Heat Pumps = Less Fire, but its not that simple

A guide on where to start and what to consider

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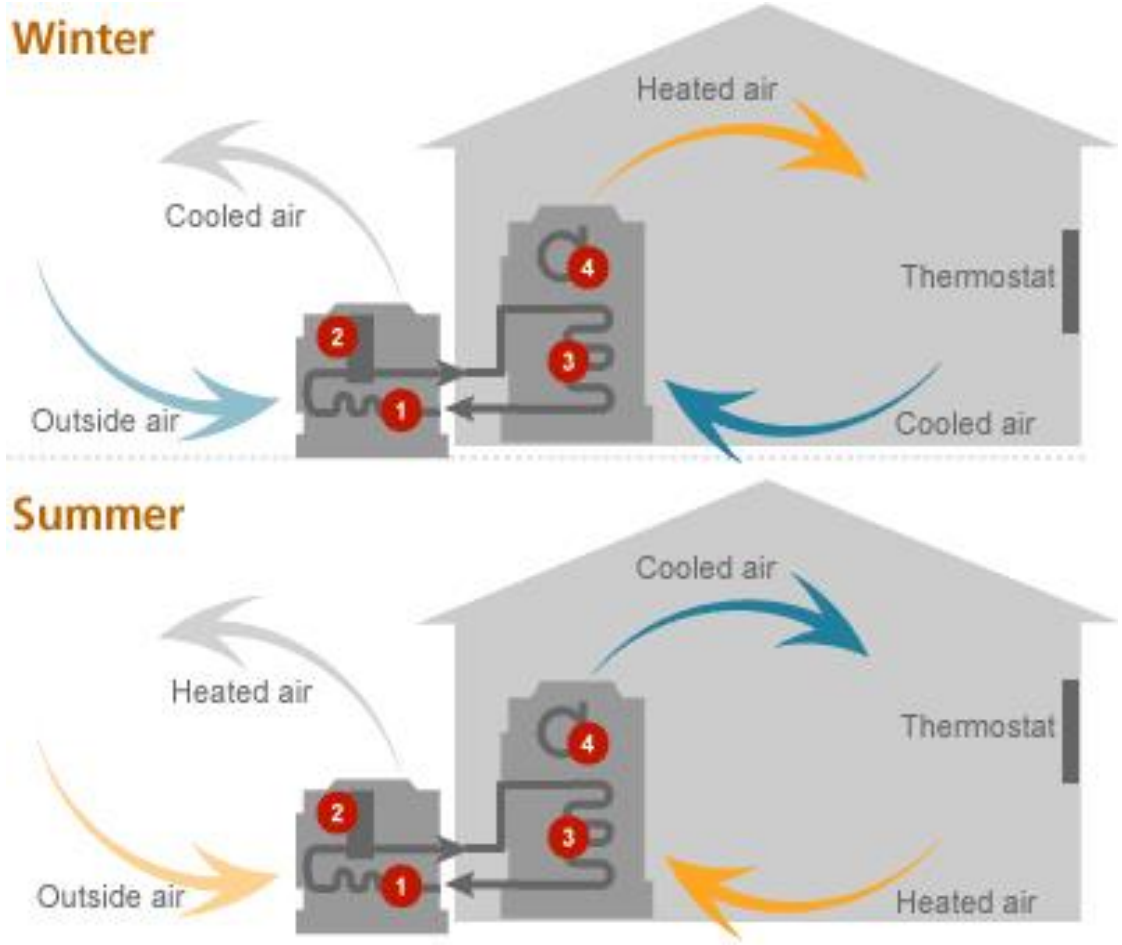
Agenda

- Intro to ASHPs
- Applications: Full Speed Ahead!
- Applications: Pilot stage, ready to launch
- Applications: Still more to come
- What is needed for HP adoption

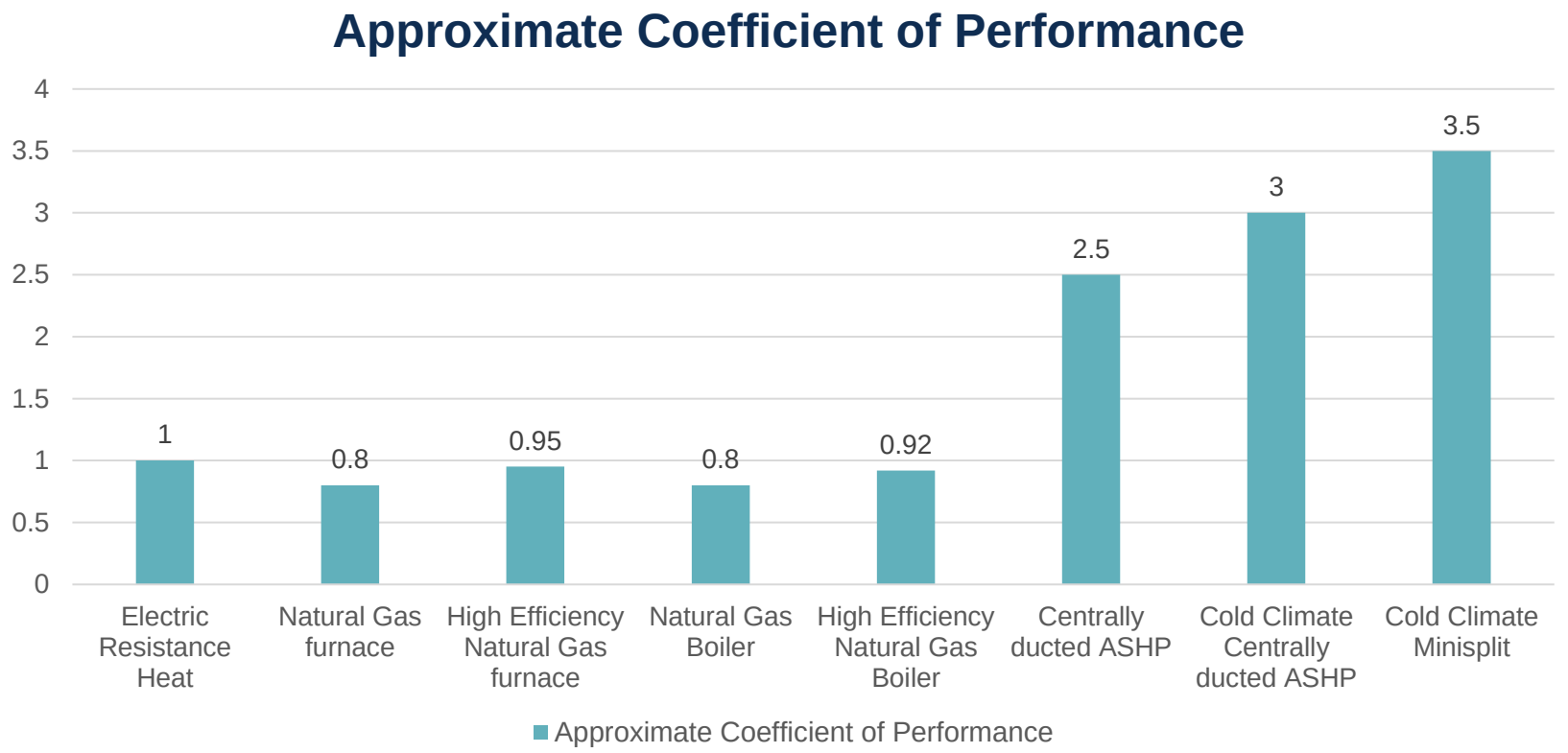
Heat Pump technology is key to building electrification

- Heat pumps are familiar technologies
  - Air conditioning
  - Refrigeration
- Strong gains in cold climate performance with variable speed HPs
- Innovation and rapid technology development
  - Disruptive technologies
  - Increasing scale
  - Policy support



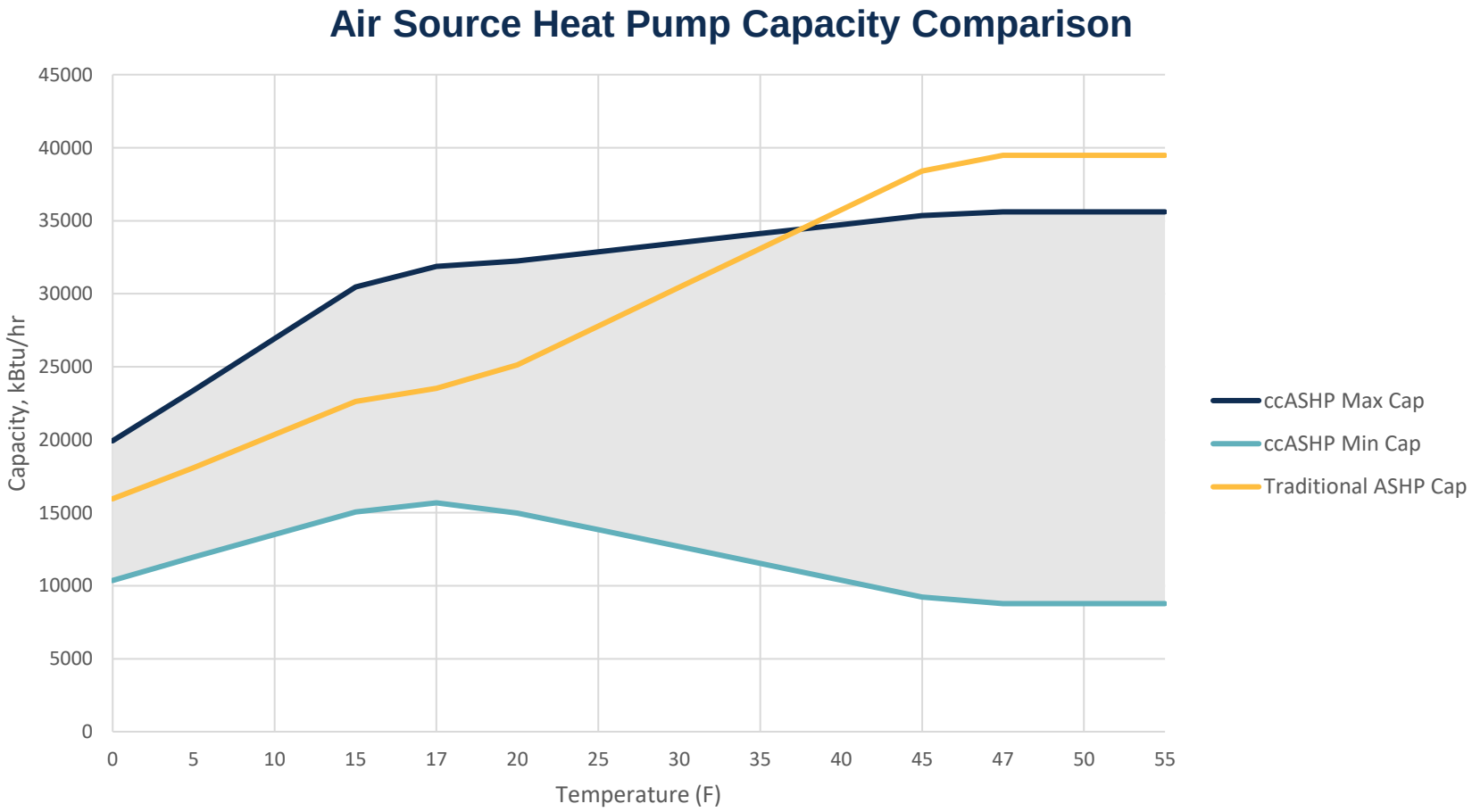
Comparing system types using COP

Coefficient of Performance – For every unit of energy utilized, how many units of heat are produced?

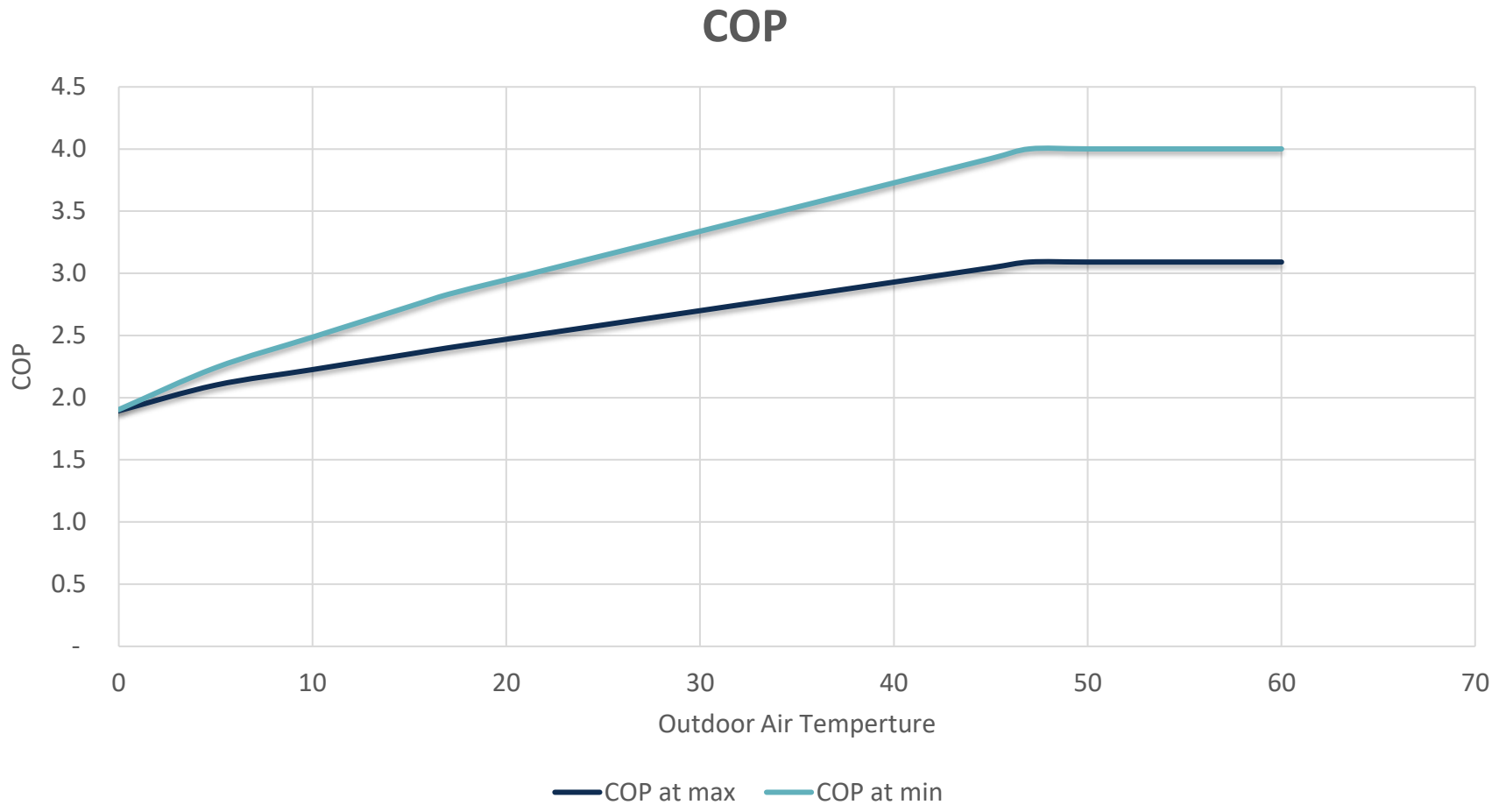


CEE ccASHP Research Timeline

ASHP Capacity



ASHP COP


COP
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
-
COP
0
10
20
30
40
50
60
70
Outdoor Air Temperture
COP at max
COP at min

ccASHP Research Findings

01

Perform well in cold climates

- Delivering heat as at temps as low as -25°F

02

Deliver increased capacity and COP

03 Lets Go!

Meet manufacturer specifications

But they must be installed correctly

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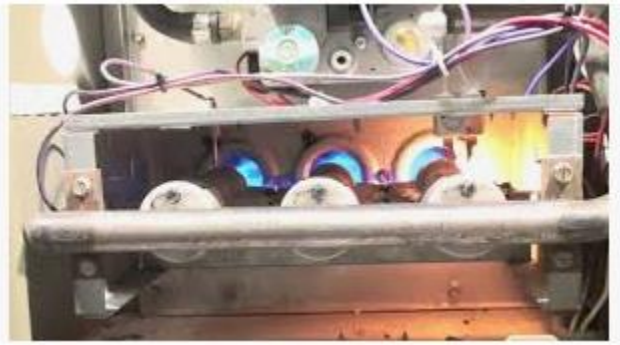
Keys to Performance - Installation Considerations

Control and Operation

Integration with backup

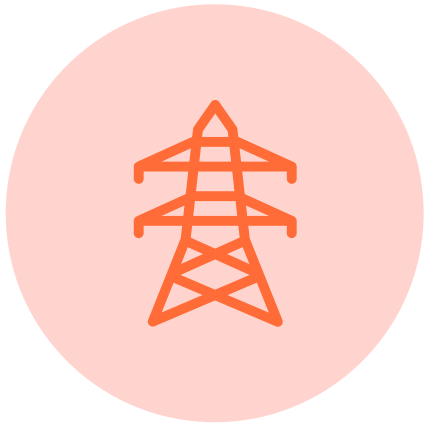


Sizing

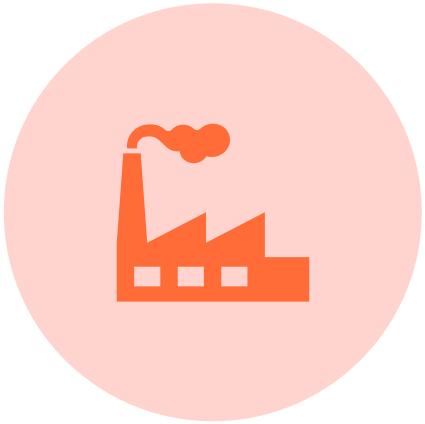
Types of ASHPs - Gift and a Curse

- Residential Heat Pumps
  - Minisplit heat pumps
  - Multi-split heat pumps
  - Centrally ducted heat pumps
  - Dual-fuel heat pumps
  - Air-to-water heat pumps
  - Ground source heat pumps
- Commercial Heat Pumps
  - VRF heat pumps
  - Ground source heat pumps
  - PTAC heat pumps
  - RTU heat pumps
- Other heat pumps
  - High temperature heat pumps
  - Heat pump water heaters
  - Automotive heat pumps

Where do we start?



SOURCE ENERGY SAVINGS



EMISSION SAVINGS – EARTH OR WIND?

CUSTOMER SAVINGS

Applications: Full Speed Ahead!

- Electric Heat Displacement
- Propane Heat or Delivered Fuel Replacement

CEE's field research results

Percentage Reductions for ccASHPs				
	Site energy	**Source energy**	**Homeowner cost**	**Emissions**
Dual-fuel ASHP vs. propane furnace	40%	10%	30%	5%
All-electric ducted & ductless HP vs. electric resistance	55%	55%	55%	55%

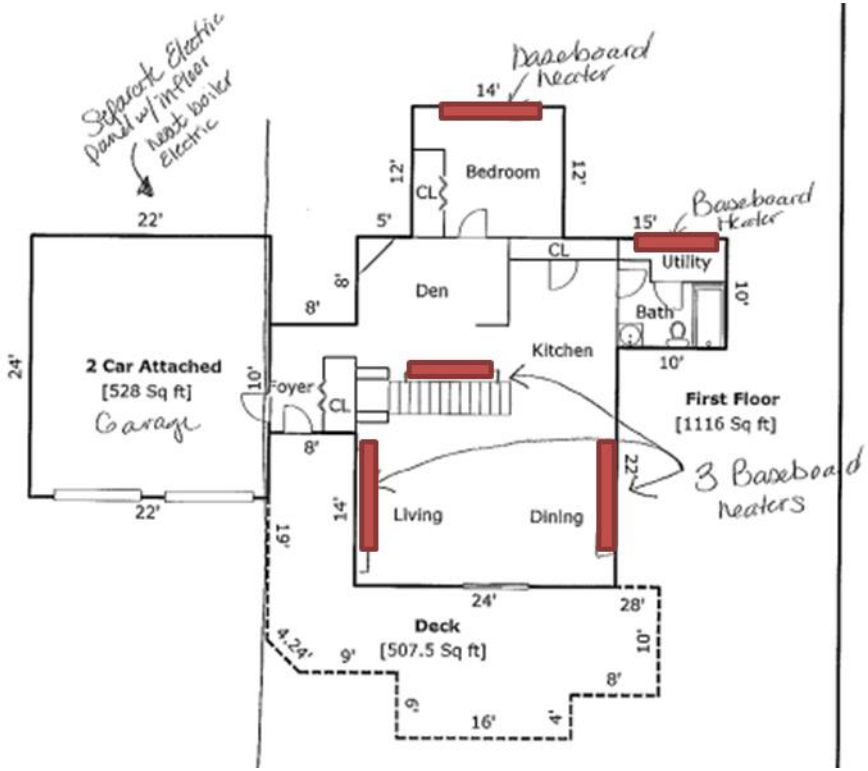
Research Report

Electric Displacement via Ductless

Electric replacement via Ductless

55% homeowner cost savings

- Head location is important
  - Size for space
- Controls – integration with heating sources is key
- Ductless will operate whenever system is capable
- Lots of design and install flexibility



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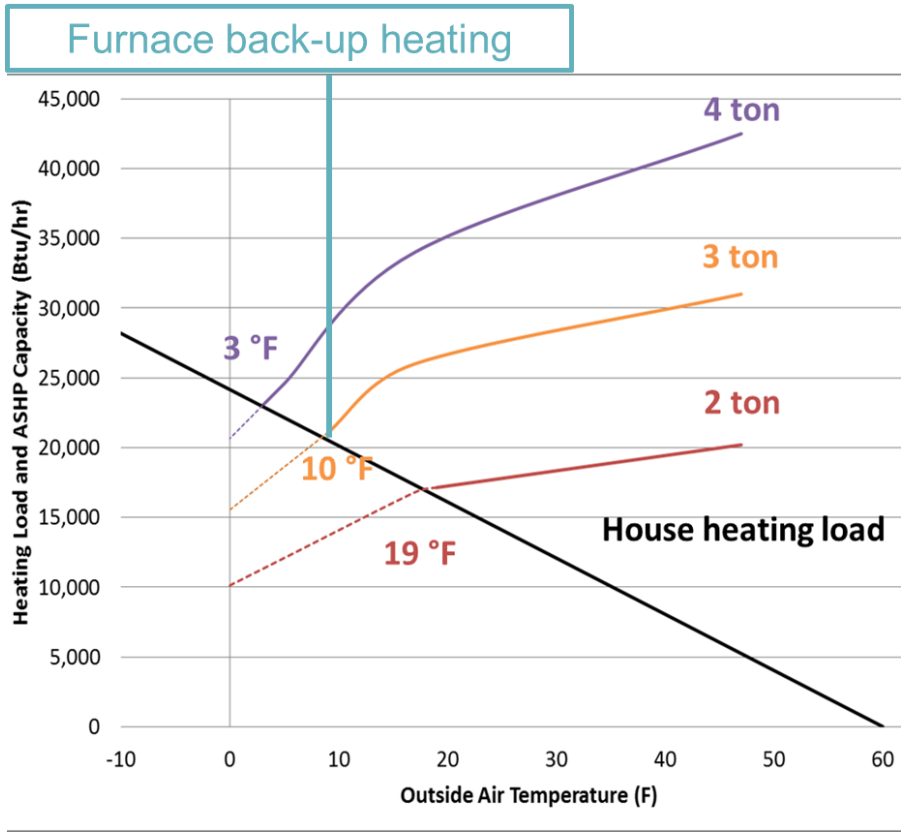
Ducted Whole House Propane Heat Replacement

Dual Fuel ccVSHP systems

30% homeowner cost savings

- Installation is very comparable to traditional furnace/AC
- Size HP for heating not cooling
- Simple, integrated controls
- Hard switch to backup heat



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Applications: Pilot stage, ready to launch

- Beneficial Electrification
- AC Replacement
- All electric
- Multifamily (zoned ER)

Beneficial Electrification

The fuel switching dream

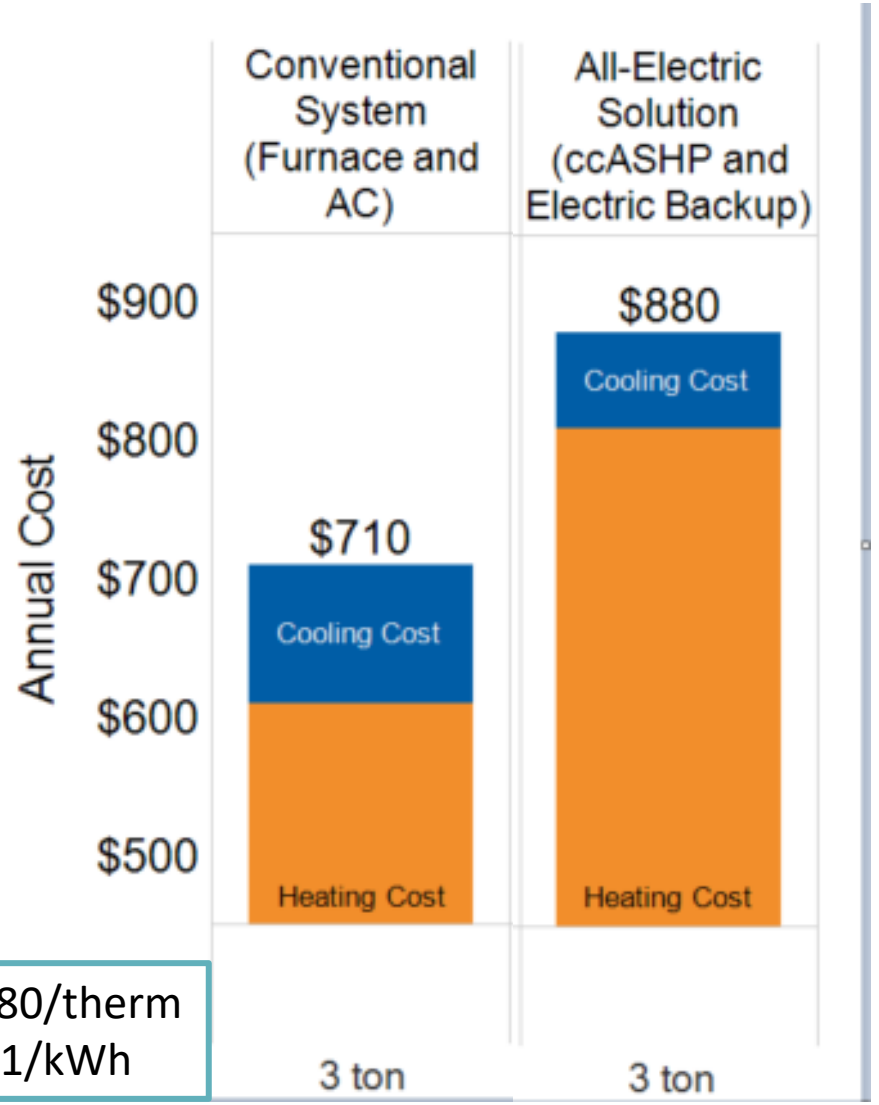
Electrify everything!

The Reality

Often increases customer costs

Starts with building envelope

Consider peak impacts

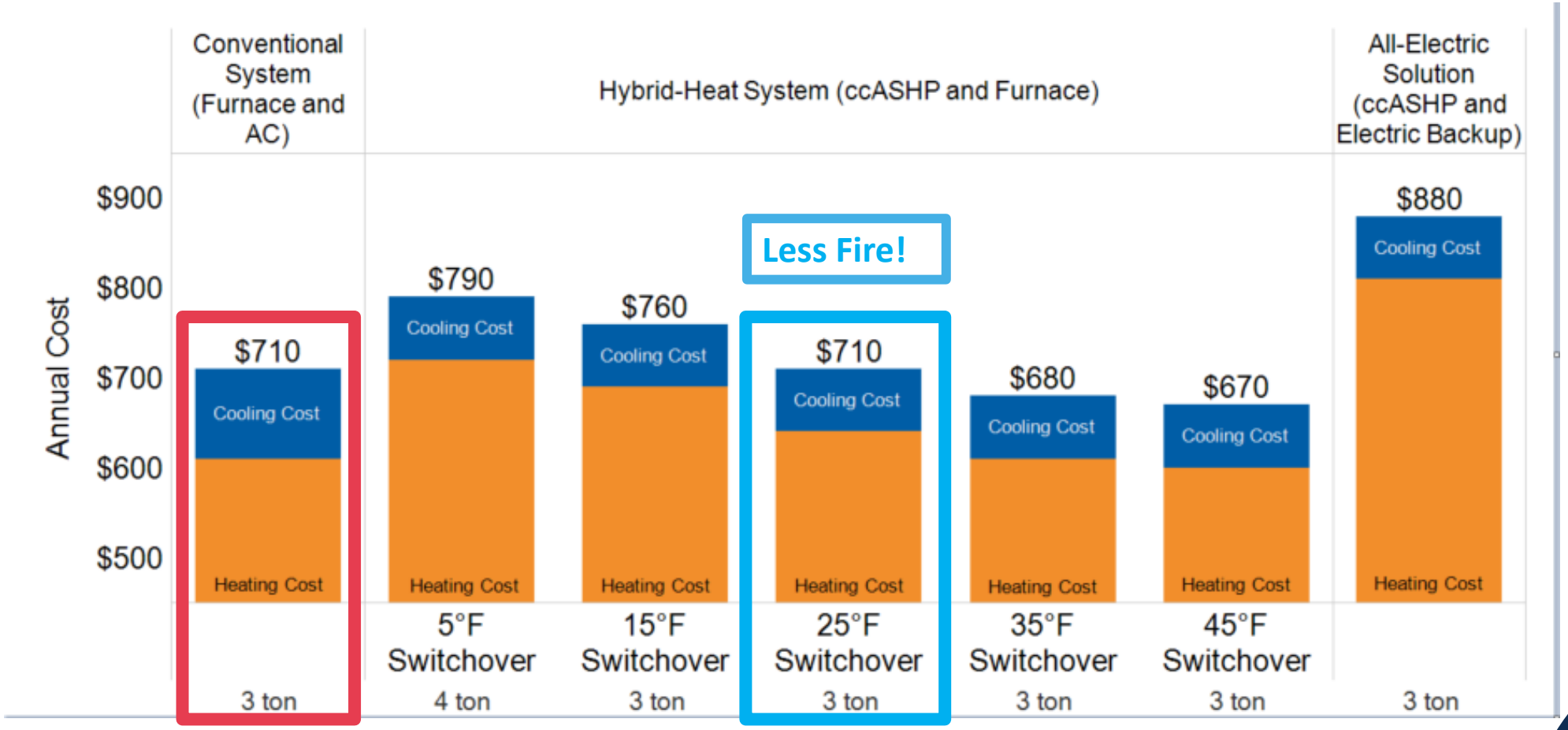


Gas cost: $0.80/therm
Electric: $0.11/kWh

Starting Point – Dual-fuel / AC Replacement

- Never install an AC again!
  - Stop incentivizing ACs
- Tiered HP rebates
  - Entry level – 15+ SEER and 8.5+ HSPF
  - Variable speed - 17+ SEER and 9.5+ HSPF
- New A-coil units
  - Compatible with existing furnace
- Eliminates peak concerns
- Current research
  - Paper coming soon

AC Replacement – customer costs



Gas cost: $0.80/therm
Electric: $0.11/kWh

When to go all-electric

Low load homes

- Weatherized, new construction

Onsite renewables

All-electric rates – 8 cents / kWh

- Competitive with $0.80/therm gas

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Multifamily Applications – target electric heat

- Lower load living space
- Cost considerations
  - Should we install a head in every room?
- Integration with backup is key
- Split incentive
  - Who pays and who saves?
- Current research
  - 20 units
  - Monitor performance and savings
  - Install and controls

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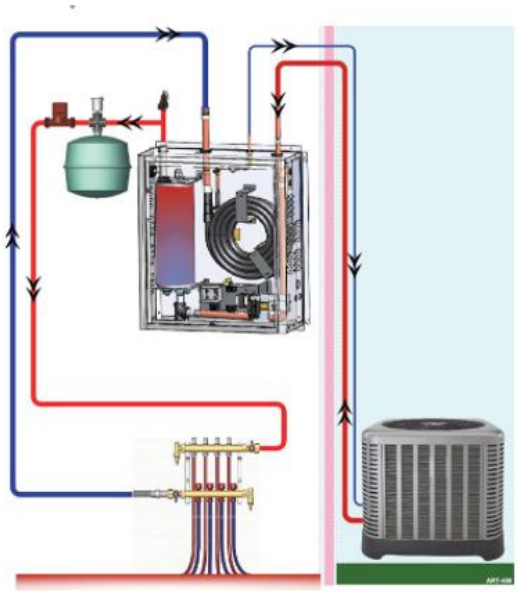
Applications: Still more to come

- Air to water heat pumps
- HP RTUs
- Through wall PTHPs

Ever increasing applications of HPs

RTUs

PTHPs



AtWHP-
CEE Research

Overcoming HP Market Barriers

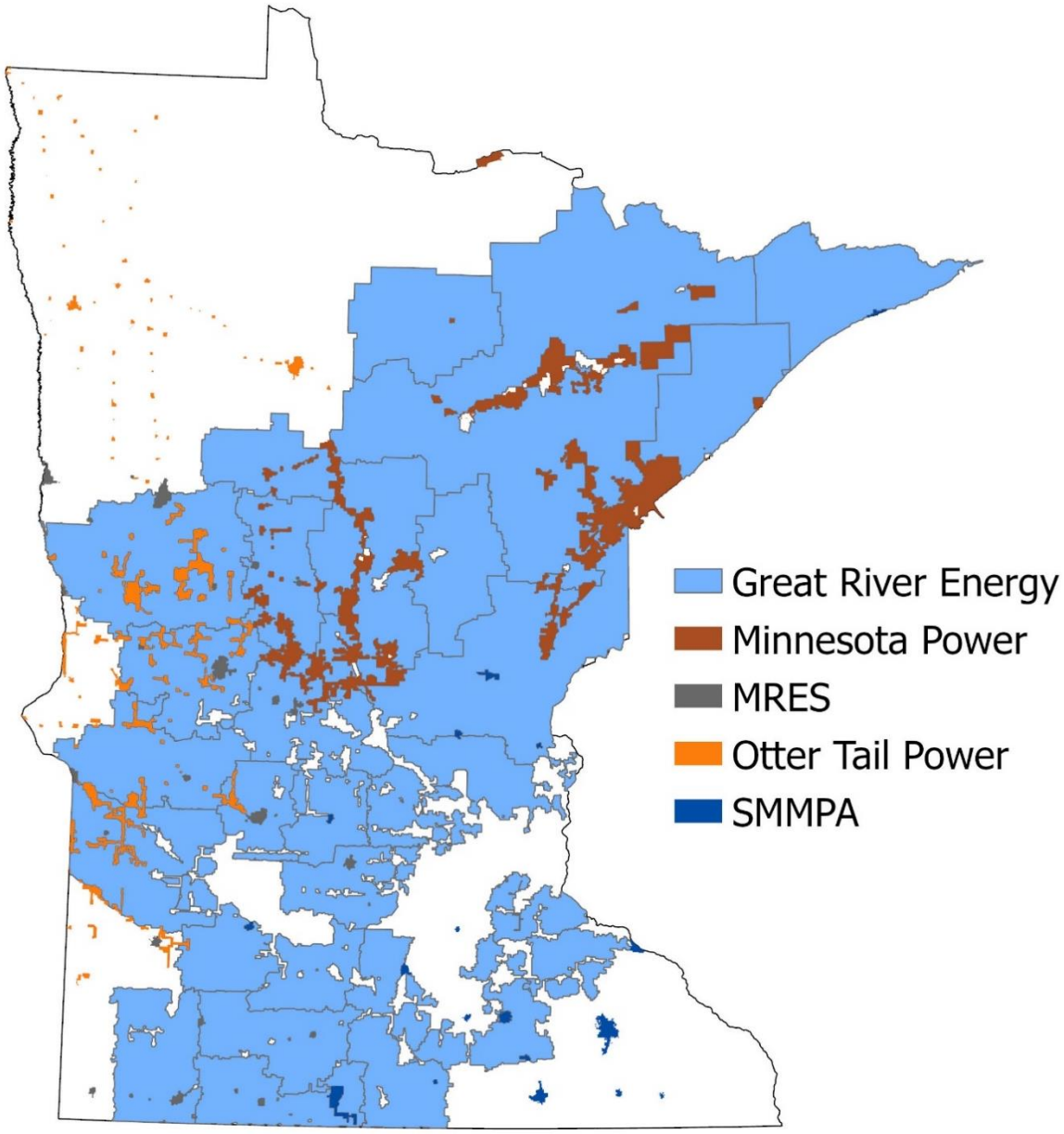
Contractor availability

Product availability

Up-front product cost

Familiarity of modern HP technology

MN ASHP Collaborative Members



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OTTER TAIL POWER COMPANY

minnesota power

GREAT RIVER ENERGY

MISSOURI RIVER ENERGY SERVICES

Southern Minnesota Municipal Power Agency

ASHP
air source heat pump collaborative

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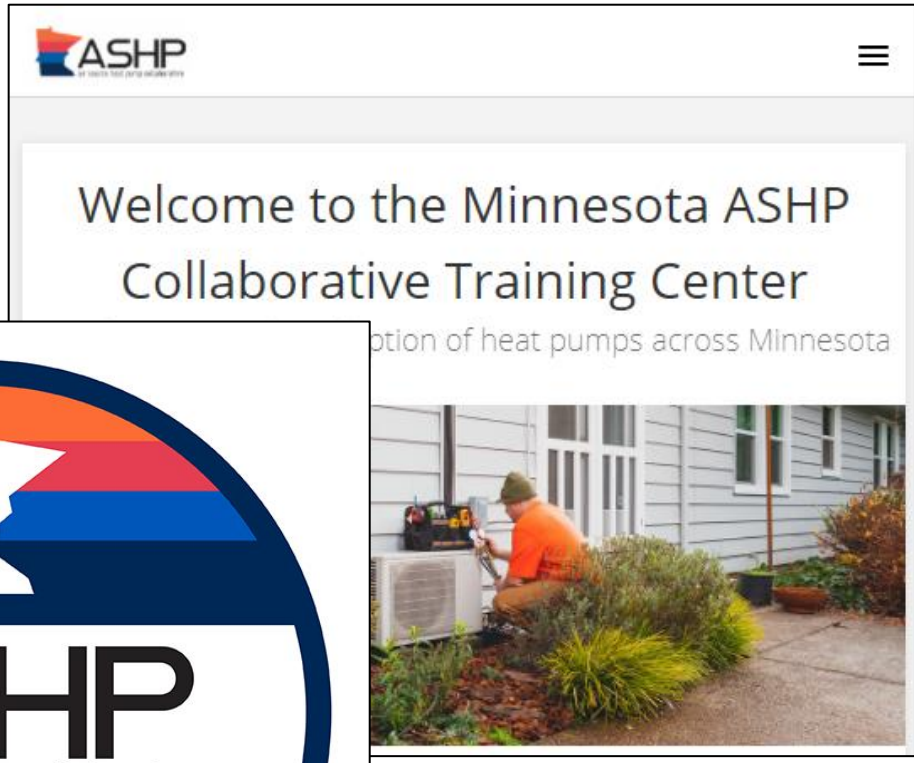
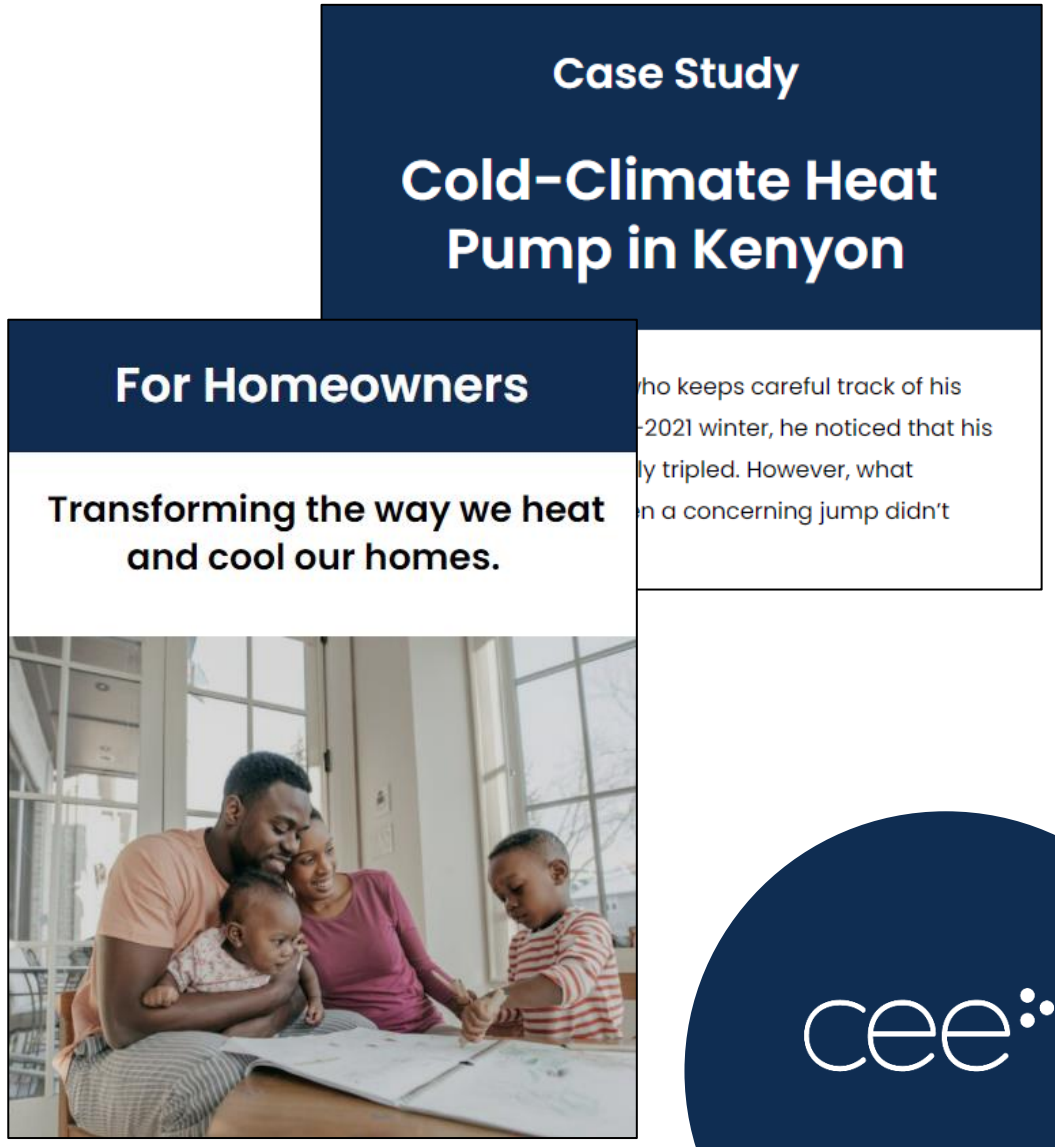
MN ASHP Collaborative Contractor Resources

- Free training modules
- Best practices guide
- Manufacturer promotions
- In person training
- Preferred Contractor Network



MN ASHP Collaborative Homeowner Resources

- Case studies across MN
- Buying guides
- Product finders
- Financing information
- FAQs
- Blog (recently launched)
- Contractor lookup through Preferred Contractor Network (coming soon)



Thank You!

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