

# MORE DUCTED APPLICATIONS!

Propane and Electric Furnaces  
All-Electric



# ASHP Market Potential

## Furnace and AC Homes

- **81%** of Xcel's residential customers have furnaces and/or air-conditioners
- **1,300,000 customers** are a great application for ducted ccASHPs
  - 40,000 - 50,000 customers annually

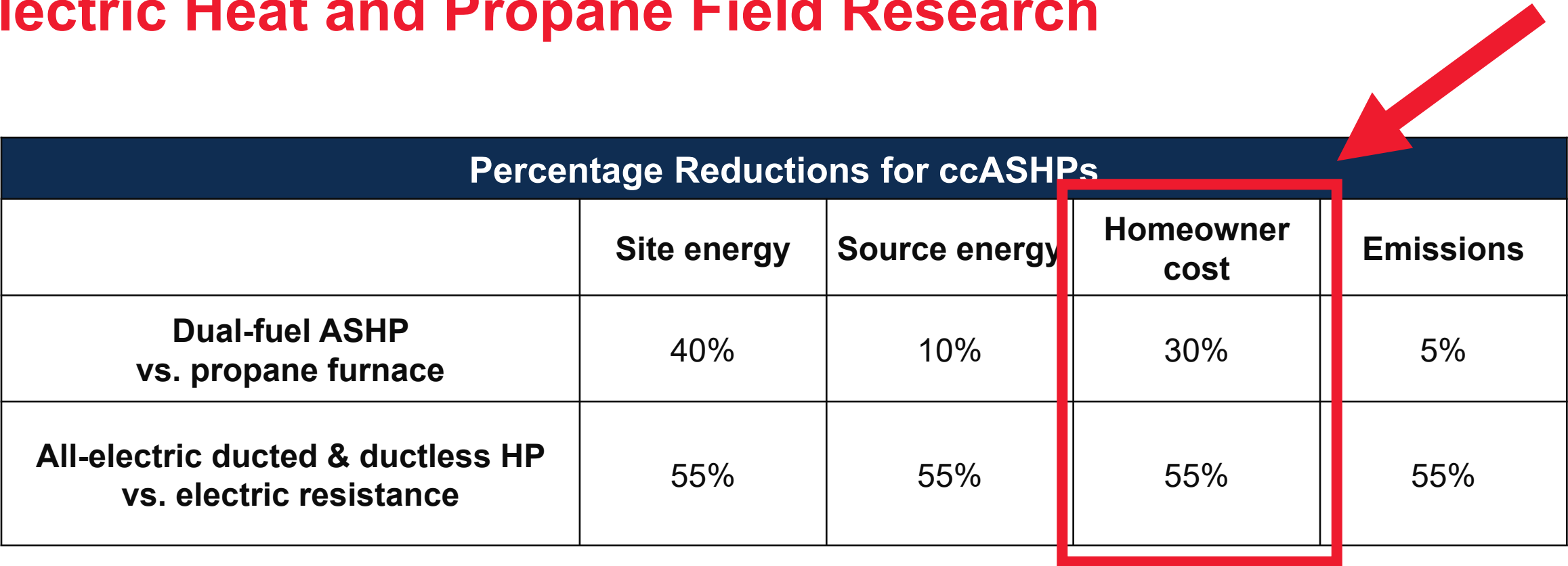
## Electrically Heated Homes

- **6%** of Xcel's residential customers heat with electricity
- **96,000 customers** can save over **55%** from a heat pump install

## Boiler Heated Homes

- **9%** of Xcel's residential customer heat with boilers
- **144,000 customers** could use ductless mini-splits for cooling and heating

# Electric Heat and Propane Field Research



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%

# Application Considerations

Large energy savings - 30% - 55%!

Select a cold-climate ASHP

- Displace as much heat as possible – size to ~5F

Simple, integrated controls

- Select switchover for propane
- Supplemental electric aux. for electric



# DUCTED ALL-ELECTRIC ASHPS

# Customer Scenario – Interested in all Electric

## Customer Type

- Carbon reduction
- Removing gas
- EV owner
- Rooftop solar
- Interested in new tech
- New construction



# Application Considerations

## Building envelope and heating load

- Good application for new construction
- Existing home – should prioritize insulation/weatherization

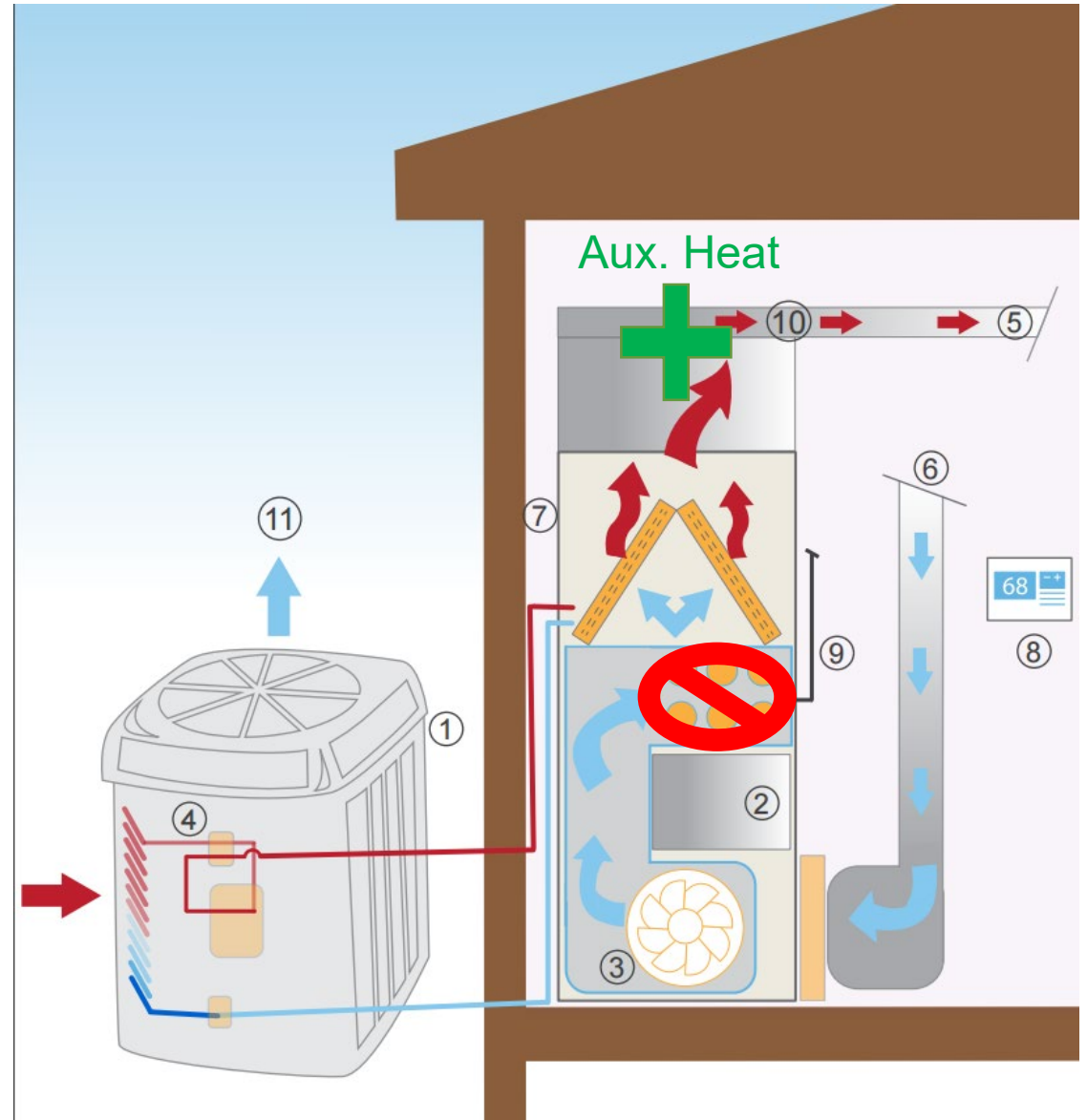
## Consider climate

- Feasible in Denver area
- Colder regions will use more electric resistance auxiliary



# Product Selection and System Design

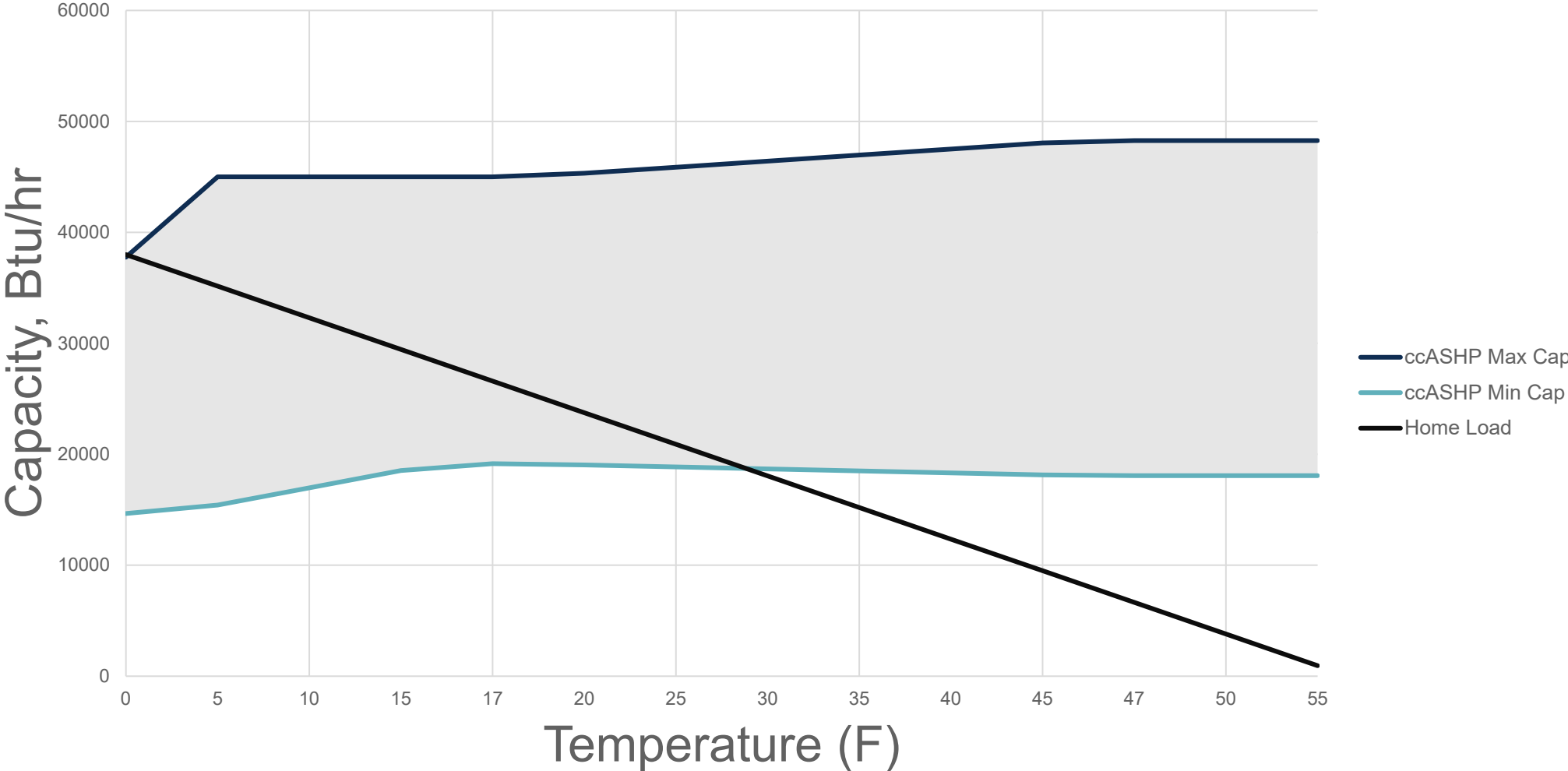
- ccASHP application
- Need low temp capacity
- Backup furnace replaced with electric resistance auxiliary heater
- Size to meet load at 5F – limit aux. heat





# Capacity – 4 ton ccASHP – Weatherized Home

## Air Source Heat Pump Capacity Comparison



# Customer Costs

- Comparable in Denver climate
  - Higher cost in colder areas
  - Weatherization will lower costs
- Educate customer on costs

Heat Pump or AC	Annual Heating and Cooling Costs	Cost Comparison	Heat Pump Heating Hours
Baseline ~14 SEER	\$910	-	-
ccASHP sized @5F w/ electric aux.	\$1,030	\$120	100%

# Emissions Savings

Heat Pump or AC	Carbon Emissions (tons)	Emissions Savings (tons)	% Carbon Reduction
Baseline ~14 SEER	5.7	-	-
ccASHP sized @5F w/ electric aux.	2.5	4.7	83%

## Carbon Reduction

- Average Car = 4.64 tons
- Assumes 11,520 miles per year

### Customer message -

- Offset the emissions from a car with a ccVSHP!

# Customer Benefits

- All-electric
  - No gas needed = no monthly fee!
- Highest emissions reduction
- Rooftop solar = lower costs
- Continuous HP operation
  - ER aux heat supplements when needed
  - Reduced temperature swings = increased comfort
  - Increased circulation = improved IAQ



# DUCTED ALL-ELECTRIC BEST PRACTICES



# Maximizing the Compressor

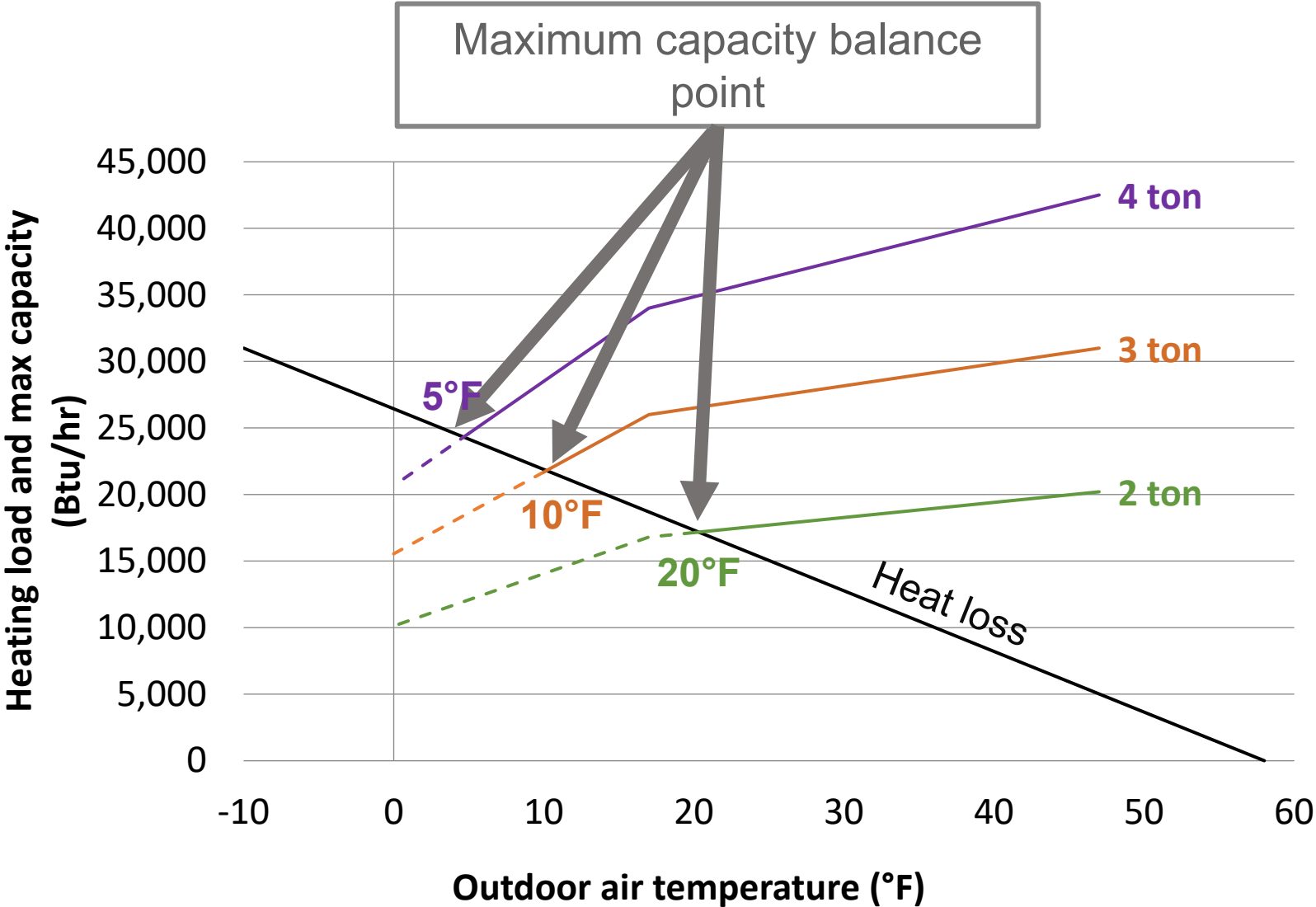
- Size correctly – know your capacity balance point
  - Size to 5F
- A true cold climate heat pump
- Size the auxiliary heat for the difference between the capacity at design temperature and the load at design conditions
- Auxiliary heat controls are really important for energy savings

# Design & Sizing for Ducted Systems

Trade-offs between HP size and fraction of heating load meet

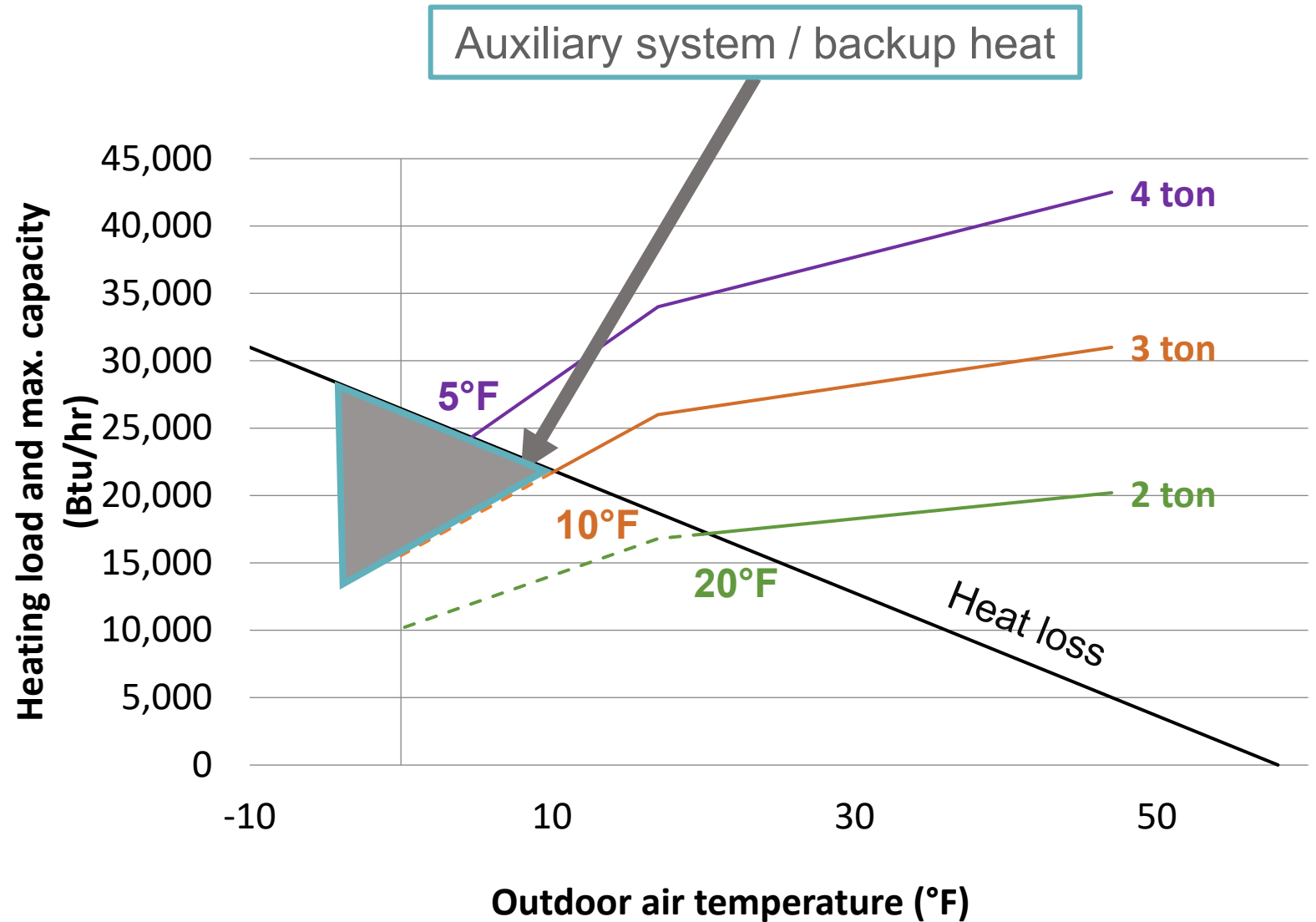
Percent heating load met by ASHP:

- 4 ton ~ 86%
- 3 ton ~ 77%
- 2 ton ~ 60%



# Design & Sizing for Ducted Systems

- Size the aux for the delta between the capacity at design temperature and the load of the house.
- Capacity at -3F is 15,000 BTUs/hr. for the 3-ton unit.
- Heat loss is 26,000 BTUs/hr. Delta is 11,000 BTUs/hr.
- Don't size the aux heat for 26,000 Btus.

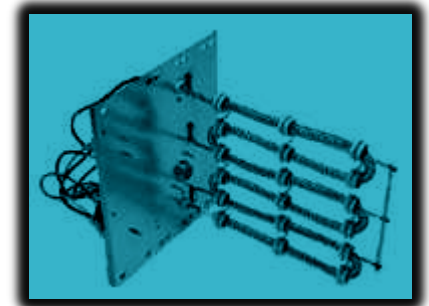




# Minimizing the Use of Auxiliary Heat

To minimize the use of aux. heat, these three steps must be taken:

1. Size the compressor large enough to provide all the heat needed if the outdoor temp is above 5° F (hint: 5° F is the “capacity balance point”).
2. Controls with outdoor thermostat (lockout aux. heat above 35°F). This prevents unnecessary aux. heat use (emergency heat will still work if wired correctly).
3. Ideally stage aux. heat 5 kW at a time.



# Auxiliary Heat Lockout

- Controlled through thermostat or outdoor unit control board on some brands
- Auxiliary (strip) heat lockout set at 35°F or below
- Must use outdoor thermistor or Wi-Fi weather station



# Compressor Lockout

- Controlled through thermostat
- Can set it to not lock out compressor at all

