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Introduction to Air Source Heat Pumps (ASHP)

Overview, Potential and Ameren Support

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Agenda

Topics
Overview and intros
Ameren Illinois Offering Vision and Clean Energy Future
Air Source Heat Pumps – Definitions, Product Advancements and Benefits
Do Heat Pumps Work in Cold Climates?
Ameren Illinois Energy Efficiency Program Details
Wrap Up

What We Hope You Take Away From Today

1. Expanded knowledge on Ameren Illinois support of Air Source Heat Pumps (ASHPs) adoption as a component of beneficial electrification and continued ASHP midstream rebates.

2. Agreed upon definitions, product advancements and the benefits of ASHPs.

3. Answers to questions about ASHP performance in colder climates.

4. Access to resources and program staff.

Ameren Illinois ASHP Support

- Using electricity as the main energy source for a building's space heating is cleaner than using fossil fuel sources.
- Clean air is an essential non-energy impact to the health of communities (particularly in underserved communities) and the economy across the Ameren Illinois territory.
- By supporting electrification, we're creating clean air across Illinois. in a number of ways.
- We believe one of the top technologies that will deliver electrification benefits to customers are heat pumps.
- We launched anew robust heat pump training initiative to support the HVAC contractor workforce in providing heat pumps for space conditioning.

Heat Pumps = Electrification

- Using electricity to do something that used to be done with a different energy source
  - Heat homes
  - Heat water
- Three criteria for electrification
  - Save money for customers long term
  - Reduce environmental impact
  - Enable better grid management

ASHP – The Big Picture

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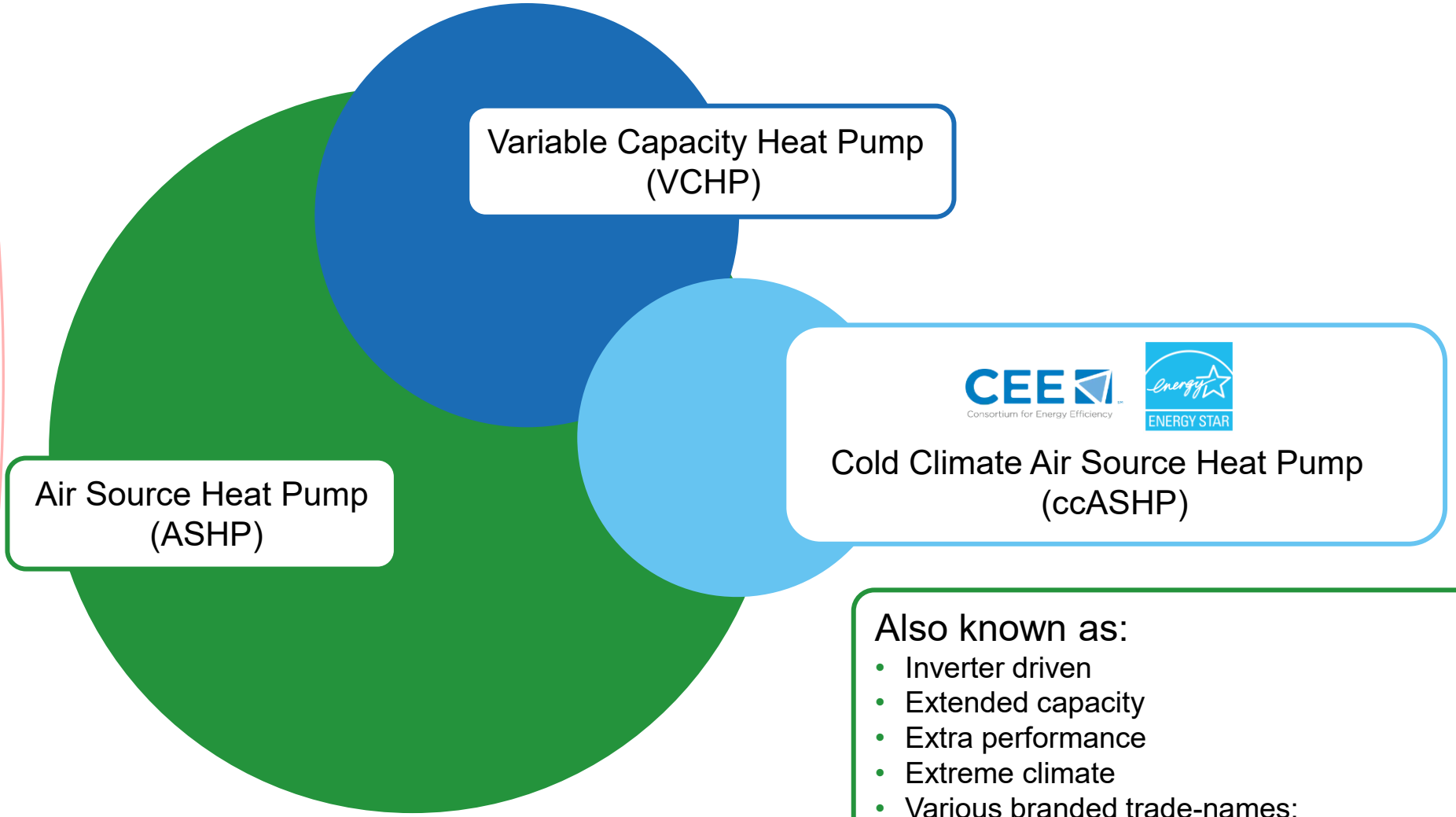
- Heating and cooling all in one system
- Heating and cooling operational cost savings
- Improved Comfort
- Air filtration
- Reduced carbon emissions

ASHP Definitions and Categories

ASHP Definitions and Categories



Also known as:

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

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

Heat Pump Factors

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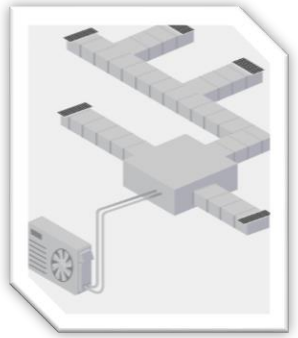
Residential air source heat pumps

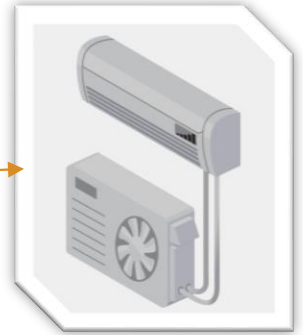
Compressor
- Inverter driven
- Conventional (single or double speed)

Cold-climate listed?
- Cold-climate listed
- Not listed

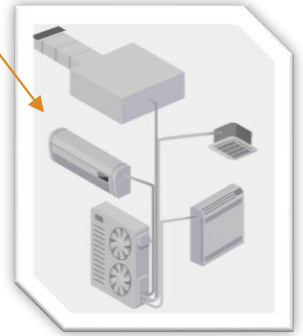
Distribution
- Centrally ducted
- Short duct
- Mini-split
- Multi-split
- Packaged terminal heat pump



Ducted

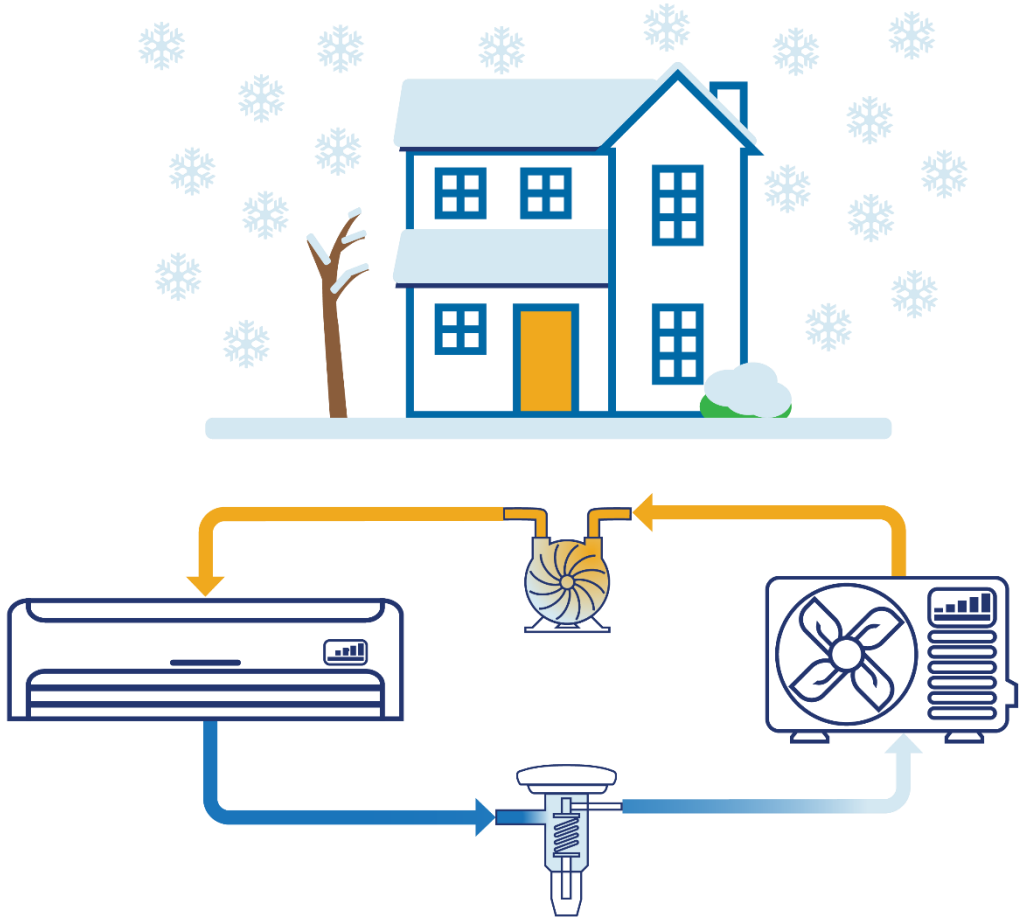


Mini-split



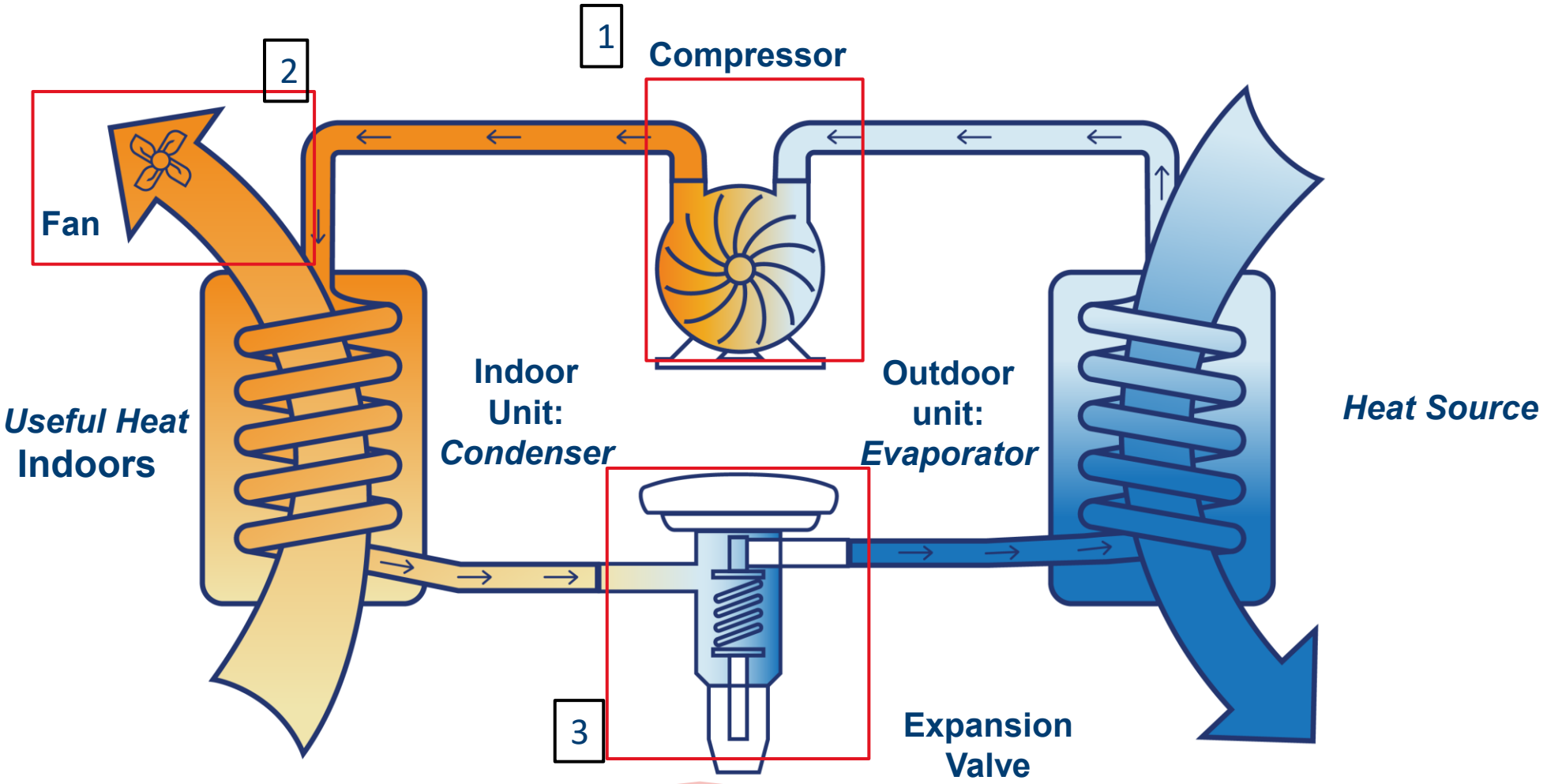
Multi-split

Product Advancements in the Last 12 Years Cold Climate Heat Pumps

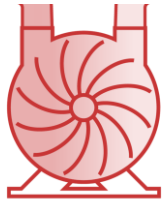


- Specially tuned to do well in cold climates
- Meets efficiency and capacity criteria set forth by the Northeast Energy Efficiency Partnership (NEEP)
- Improved components combine to provide *variable* speeds
  - Standard heat pumps are single-speed or two-speed only
  - Akin to a fixed speed bike vs. a 21-gear bike

Heat Pump Components

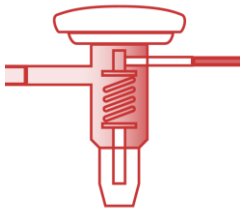


Variable Capacity Heat Pump (VCHP) Component Differences



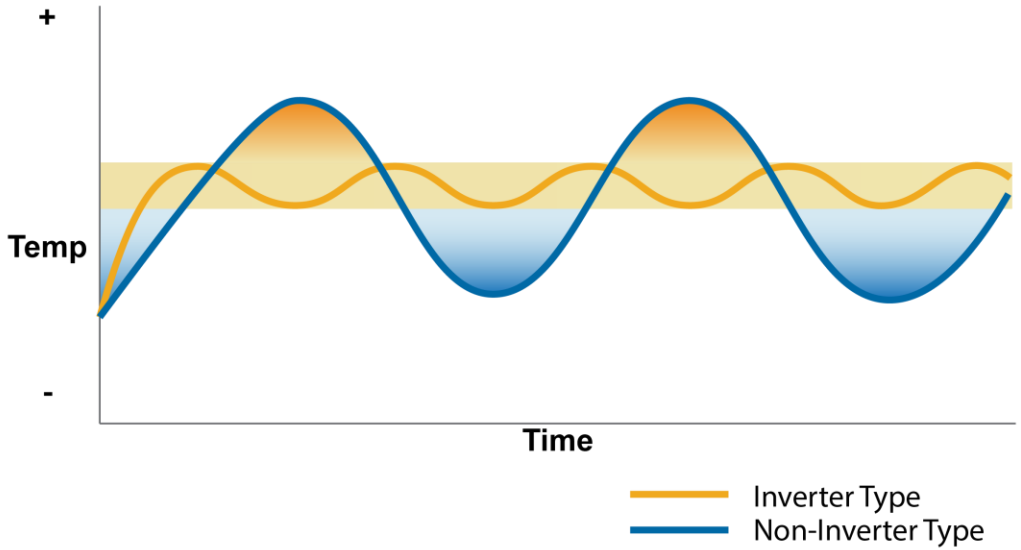
Compressor motor is inverter driven for multi-stage variance.

Fan is controlled by an electronically commutated motor for variable speeds.



Expansion valve controlled by an electromagnetic piston to vary the firing rate.

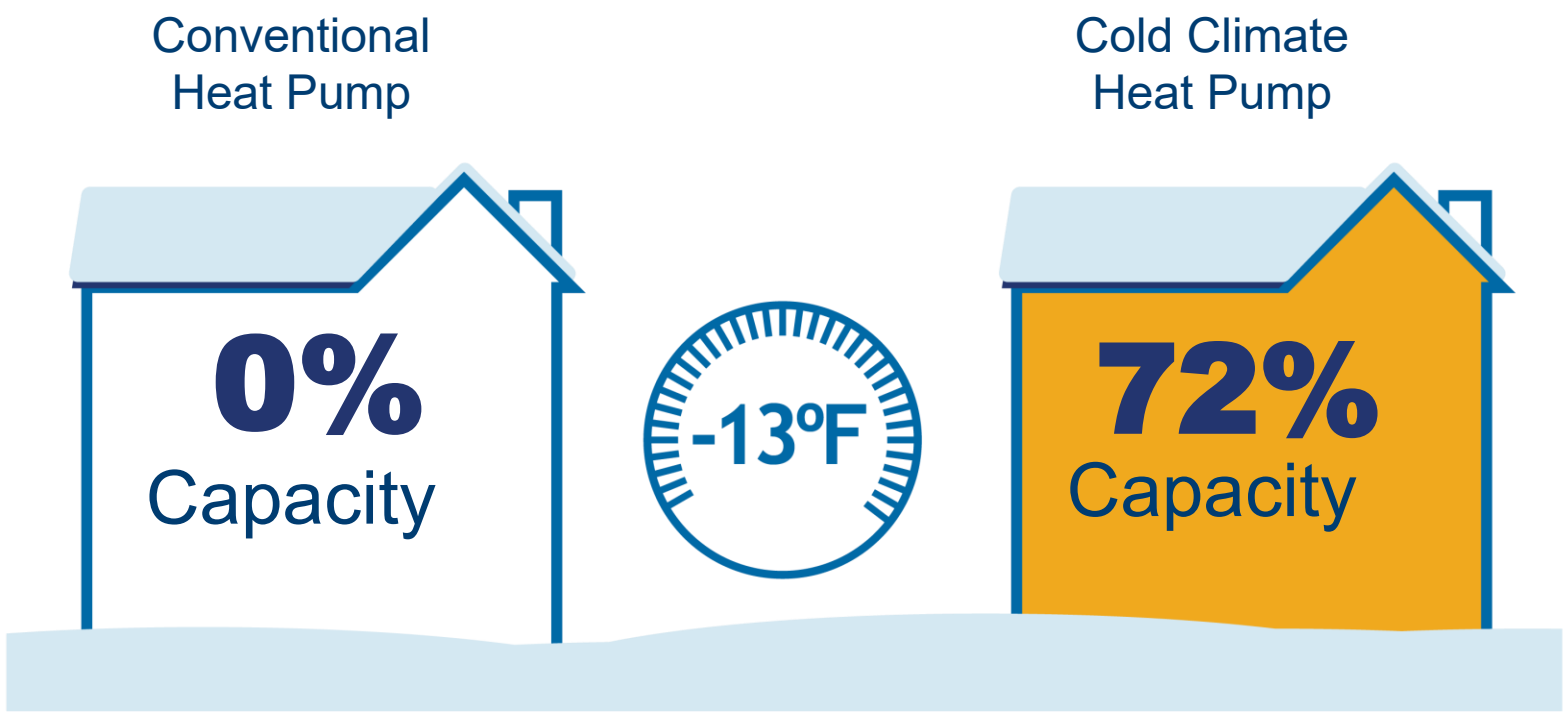
Product Advancements in the Last 12 Years Cold Climate Ductless Heat Pumps



- More control
- Less waste
- **Improved comfort**

How Modulation Helps – Capacity

- Traditional heat pumps cannot perform at low temperatures and therefore require supplemental heat.
- Cold climate heat pumps require less supplemental heat.



Energy Savings, Flexibility and Comfort

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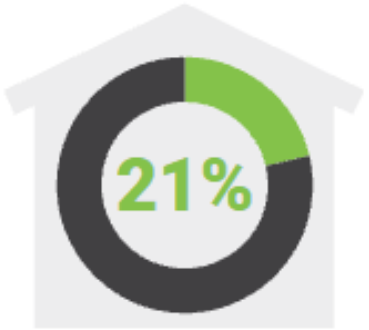
ResStock | Back to all states | Analysis approach | Print

ILLINOIS

Residential Energy Efficiency Potential

Cost-effective package savings potential in Illinois single-family homes

- **1.4 billion** dollars per year utility bill savings
- **77.0 trillion** Btu per year gas, propane, and fuel oil savings
- **7.0 billion** kWh per year electricity savings
- **2.1 million** cars of pollution reduction



Energy used by Illinois single-family homes that can be saved through cost-effective improvements

Illinois existing jobs in energy efficiency (2016)[1]

Design Decision Methods Identify Customer's Needs

- Interest/willingness for doing load reduction measures first
- Occupancy patterns (away from home frequently 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
- Desire to stop using fossil fuels

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North American Climate Zones

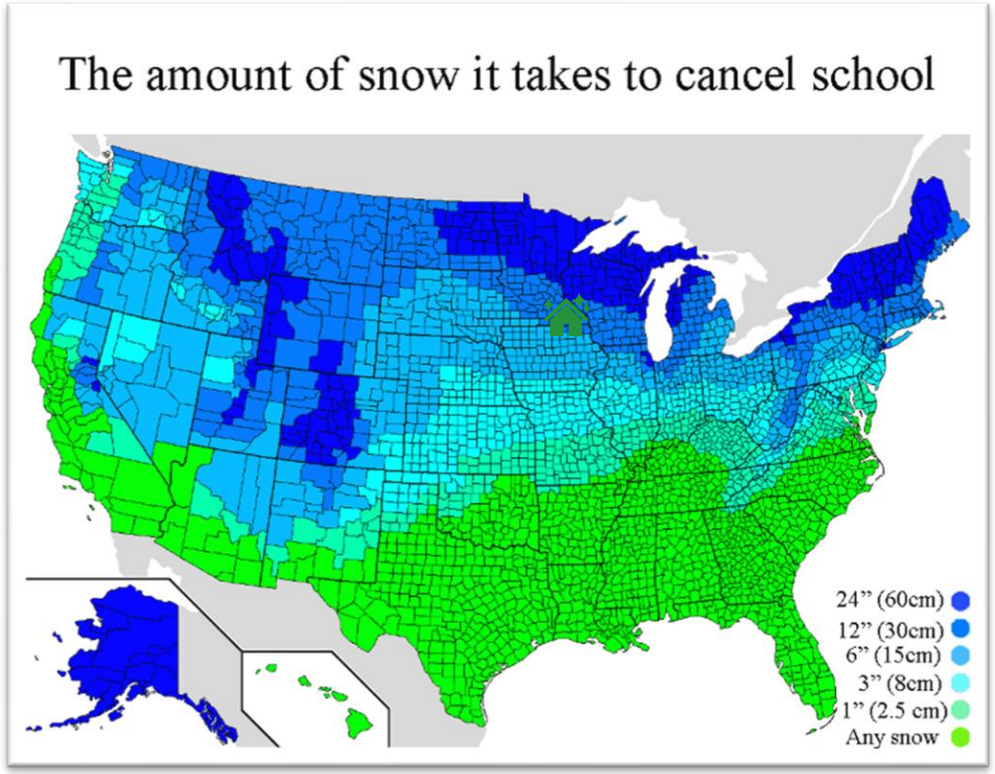

Image courtesy Reddit

- The home's location and climate dictate the heating and cooling loads.
- Different heat pumps are appropriate depending on the climate zone.
- Climate dictates the home's load ***and*** the heat pump's environment.
- If it takes 6 inches or more to cancel school, you are in a cold climate.

Example Estimator for Cold Climates – NEEA

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Heating Load Estimator
(in BTUs per square foot of floor area)

House Description	Local Design Temperature			
	Below -10˚ F	-10˚ F to 5˚ F	5˚ F to 20˚ F	Above 20˚ F
No wall Insulation; single pane window	47	41	35	29
2x4 construction w/insulation; 2P windows	25	22	19	16
2x6 construction w/insulation; 2P windows	18	15	13	11
New construction (Post 2012)	16	14	12	9

Do Heat Pumps Really Work in Illinois?

- **Yes,** but… we must set the right expectations and direction to avoid:
  - Discomfort
  - Calls for no heat
  - High bill complaints
- So, know your heat pump options and your customers' needs and wants:
  - Air Source Heat Pump- single and two stage
  - Variable Capacity Heat Pump- may/may not be cold climate
  - NEEP Cold Climate Air Source Heat Pump (ccASHP)
  - NEEA Cold Climate Ductless Heat Pump (ccDHP)

NEEP's Cold Climate Specification

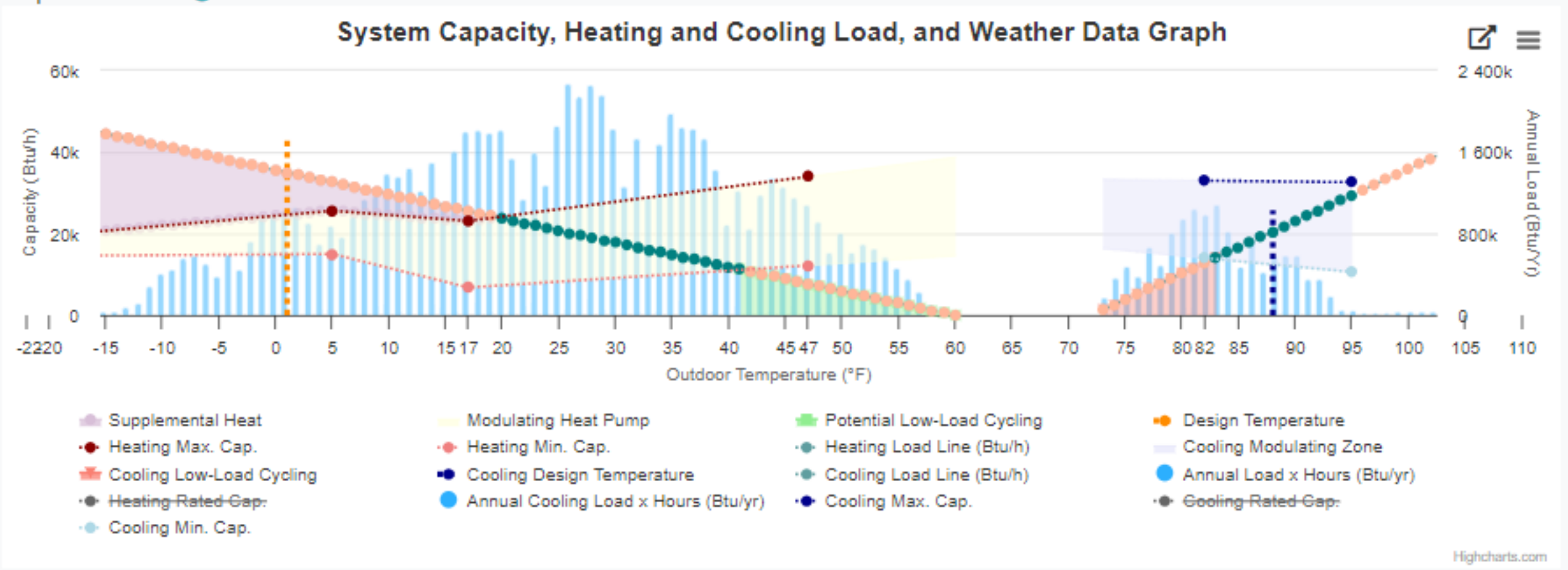
NEEP'S COLD CLIMATE AIR SOURCE
Heat Pump List

- Variable capacity, residential-scale, air source heat pump. Ducted or ductless
- High rated heating efficiency (≥ 9 HSPF ductless, ≥ 10 HSPF ducted)
- High efficiency even at 5°F (COP ≥ 1.75)
- Highly rated cooling efficiency
- Capacity and efficiency data reported at multiple operating conditions

- Sets and periodically updates the standard
- Maintains a qualifying product list
- Publishes the resultant engineering data

NEEP's Advanced Sizing/SelectionTool

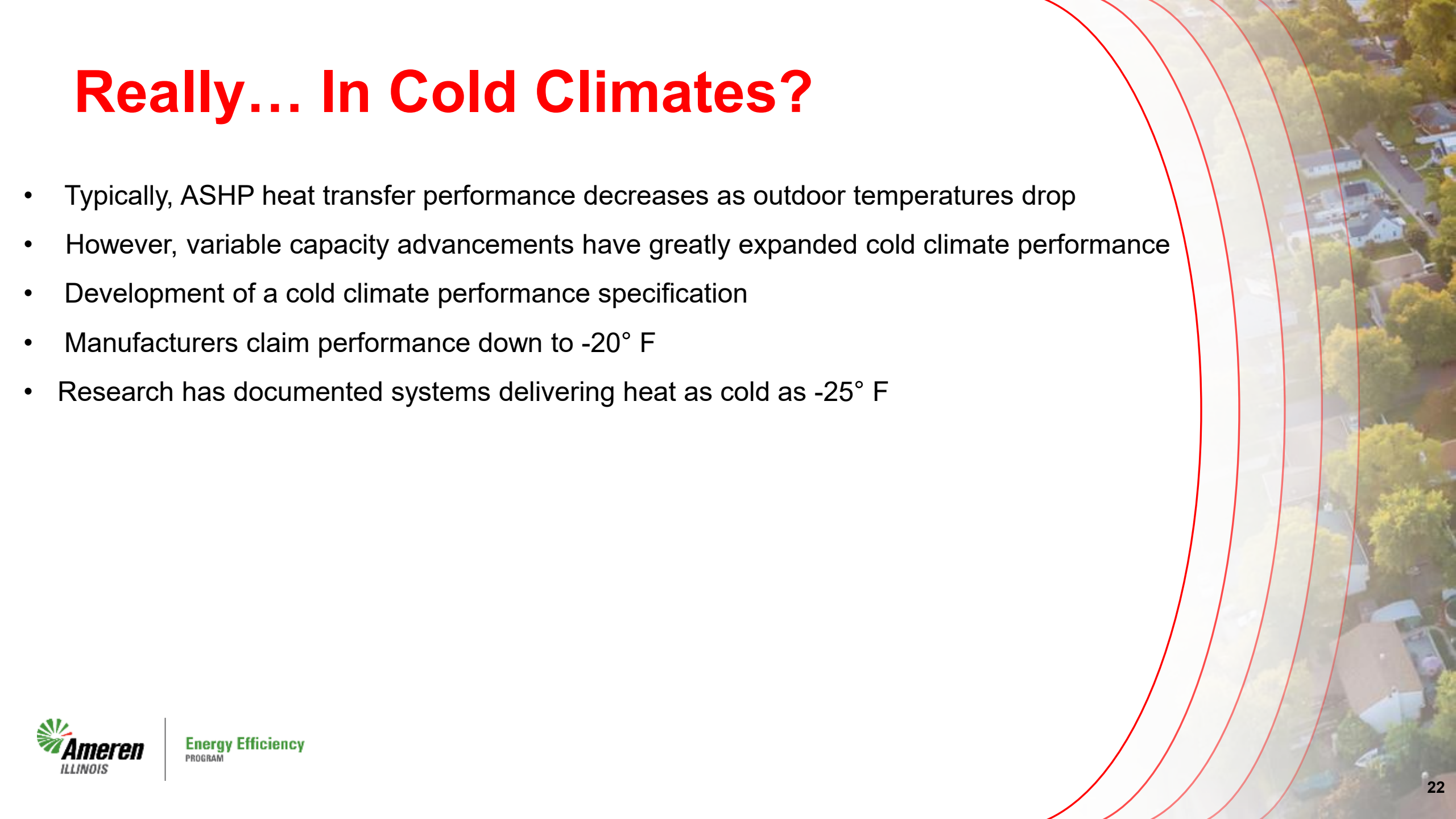
Graph Information



[NEEP Advanced Sizing and Selection Tool Tutorial]

Really… In Cold Climates?

- Typically, ASHP heat transfer performance decreases as outdoor temperatures drop
- However, variable capacity advancements have greatly expanded cold climate performance
- Development of a cold climate performance specification
- Manufacturers claim performance down to -20° F
- Research has documented systems delivering heat as cold as -25° F



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Proof From Michigan

Slipstream field research study

- 8 centrally ducted dual fuel HP in existing homes
  - 4 VCHP, 4 ASHP
- Monitor installed field performance of ASHP and backup propane furnace
- Market designed and installed with no major ductwork modifications
- Adoptee Motivations:
  - Minimize use of propane
  - Replacement failing GSHP
  - Climate/resilience in mind
- Climate zones 5 and 6

Compressor Type	Average Site Energy Reduction	Annual Savings	Emissions
Variable Speed	56%	$712	10%
Five Speed	43%	$308	12%
Two Speed	59%	$576	9%
Single Speed	49%	$451	11%

*Annual Savings for Ameren IL customers may vary

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Michigan System Details- Partial Load

Site	Square Feet	Year Built	Lockout Temp °F	Compressor Type	Capacity (95, 47, 17)°F	HP Model	Capactiy Btu/hr	Model	Site Energy reduction	Annual Savings to Homeowner	Emissions
1	2426	1998	20	Variable-speed	34,600 32,200 26,400	American Standard Platinum 17	80,000	American Standard Platinum 95	64%	$811	9%
2	2400	1860	25	Variable-speed	34,800 31,600 20,200	Lennox Signature XP25	88,000	Dave Lennox Signature	50%	$678	11%
3	1400	2018	30	Variable-speed	24,200 21,400 16,900	Trane XV18	60,000	Trane XC 95M	41%	$273	8%
4	2200	2000	None	Variable-speed	45,000 46,500 48,500	Bryant Evolution Extreme	80,000	Bryant Evolution	67%	$1,085	13%
5	1700	1996	None	Two-speed	37,200 33,600 21,400	Trane XR17	60,000	Trane S9X2	59%	$576	9%
6	2000	2004	28	Five-speed	23,200 24,000 16,100	Bryant Evolution V	60,000	Bryant Evolution	43%	$308	12%
7	2400	2018	20	One-speed	36,000 34,200 22,400	American Standard Silver 16	80,000	American Standard Gold 95	34%	$299	5%
8	2500	2016	25	One-speed	28,000 28,200 16,800	Bryant Legacy Line	80,000	Bryant Preferred Series	63%	$603	16%

*Annual Savings for Ameren IL customers may vary

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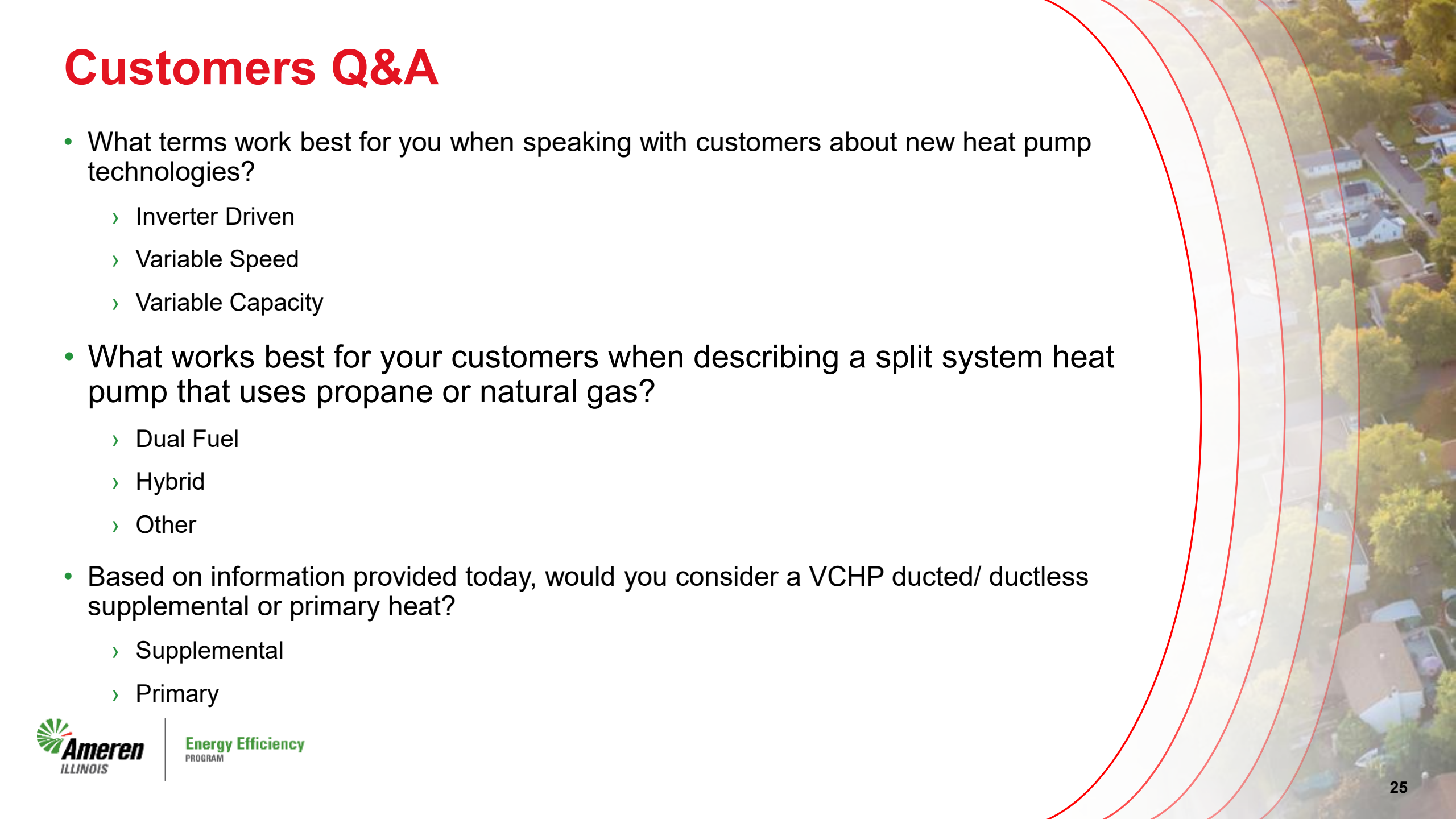
Customers Q&A

- What terms work best for you when speaking with customers about new heat pump technologies?
  - Inverter Driven
  - Variable Speed
  - Variable Capacity
- What works best for your customers when describing a split system heat pump that uses propane or natural gas?
  - Dual Fuel
  - Hybrid
  - Other
- Based on information provided today, would you consider a VCHP ducted/ ductless supplemental or primary heat?
  - Supplemental
  - Primary

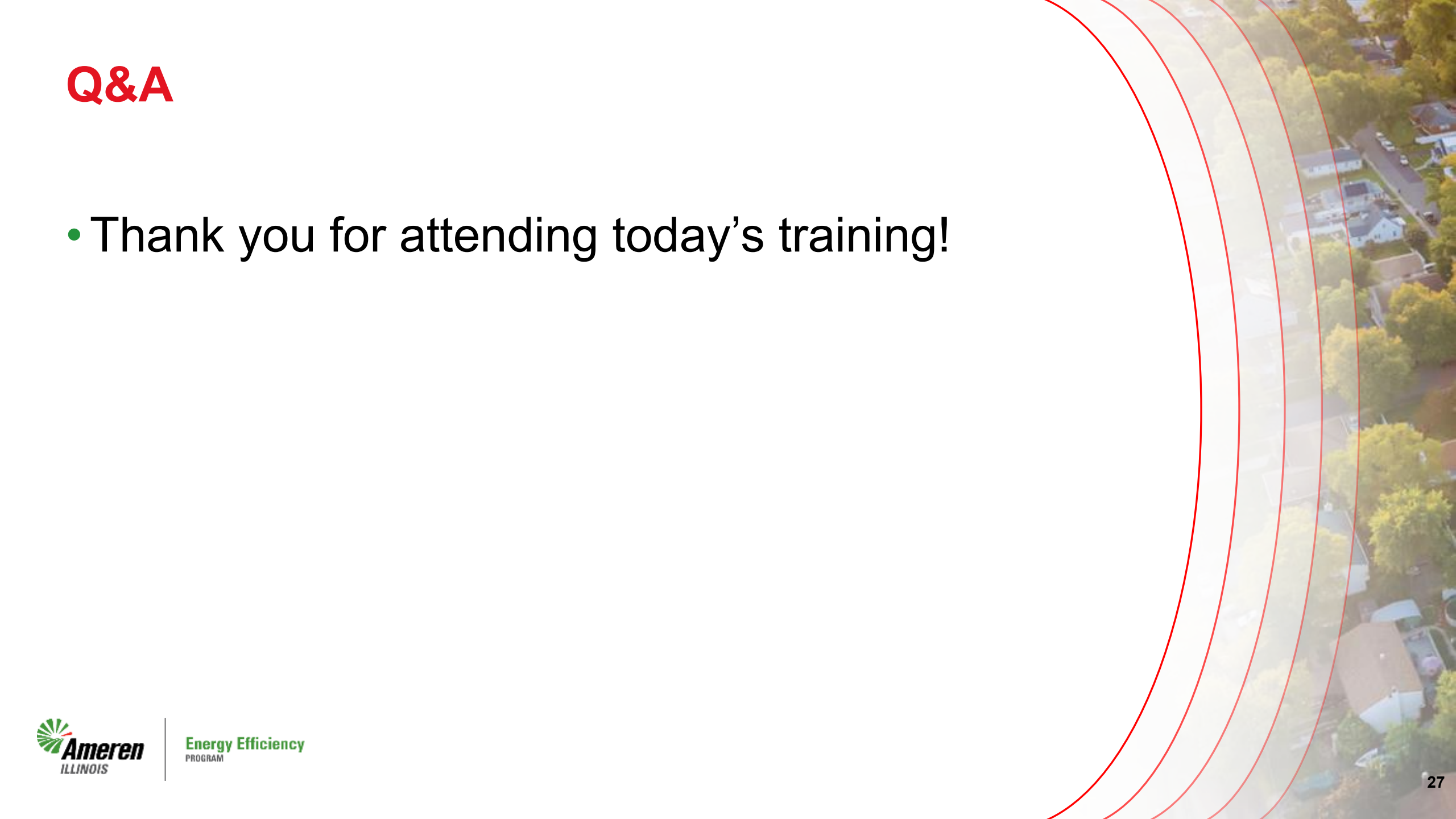


Incentives and Specifications – Ameren Illinois Energy Efficiency Program's Instant Incentives Offering Overview for 2025

Residential Equipment	Type/Rating	2025 Incentive Amount
Air Source Ducted Mini-Split Heat Pumps	Less than 65 kBtu	$900
Ductless Mini-Split Heat Pumps	Must be 16 SEER2 (16 SEER) and 8.55 HSPF2 (9.5 HSPF) or greater as confirmed by AHRI.	$630

Q&A

- Thank you for attending today's training!



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Thank you!