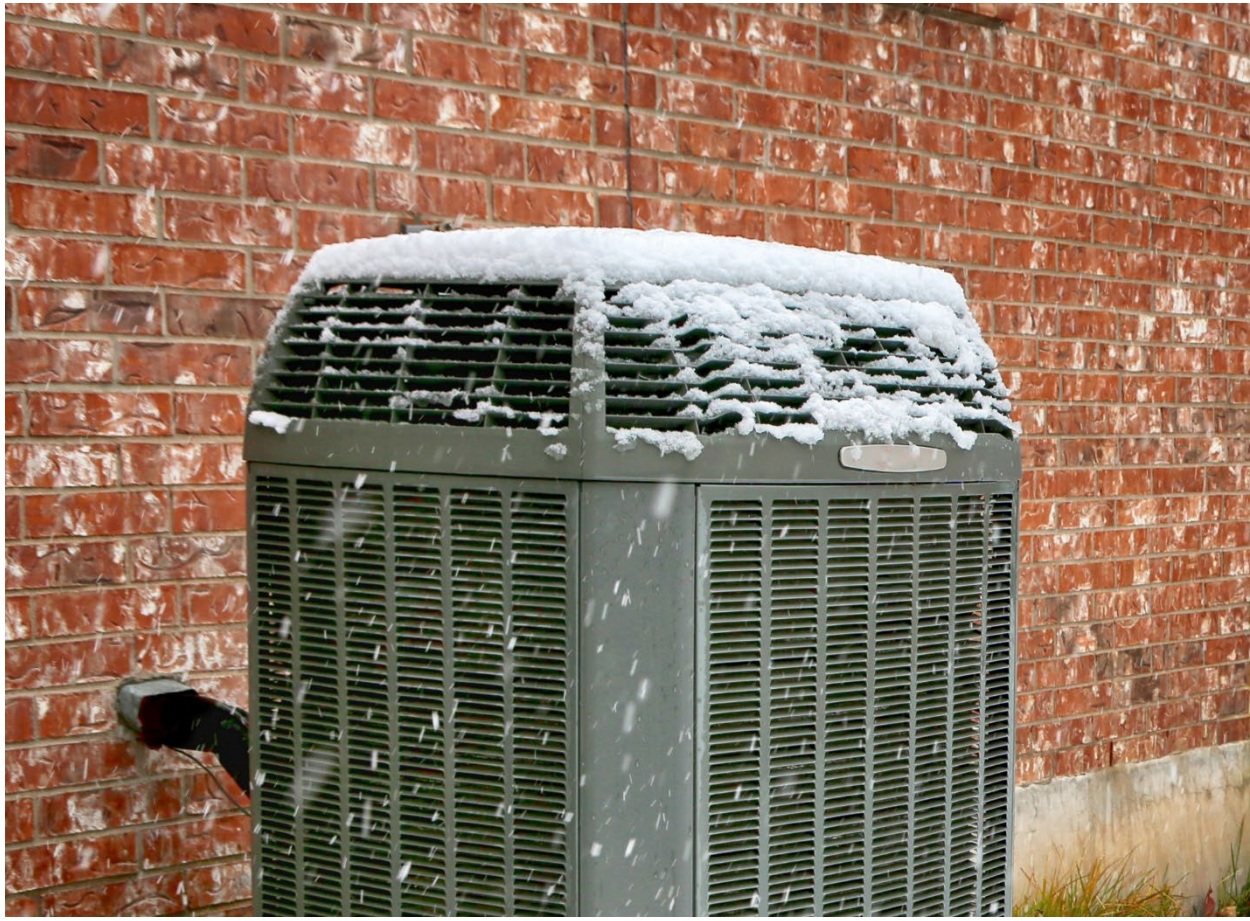
- **Achieving the best efficiency first cost and operation cost**
- **Size for heating load**
  - Up to 115% of cooling load
  - Use max capacity at 17° F or 5° F
- **Furnace replacement or integrate with existing?**
  - If propane is the fuel source
  - Replace if near end of life or
  - If inefficient <92 AFUE without ECM blower
- **Backup Heat / Controls**
  - **Thermostat - temperature based switchover***
  - Integrated load-based backup heat
- **Homeowner Education**
  - No thermostat setbacks
  - When used setbacks typically align operation with peak times
  - No constant fan

*use balance point or economic switchover temperature

All electric cold-climate heat pump to replace furnace and AC, or New Construction

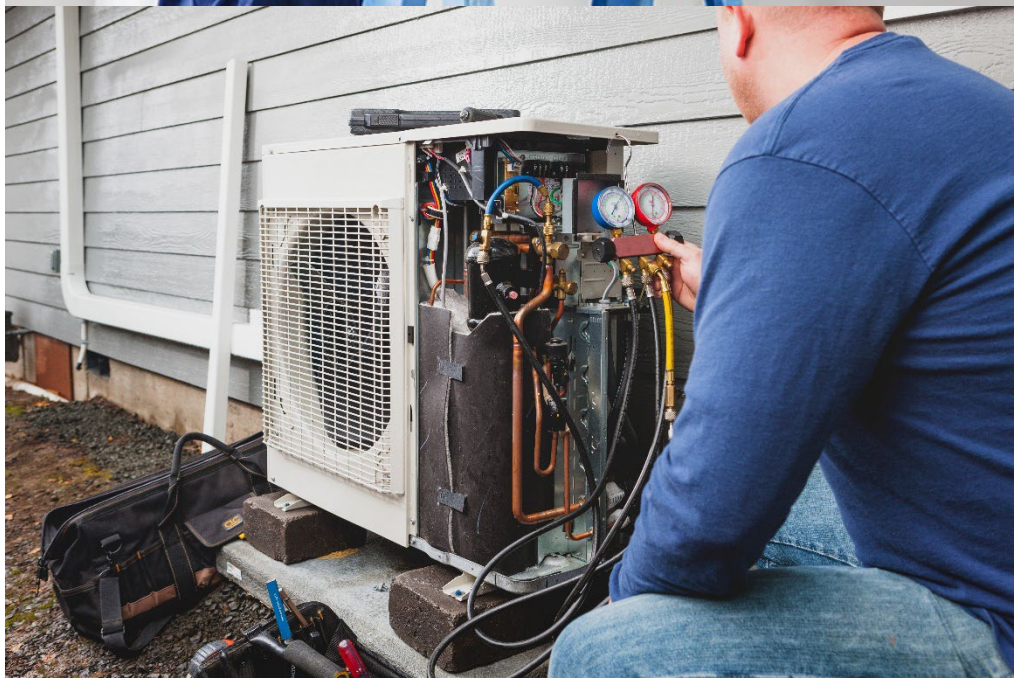
Benefits

- Both furnace and AC ready to replace
  - Ideal for high performance homes
  - Ready for Propane homes
  - Ready for New Construction
- Reduced carbon impact
  - Rooftop solar
  - EV owner
  - Zero Carbon Code Homes

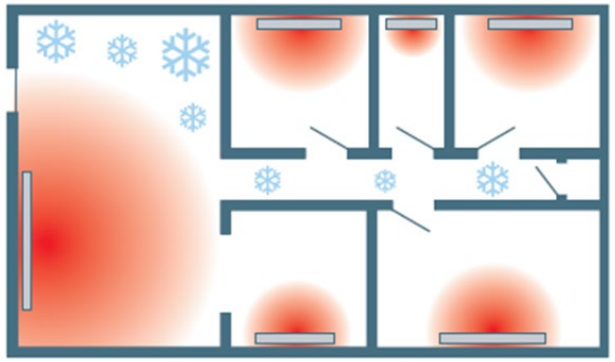


Cold-climate ductless heat pumps

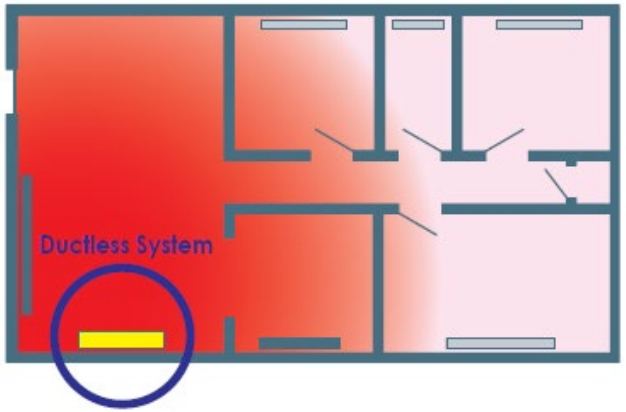
1. Homes with electric baseboard
2. Homes with natural gas boilers
3. Remodel, accessory dwelling units, trouble spots



Ductless solution selection



- Customer need: Increase comfort, reduce costs



- **Simple Solution:** Single zone ductless unit or 1-3 room compact-ducted.
- **Advanced Solution:** 2-5 zone ductless/compact ducted multi split or multiple single zone systems if simultaneous cooling/heating desired
- **Sizing Strategy:** locate first/single zone where it will cover most of central living area, establish additional zones as needed based on customer use.
- **Equipment Selection Considerations:** In much of the cold-climate U.S., a ccASHP that covers only 60% of the design load will fulfill over 90% of the home's annual heating load.

A Summary of ASHP Benefits

- Improved comfort*
- Resiliency against price volatility
- Operational cost savings for certain application types
- Increased energy efficiency
- Decrease furnace short cycling during shoulder months

*Potentially – dependent on right sizing, proper controls, and homeowner education

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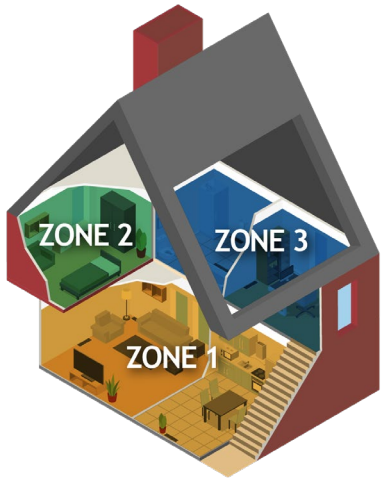
Homes ready for heat pumps

How is a heat pump sized and what matters?

The colder it is outside, the more heating energy needed to stay comfortable.

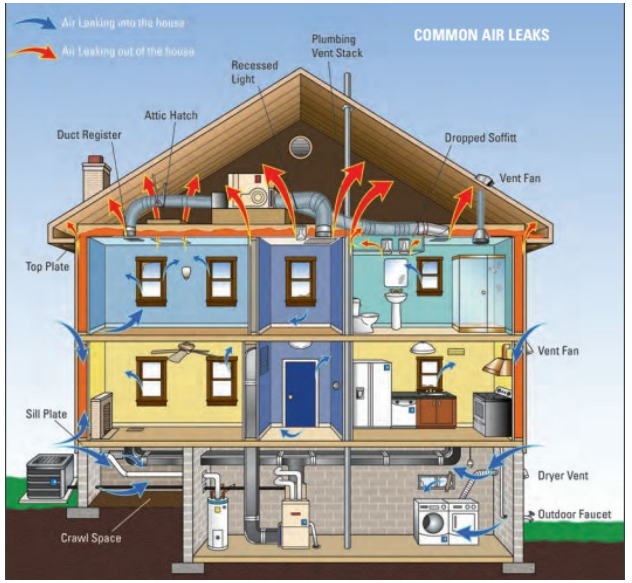
The heating load is judged based on the coldest days of the year.

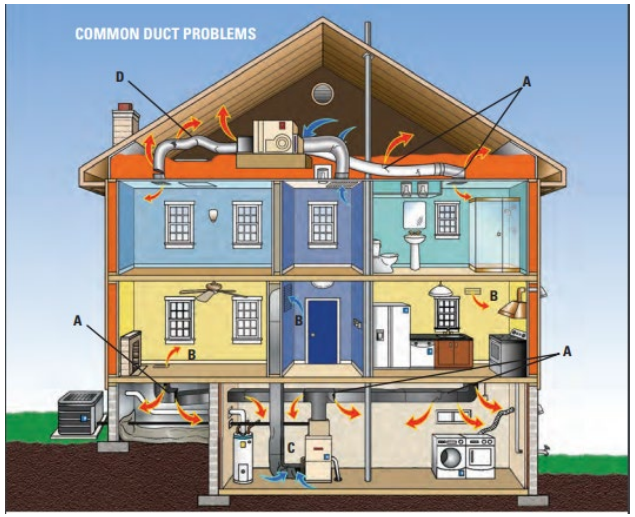


- How much heat is needed?
  - In the home (block load)
  - In a zone (e.g., floor or wing)
  - In a room
- What goes into the calculation?
  - Design temperature (the regional climate)
  - Size of the home
  - Insulation – walls, ceilings, floors
  - Window quality and location
  - Building orientation

Weatherization for the win!
Weatherize first, *then* size for heating

- **Keys to weatherization**
  - Define the boundary of your conditioned space
  - Air seal
    - Top plates, joists
    - Recessed lights, duct boots
    - Penetrations
    - Weather stripping
    - Chimney dampers
    - Test with a blower door
  - Insulate
    - Attics, walls (if accessible)
    - Floors
    - Windows
- **Size the heat pump *after* weatherization**
  - Improved comfort
  - Smaller, less expensive heat pump
  - Reduces install challenges (ducting, indoor head locations)
  - Can make ductless applications more viable





When should equipment be sized, selected, and installed?

Is bigger better?

Average colder climate house heating system size

3.5 to 5 tons

Post weatherized homes

2 to 4 tons

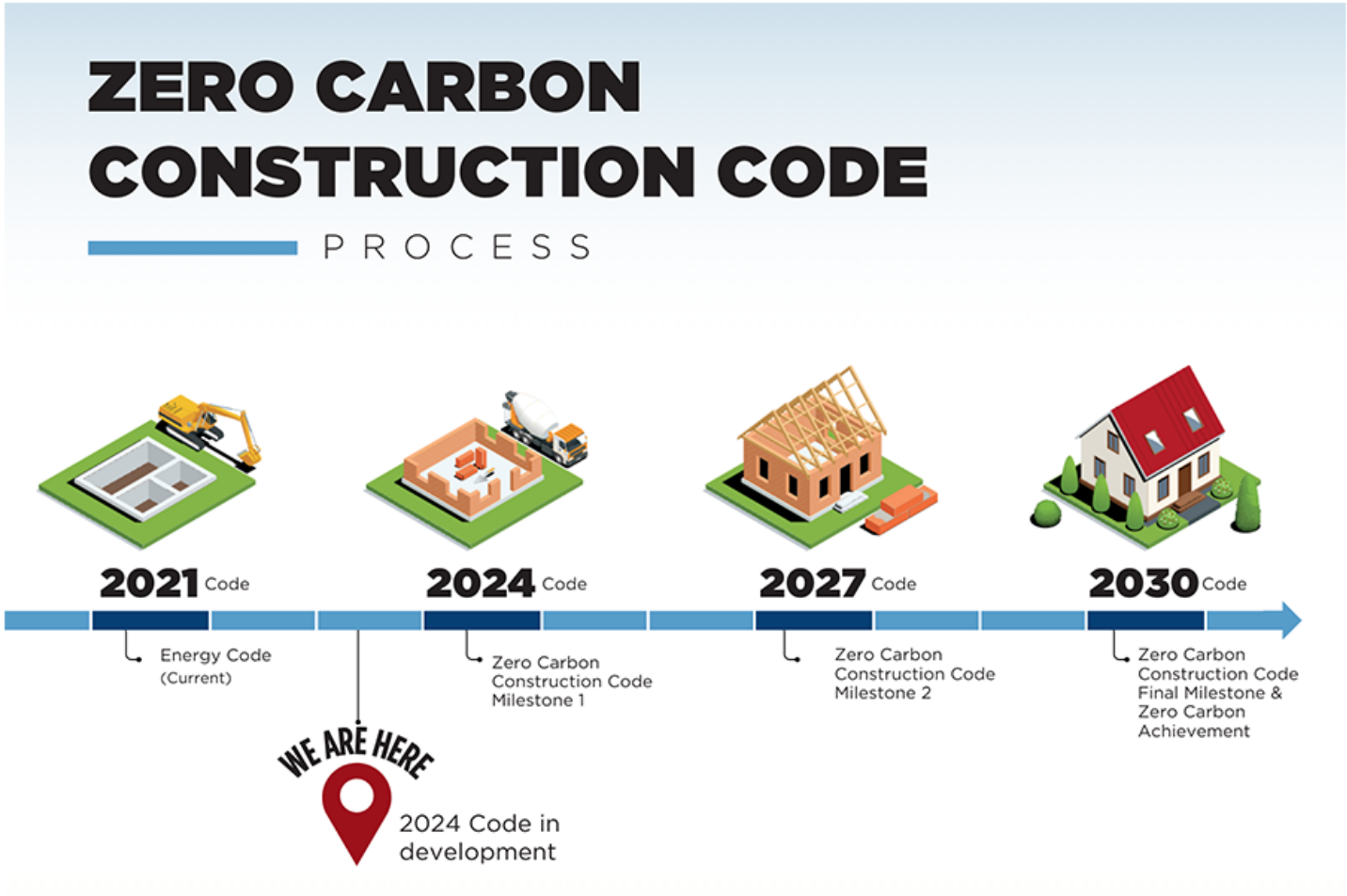
Other key ingredients

Old or undersized electric panels/wiring may not be ready for a heat pump

- Very old panels
- Homes with furnace and no central AC
- Homes with boilers
- Homes heated with woodstoves
- Old knob and tube wiring

New Construction Considerations

- 2021 IECC with amendments
- Electric readiness
- Options
  - V3.1 ENERGY STAR or higher
  - Next Gen ENERGY START
  - DOE ZERH
  - PassiveHouse



All Electric ccASHP

- **Most cost-efficient option where a space heating electric rate is available**
- **Size heat pump for heating load**
  - Don't oversize
  - *Use maximum capacity at 5°F*
- **Location**
  - Outdoor unit must be elevated for drainage
  - Avoid areas where snow drifts and there is exposure to strong winds
- **Ductwork**
  - Located inside thermal envelope and sealed
- **Supplemental heat / controls**
  - Use a central thermostat with integrated controls for electric plenum heater
  - Triggered by outdoor temperature sensor or air delivery temperature

- **Provide homeowner education when systems are not common**
  - No thermostat setback
  - Regular filter maintenance
  - Condensate management
- **Caution:** Size supplemental heat only for the difference between design load and capacity at 5°F or outdoor design condition.

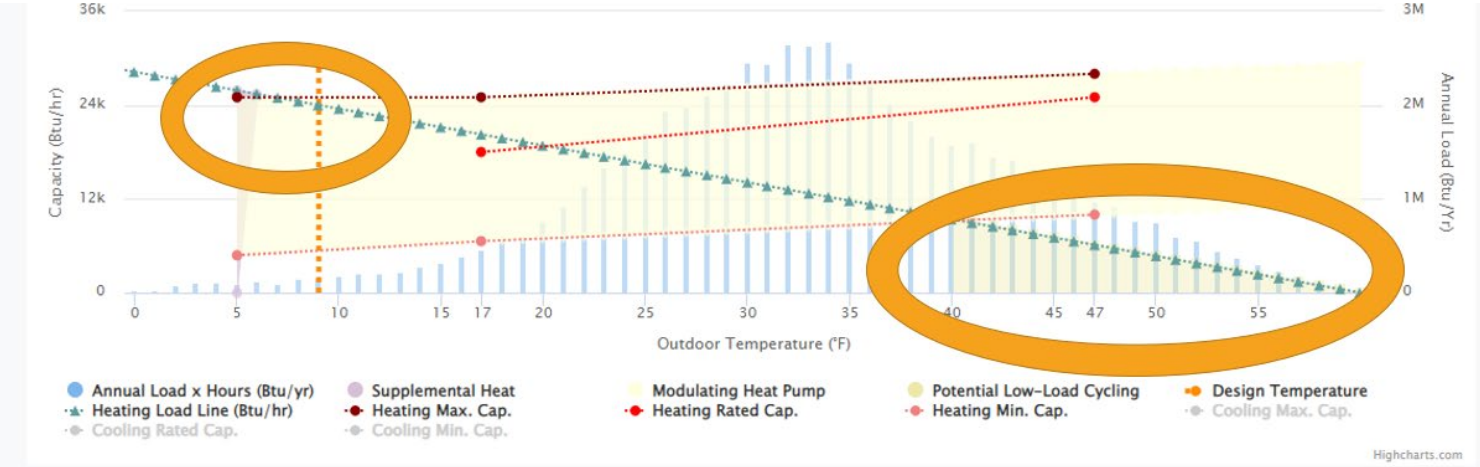
Also Known As:

- Inverter driven
- Extended capacity
- Extra performance
- Extreme climate
- Various branded trade-names:

  Hyper heat®, Aurora®, Halcyon XLTH®, Max-Heat®, RED®

All Electric ccASHP

- **Success with new construction**
- **Think envelope reduction first**
  - ENERGY STAR® v3.1 or higher
  - Eliminate thermal bridging
  - ENERGY STAR v6.0 or 7.0 windows
- **Air tightness and ventilation**
  - Aim for 2.5 ACH 50 or lower
  - Think through ventilation strategies
    - Heavily consider heat / energy recovery
- **Size system as indicated, checking your sizing**
  - 2,450 sq. ft. home, 11 BTU h / sq. ft. with improved envelope
  - 2.5-ton equipment
- **Get heating load to within 133% of the cooling load**



Product Sizing For Heating

Field Information	
Capacity Balance Point (°F)	7
Minimum Capacity Threshold (°F)	40
Maximum Capacity at Design Temp (Btu/hr)	25,000
Percent Design Load Served	104.2%
Annual Heating Load (MMBtu)	59.1
Percent Annual Heating Load Served	99.0%

Field Information	
Annual Btu's Covered by Supplemental Heat (MMBtu)	0.6
Hours Requiring Supplemental Heat	22
Percent Hours Requiring Supplemental Heat	0.4%
Percent Annual Load Modulating	72.1%
Percent Annual Load with Low-Load Cycling	24.3%

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

Distribution or Ductwork Considerations

- **Ductless**
  - Compressor locations
  - Where refrigerant lines will be run
  - What style indoor units will I use
  - Indoor unit / head placement
- **Ducted**
  - Ductwork location
  - Supply register locations
  - Backup / supplemental heat options
  - Compressor size and reduced location options
  - Potential to add humidification and dehumidification
- **Mixed Ducted / Ductless**
  - Considering home layout and proper heat and cool delivery

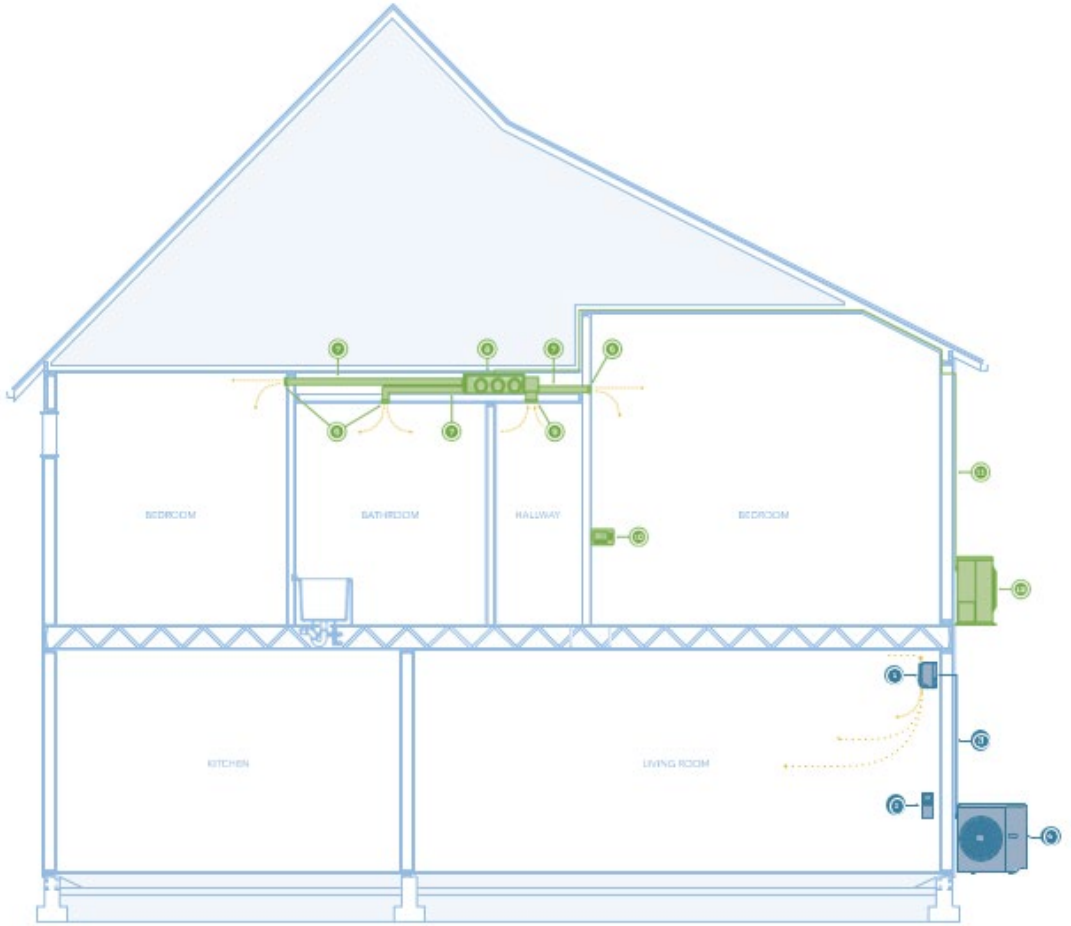


Image courtesy BetterBuiltNW

Equipment for Larger Custom Homes

- **Ductless**
  - Multiple-mini / multi-splits based on sun exposure
  - VRF for capacities ≥ 5 tons
    - Simultaneous heating and cooling with heat recovery
- **Unitary Centrally Ducted**
  - Up to 5 tons of capacity or dual fuel
  - Multiple systems can be used
- **Geothermal**
  - Water-to-air
  - Water-to-water
  - Optional domestic hot water
  - Vertical and horizontal loops or open-loop with well water

Customers ready for heat pumps

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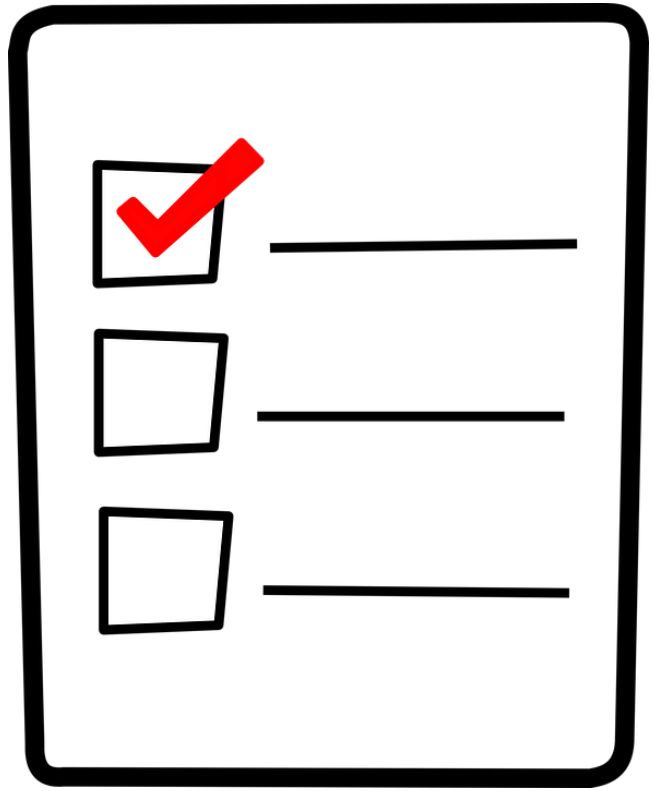
Getting to know heat pumps

- ❑ Attended online events and read blogs
- ❑ Know where to find additional resources
- ❑ Have checked their own goals and the benefits of heat pumps for alignment
- ❑ **Learn what to ask contractors and builders about heat pumps**
- ❑ Find out if their utility offers “dual fuel” or “all electric” rates
- ❑ Talking to contractors, utilities, builders, etc.. about incentives, rebates, and tax credits



Living with a heat pump

Furnace + AC

- Delivered air temp ranges from 115°F to 130°F (most of the time)
- Set back 3 to 6 degrees when away
- Check condensate line in winter (with 90% furnace)
- Change filter every 3 months

Heat Pump

- Delivered air temp ranges from 100°F to 120°F (most of the time)
- Set back 0 to 3 degrees when away (set it and forget it)
- Check condensate line in the summer
- Change filter every 3 months

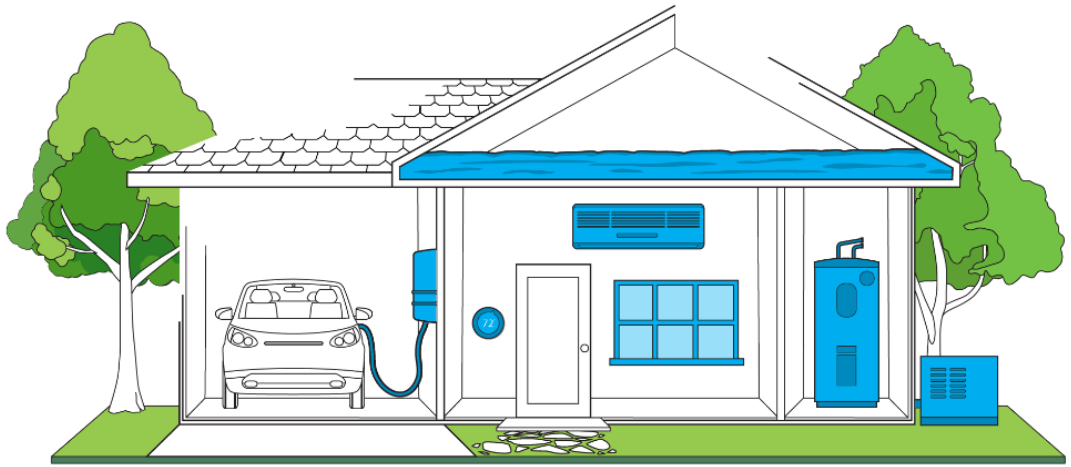
Homeowner resources

- MN ASHP Collaborative FAQ
- ENERGY STAR Home Upgrades
- NEEP ASHP Buyers Guide
- Clean Energy Resources Team ASHPs
- NYSERDA Heat Pump Buying Guide
- Consortium for Energy Efficiency Resources

ENERGY STAR HOME UPGRADE

The ENERGY STAR Home Upgrade is a carefully crafted set of six high-impact, energy efficiency improvements for your home. Designed to work together to deliver significant energy and cost savings, these upgrades can also help you transition from fossil fuels for a cleaner, healthier and more comfortable home. You can choose the improvements that make the most sense for your home and implement them at your own pace.

Our energy supply is getting cleaner and more renewable every day. Taking action now can help you prepare for a clean energy future, while enjoying energy savings and a more comfortable home today. Count on ENERGY STAR to help you navigate the process.



CLEAN HEATING AND COOLING

SUPER-EFFICIENT WATER HEATER

SMART THERMOSTAT

WELL-INSULATED AND SEALED ATTIC

HIGH PERFORMING WINDOWS OR STORM WINDOWS

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Contractors ready for heat pumps

Heat pump myths and misconceptions

- Almost all manufacturers have their own blog or resource on heat pump myths!
- There are several third-party sites with *mythbusting* heat pump posts and resources:
  - https://www.efficiencymaine.com/docs/Heat-Pump-Myths-and-Facts.pdf
  - https://www.ase.org/blog/myth-busting-common-misconceptions-about-heat-pumps
  - https://carbonswitch.com/do-heat-pumps-work-in-cold-weather/

- There are numerous case studies available for homeowners and contractors:
  - https://www.mnashp.org/guides
  - https://concordma.gov/2776/Heat-Pump-Case-Studies
  - https://sustainabletechnologies.ca/app/uploads/2022/03/HP_Case_Study_4_Final.pdf

Is your contractor trained?

All contractors likely have some formal training and many years of on-the-job training!

Have you had training on:

Manufacturer training on cold climate and dual fuel or “hybrid” heat pumps	Heat pump controls, hybrid system controls, and homeowner guidance on settings	Sizing and selection of variable speed heat pumps

Finding a contractor

- MN ASHP Collab - How to choose a contractor
- Love Electric - Tips for Planning Your Installation
- Energy Sage - 8 Questions to ask your contractor
- Look for a Preferred Contractor Network!
- Use Buyers Guides!

NEEP Tool Updates

- The Northeast Energy Efficiency Partnership has made updates and added features to the Advanced Sizing for Heating and Cooling Tool in the ccASHP Product List.

- Recorded webinar available!

- https://neep.org/event/using-neeps-ccashp-sizing-tools-product-tutorial

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Selling heat pumps

KEEP THIS IN MIND

1. *When you go into a home, you are selling <u>yourself and your company</u>*
2. You are selling <u>technology</u>

For most homeowners, a HEAT PUMP *is a <u>new technology</u>*

Design Decision Methods Identify Customer's Needs

- Interest/willingness for doing load reduction measures first
- Desire to stop using fossil fuels
- Occupancy patterns (long spells away from home vs. consistently occupied)
- Do they want cooling throughout the house or just in certain rooms?
- Cost concerns
  - First cost vs. ongoing fuel and maintenance costs
- Plans for renovations or additions

Listen to Hurts, Needs and Wants

67%

Are unsatisfied or somewhat unsatisfied
with their ***current*** heating system

source: 6th annual NW DHP Project Market Progress Report

Goals of market research

Uncover homeowner perceptions

- What do customers values?
- 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

Customer insights

- Before being explained, 40-55% of interviewed homeowners are aware of how heat pumps differ from air conditioners

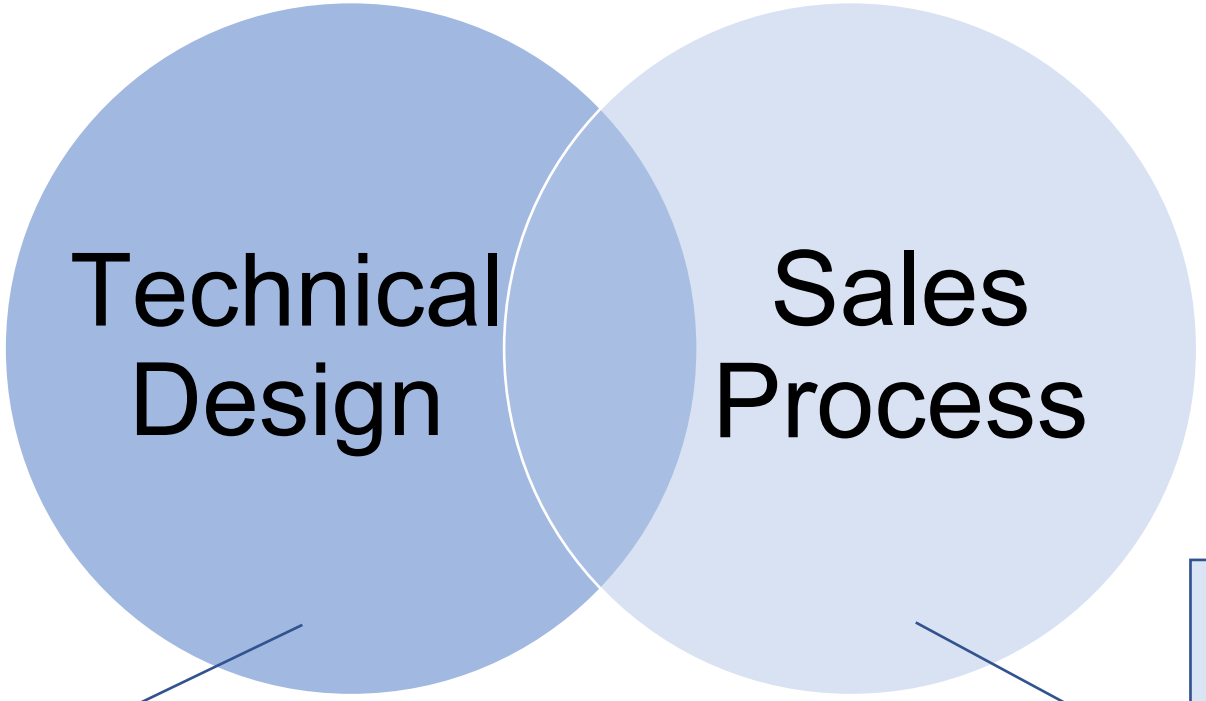
- After heat pump benefits were explained, about **half of interviewed homeowners said "saving money" was a motivation** and almost a third said "hearing good things about heat pumps" motivated them.

- **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.

Success in Sales of

HEAT PUMPS = TECHNICAL DESIGN + SALES PROCESS



1. Load Calculation
2. Ductwork evaluation
3. Equipment selection
4. Balance Point calculation
5. Cost of Operation
6. Create a sales proposal

1. Introducing choice
2. Interview
3. Evaluating the home
4. Getting permission
5. Review options
6. Sales presentation

Created By

MAINSTREAM INNOVATIONS

Success through Innovation

New systems should not increase costs for homeowners without their notice!

1. Dual Fuel Systems can be set to cost the same or less than a gas furnace with an AC
2. Homeowner desires for comfort, IAQ, carbon savings, or other drivers may supersede operational cost
3. Systems settings can be changed annually (or more often) to best address comfort and energy bills

CREATE THE SALES PROPOSAL

TIPs:

1. Show the customer your design work:
   - Load calculation
   - Equipment selection and performance curves.
   - Balance point calculation
   - The equipment models (as reflected in the load calc and curves)
   - Cost of operation estimate
2. Price to come <u>at or lower</u> than the “ballpark” range you offered earlier.
3. Good, Better, Best – should include at LEAST one heat pump option (or two).
4. For New Construction – think future proofing and best in class, high-performance for homeowners.

Jake's Heating and Air

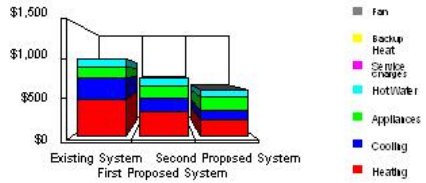
8724 West Halver St.
Allentown, PA 18100
(215) 555-HEAT
"Your Comfort is Our Only Concern"

- *Serving Allentown and surrounding areas since 1985*
- *Nobody beats our prices*
- *Nobody beats our service*

Project Summary

Project Title:	Jones Residence
Designed By:	Your Name
Project Date:	Monday, April 08, 2002
Project Comment:	Proposal for change out, as existing unit needs repairs, and is 12+ years old.
Client Name:	Mr. and Mrs. Jeffrey Jones
Client Address:	1234 First Street NW
Client City:	Harrisburg, PA 17103
Client Phone:	(717) 555-5294
Client Fax:	None
Client Comment:	Mrs. Jones prefers no calls before noon.

System Comparison



Cooling Equipment	Existing System	Option 1	Option 2
Model Type:	Standard Air Conditioner	Air Source Heat Pump	Ground Source Heat Pump
Model Number:	Slow Cool	QC-H17-S10-H7.1	QCWS-H15-S11
Capacity:	18,000	17,300	18,700
Efficiency:	6 SEER	10.2 SEER	12.5 EER
Installed Price:	*N/A*	*$1,675.00*	*$1,795.00*

Heating Equipment	Existing System	Option 1	Option 2
Model Type:	Natural Gas Furnace	Air Source Heat Pump	Ground Source Heat Pump
Model Number:	Slow Heat	QC-H17-S10-H7.1	QCWS-H15-S11
Capacity:	24,000	18,400	20,000
Efficiency:	65 AFUE	7.1 COP	4.2 COP
Installed Price:	*N/A*	*$1,545.00*	*$1,795.00*
System Description:	Existing System	First Proposed System	Second Proposed System
Total System Price:	*N/A*	*$3,220.00*	*$3,590.00*

Annual Energy Cost:	Existing System	Option 1	Option 2
Year 1	$1,013	$755	$602
Year 5	$1,041	$800	$636
Year 10	$1,079	$861	$681
Year 20	$1,168	$1,004	$787
Year 30	$1,277	$1,177	$916

ACCEPTANCE OF PROPOSAL:
The above prices, specifications and conditions are satisfactory and are hereby accepted. You are authorized to do the work as specified. Payment will be made as outlined above.

Signature:_____ Date:_____

Example from Elite Software

cee
Center for Energy and Environment

Q and A

Feedback, comments, or questions?

THANK YOU

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https://linkedin.com/in/danwildenhaus

CEE1 New Resources Finalized

- Duct Retrofit Decision Guide
  - Inadequate ducts can significantly reduce the performance of air source heat pumps (ASHPs). Repurposing existing ducts for heat pump use requires thoughtful sizing and duct-quality considerations. This guide informs contractors on how to determine when ducts should be fixed or abandoned.
- System Design with Existing Heating
  - Adding a heat pump to a building with a legacy system introduces several new design and operation considerations. These challenges include different operating costs, division of capacity between the systems, interaction between the systems, and when to run each system. This document describes potential applications for heat pumps in houses with functional legacy heating systems.
- Weatherization Guide – Homeowner Version | Contractor Version
  - Heat pumps run more efficiently in buildings that are sufficiently weatherized. Air sealing, insulation, and upgrading windows can also lower the capacity needed, thereby simplifying the heat pump distribution design requirements and lowering the cost of installing and operating a heat pump. These documents outline the benefits of weatherization before installing a heat pump.

CEE1 New Resources Finalized

- You Installed a Heat Pump, What Now?
  - Heat pumps operate differently than either electric resistance or fossil fuel heating systems. Expectation setting should be as proactive as possible. Proper education around usage and maintenance can help ensure that customers are satisfied with their heat pumps. This document addresses basic information, operation, maintenance, controls settings, and frequently asked questions. It is intended to teach a new heat pump owner or potential heat pump owner all they need to know to operate their heat pump safely and efficiently.
- Heat Pump Design Decision Matrix and System Design Guide | Web Based Widget
  - The decision-making process around heat pump installations is complex. For both customers and contractors who are less familiar with the options, there is a need to clearly describe the factors that will lead to appropriately implemented systems. Distribution methods can be difficult to choose from, and the options can be overwhelming to homeowners, especially for emergency replacements, when they have little planning time. This resource is a comprehensive workflow that simplifies heat pump installations into a series of decisions based on site conditions and customer needs. It is available both as full descriptive guide and as a web-based widget.
- Two-System Controls Guide – Homeowner Version | Contractor Version
  - Awareness of integrated controls is a limiting factor in their adoption. Homeowners are often unaware of what integrated controls are, what situations would benefit from integrated controls, and how to operate them. Contractors are more likely to be familiar with the technology, but they are unaware of best practices and value propositions. These documents describe integrated controls, best practices, and their value proposition.