Welcome!
HEAT PUMP SUMMIT

Troy

September 11th, 2025

MI
HEAT PUMP COLLABORATIVE

WHAT IS THE MICHIGAN HEAT PUMP COLLABORATIVE?

- The Michigan Heat Pump Collaborative aims to remove barriers to increase the adoption of heat pumps in Michigan.
- It is designed to bring top tier heat pump education opportunities and resources to contractors supporting Michigan residents.
- We are here to support you!
- Sponsored by:

Consumers Energy Count on Us®

DTE

INDIANA MICHIGAN POWER℠ An AEP Company

UPPCO®

slipstream

Climate + Clean Energy Solutions for everyone.

The knowledge, people, and resources to solve our biggest energy challenges.

MI HEAT PUMP COLLABORATIVE

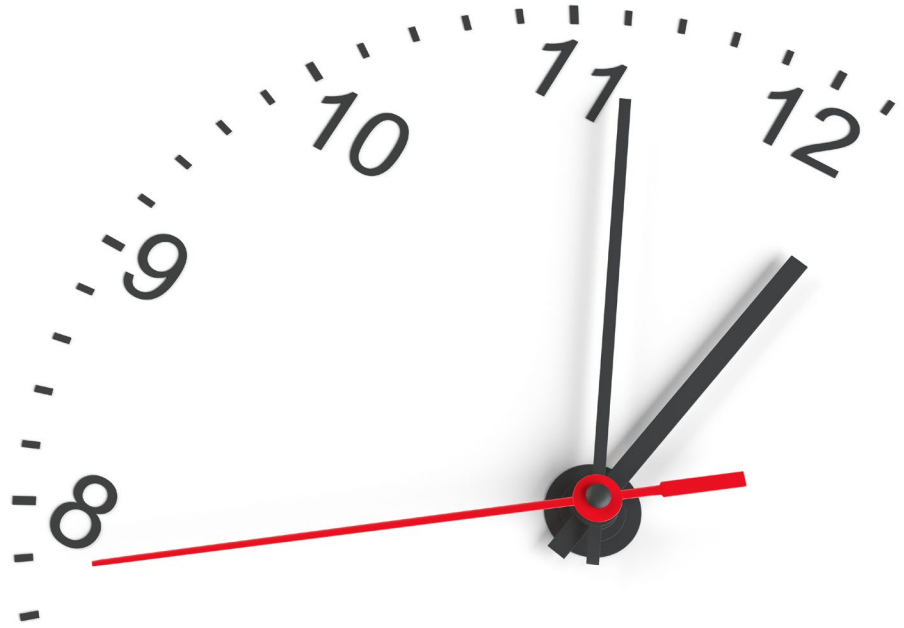
MIDWEST HEATING AND COOLING COLLABORATIVE

MIDWEST COLLABORATIVE

- The Midwest Collaborative was formed in 2022 to accelerate ASHP adoption in the Midwest
- The Midwest Collaborative focuses on providing industry resources in the Midwest to address needs and overcome barriers to ASHP adoption.

https://mwcollab.org/

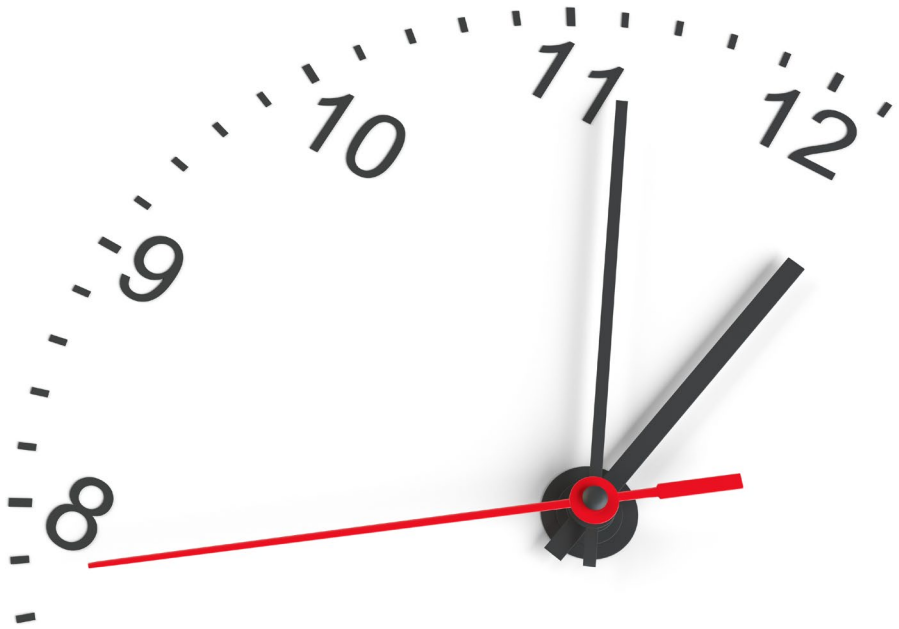
MORNING AGENDA



Time	Session
9:00 – 9:15	Welcome & Event Overview
9:15 – 9:30	Introduction to Heat Pumps
9:30 – 10:15	Incentives & Rebates
10:15 – 10:30	Break & Networking
10:30 – 11:15	Value of HP Discussion
11:15 – 12:00	Industry Discussion
12:00 – 1:00	Lunch & Networking

AFTERNOON AGENDA

Time	Session
1:00 - 2:00	Destination Training 1
2:00 – 2:15	Break
2:15 – 3:15	Designation Training 2
3:15 – 3:30	Break
3:25 – 4:30	Designation Training 3 + Closing



BENEFITS OF GRADUATE DESIGNATION

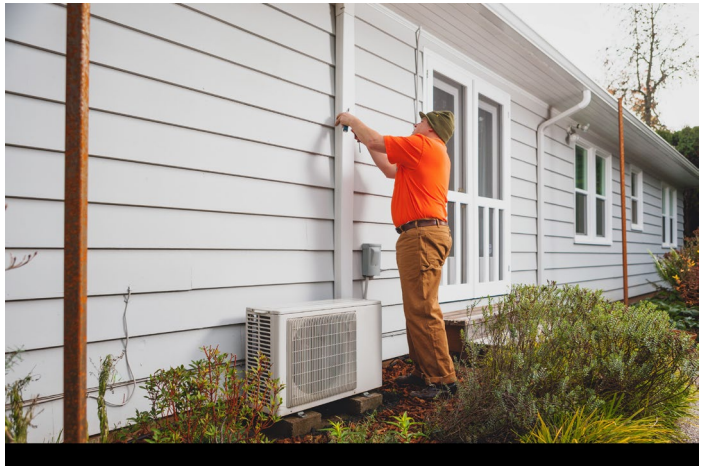
- Help connect you to customers looking to install heat pumps
- Promote the designation on your website/social/materials
- Listed on our contractor search tool
- Access to educational resources for your customers

MI
HEAT PUMP COLLABORATIVE

WHAT IS A HEAT PUMP?

RESIDENTIAL ELECTRIC HEAT PUMPS

- Air-to-air
  - Minisplit heat pumps
  - Centrally ducted heat pumps
  - Dual-fuel heat pumps
- Air-to-water heat pumps
- Ground source heat pumps
- Heat pump water heaters
- Commercial heat pumps
  - VRF heat pumps
  - RTU heat pumps
  - Central heat pump water heaters
- Industrial heat pumps



HEAT PUMP TAXONOMY

Residential air source heat pumps

Compressor

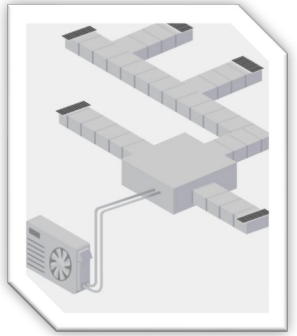
- Inverter driven
- Conventional (single or double speed)

Cold-Climate listed?

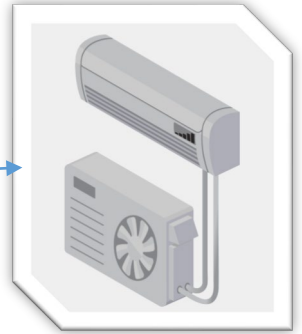
- Cold-climate listed
- Not listed

Distribution

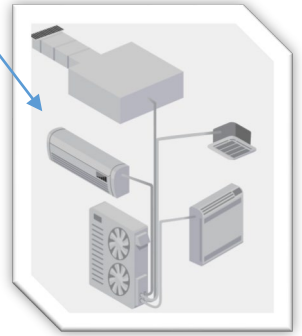
- Centrally ducted
- Short duct
- Mini-split
- Multi-split
- Packaged terminal heat pump



Ducted



Mini-split



Multi-split

HEAT PUMP WATER HEATERS PERFORMANCE

- Available since 2009
- Great technology for replacing electric resistance water heaters in basements of single-family homes
- Advanced features that homeowners want
- No detectable space heating impact

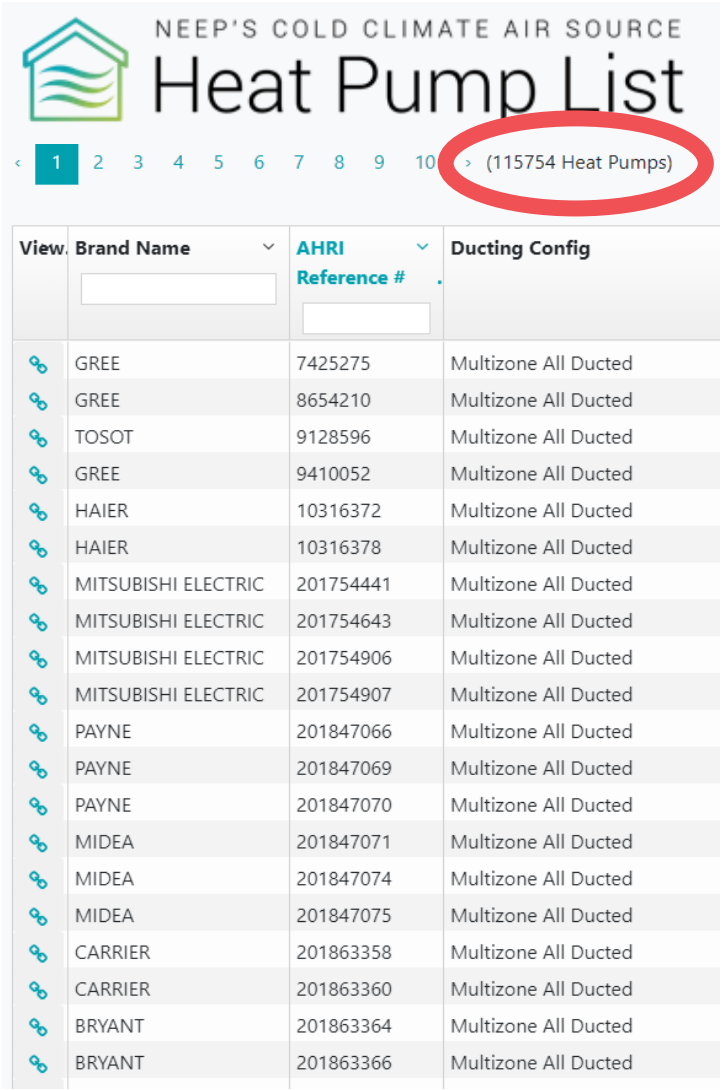
Baseline	Operating Cost Savings	
	Heat Pump Mode	Hybrid Mode
Electric Resistance	$304	$274
Propane	$213	$182
Natural Gas	$19	$ -12

Source: Michigan HPWH field study (2022)

AIR SOURCE HEAT PUMPS IN COLD CLIMATES

IN 2025, HEAT PUMPS CAN ABSOLUTELY WORK IN COLD CLIMATES!

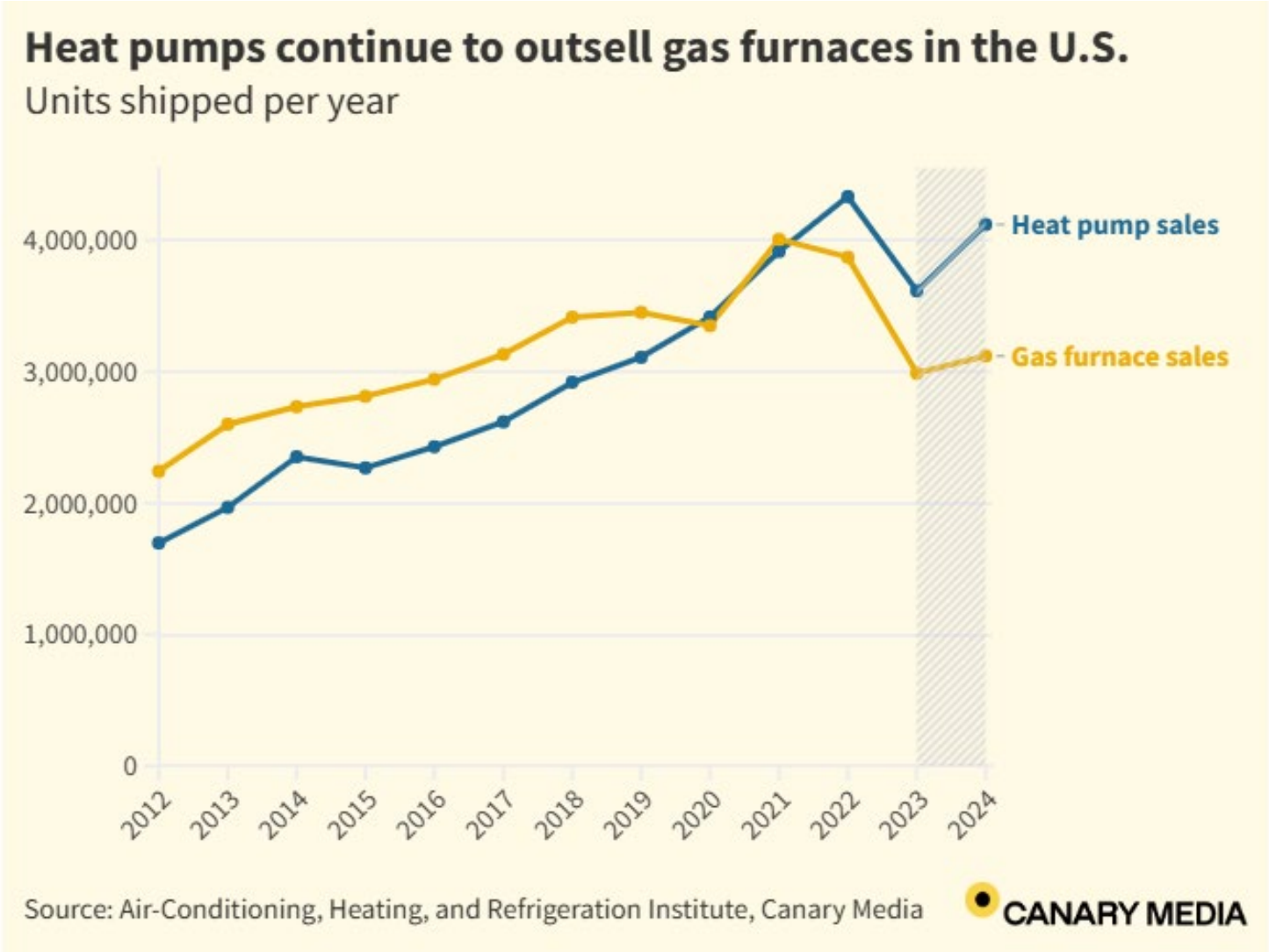
- Cold Climate ASHPs offer promise for large site energy savings and emissions reductions
- Many models work at very cold design temperatures
- They still have capacity limitations compared to space heating needs



View	Brand Name	AHRI Reference #	Ducting Config
	GREE	7425275	Multizone All Ducted
	GREE	8654210	Multizone All Ducted
	TOSOT	9128596	Multizone All Ducted
	GREE	9410052	Multizone All Ducted
	HAIER	10316372	Multizone All Ducted
	HAIER	10316378	Multizone All Ducted
	MITSUBISHI ELECTRIC	201754441	Multizone All Ducted
	MITSUBISHI ELECTRIC	201754643	Multizone All Ducted
	MITSUBISHI ELECTRIC	201754906	Multizone All Ducted
	MITSUBISHI ELECTRIC	201754907	Multizone All Ducted
	PAYNE	201847066	Multizone All Ducted
	PAYNE	201847069	Multizone All Ducted
	PAYNE	201847070	Multizone All Ducted
	MIDEA	201847071	Multizone All Ducted
	MIDEA	201847074	Multizone All Ducted
	MIDEA	201847075	Multizone All Ducted
	CARRIER	201863358	Multizone All Ducted
	CARRIER	201863360	Multizone All Ducted
	BRYANT	201863364	Multizone All Ducted
	BRYANT	201863366	Multizone All Ducted

https://ashp.neep.org/

Heat pumps outsold gas furnaces by their biggest-ever margin in 2024



Takemura, A. F. (2025, February 20). *Heat pumps outsold gas furnaces by their biggest-ever margin in 2024*. Canary Media. https://www.canarymedia.com/articles/heat-pumps/heat-pumps-keep-widening-their-lead-on-gas-furnaces
Both title and interactive graph pulled from article

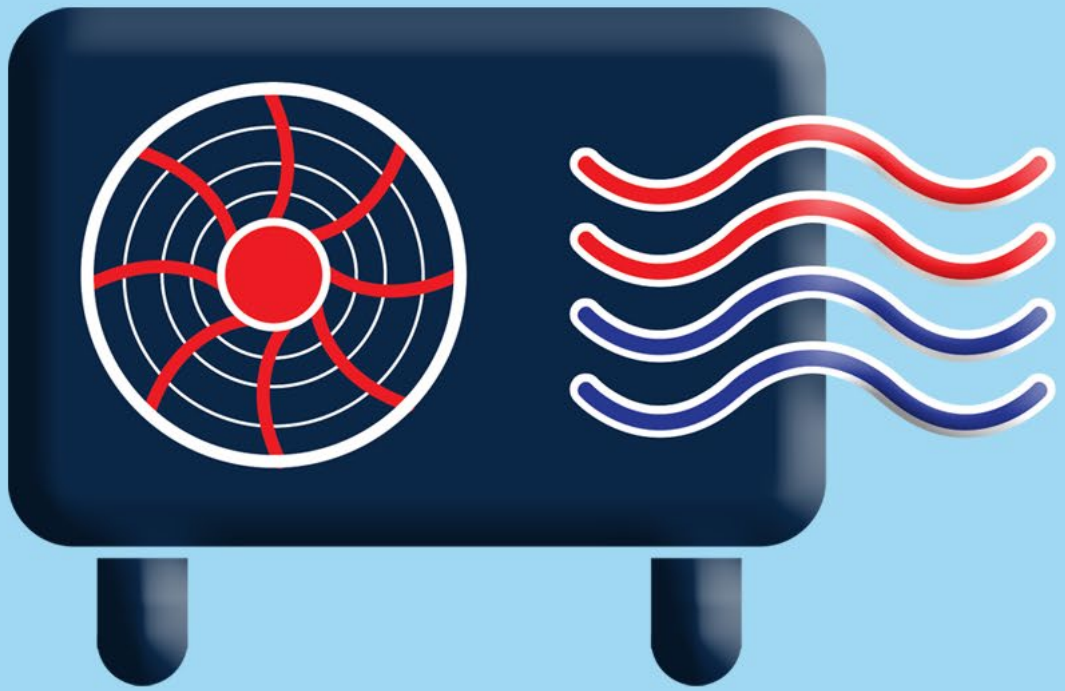
HYBRID / DUAL FUEL FIELD PERFORMANCE

	Compressor Speed	Incremental cost	Propane reduction	Simple payback	Lockout (°F)
1	Variable	$2,600	64%	4 years	20
2	Variable	$3,200	50%	5 years	25
3*	Variable	$2,400	41%	9 years	30
4	Variable	$2,600	67%	3 years	None
5	Two	$900	59%	2 years	None
6	Five	$2,000	43%	7 years	28
7	One	$700	34%	3 years	20
8	One	$600	63%	1 year	25

*On NEEP cold-climate qualification list

Source: MI Dual Fuel Heat Pump Field Study (2020)

Heat Pumps 101



MI HEAT PUMP COLLABORATIVE

INCENTIVES, TAX CREDITS, FINANCING, & RESOURCES

AGENDA

- DTE
- Consumers Energy
- Michigan Saves
- MiHER

2025 Energy Efficiency Programs

MI Heat Pump Collaborative Summit

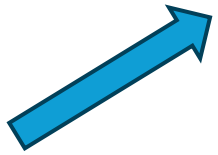
September 2025

2025 Multifamily Energy Efficiency Program Rebates

DTE

Eligibility

- Multifamily property must have DTE service
  - Rebate is paid to property owner, but can be reassigned to contractor, upon request
- 3 or more units under one roof (high or low rise)
- Both new construction and existing buildings are eligible
  - Existing buildings: heat pump and heat pump water heater installations must replace existing electric heating
- Income-Qualified
  - Eligibility must meet at least 1 of the 4 requirements
  - Enhanced rebates offered
- Market-rate
  - Standard rebates offered



Income-Qualified Customers

DTE offers an Income-Qualified (IQ) component as part of the Multifamily Program. The Income-Qualified program is focused on energy savings for both subsidized and income-qualified public housing multifamily properties by offering enhanced rebates and specialized services for this segment. An Income-Qualified Multifamily property may be eligible to participate if they meet any of the following requirements:

1. Participation in an affordable housing program

Automatic qualification for any property that can provide evidence of participation in a federal, state or local affordable housing program, for example: Low-Income Housing Tax Credit (LIHTC), U.S. Department of Housing and Urban Development (HUD), U.S. Department of Agriculture (USDA), Michigan State Housing Development Authority (MSHDA), local tax abatement for income-qualified properties and so on.

2. Location in an income-qualified Census Tract

Location within HUD's annually published "Qualified Census Tracts." More information can be found at **huduser.gov/portal/sadda/sadda_qct.html**.

3. Rent roll documentation

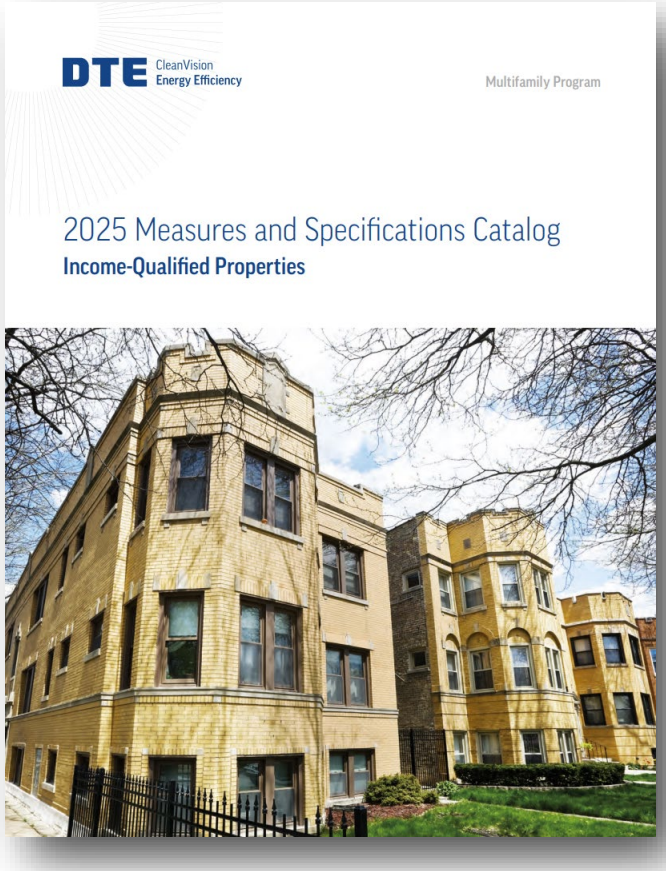
Submission of rent rolls documenting that the average rents charged by a particular property are affordable to households meeting HUD's definition of Income-Qualified. Properties with average rental rates at or below 80% of local "Fair Market Rent" as published annually by HUD will be eligible to participate in the Income-Qualified rebates.

4. Resident income information

Submission of resident income information showing that at least 50% of apartment units are rented to households meeting one of the following criteria:

A. At or below 250% of the Federal Poverty Level
B. At or below 80% of Area Median Income

2025 Income-Qualified Rebates

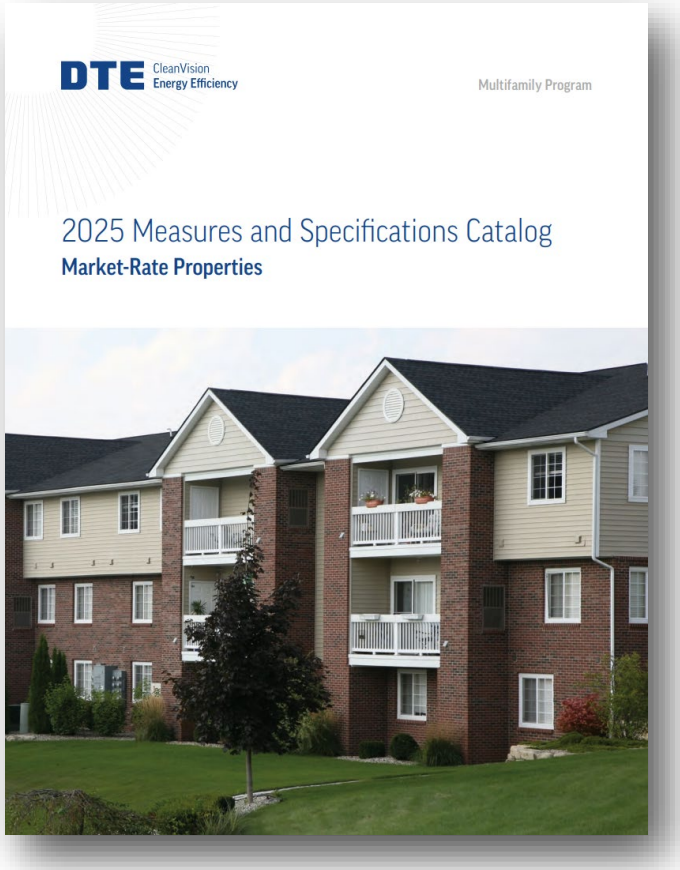


Measure	Incentive	Requirements*
Cold-Climate Heat Pump (1.5 tons or less)	$5,000/Heat Pump	• 16 SEER2 or higher • 8.4 HSPF2 or higher • COP at 5°F must be 1.75 or higher at maximum capacity operation
Cold-Climate Heat Pump (greater than 1.5 tons)	$6,000/Heat Pump	• 16 SEER2 or higher • 8.4 HSPF2 or higher • COP at 5°F must be 1.75 or higher at maximum capacity operation
Heat Pump Water Heater	$2,000/Heater	• 3.0 UEF or higher

*Heat Pump rebates are limited to $450,000 per property per year, unless approved by the Program Team

*Note: Heat pump and heat pump water heater installations must be made in buildings with existing electric heating

2025 Market Rate Rebates



Measure	Incentive	Requirements*
Cold-Climate Heat Pump (1.5 tons or less)	$1,400/Heat Pump	• 16 SEER2 or higher • 8.4 HSPF2 or higher • COP at 5°F must be 1.75 or higher at maximum capacity operation
Cold-Climate Heat Pump (greater than 1.5 tons)	$1,700/Heat Pump	• 16 SEER2 or higher • 8.4 HSPF2 or higher • COP at 5°F must be 1.75 or higher at maximum capacity operation
Heat Pump Water Heater	$500/Heater	• 3.0 UEF or higher

*Heat Pump rebates are limited to $50,000 per property per year, unless approved by the Program Team

*Note: Heat pump and heat pump water heater installations must be made in buildings with existing electric heating

DTE Multifamily Program Contact Information

DTE Website and Catalog

The DTE Energy Multifamily Program | DTE Energy

Contractor Website

www.DTEMultifamily.com

Program Phone and Email

(866) 796-0512 (option 2)
dtemultifamily@michiganefficiency.com

Program Manager Contacts

Sereen Dababneh – sereen.dababneh@dteenergy.com

2025 Residential HVAC Energy Efficiency Program Rebates – Heat Pumps

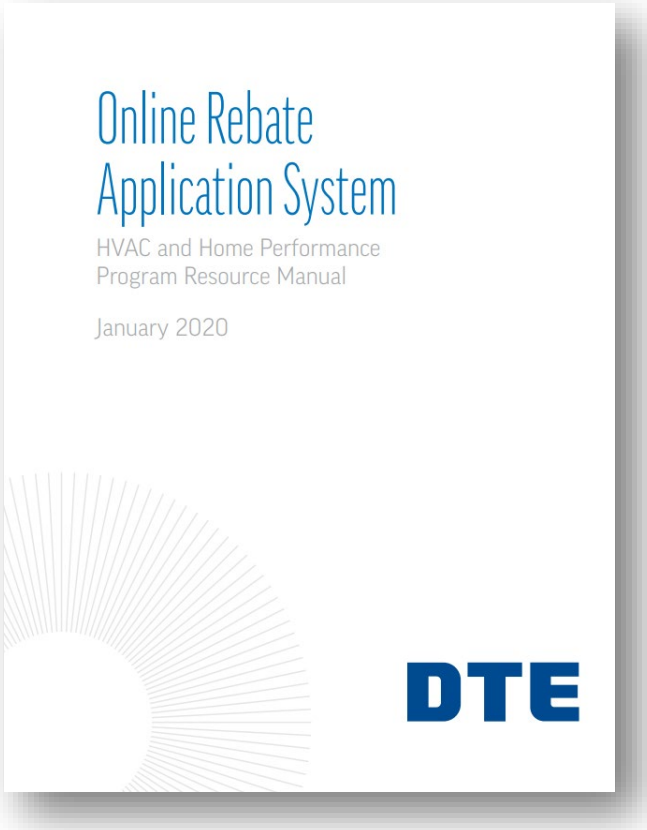
Eligibility

- Premise must have DTE Energy electric service *with* existing electric heating
- Premise eligibility is limited to single family homes. Single family homes are defined as 2 or less connected units, individually metered, with individual HVAC equipment.
- Existing retrofit only, new construction is not eligible under the DTE HVAC program

Payment

Rebate is paid to Account Holder but can be reassigned to contractor to allow for an instant markdown on the invoice at the time of sale. Contractor must complete the rebate reassignment form.

2025 DTE Rebates



Heat Pump Type	Efficiency Criteria	DTE Rebate
Cold Climate Air Source	16+ SEER2, 9.1+ HSPF2, EER2 ≥ 10.0	$1,200
	16+ SEER2, 8.4+ HSPF2, EER2 ≥ 10.0	$1,000
	15.2-15.99 SEER2, 8.4+ HSPF2, EER2 ≥ 10.0	$900
Ground Source	20+ EER2	$800
	17-19.99 EER2	$600
Ductless Mini-Split	>31.5 SEER2 and HSPF2 10	$1,000
	17-31.5 SEER2 and HSPF2 8	$700
Air Source	18+ SEER2 AHRI rated	$500
	15.2-17.99 SEER2 AHRI rated	$150

Cold Climate ASHP $250 Bonus!

Customer must meet program eligibility requirements

Installs completed prior to December 31, 2025

Cold Climate Air Source Heat Pump Specifications	Incentive	Bonus	Total Incentive
15.2-15.99 SEER2 with 8.1+ HSPF2	$800	$250	$1,050
15.2-15.99 SEER2 with 8.4+ HSPF2	$900	$250	$1,150
16+ SEER2 with 8.4+ HSPF2	$1,000	$250	$1,250
16+ SEER2 with 9.1+ HSPF2	$1,200	$250	$1,450

DTE HVAC Program Contact Information

HVAC Program Website

www.michiganrebates.com

Contractor Website

https://mydteprogram.com

Program Phone and Email

855-539-1906 - mydteprogram@icf.com

Account Manager Contact

Jacob Sebrell – Jacob.Sebrell@icf.com

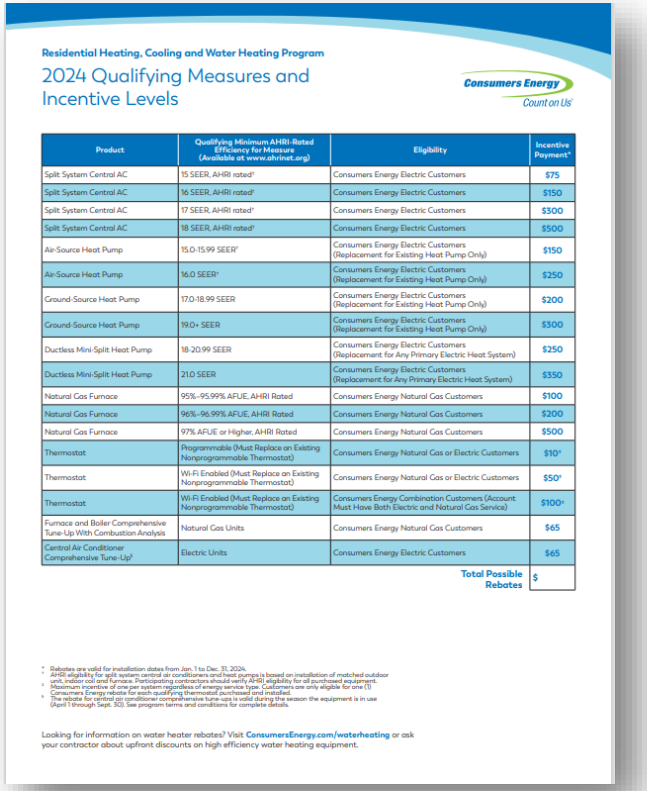
Consumers Energy Eligibility

- Premise must have Consumers Energy electric service *with* existing electric heating
- Premise eligibility is limited to single family homes. Single family homes are defined as 2 or less connected units, individually metered, with individual HVAC equipment.
- Existing retrofit only, new construction is not eligible under the Consumers HVAC program

Payment

Rebate is paid to Account Holder but can be reassigned to contractor to allow for an instant markdown on the invoice at the time of sale. Contractor must complete the rebate reassignment form.

2025 Consumers Energy Rebates



Residential Heating, Cooling and Water Heating Program

2024 Qualifying Measures and Incentive Levels

Consumers Energy Count on Us®

Product	Qualifying Minimum AHRI-Rated Efficiency for Measure (Available at www.ahrinet.org)	Eligibility	Incentive Payment*
Split System Central AC	15 SEER, AHRI rated[1]	Consumers Energy Electric Customers	$75
Split System Central AC	16 SEER, AHRI rated[1]	Consumers Energy Electric Customers	$150
Split System Central AC	17 SEER, AHRI rated[1]	Consumers Energy Electric Customers	$300
Split System Central AC	18 SEER, AHRI rated[1]	Consumers Energy Electric Customers	$500
Air-Source Heat Pump	15.0-15.99 SEER[1]	Consumers Energy Electric Customers (Replacement for Existing Heat Pump Only)	$150
Air-Source Heat Pump	16.0 SEER[1]	Consumers Energy Electric Customers (Replacement for Existing Heat Pump Only)	$250
Ground-Source Heat Pump	17.0-18.99 SEER	Consumers Energy Electric Customers (Replacement for Existing Heat Pump Only)	$200
Ground-Source Heat Pump	19.0+ SEER	Consumers Energy Electric Customers (Replacement for Existing Heat Pump Only)	$300
Ductless Mini-Split Heat Pump	18-20.99 SEER	Consumers Energy Electric Customers (Replacement for Any Primary Electric Heat System)	$250
Ductless Mini-Split Heat Pump	21.0 SEER	Consumers Energy Electric Customers (Replacement for Any Primary Electric Heat System)	$350
Natural Gas Furnace	95%-95.99% AFUE, AHRI Rated	Consumers Energy Natural Gas Customers	$100
Natural Gas Furnace	96%-96.99% AFUE, AHRI Rated	Consumers Energy Natural Gas Customers	$200
Natural Gas Furnace	97% AFUE or Higher, AHRI Rated	Consumers Energy Natural Gas Customers	$500
Thermostat	Programmable (Must Replace an Existing Nonprogrammable Thermostat)	Consumers Energy Natural Gas or Electric Customers	$10[3]
Thermostat	Wi-Fi Enabled (Must Replace an Existing Nonprogrammable Thermostat)	Consumers Energy Natural Gas or Electric Customers	$50[3]
Thermostat	Wi-Fi Enabled (Must Replace an Existing Nonprogrammable Thermostat)	Consumers Energy Combination Customers (Account Must Have Both Electric and Natural Gas Service)	$100[3]
Furnace and Boiler Comprehensive Tune-Up With Combustion Analysis	Natural Gas Units	Consumers Energy Natural Gas Customers	$65
Central Air Conditioner Comprehensive Tune-Up[4]	Electric Units	Consumers Energy Electric Customers	$65
		Total Possible Rebates	$

* Rebates are valid for installation dates from Jan. 1 to Dec. 31, 2024.
[1] AHRI eligibility for split system central air conditioners and heat pumps is based on installation of matched outdoor unit, indoor coil and furnace. Participating contractors should verify AHRI eligibility for all purchased equipment.
[3] Maximum incentive of one per system regardless of energy service type. Customers are only eligible for one (1) Consumers Energy rebate for each qualifying thermostat purchased and installed.
[4] The rebate for central air conditioner comprehensive tune-ups is valid during the season the equipment is in use (April 1 through Sept. 30). See program terms and conditions for complete details.

Looking for information on water heater rebates? Visit ConsumersEnergy.com/waterheating or ask your contractor about upfront discounts on high efficiency water heating equipment.

Heat Pump Type	Efficiency Criteria	CE Rebate
Ground Source	EER 19 or Higher	$300
	EER 17 to 18.99 EER	$200
Mini-Split	SEER2 17 to 25+, 8.0 to 12.5+ HSPF2	$350
Air-Source Heat Pump	SEER2 15.2 to 15.99 or Higher	$300

Consumers Energy HVAC Program Contact Information

HVAC Program Website

www.michiganrebates.com

Contractor Website

https://myceprogram.com

Program Phone and Email

855-263-5390 - consumershvac@icfi.com

Account Manager Contact

Jacob Sebrell – Jacob.Sebrell@icf.com

2025 Energy Efficiency Assistance (EEA) Program Information

Program Purpose

To increase the energy efficiency of Single-Family Income Qualified households.

- Providing Income Qualified households with no-cost energy efficiency upgrades through Program Partners
  - Program Partners include non-profit and community-based organizations
- Conducting comprehensive quality assurance
- Driving increased consumer awareness of for energy-efficient measures

Customer Eligibility Requirements

- Income-Qualified Single-Family homes receiving DTE electric, gas, or both)
- Heat pump installations must be made in homes with existing electric heating
- EEA Installations can not be submitted separately to market rate programs (e.g., HVAC or INWIN)
- Both Homeowners and Renters eligible for EEA Program

Key Difference between EEA and other DTE programs

EEA Rebates are paid to Program Partners, not directly to Contractors

- Program Partners are nonprofit organizations both large and small across DTE service territory
- Contractor relationship is maintained by Program Partners

DTE Program Contact Information

DTE Website and Catalog

Limited Income Assistance - EEA | DTE Energy

Program Phone and Email

(866) 796-0512
energy_savings@dte.com

Contacts

Program Manager: Noah Purcell – noah.purcell@icf.com
Deputy Program Manager: Cara Freitag – cfreitag@seelllc.com
Contractor Management: Smith Her – smith.her@icf.com

Consumers Energy Multifamily Program

Heat Pump Water Heaters Incentives

SECTION 4: IN-UNIT HEAT PUMP WATER HEATER TANKS

Specifications

- Heater must replace a standard efficiency electric resistance water heater.
- New heater must be ENERGY STAR® Qualified and meet the qualifying efficiency rating listed in the measure name.
- Storage capacity must be ≤55 gallons

ID	MEASURE	$	QTY
WT401	ENERGY STAR® Heat Pump Water Heater, UEF ≥2.0	$500.00 / Unit	
WT402	ENERGY STAR® Heat Pump Water Heater, UEF ≥2.5	$550.00 / Unit	
WT403	ENERGY STAR® Heat Pump Water Heater, UEF ≥3.0	$600.00 / Unit	
WT404	ENERGY STAR® Heat Pump Water Heater, UEF ≥3.5	$650.00 / Unit	

Mark Rate

Income Qualified

SECTION 4: IN-UNIT HEAT PUMP WATER HEATER TANKS

Specifications

- Heater must replace a standard efficiency electric resistance water heater.
- New heater must meet the qualifying efficiency rating listed in the measure name.
- Storage capacity must be ≤55 gallons.

ID	MEASURE	$
WT401	ENERGY STAR® Heat Pump Water Heater, UEF ≥2.0	$1,700.00 / Unit
WT402	ENERGY STAR® Heat Pump Water Heater, UEF ≥2.5	$1,900.00 / Unit
WT403	ENERGY STAR® Heat Pump Water Heater, UEF ≥3.0	$2,100.00 / Unit
WT404	ENERGY STAR® Heat Pump Water Heater, UEF ≥3.5	$2,200.00 / Unit

Air Source Heat Pump Incentives

Mark Rate

SECTION 4: AIR SOURCE HEAT PUMPS

Specifications

- Incentives are available to install replacement air source heat pumps that meet or exceed the SEER2 listed in the application. They can be either split system or single package units.
- In-unit installations require the completion of the "In-Unit Installations" sheet on Appendix B.
- Existing equipment efficiency must be less than or equal to 14.3 SEER 2 and 7.5 HSPF2.
- All packaged and split system cooling equipment must meet AHRI standards (210/240, 320, or 340/360), be UL listed, and use a minimum ozone-depleting refrigerant. Split system efficiency must be for air handling and condensing unit combined. Incentives are per ton of refrigeration.

ID	MEASURE	$	QTY	TOTAL
HV401	Air Source Heat Pump - No Cooling + Electric Heat	$550.00 / Ton		
HV402	Air Source Heat Pump - Central Air + Electric Heat	$600.00 / Ton		
HV403	Air Source Heat Pump - Room AC + Electric Heat	$700.00 / Ton		
HV404	Air Source Heat Pump - SEER2 15.2	$20.00 / Ton		
HV405	Air Source Heat Pump - SEER2 16	$40.00 / Ton		
HV406	Air Source Heat Pump - SEER2 17	$60.00 / Ton		
HV407	Air Source Heat Pump - SEER2 18	$75.00 / Ton		
HV408	Air Source Heat Pump - SEER2 19	$90.00 / Ton		
HV409	Air Source Heat Pump - SEER2 20	$105.00 / Ton		
HV410	Air Source Heat Pump - SEER2 21	$120.00 / Ton		
HV411	Air Source Heat Pump - SEER2 22	$130.00 / Ton		
HV412	Air Source Heat Pump - SEER2 23	$135.00 / Ton		

Income Qualified

SECTION 4: AIR SOURCE HEAT PUMPS

Specifications

- Incentives are available to install replacement air source heat pumps that meet or exceed the SEER2 listed in the application. They can be either split system or single package units.
- In-unit installations require the completion of the "In-Unit Tally" sheet on Appendix B.
- Existing equipment efficiency must be less than or equal to 14.3 SEER 2 and 7.5 HSPF2.
- All packaged and split system cooling equipment must meet AHRI standards (210/240, 320, or 340/360), be UL listed, and use a minimum ozone-depleting refrigerant. Split system efficiency must be for air handling and condensing unit combined. Incentives are per ton of refrigeration.

ID	MEASURE	$	QTY	TOTAL
HV401	Air Source Heat Pump - No Cooling Electric Heat	$1800.00 / Ton		
HV402	Air Source Heat Pump - Central Air Electric Heat	$2000.00 / Ton		
HV403	Air Source Heat Pump - Room AC Electric Heat	$2200.00 / Ton		
HV404	Air Source Heat Pump - SEER2 15.2	$65.00 / Ton		
HV405	Air Source Heat Pump - SEER2 16	$135.00 / Ton		
HV406	Air Source Heat Pump - SEER2 17	$200.00 / Ton		
HV407	Air Source Heat Pump - SEER2 18	$250.00 / Ton		
HV408	Air Source Heat Pump - SEER2 19	$300.00 / Ton		
HV409	Air Source Heat Pump - SEER2 20	$350.00 / Ton		
HV410	Air Source Heat Pump - SEER2 21	$400.00 / Ton		
HV411	Air Source Heat Pump - SEER2 22	$450.00 / Ton		
HV412	Air Source Heat Pump - SEER2 23	$480.00 / Ton		

Cold Climate Heat Pump Incentives

Mark Rate

SECTION 5: COLD CLIMATE HEAT PUMPS

Specifications

- Existing equipment efficiency must be less than or equal to 14 SEER2 and 8.2 HSPF2.
- All packaged and split system cooling equipment must meet AHRI standards (210/240, 320, or 340/360), be UL listed, and use a minimum ozone-depleting refrigerant. Split system efficiency must be for air handling and condensing unit combined. Incentives are per ton of refrigeration.
- In-unit installations require the completion of the "In-Unit Installations" sheet on Appendix B.
- Heat Pumps must be NEEP qualified
- Cold Climate Air Source Heat Pumps must maintain COP of 1.5 at 5 degrees F

ID	MEASURE	$	QTY	TOTAL
HV501	Cold Climate Air Source Heat Pump - No Cooling Electric Heat	$250.00 / Ton		
HV502	Cold Climate Air Source Heat Pump - AC Electric Heat	$290.00 / Ton		
HV503	Cold Climate Air Source Heat Pump - Central Air Electric Heat	$335.00 / Ton		
HV504	(Model SEER2 - 14.3) x Tonnage	$13.00 / (Diff x Ton)		
HV505	(Model HSPF2 - 7.5) x Tonnage	$35.00 / (Diff x Ton)		

Income Qualified

SECTION 5: COLD CLIMATE HEAT PUMPS

Specifications

- Existing equipment efficiency must be less than or equal to 14 SEER2 and 8.2 HSPF2..
- All packaged and split system cooling equipment must meet AHRI standards (210/240, 320, or 340/360), be UL listed, and use a minimum ozone-depleting refrigerant. Split system efficiency must be for air handling and condensing unit combined. Incentives are per ton of refrigeration.
- In-unit installations require the completion of the "In-Unit Tally" sheet on Appendix B.
- Heat Pumps must be NEEP qualified
- Cold Climate Air Source Heat Pumps must maintain COP of 1.5 at 5 degrees F

ID	MEASURE	$	QTY	TOTAL
HV501	Cold Climate Air Source Heat Pump - No Cooling Electric Heat	$950.00 / Ton		
HV502	Cold Climate Air Source Heat Pump - AC Electric Heat	$1075.00 / Ton		
HV503	Cold Climate Air Source Heat Pump - Central Air Electric Heat	$1150.00 / Ton		
HV504	(Model SEER2 - 14.3) x Tonnage	$40.00 / (Diff x Ton)		
HV505	(Model HSPF2 - 7.5) x Tonnage	$125.00 / (Diff x Ton)		

OUTREACH TEAM

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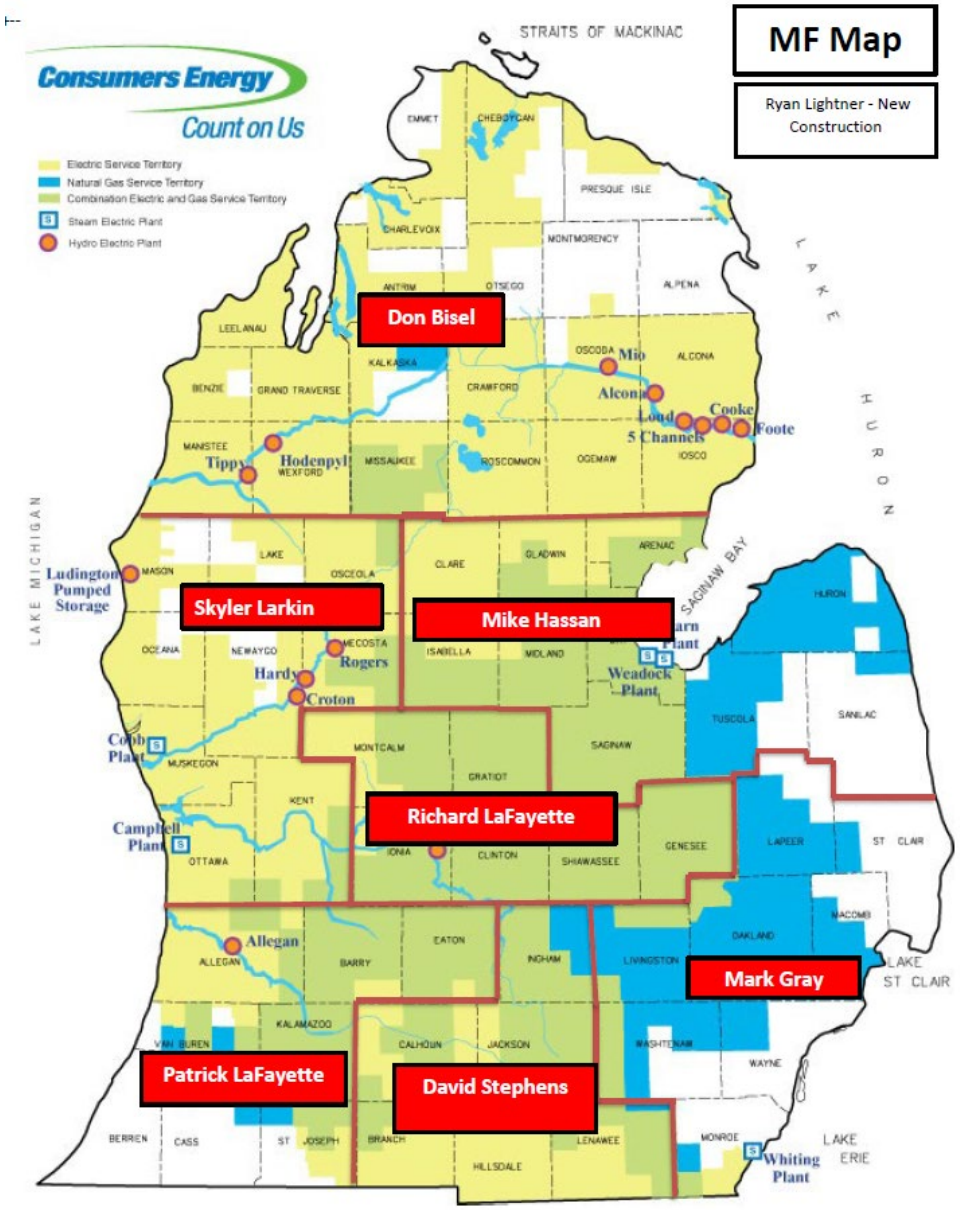


THANK YOU!

Michigan Saves Financing and Electrification

Mac McCabe

248-249-3775

MichiganSaves.org

Michigan Saves®
The Nation's First Nonprofit Green Bank

What Makes Michigan Saves Different?

- Nonprofit green bank, we are local
- Loss reserve for lenders
- Oversight of authorized contractors
- Program guidelines and
- quality assurance
- Excellent customer service, you can talk to a person
- Special programs (Oakland Saves, Go Green, Access Energy)

Why Michigan Saves?

- Low contractor fee- 2.49%
- Low interest rate- as low as 6.5%
- Long terms (15 years on loans over $15K)
- High approval rate- 65% (credit challenged program starts at 600)
- Leads from our contractor locator
- Easy-to-use software (immediate decision)

Electrification Program

- Provides leads for contractors.
- Teaches contractors electrification basics.
- For energy auditors and contractors that install heat pumps (water heater, air source, geothermal), solar, electrical panel upgrades and induction stoves.
- It breaks down the myths about electrification. For example: heat pumps don’t work in cold weather, Michigan doesn’t have enough sun for solar and the grid can’t handle electrification.

Electrification Program

- There are 5 videos and 5 tests. Score 80% or higher to get a passing grade.
- Earn a badge that is displayed on our contractor locator. The contractor can also use the badge in any marketing materials.
- Leads from around Michigan will be funneled to the Michigan Saves contractor locator. Leads will come from our partners, like Ann Arbor, but also from direct marketing efforts such as Google Ads.
- Badged contractors have access to exclusive resources.

Kelley Brothers LC	• Heating, Ventilation, and Air Conditioning (HVAC) • Geothermal • Duct Sealing • Boilers • Water Heaters • Generators • **Heat Pumps/Mini-splits**	Contact Kelley Brothers LC 37100 Amrhein Rd, Livonia, MI 48150-1107 734-462-6266 www.kelleybrothersllc.com 26.85 miles away	★★★★★ 4.7 3 Reviews
Expert Heating & Cooling Michigan Saves ELECTRIFICATION BADGE	• Heating, Ventilation, and Air Conditioning (HVAC) • **Heat Pumps/Mini-splits** • Electrification	Contact Expert Heating & Cooling 24400 Northline Rd, Taylor, MI 48180-4588 734-676-4488 expertheatcool.com 37 miles away	★★★★★ 5 22 Reviews

Thank you.

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MICHIGAN DEPARTMENT OF
ENVIRONMENT, GREAT LAKES, AND ENERGY

Michigan Home Energy Rebate Program: Overview

JOSEPH CASTELLANOS, WALKER-MILLER ENERGY SERVICES,
JCASTELLANOS@WMENERGY.COM

MiHER Program Goals

EGLE has identified the following guiding principles to shape the design, structure, implementation, and desired outcomes of Michigan's Home Energy Rebate (MiHER) Programs:

The program is committed to servicing households with <80% Area Median Income (AMI) located in disadvantaged communities.

What Homes Qualify for MiHER?

Primary Homes:
A homeowner can only apply for their primary homes only. Secondary homes do not qualify.

Condos:
Qualify for the program. There may be additional permission from the HOA if work is going to be performed to the outside of building or to the outside appliances (A/C and or Heat Pumps)

Renters:
Qualified renters may participate in the program and will have to agree to the landlord/tenant agreement

MiHER Program: Two Rebates Pathways

HOMES rebates are primarily focused on home weatherization measures. HEAR rebates are primarily focused on electrification measures. Rebates cannot be used from both HOMES and HEAR for the same measure.

50121

Home Efficiency Rebates Program (HOMES)

Total allocation $105,696,321

Who is eligible?

Low to moderate income households, defined as:
- 80% area median income (AMI) or less = 100% of project cost covered
- 80+% area median income = 50% of project cost covered

What is eligible?

- Insulation, Air Sealing
- Windows, Doors, Skylights
- Furnaces, Boilers, Central A/C
- Heat Pump
- Water Heaters
- Wood Pellet/Stove
- Pool Pump
- ENERGY STAR Appliances

Max rebate amounts

Modeled Energy Savings	<80% AMI	80+%
20-34%	$12,000	$2,000
35+%	$20,000	$4,000

50122

Home Electrification and Appliance Rebates (HEAR)

Total allocation $105,291,160

Who is eligible?

Low to moderate income households, defined as:
- 80% area median income (AMI) or less = 100% of project cost covered
- 80-150% area median income = 50% of project cost covered

What is eligible?

Max Rebates per Measure:
- Heat pump HVAC - $8,000
- Heat pump water heater - $1,750
- Heat pump clothes dryer - $840
- Electric stove/cooktop - $840
- Breaker box - $4,000
- Electric wiring - $2,500
- Weatherization - $1,600

Max rebate amounts

- Max Consumer Rebate: $14,000
- Max Contractor Rebate: $500
- Max multi-family rebate: up to $14,000 a unit

HOMES Measures

Air Conditioning – Central	Clothes Dryer
Air Sealing	Dishwasher
Clothes Washer	Duct Sealing
Doors	EPA Certified Wood Stove
Energy Star Boiler	Furnace
Freezer	Heat Pump – Geothermal
Heat Pump – Central	Insulation
Heat Pump – Variable Speed Mini Split	Refrigerator
Pool Pump	Stove Range
Skylights/Windows	Water Heater
Ventilation Fans	Additional Project Costs

HEAR Measures

Measure	Low Income Rebate (<80% AMI)	Moderate Income Rebate (>=80% AMI)
Heat Pump – Central/Geothermal/Mini Split	$8,000	$4,000
Air Sealing/Insulation/Ventilation	$1,600	$800
Heat Pump Water Heater	$1,750	$875
Electric Stove/Cooktop/Oven	$840	$420
Heat Pump Clothes Dryer	$840	$420
Electric Panel	$4,000	$2,000
Electrical Wiring	$2,500	$1,250

MiHER Program: Contractor Overview

Due to requirements set by the Department of Energy requiring one set of project data and one invoice to be submitted per project (even if the project included multiple trades / contractors), the MiHER Program will delineate contractors participating in MiHER into the two following categories:

Primary Contractor*

A Primary Contractor (PC) will be responsible for submitting documentation required to claim the rebate for a home including the energy assessment data and energy model. If energy upgrades in a home involve multiple trades and multiple contractors (e.g. HVAC and Air Sealing), the MiHER program requires that a single invoice is submitted by the PC which incorporates all trades. The PC can subcontract any of the work to ensure the project will be completed successfully and holistically.

Supporting Contractor*

Supporting Contractor (SC) participates in the program in their specific field, such as Energy Audits, insulation and air sealing or HVAC. The SC will be responsible for working with/under a PC and will provide documentation of their work which is required for the rebate capture.

*The Primary Contractor may also act as a Supporting Contractor on projects, based on need

Contractor Requirements: General

The following series of general requirements safeguard consumer protection and program quality, ensuring a straightforward process for registered contractors.

Proof of Business and Payment

- Provide your businesses federal unique entity identifier (UEI) – ***Primary Contractor Only***
- Provide your MI Statewide Integrated Governmental Management Applications (SIGMA) Vendor Account Number – ***Primary Contractor Only***
- Agree to provide a one-year warranty on all work performed
- Provide copies of business license(s) and applicable Michigan contractor's licenses. Contractors cannot have any pending actions against them and must not be debarred or noncompliant with HUD or MSHDA.
- Proof of liability, automobile and workers compensation insurance.
- Provide financial information; W-9 form (signed and dated) or EIN/tax documents, and banking information (voided check or direct deposit)

Consumer Protection and Program T&C

- Documentation of criminal background checks for all employees who will be entering homes.
- Sign and agree to the program's terms and conditions.
- Contractors accepted to the program must commit to have a minimum of one employee complete a yearly virtual training on the program. The training will cover topics like invoicing, quality assurance documentation and other program requirements.
- **OPTIONAL:** Certification of an apprenticeship program

Contractor Certifications

The following trade specific licenses and certifications are required. These requirements were collated based on standing contractor requirements from MI Saves and Weatherization Assistance Program.

Boilers:

- Boiler Install License
- Master Plumber license or Plumbing Contractor
- Mechanic Contractor License with the following classifications, Hydronic heating,
  cooling and process piping, HVAC equipment

Electrical:

- Masters' electrician or electric contractor licenses

Energy Auditors:

- BPI Building Analyst Professional, RESNET, LIUNA Auditor or WAP Level 1 or 2 Inspector

HVAC/R:

- Mechanic Contractor License with the following classifications, Hydronic heating, cooling and process piping, HVAC equipment. For Geothermal heat pumps also need limited heat service, limited refrigeration and AC service.
- Demonstration of the ability to secure an extended manufacturer warranty for the product(s) being installed

Water Heaters:

- Mechanic Contractor License with the following classifications, Hydronic heating, cooling and process piping, HVAC equipment
- Master plumber licenses or Plumbing Contractor License
- Demonstration of the ability to secure an extended manufacturer warranty for the product(s) being installed

Windows/Doors, Insulation and Air Sealing:

- Residential builders or Residential Maintenance and Alteration licenses
- Where applicable (ex. Air Sealing work or spray foam insulation) provide a third-party certification demonstrating a contractor's ability to perform diagnostic testing

LEAD Paint Work:

- LEAD Safe Certification

EGLE

Home Assessment Requirements

A home assessment is required for all MIHER projects. Depending on the pathway, the assessment has different requirements.

All **HOMES** Modeled Assessments shall require:

- A BPI-2400 Calibrated Energy Assessment: MIHER BPI-2400 Calibrated Energy Assessment Checklist.
  - DOE-Approved Software: Snugg Pro, OptiMiser & PSD
- 12 months utility data
- $400 compensation

All **HEAR** Assessments shall require:

- An Uncalibrated Energy Assessment: MIHER Uncalibrated Energy Assessment Checklist
- 12 months utility data
- A Utility Impact Bill Analysis (Only if a Heat Pump or Heat Pump Water Heater is Installed)
- $250 compensation

All **Walk-Away** assessments shall require:

- MiHER Contractor Walk Away Evaluation
- $125 compensation

Materials Recycling Commitment

The MiHER program also provides an opportunity to support an advanced circular economy to create new companies and jobs in the state and divert 45% of our current waste stream from landfills.

All Contractors participating in the program are required to sign a Recycling Pledge as part of the MiHER program.

Pledge Commitments:

- Make waste reduction and recycling a part of our daily professional work routine.
- Educate staff, colleagues, vendors, and clients on the importance of waste reduction and recycling.
- Recycle or donate appliances with refrigerants removed and disposed of appropriately.
- Work with clients to use their available municipal recycling programs to keep materials out of landfills.
- Put the right materials in client curbside Recycling carts or community drop off centers.

EGLE

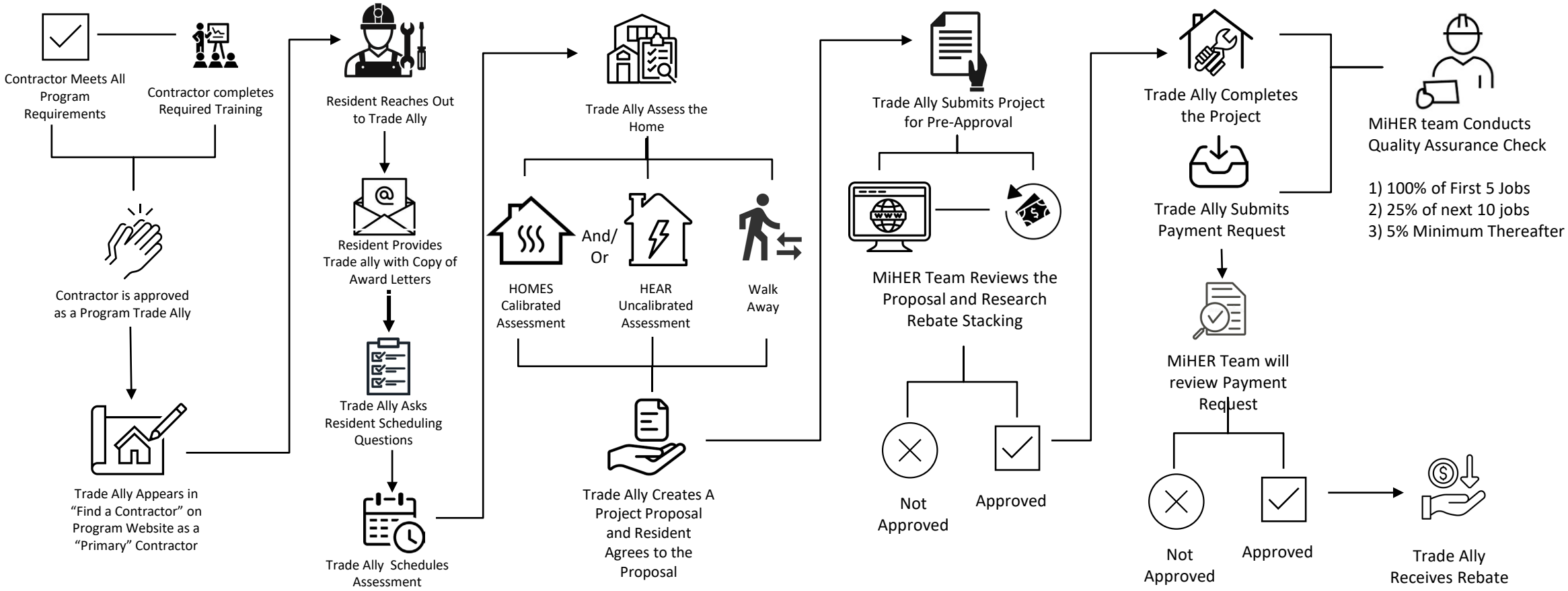
Disadvantaged Communities Contractor Incentive

Qualifying Activity	HEAR Incentives	HOMES Incentives
Substantial installation located within a disadvantaged community (excludes installations of electric stoves and electric heat pump dryers) per dwelling unit	$150	$200
Installation of one or more electric heat pump water heaters	$150	$0
Installation of one or more electric heat pumps for space heating and cooling per dwelling unit – ducted	$150	$0
Installation of one more electric heat pumps for space heating and cooling per dwelling unit – unducted	$150	$0
Installation of one electric stove, cooktop, range, or oven	$0	$0
Installation of one electric heat pump clothes dryer	$0	$0
Installation of one or more electric load service center	$150	$0
Installation of insulation per dwelling unit	$150	$0
Installation of air sealing and materials to improve ventilation per dwelling unit	$150	$0
Installation of electric wiring per dwelling unit	$150	$0
Total maximum incentive per dwelling unit	$500	$200

Contractors will receive an incentive for servicing households located in "disadvantaged communities" as defined by HUD.

Maximum Project Incentive: $500

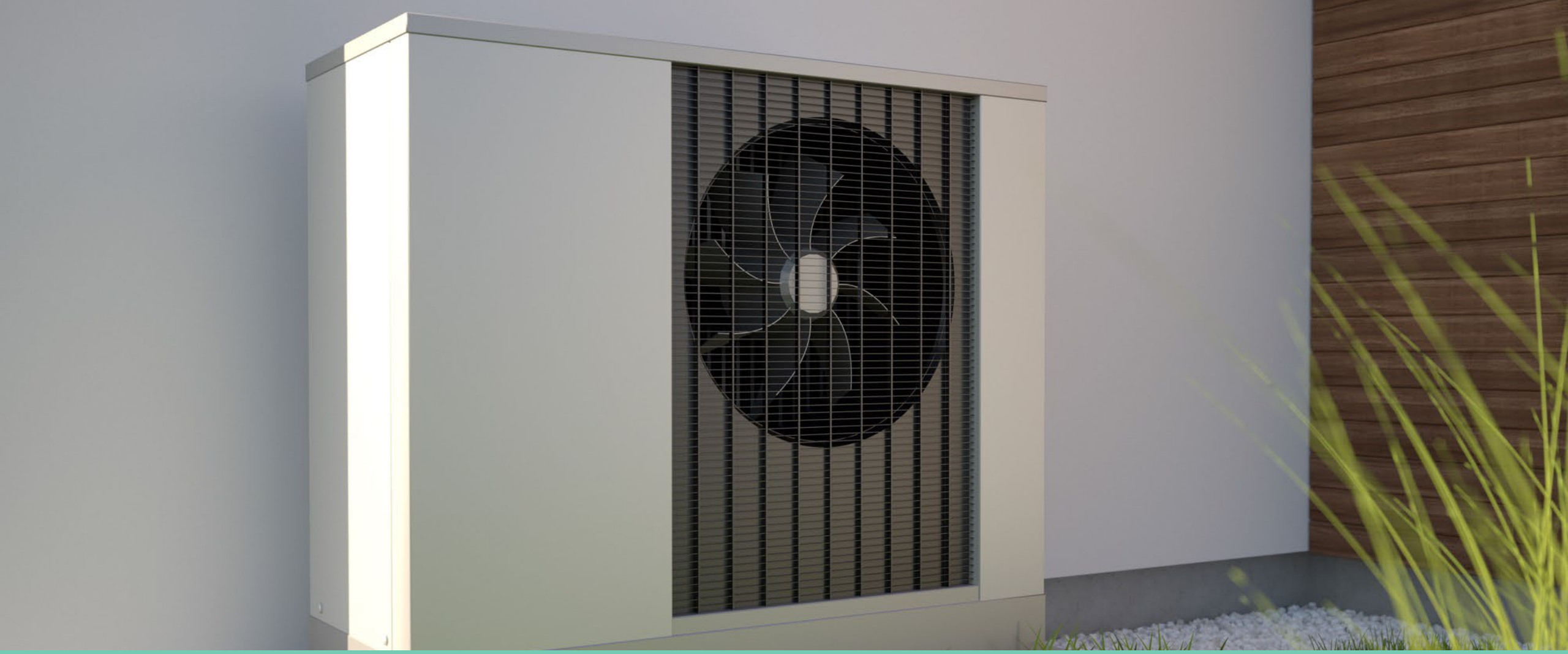
Contractor Journey



Questions

MI HEAT PUMP COLLABORATIVE

BREAK



VALUE OF HEAT PUMPS

INDUSTRY DISCUSSION

Meet today's panelists!

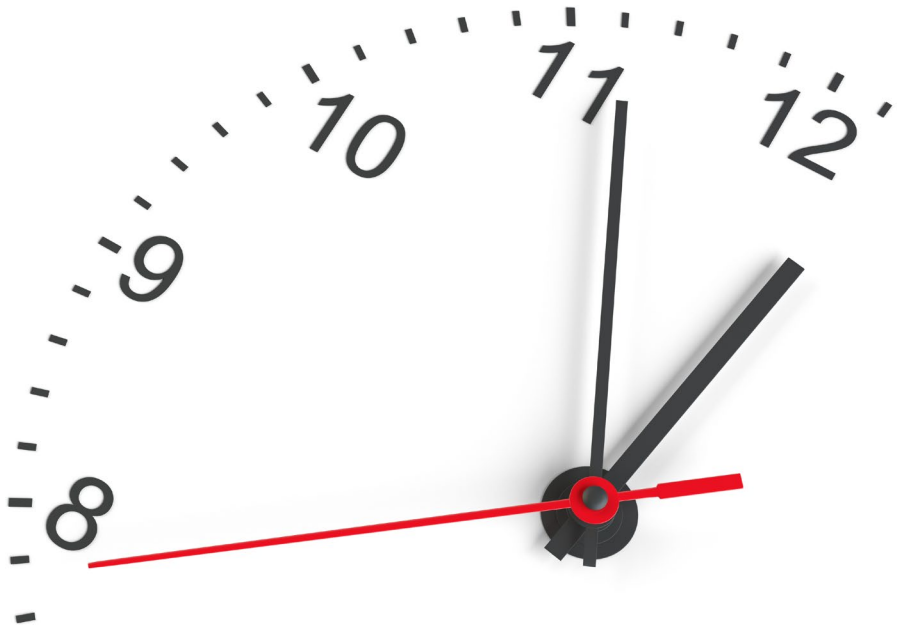
Larry Rosen
Williams Distributing, Daikin

Dianna Cacko
Mitsubishi

JT Stewart
Slipstream

AFTERNOON AGENDA

Time	Session
1:00 - 2:00	Destination Training 1
1:00 – 2:00	Friends of the Collaborative Breakout
2:00 – 2:15	Break
2:15 – 3:15	Designation Training 2
3:15 – 3:30	Break
3:25 – 4:30	Designation Training 3 + Closing



MI HEAT PUMP COLLABORATIVE

LUNCH

We want your feedback!

Please follow this QR code to the event evaluation to help us improve future events!

Why Offer Heat Pumps?

(Designation Training #1)

MI

HEAT PUMP COLLABORATIVE

Connect With Me

Friends of the Collaborative Session

See Elena for Breakout Room

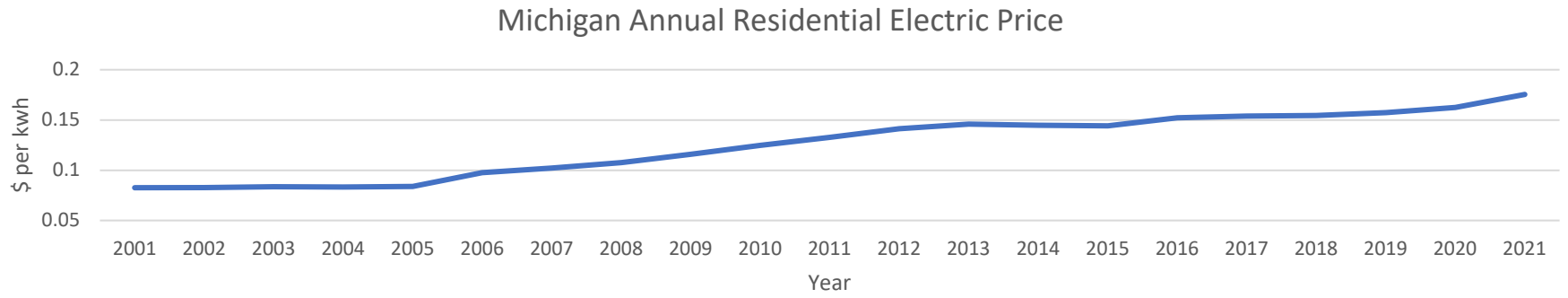
MI

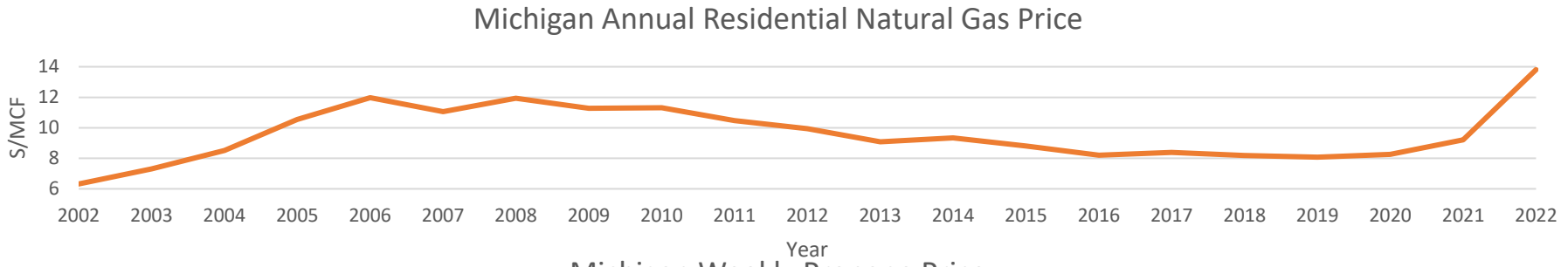
HEAT PUMP COLLABORATIVE

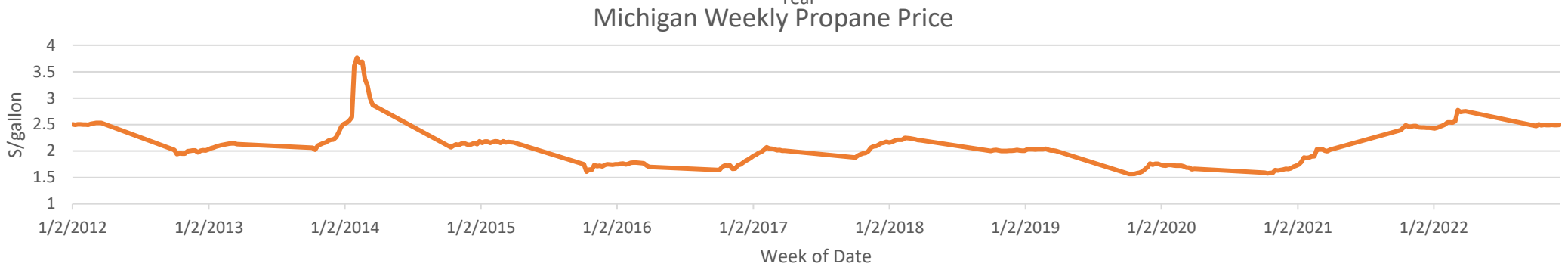
Overview of Market Opportunities

- Electric heat displacement
  - Electric furnaces
  - Electric baseboard
  - Space heaters
- Propane displacement
- Wood heat displacement
- AC add on or replacement
  - ASHP economic
  - VCHP comfort and carbon emissions

Heating Fuel Costs



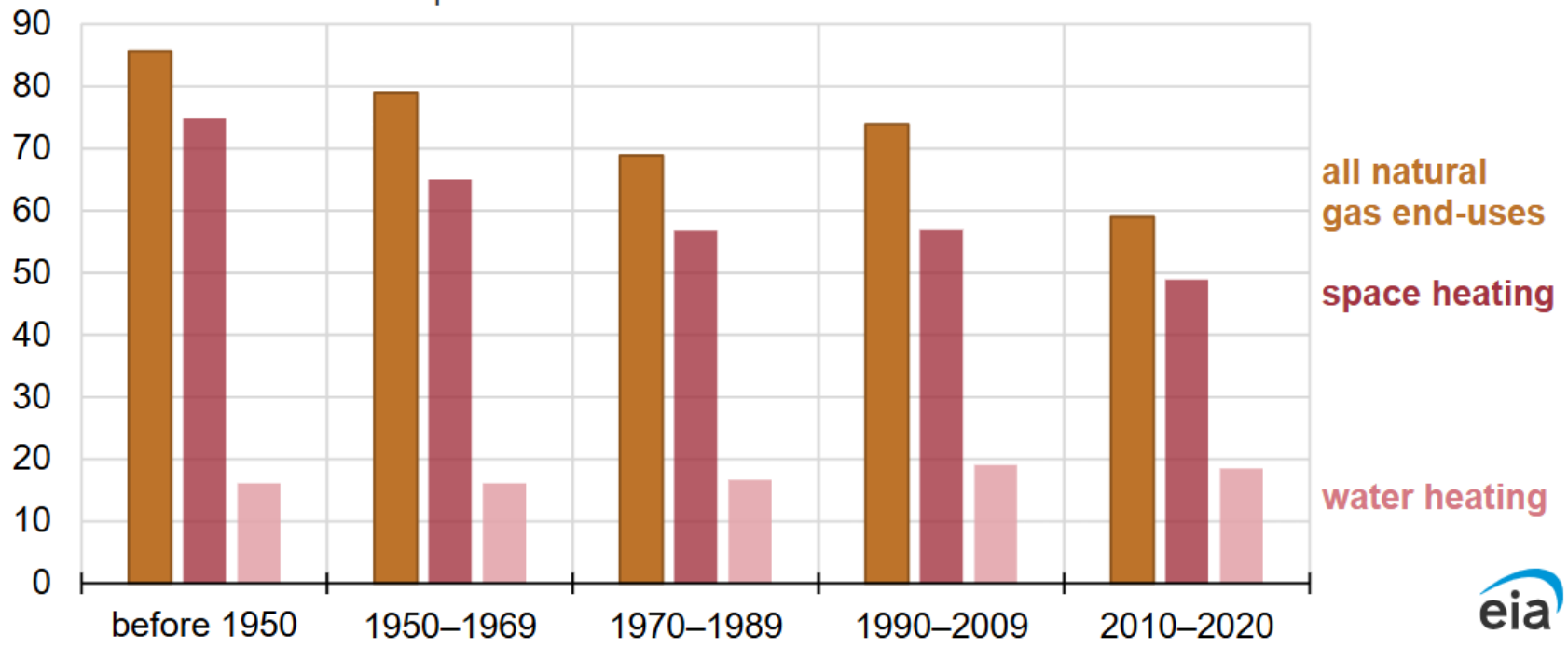




AUGUST 7, 2023

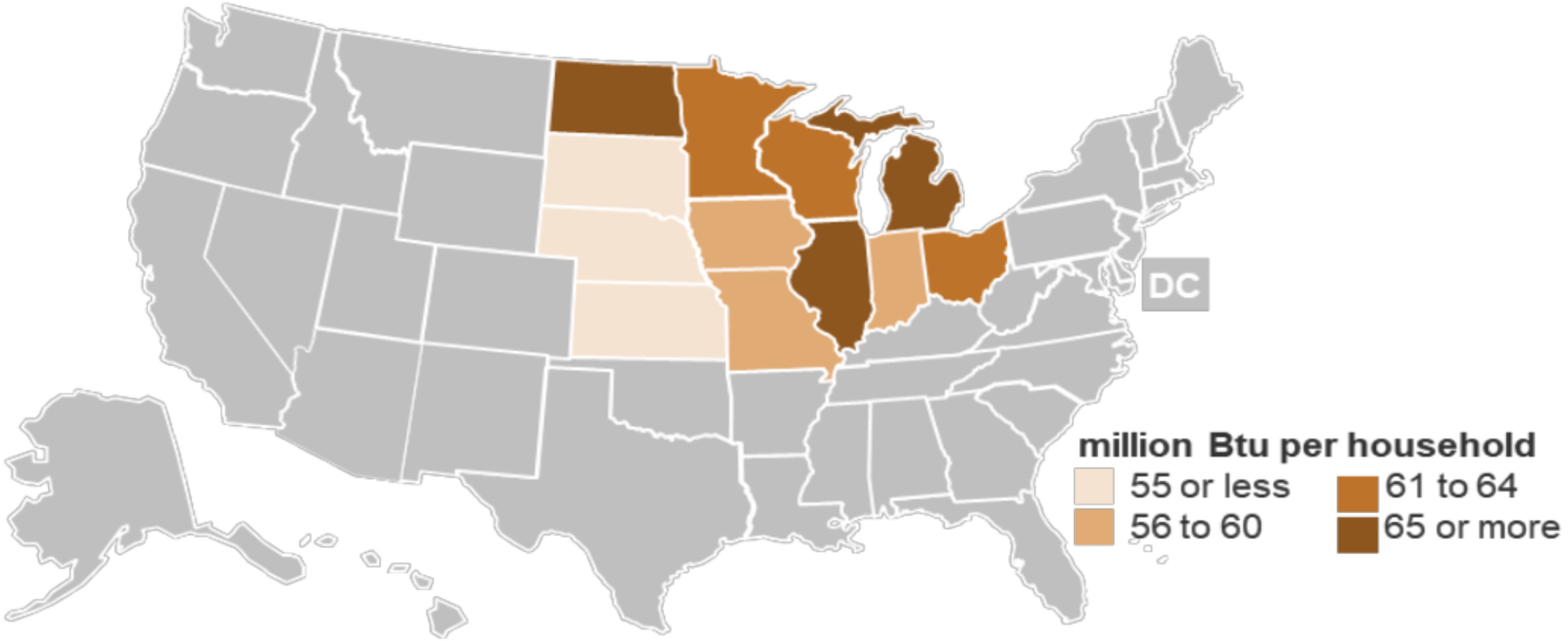
Midwest homes, notably older homes, consume more natural gas than most other U.S. homes

Residential natural gas consumption, U.S. Midwest region (2020)
million British thermal units per household



Data source: U.S. Energy Information Administration, *2020 Residential Energy Consumption Survey*
Note: Average consumption for homes that use natural gas for the specified end use.

Natural gas consumption for space heating, U.S. Midwest (2020)



Data source: U.S. Energy Information Administration, *2020 Residential Energy Consumption Survey*
Note: Average consumption for homes that use natural gas for space heating. Btu=British thermal units.

Heat pump options by home type

Large Home or Large Lot:
Geothermal or Multi-zone heat pump

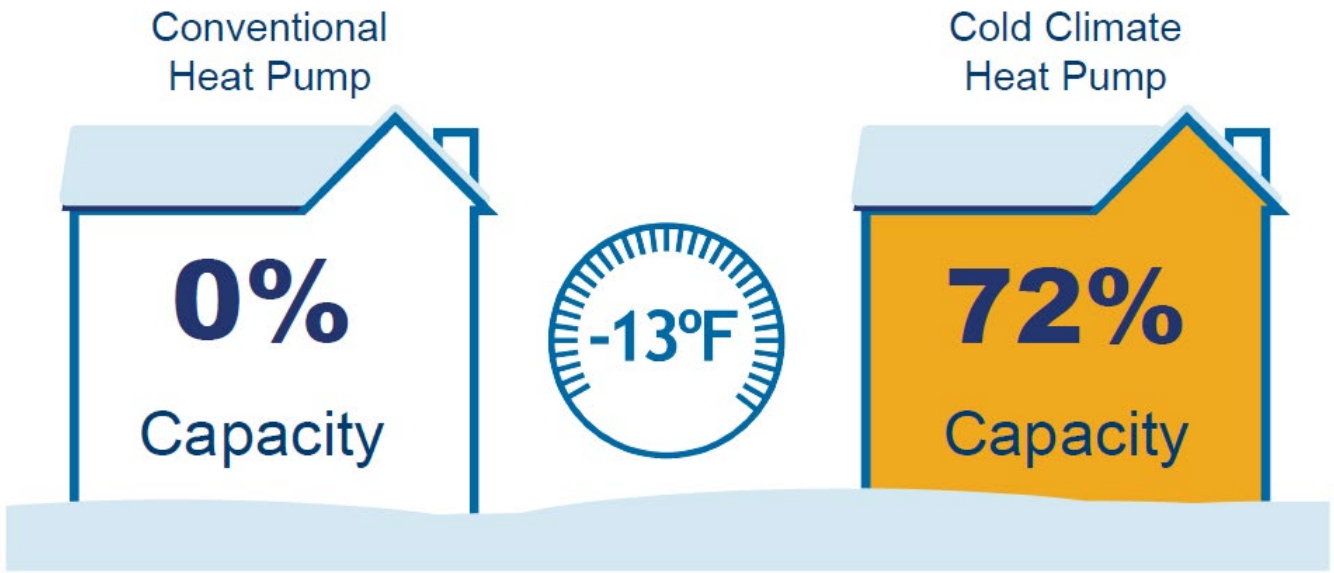
Average Size Home *well insulated*:
Air Source heat pump / Air to water heat pump

Adding Cooling and displacement of Baseboard heating:
Mini-Split / Multi-Split solutions

Replacing Gas Furnace and AC
Dual fuel Applications

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



Replacements are Opportunities for Change

67%

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

source: 6th annual NW DHP Project Market Progress Report

Building a replacement culture increases business profits

- Repair yields are 20-40% net profit
- Replacement yields are average 20% net profit of higher total
- Heat pumps increase the ticket total
- Rebates and tax credits **reduce consumer cost**
- Heat pumps can **solve larger comfort issues**
- Quality replacements will increase **Customer Referrals**

Repair VS Replace

- Contactor
- Capacitor
- Condenser fan motor
- Low refrigerant

- $1,000

- AC Condenser
- Indoor Coil
- Installation costs

- $5,000

- HP Condenser
- Indoor Coil
- Installation costs

- $7,500

Good/Better/Best Sales

- Single or 2 Stage HP
- Standard air handler / furnace and coil
- Controls package
- Minimum to meet needs and existing system set up

- Variable speed heat pump
- Matching air handler/ Furnace and coil
- Control package
- Minimum to hit rebate requirements

- Cold climate Variable speed heat pump
- Matching air handler / Furnace and Coil
- Control package
- Advanced comfort performance and higher rebate/tax credit tier

Heat Pump Benefits – Big Picture

Heating and cooling all in one system

Heating and cooling operational cost savings

Improved comfort

Air filtration

Reduced carbon emissions

Set Homeowner Expectations

Benefits and Challenges of HP Adaptation

- Increased Customer satisfaction
  - Comfort improvements
  - Consumer savings
- More customers making referrals
  - Reduced advertising costs
- Need for sizing, sales, and product training
  - Low-cost training is available through distributors, online from manufactures, utilities

Customer Demand

When thinking about incoming calls for estimates over the last few years have customer inquiries for heat pumps?

- A. Increased
- B. Decreased
- C. Stayed the same
- D. Unknown

MI HEAT PUMP COLLABORATIVE

“People purchase based on emotion but want to justify the purchase based on facts.”

Suzanne Shelton, The Shelton Group

Now What?

1

Identify the benefits that resonate

2

Recognize the emotional ties

3

Support with features and facts

Heat Pump Categories

Air Source Heat Pumps

Air to Water Heat Pumps

Ground Source Heat Pumps

Heat Pump Water Heaters

Air Source Heat Pumps

- Non-Ducted
  - Mini/Multi Splits
- Short Ducted Mini-Split
- Ducted systems
  - Central all electric
  - Central dual fuel
- Cross over solutions
  - Dual fuel with mini/multi outdoor unit
- Air to Water Heat Pumps
  - Boiler replacements
  - Forced air hydronic systems
- Additional Heat Pumps
  - Packaged terminal
  - Window units

Non-Ducted Air Source Heat Pumps

Customer need: Increase comfort, reduce costs

1:1 Mini-Split Units

- Excellent for open spaces
- No thermal loss to duct work or unconditioned space

1:2-4 Multi-head Units

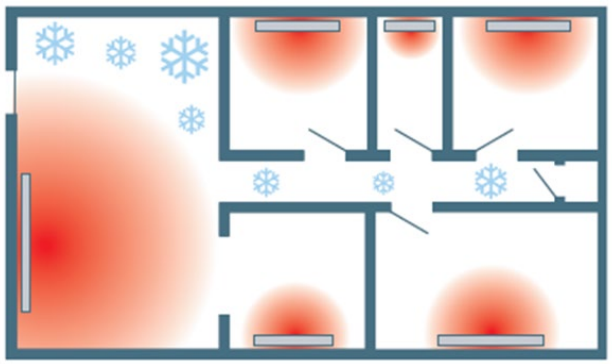
- Not optimal for highest efficiency
- Helpful under limited conditions

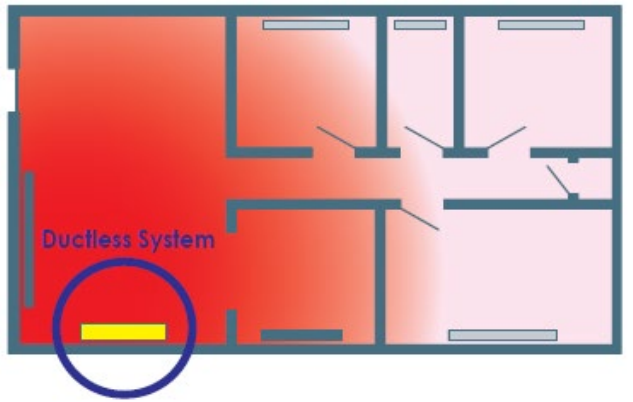
PTHP

- Fits in an existing PTAC sleeve

Best Uses

- Small weatherized homes
- Uncomfortable rooms
- Seasonal use cabins





Centrally-Ducted Air Source Heat Pumps

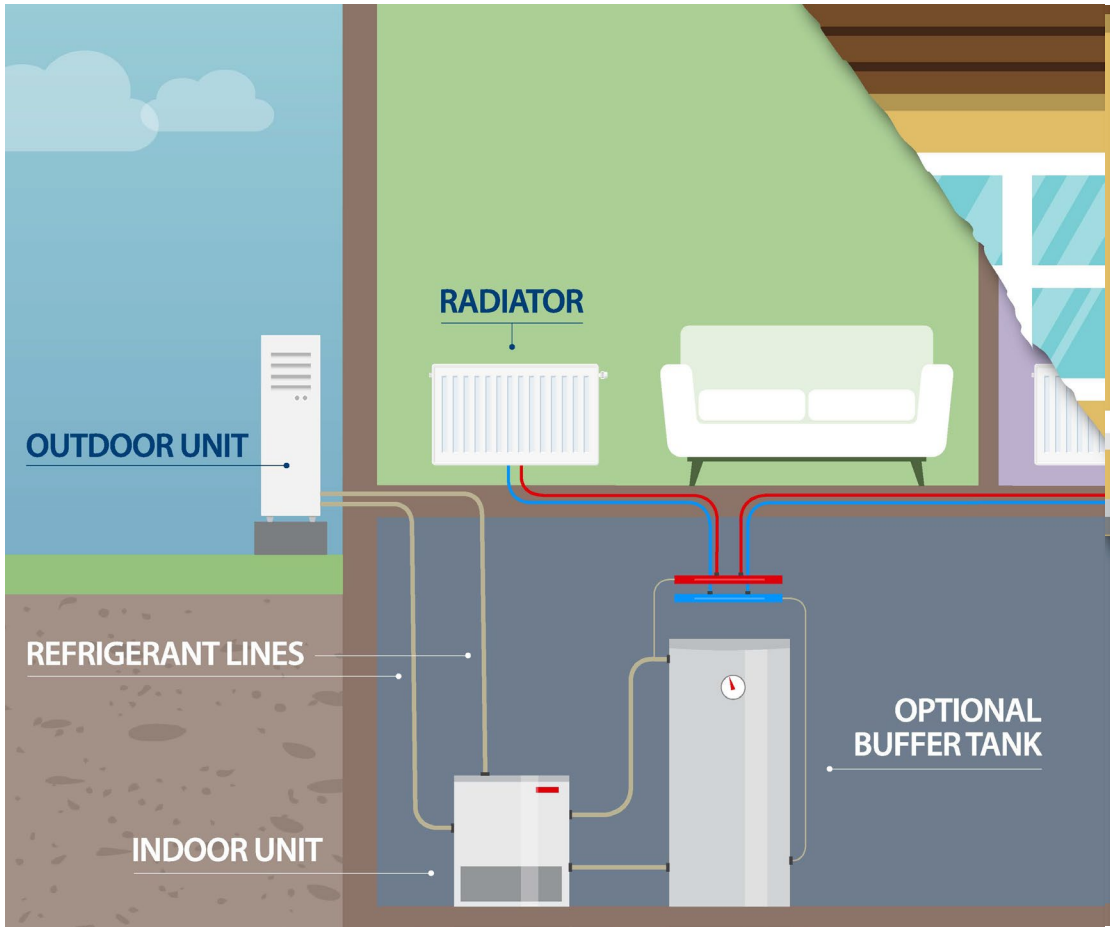
- **Standalone**: air source heat pump + new coil, existing furnace kept.
  - Caution: there are only a few products that meet eligibility for rebates in this category
  - The eligible models in this category are inverter based
- **Single Stage**
- **Two/Three Stage**
- **Variable Capacity (Inverter Compressors)**
  - May or may not be cold climate rated by NEEP
  - Can include cross over solutions from Bryant/Carrier and Mitsubishi

Air-to-Water Heat Pumps

Air to Water Heat Pumps

- No ground loop
- More efficient than Air to Air
- Multiple distribution options
  - In floor
  - Radiators
- Smaller distribution lines than forced air
- Optional
  - Forced air cooling
  - Domestic hot water

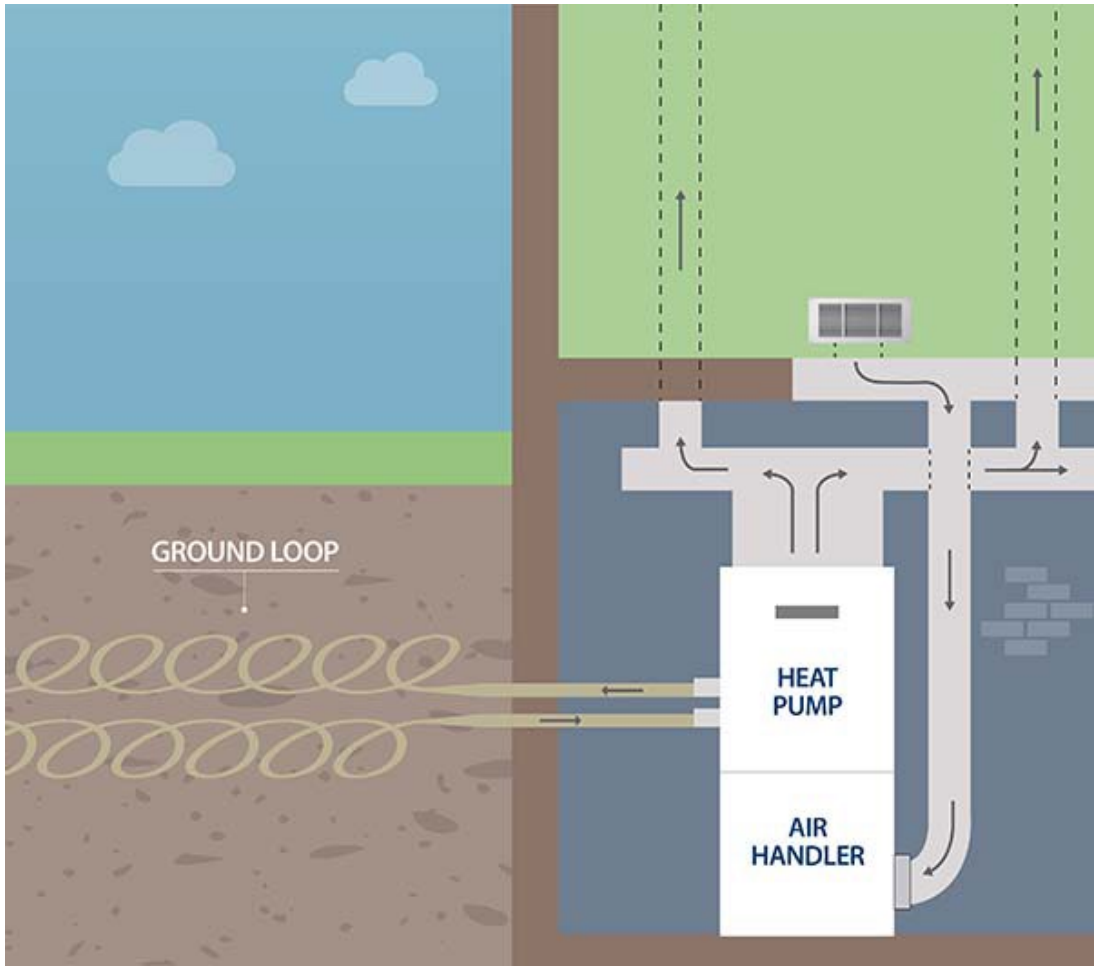
- Best uses
  - Small homes with lower loads
  - Existing low temperature radiant heat
  - Outdoor wood boiler replacement
  - New construction



Ground Source Heat Pumps

Ground Source Heat Pumps

- Closed loop
  - Higher upfront cost for loop installation
    - Horizontal straight
    - Horizontal Slinkey (shown)
    - Vertical
    - Lake loops
  - Lower operation cost
  - Water quality issues not a problem
  - Uses significantly less backup heat
    - More stable ground temperature

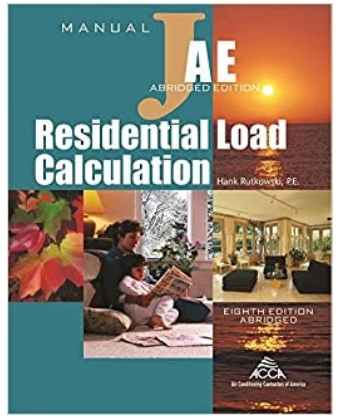


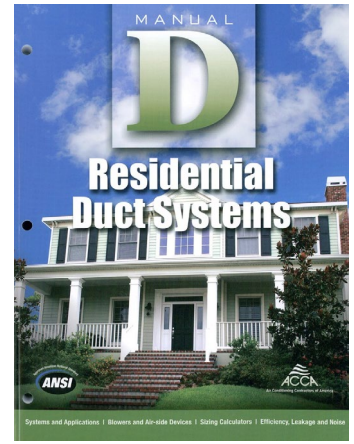
MI HEAT PUMP COLLABORATIVE

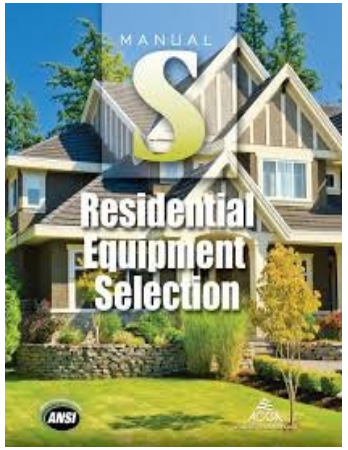
APPLICATION CONSIDERATIONS

Challenges

- Collecting enough information for accurate load calculations
- Determining when to size for heating vs. cooling
- Distribution (ductwork) not properly designed for variable speed equipment
- Belief that heat pumps aren't a viable year-round heating technology in cold climates
- Inaccurate expectations of how heat pumps should operate, leading them to not use them/overuse them, or request unnecessary service calls
- Selecting the right heat pump for the use case
- Selecting the best control strategy for the customer and equipment
- For more resources visit: www.acca.org/standards/approved-software







Features to Help Rationalize the Best Option

Provides both heating and air conditioning

- Capacity varies with heating and cooling needs

Advanced heat pump technology

- Inverter driven compressor
- Low ambient noise
- Works well when it is cold outside

Highest efficiency

- Heating Seasonal Performance Factor (HSPF)
- Seasonal Energy Efficiency Ratio (SEER)

Emotional Ties

- Cool new technology
- Ultra comfort
- Easy new home improvement
- No more propane delivery
- Look good/smart

And it saves money!

(easy to rationalize)

Facts to Back it Up

Up to 55% annual savings on electric bills

Possible upfront savings through utility incentives

Multiple **price options**

Cooling! High efficiency, high quality

Ductless means **simple install**

Central ducted means **reliable fuel source**

MI HEAT PUMP COLLABORATIVE

APPLICATIONS

MI HEAT PUMP COLLABORATIVE

Ducted Fossil Fuel Furnace and A/C

ASHP Use Case: Existing Furnace and AC

Typical home attributes

- 80%-95% efficient furnace
- 2-ton AC ≤13 SEER
- Existing heating fuel natural gas or propane

Questions to answer/consider

- Is existing furnace oversized?
- Are there comfort complaints and where?
- Does the ductwork need modification?
- How much time is spent at home vs. away?
- What is the heating fuel?
- Do they have climate concerns?

Dual-Fuel – Multistage ASHP and Furnace

How to achieve best cost efficiency for multistage systems

- **Size at the high end of the cooling load**
  - Minimal oversizing a ½-1 ton more than cooling need
  - Use maximum capacity at 17°F
  - Specify heat pump with ≥16 SEER efficiency
- **Furnace replacement or integrate with existing?**
  - Unless using Bosch or Mitsubishi the furnace must match manufacture compatibly
  - Replace if near end of life, or
  - If inefficient <95 AFUE without ECM blower
- **Thermostat and other controls**
  - Wherever possible, use the manufacturers' suggested thermostat
  - Customized temperature-based switchover from customer discussion

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?**
  - Furnace must match manufacturer compatibly unless standalone
  - Variable speed blowers typically needed
- **Backup heat/controls**
  - Thermostat – temperature-based switchover*
  - Integrated load-based backup heat

*use balance point or economic switchover temperature

MI
HEAT PUMP COLLABORATIVE

All Electric Furnace

Replacing Electric Furnace with ccASHP, Beneficial Electrification

All Electric ccASHP Ducted

Achieving the best operational efficiency with all electric systems

- **Start with building inspection and owner interview**
  - Air infiltration, insulation levels and quality
- **Size for heating load**
  - Maximum capacity at 5°F reported by manufacturer
  - Up North and UP use manufacturer reported maximum capacity @ outdoor design condition
- **Backup heat/controls**
  - Plenum heat sized for capacity difference between heat pump and load of home at design conditions
  - Back up for heat pump failure - you must stage electric heat to prevent overuse for supplemental heat
- **Caution:** Are there roadblocks on the path?
  - Possible panel capacity - consult envelope improvements
  - Limited room to expand supply and returns for greater air volume - ductless for some locations

Ducted ASHP Summary

- **Suggested solutions for AC replacement:** Single/two stage ≈ 16 SEER heat pump for cost-conscious customers, ccASHP ≈ 18 SEER for those seeking to reduce electric heat and propane, or eco-minded.
- **Advanced solution for comfort concerns:** Add a ductless single zone system to address basement comfort or upstairs bedroom comfort issues or offer a central system that can integrate with a ductless unit. (Mitsubishi Intelli-Heat, Carrier/Bryant Crossover Solutions)
- **Existing system treatment:** Pre-existing system is kept or upgraded to matched furnace or AC. Ducts used when in conditioned space and adequately sized for required heat pump air flow. Existing ducts in unconditioned spaces that remain in use should be sealed and insulated.
- **Sizing strategy:** Single/two stage need to size toward cooling load, variable capacity can size for heating if ductwork adequate but still not more than 115% over cooling size.
- **Equipment selection considerations:** Use manufacturer published performance at design conditions for heat pump operation to identify systems with adequate heating and cooling capacity.
- **Oversizing concerns/tradeoffs:** When minimum speed cooling capacity is over 115% of design cooling load, look for equipment with a higher ratio of heating to cooling capacity, a lower minimum capacity, or both. **Consider the existing furnace and AC size may be incorrect to start with.**

MI HEAT PUMP COLLABORATIVE

Ductless Mini and Multi-Splits

Ontonagon, Michigan

ONTONAGON VILLAGE HOUSING

CHALLENGE
Local housing commission needed an all-electric heating and cooling solution to provide year-round comfort in a climate subject to extreme cold

SOLUTION
M-Series Systems from Mitsubishi Electric

RESULT
Housing commission saves $30,000 per year and offers residents energy-efficient comfort in all seasons

Nestled in a remote part of Michigan, Ontonagon is a village sitting on the edge of Lake Superior. With a population of about 1,500, Ontonagon residents are used to beautiful but humid summers on the lake and bitter cold winters. After years of enduring expensive and uncomfortable electric-resistance heat, Ontonagon Village Housing, a subsidized housing facility, decided to consider alternative HVAC options.

"The electric bills kept getting higher, and we decided to price out bringing in natural gas lines," explained Karen Jackson, executive director, Ontonagon Village Housing. With a projected cost of nearly a million dollars, local utility provider Upper Peninsula Power Company (UPPCO) swiftly proposed a solution.

"I looked at them and said, 'Why would you want to introduce that infrastructure? That cost?'" said Andrew McNeally, energy-efficiency program administrator, UPPCO. "My experience being from New England says cold-climate heat pumps will take care of your problem without negatively impacting your tenants." UPPCO's heating and cooling selection for Ontonagon Village Housing: M-Series mini-split heat pumps from Mitsubishi Electric.

A MODERN-DAY ALTERNATIVE TO BASEBOARD HEAT

UPPCO has been working on energy-efficiency programs since 2009, when Michigan law went into effect, incentivizing utilities to help customers move beyond fossil fuels. A 60-unit, all-electric, 15-building property, Ontonagon Village Housing had always used electric resistance for heating. Unfortunately, the electric-resistance systems struggled to keep up with the freezing temperatures. "Electric resistance can be quite expensive, especially now, and heat pumps do a phenomenal job," noted Mike Duquaine, warehouse manager, Stop's Heating and Cooling. Additionally, heat pumps solve comfort challenges year-round. With no central air conditioning in the summers, Ontonagon residents depended on box fans and inefficient

Ductless Mini- and Multi-Splits

- No ductwork
- Comfort and energy savings
- Superior performance
- Cooling and heating where you want it
- Quieter and greater comfort than window AC

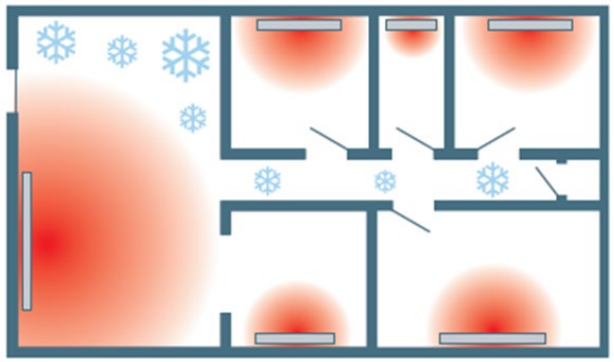
MI HEAT PUMP COLLABORATIVE

MI HEAT PUMP COLLABORATIVE

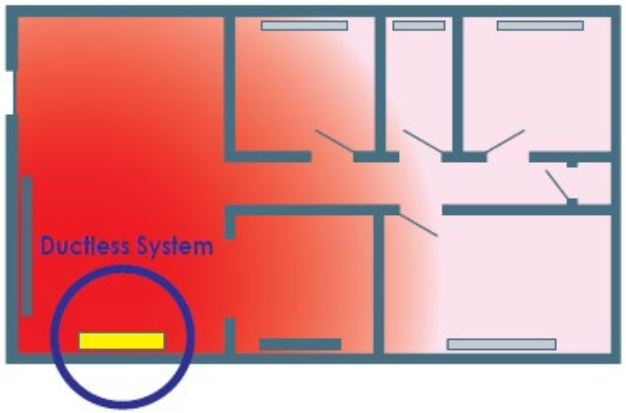
Ductless Displacement

ASHP Use Case: Adding Mini-Splits to Homes with Electric Heat

Ductless Solution Selection



Customer need: Increase comfort, reduce costs



- **Simple solution:** Single zone ductless unit or 1-3 room compact-ducted
  - If compact-ducted, set static pressure
- **Advanced solution:** 2-5 zone ductless/compact-ducted multi-split or multiple single-zone systems if simultaneous cooling/heating desired
  - Turn down ratios limited to % of outdoor unit capacity on multi-zone, not indoor unit
- **Sizing strategy:** Locate first/single zone where it will cover most of central living area, establish additional zones as needed, based on customer use
  - Block loads, when combined, are likely to be less than whole-home load
  - Bedrooms are often too small for their own indoor unit
    - Compact-ducted or transfer grills and thermostat
- **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

Expectations Ductless ccASHP

What the heat pump will do:

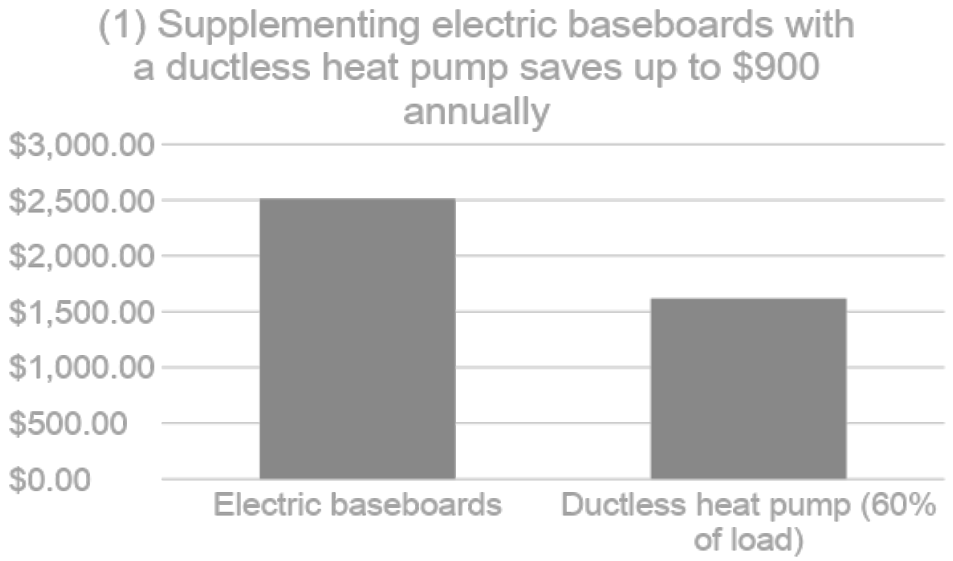
- **Sized for most of the heating load and could be running as low as -14°F**
  - Make quote standout - include temperature where capacity stops meeting load
- **Acts as the primary heat source**
  - Based on hours of operation
  - Not based on maximum heating load at design condition
- **Constantly adjusts supply to meet:**
  - Standard cooling load
  - Extreme cooling needs
  - Nearly all heating needs.
- **Provides efficient cooling and help with humidity**
- **Provides consistent warm comfy heat, not hot blasts for short times**
  - Some call this cozy heat Hygge

What the homeowner should do:

- **Set remote or wall thermostat for heat pump to the desired comfort temp**
  - Adjust mode of operation as needed when seasons change
  - Stop the use of setbacks or system shut down when away for a few hours
- **Will clear snow from around the heat pump**
  - If unable consider wall mount out of snow depth
- **Existing baseboards**
  - Turn down 5 degrees or turn off in rooms that have indoor units
  - For best savings use only when heat pump isn't providing enough comfort
- **Managing electric bills**
  - DTE Energy has Cool Currents
    - Requires second meter
  - DTE Energy time of use limit operation from 3-7pm weekdays
  - UPPCO has electric heat rate - submit verification of electric space heat

Economics Ductless ccASHP

- First costs could be reduced
- Sized for 60% of the load, up to 55% reduction in space heating costs
- Switching from electric space heater to a mini-split in one example
  - Saves up to 611 kWh per month
  - 63% savings
- Switching from the standard rate to the electric heat rate for UPPCO saves
- Switching from the DTE Energy standard electric rate to CoolCurrents saves
  - December 2021 2002 KWH consumed cost $383.21
  - December 2022 2017 KWH consumed cost $285.34
  - 1,719 KWH were for space heating in 2022
  - $97.87 savings as rate is ≈$0.1301



ASHP Use Case: Adding Mini-Splits to Homes with Boilers

Expectations Ductless ASHP for Cooling

What the heat pump will do:

- **Provide cooling, dehumidification, and heating at mild temps**
  - Make quote standout - include temperature where capacity stops meeting heat load
- **Acts as the primary heat source**
  - Based on hours of operation
  - Not based on maximum heating load at design condition
- **Constantly adjusts supply to keep:**
  - Indoor temperature consist
  - Reduce humidity

What the homeowner should do:

- **Set remote or wall thermostat for heat pump to the desired comfort temp**
  - Adjust mode of operation as needed when seasons change
  - Stop the use of setbacks or system shut down when away for a few hours
- **Existing boiler**
  - Turn down thermostat 5-10 degrees for zones with indoor units
  - Boiler will likely be source of heat starting at 20 degrees
- **Managing electric bills**
  - When using to displace propane or fuel oil boilers use heat pumps until comfort no longer maintained
  - For natural gas provide outdoor temperature where the boiler may cost less to run

Ductless Solution Placement

- **Indoor unit placement:**
  - Floor or wall units should be specified based on customer preference
  - Wall units should be a minimum of 6 inches below ceiling and no more than 8 feet up
  - Be sure that return and supply are not impeded by shelves or other objects below
  - For zones with smaller loads consider compact-ducted units or use of transfer grills
- **Outdoor unit placement:**
  - Elevate out of potential snow fall depth
  - Stand vs. wall mount. Stands reduce noise transfer
  - Wind baffles, drip caps or custom-made solutions to protect from snow and ice
- **Existing system treatment:**
  - Evaluate controls for reuse
  - Boiler or baseboard thermostats should be set back four degrees below setpoint of heat pump
    - Use a centrally-located thermostat, rather than remote, for heat pump
    - Customer education is the most important step to ensure comfort and savings

Technical Considerations

- **Code Requirements**
  - Specifications on type of connections used
  - High voltage wiring in conduit

- **Location Consideration**
  - Wind + Snow = Ice build up on fan got Wind Baffles?
    - Improves low ambient operation
    - Locate to an area with less driving wind
  - Stand or Mounting
    - Wall mounting could be noisy
  - Theft protection

- **Power**
  - Surge protection for outdoor and indoor units if prone to voltage spikes or brown outs
  - Single zone and small capacity multi-zone may not require panel upgrade - some only require 20amps.
    - Where hardwired baseboard exists, some can come offline

Result of Adding Ductless Mini-Splits

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BREAK – 10 minutes

Design Principles for Air Source Heat Pumps

(Designation Training #2)

MI

HEAT PUMP COLLABORATIVE

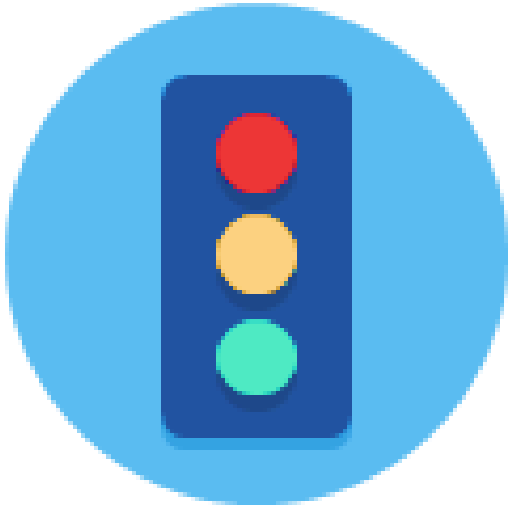
MI HEAT PUMP COLLABORATIVE

Sizing, design, and selection is often done based solely on rules of thumb and based on previous sized systems.

“Variable Capacity Air Source Heat Pumps perform best and meet savings goals when sized appropriately for system type, application, and supplemental fuel type.”

Current Common Approaches to Load Calcs:
What People are Putting in it Most Often

- “Shoot from the hip”
- Sized off existing equipment size
- Using rules of thumb
- Utility bill analysis
- Block load calculation



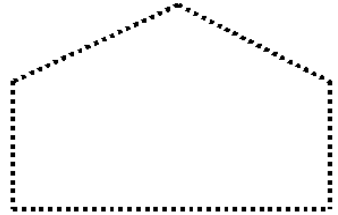
Sizing – Rules of Thumb

- One thousand BTU per 100 sq ft
- One cfm per sq. ft. of house
- 35 btu per sq ft
- Tonnage = half the number of cylinders in the customer's biggest car/truck
- What's in the shop today
- ½ ton bigger than their neighbor

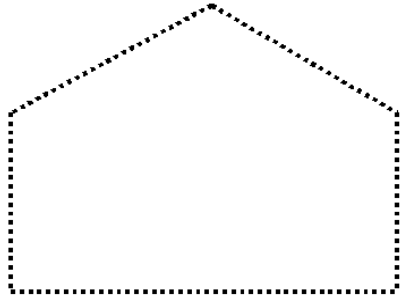
Air Conditioner or Heat Pump Sizing Chart

(Please understand that this is meant as humor,
however it is just as accurate as "x" number of square feet per ton!)

1 1/2 to 2 ton



2 1/2 to 3 1/2 ton



4 to 5 ton

Slide courtesy Bruce Manclark

Does Sizing Impact Energy Use and Utility Bills?
What's Wrong with Inaccurate Load Calculations?

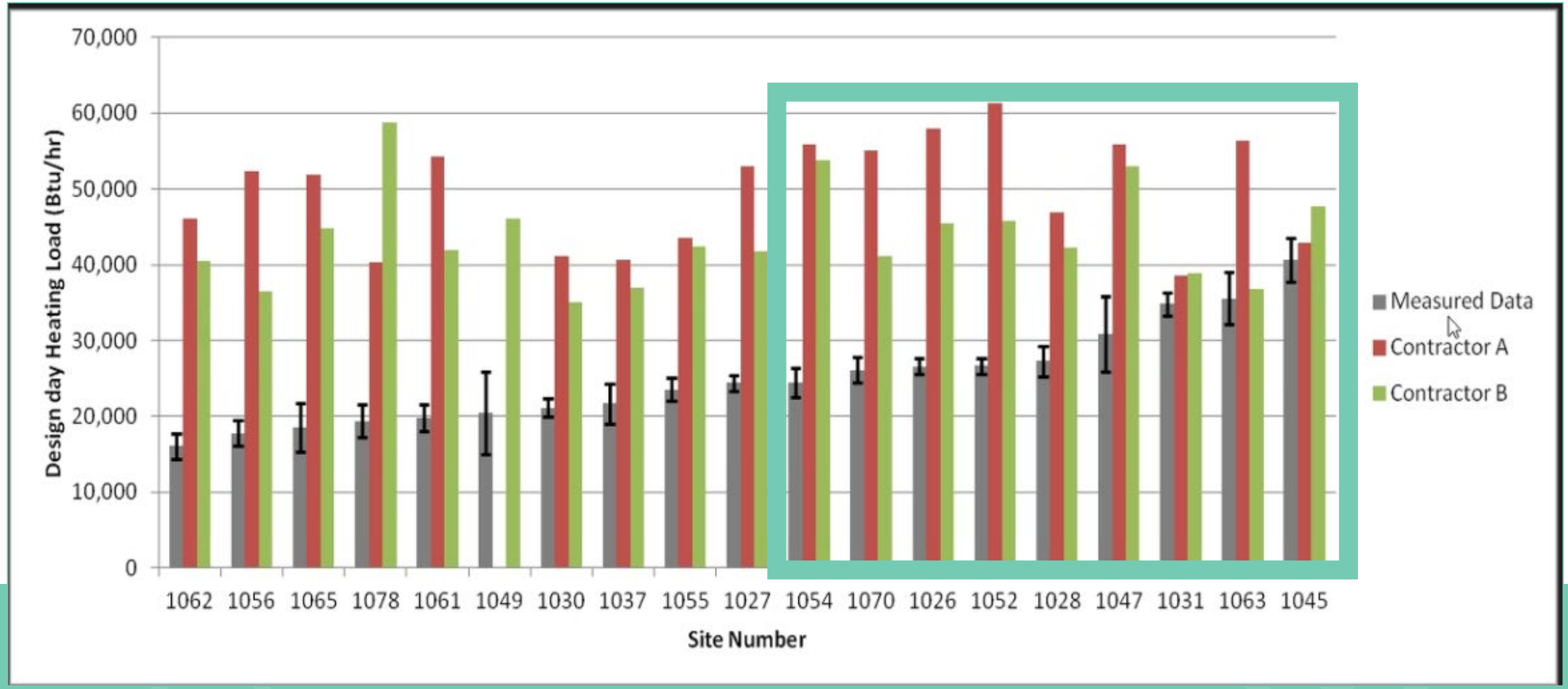
For single and **two speed systems**, maximum **efficiency happens during long run times,** not starts and stops. **This LIKELY has energy penalties for over-sized systems oversized by more than 25%.**

For variable capacity equipment, **longer run times** may **mean more time spent at medium and low heat/fan speed**. This **LIKELY has energy penalties for systems oversized by more than 40% as they potentially will not have shorter run times and at higher heat/fan speed.**

Wrong sized for the **ductwork can lead to** much **higher fan watt draw**. An AHRI report showed that adding static pressure to Electrically Commutated Motors only reduced flow from 1 to 3% with increased fan power draw up to 48%!

NIST, NREL, Proctor Engineering, Illinois Institute of Technology

Concerned that Manual J Won't Size Large Enough?



Accuracy is Necessary for Developing Your Business Case and Unique Value Propositions

Investments

- Load calc training, software, and time per job to generate
- Sizing and selecting with online tools requires training and time per job
- Performing duct evaluations takes training, equipment, and time per job
- It takes a lot of time to invest and risk if we don't succeed in adding to service contracts

When developing a business case for adding new work into your process, don't just list the "costs" or "investments" with a single end benefit.

For each investment, your business case should be balanced with correlating benefits.

For the rest of this presentation, when you see this icon, we've hit on a solid business case point.

How Should We Perform Load Calculations

- ✓Determine type of load calc you'll perform
- ✓Collect data by phone, online, and on site
- ✓Understand physical location and design temperatures
- ✓Use tools that you are comfortable with
- ✓Develop results to be used in sizing and selection process
- ✓If need be, compare against enhanced rules of thumb for comparison

MI grand rapids demo house	
Site ID: 19308	Heating: 64,400 BTU/hr
Area: 1,856 ft²	Cooling: 34,000 BTU/hr
Climate: Grand Rapids AP	Latent: 3,500 BTU/hr

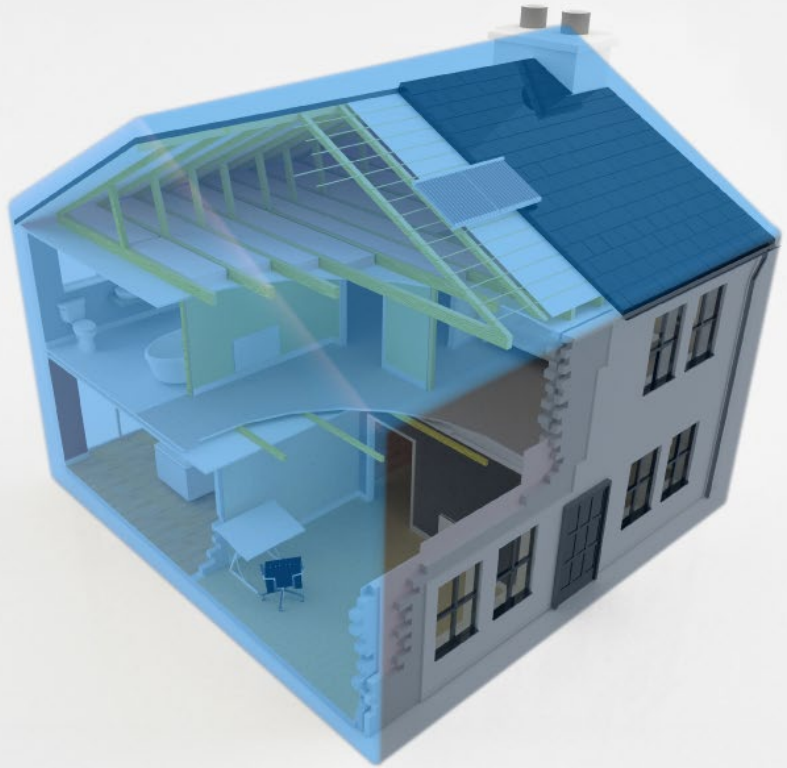
MI demo house Marqette	
Site ID: 19306	Heating: 31,800 BTU/hr
Area: 2,000 ft²	Cooling: 22,200 BTU/hr
Climate: Marquette CO	Latent: 1,600 BTU/hr

Low quality methods

- Duplicating existing equipment size
- A rule of thumb
- The Heating Load Estimator

Medium quality methods

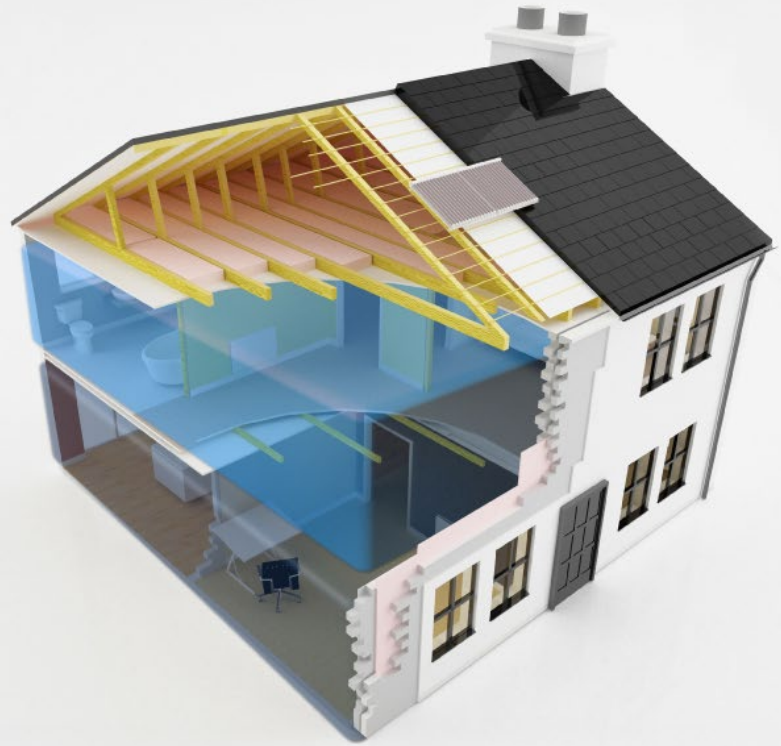
- Comfort consultation
- Block load calculation
  (Manual J or equivalent)
- Account for detailed building
  envelope information
- Factor in design temperatures



High quality methods

- Comfort consultation
- **Comfort Survey**
- Room-by-room Manual J or equivalent
  - Account for detailed building envelope information
- **Ductwork evaluation**
- Factoring in existing equipment's run time or customer's utility bills
  - When applicable
- Factor in design temperatures

"The Home as a System"



Right Sizing Journey

Identify homes loads.
Identify resident wants and needs.

Evaluate equipment that can meet goals.
Determine how far residents wish to go.

Recognize applications and limitations.
Identify fuel types.

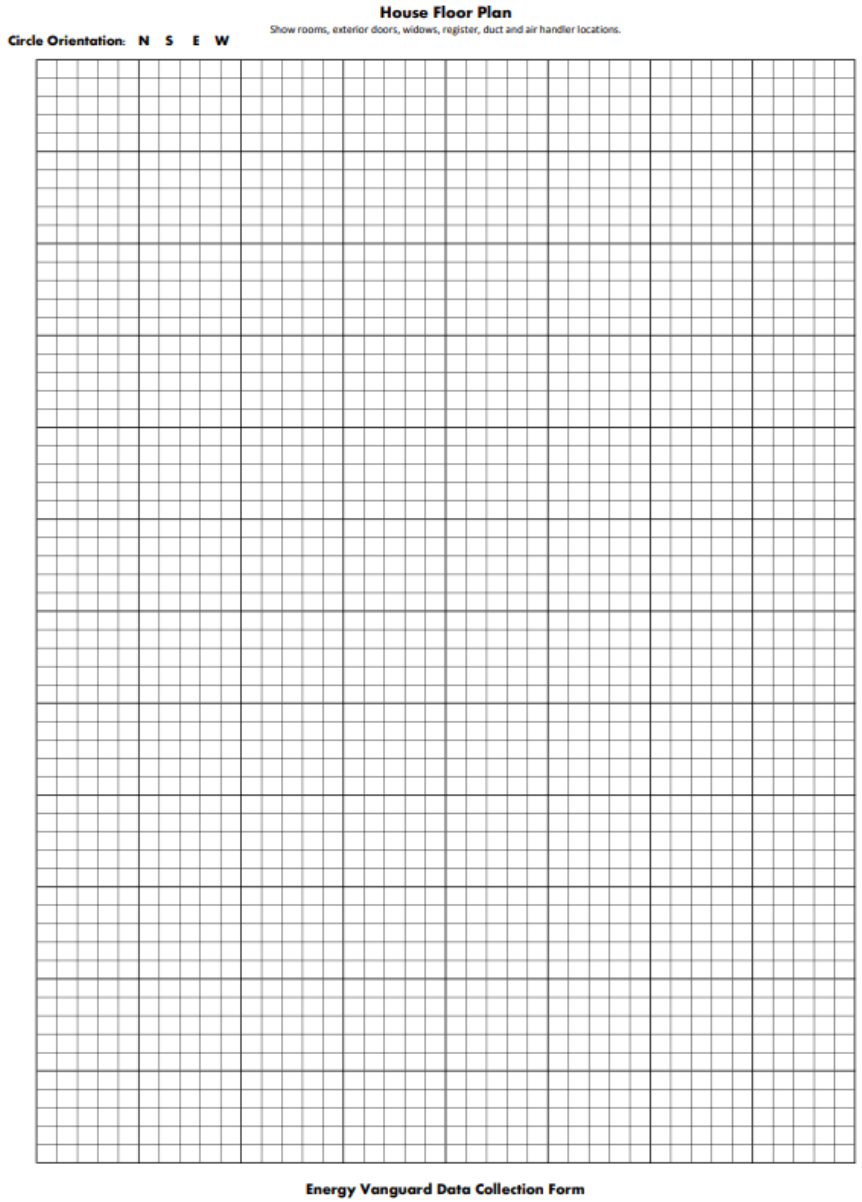
Install properly.
Educate residents to operation.
Set controls.

When you see this icon, you have landed on a key milestone.

Data Collection: Three Primary Steps

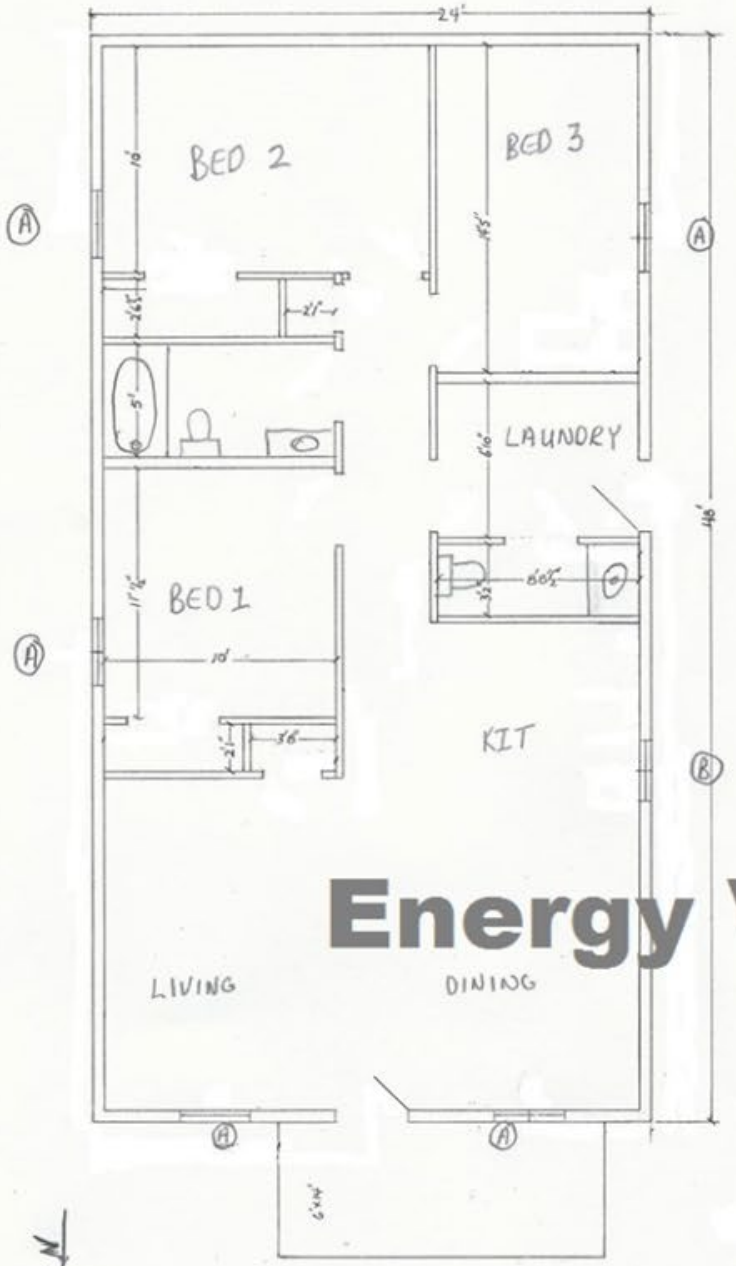
From Energy Vanguard Available to download from their website

1. Start with house drawing, then
2. Move on to home data collection, then
3. Move on to system data collection



https://www.energyvanguard.com/hvac-design/data-collection/

ROOF
4/12 w 12" OH



24'x46' REVISED

EXT DOORS
3-0 STEEL
INSUL

WINDOWS
(A) 3-0 X 5-2
(B) 2-8 X 3-0

SINGLE HUNG
LOW E

S=supply
R=Return
AH=Air Handler

W=Window
D=Door

Ma Bed ceiling = 9.3ft
Ma Bath ceiling = 8.75ft
All other ceiling = 8ft.

Ma Bed & Bath have slab.
All other crawl.

All supplies are = 6in
except guest bath = 4in

Return in kitchen = 12x24

Return in HVAC closet =
10x20

Wall lengths are black

Supply distances are red

Walls are blue

Energy Vanguard
533 W Howard Ave, Suite E, Decatur, GA 30033
hvac@energyvanguard.com · (404) 428-3393

Manual J Data Collection Form for New Homes

Date			
Data Collector		Contact #	
Homeowner / Builder		Contact #	
Property Street Address		Code Year	
City, State & Zip Code			

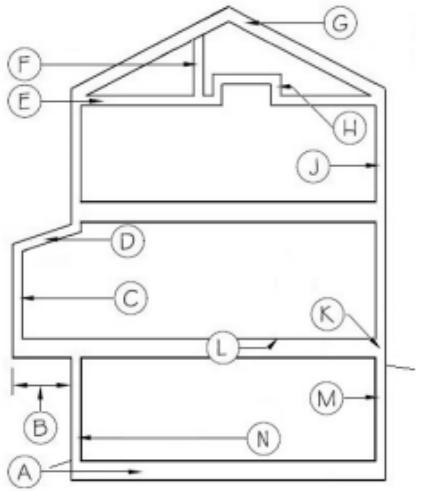
1. Front Door Faces ☐ N ☐ NE ☐ E ☐ SE ☐ S ☐ SW ☐ W ☐ NW

2. Home Description

3.Air Infiltration Rate

Blower Door @ cfm50	or	☐Tight	☐Semi-Tight	☐Average

4. Insulation



Location	R-Value Type	Cavity	Continuous
A: Slab Under			
Slab Edge			
B: Cantilevered & Frame Floors			
C: Exterior Walls, above grade			
D: Vaulted or Sloped Ceilings			
E: Flat Ceilings (typical blown attic)			
F: Attic Knee-walls			
G: Roofline (typical spray foam)			
H: Tray Ceiling Top/Side			
K: Rim/Band Joists			
L: Floor over Bsmt/Crawl/Garage			
M: Poured Bsmt or Crawl Walls Cavity			
Continuous ☐Exterior ☐Interior			
N: Framed Bsmt Walls			

XPS Extruded Polystyrene
EPS Expanded Polystyrene
ISO Polyisocyanurate
FGB Fiberglass Batts
BLN Blown Fiberglass/Cellulose
OC Open Cell Foam
CF Closed Cell Foam

5. Mark additional energy saving features present: ☐conditioned crawlspace, ☐encapsulated attic, ☐reflective shingles, ☐attic radiant barrier, ☐Energy Star home, ☐other above code certification program, ☐fireplace (sealed combustion), ☐fireplace (vented w/ outside air), ☐other: _____

6. Solid Doors (Only for information not on plans)

	Description	Location	Size (W x H x Thick)	☐R or ☐U-Value
Type 1				
Type 2				
Type 3				
Type 4				

7. Windows & Glazed Doors (=>50% glass) (Only for information not on plans)

	Description	Location	Size (W x H)	U-Value	SHGC
Type 1					
Type 2					
Type 3					
Type 4					
Type 5					
Type 6					
Glazed Doors					
Other					
Skylights					

8.HVAC System Preferences ☐no preference

	Location	Manufacturer	Area Served	Efficiency	Heat-Pump	Gas	Duct Type
1							
2							
3							

RM Round Metal **VF** Vinyl Flex
SQ Square Metal **DB** Duct Board

9. Mechanical Ventilation Preferences ☐no preference

On which system(s)? ☐1 ☐2 ☐3 ☐separately ducted

Fresh Air Intake Type	☐Vent. Dehumidifier	☐Supply Only	☐Exhaust Only	☐Balanced
Manufacturer		Model		
Rate (CFM)		Notes		

New solutions to make high quality load calculations easier

Tablet-based room scanning software (LiDAR)

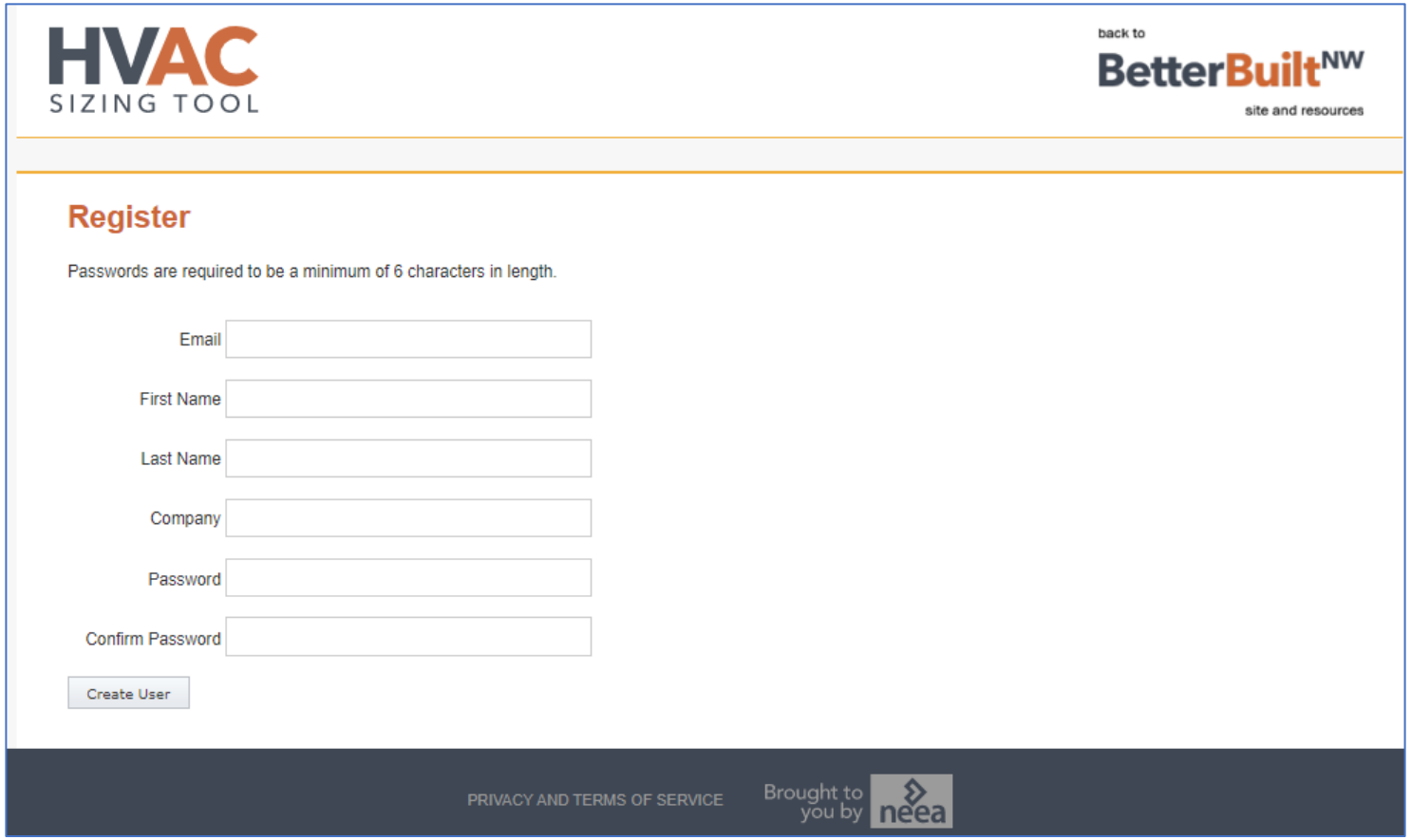
- Amply
- ConduitTech
- CoolCalc

Online tools

- NEEP ccASHP for Heating tool

MI HEAT PUMP COLLABORATIVE

Free Online Sizing Tool – Using Today



http://hvac.betterbuiltnw.com/Account/Register.aspx

Example Houses

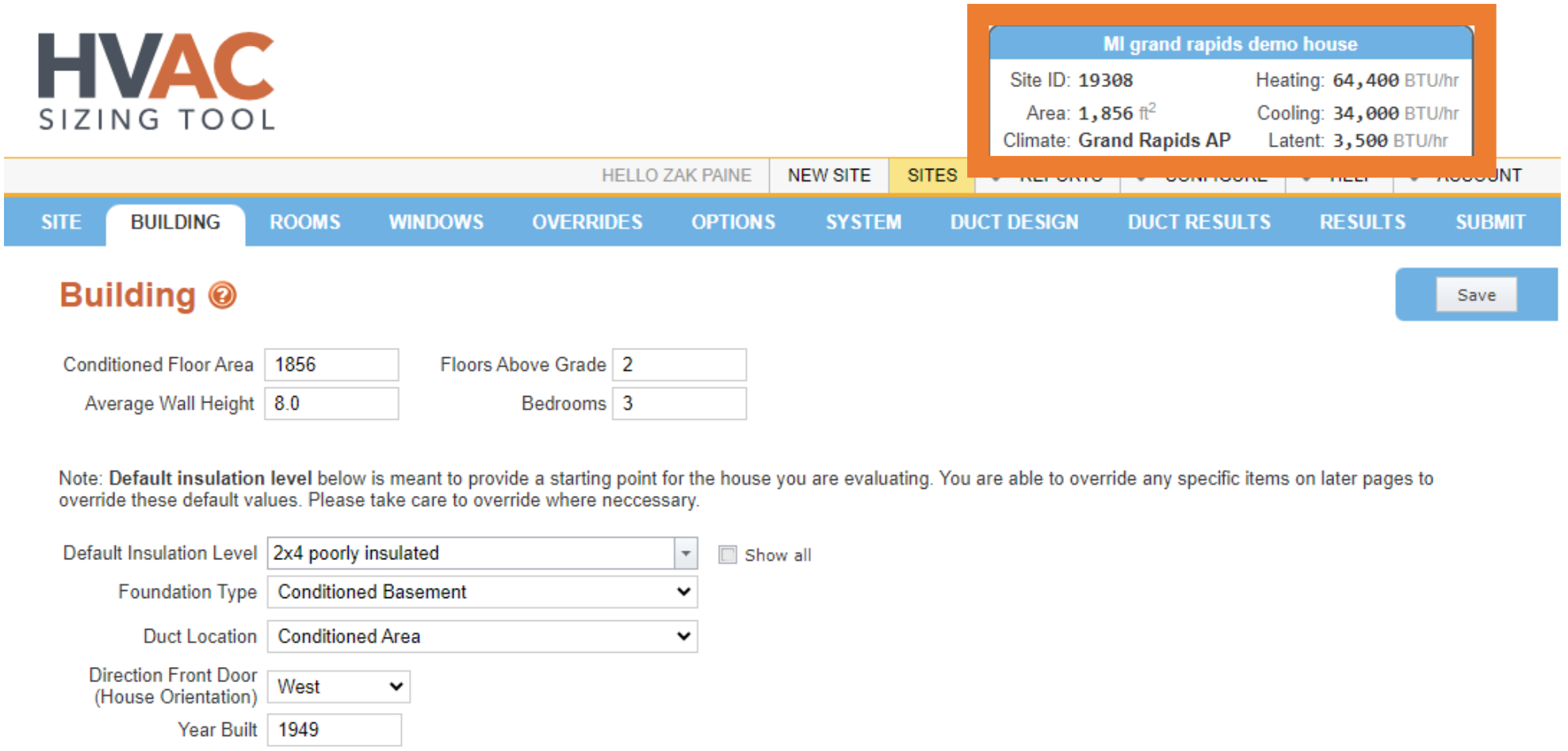
Older house (1950s)

- 1856 sq ft, 2 story home over a semi-conditioned basement.
- Heating load double the cooling load.

Newer house (2006)

- 2000 sq ft, 2 story home over a partial basement
- Heating and Cooling loads are much closer.

Example House – 1950's Home



Rule of Thumb vs Manual J for Older Home

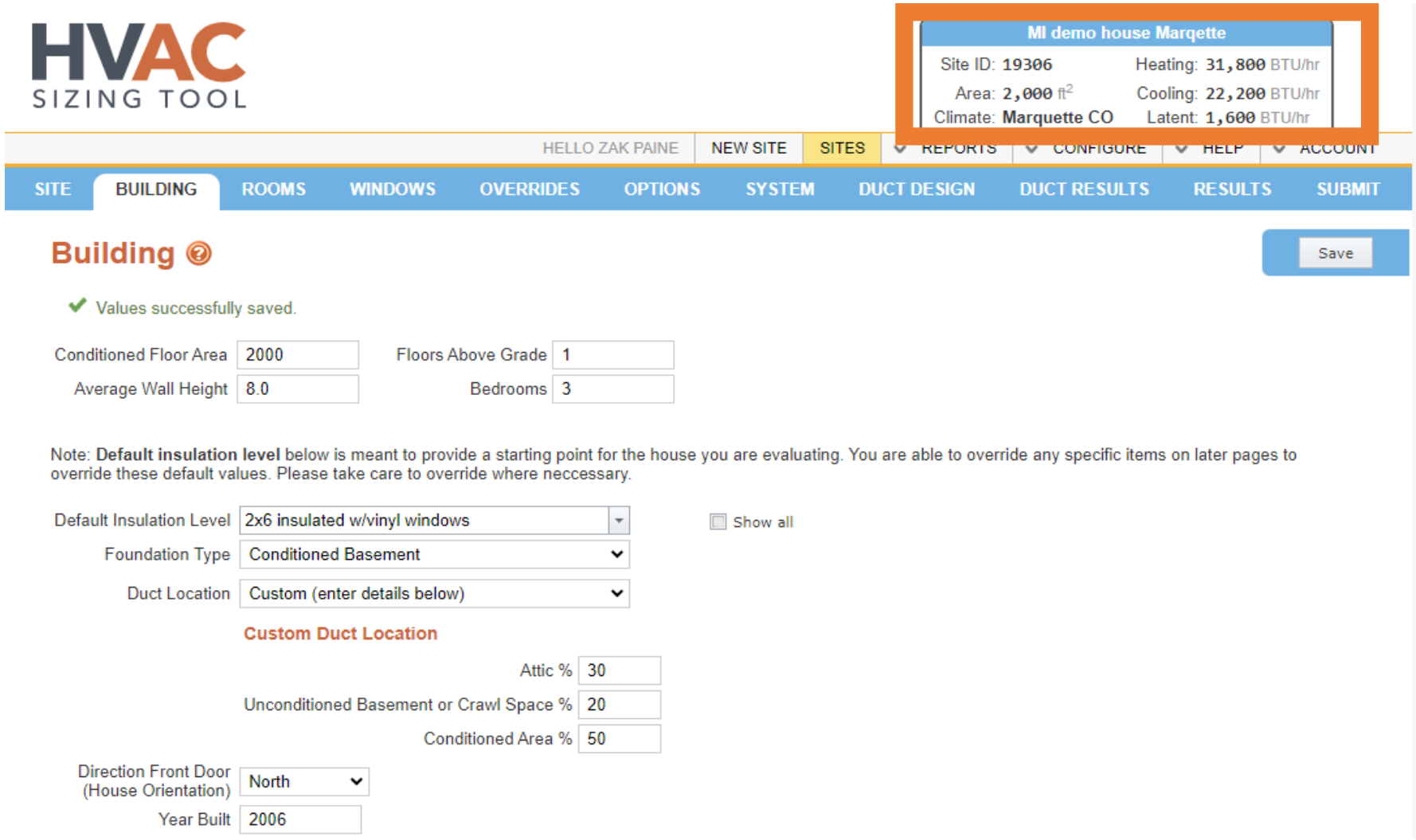
- **Was system oversized for heating?**

- 35 btu per sq ft
- 1856 sq ft = 64,960

- Man J = 64,400

- **No only off by 1%!!**

Example House – Newer Home 2006

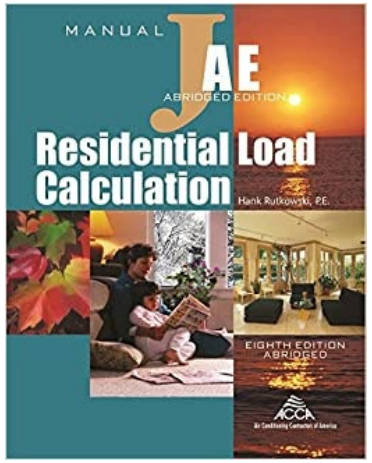


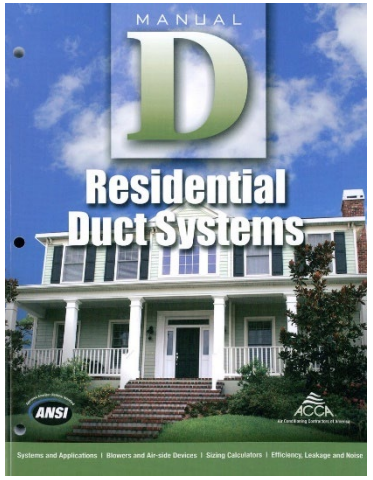
Rule of Thumb vs Manual J for Newer Home

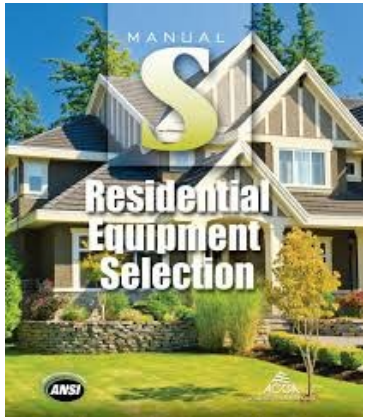
- **Was system oversized for heating?**
- 35 btu per sq ft
- 2000 sq ft = 70,000 btu's
- Man J = 31,800 btu's
- **YES, by ~55%!!**

Design Challenges

- ✓ Accurate load calculations
- ✓ Determining when to size for heating vs cooling
  - ✓ AC replacement – always size for cooling
  - ✓ Cheap “backup or supplemental heat” – size for cooling
  - ✓ Expensive backup heat or carbon as driver – size for heating and cooling
- ✓ Distribution (ductwork) not properly designed for variable speed equipment
- ✓ Set expectations for performance with homeowners
- ✓ Selecting the right heat pump for the use case
- ✓ Selecting the best control strategy for the customer and equipment

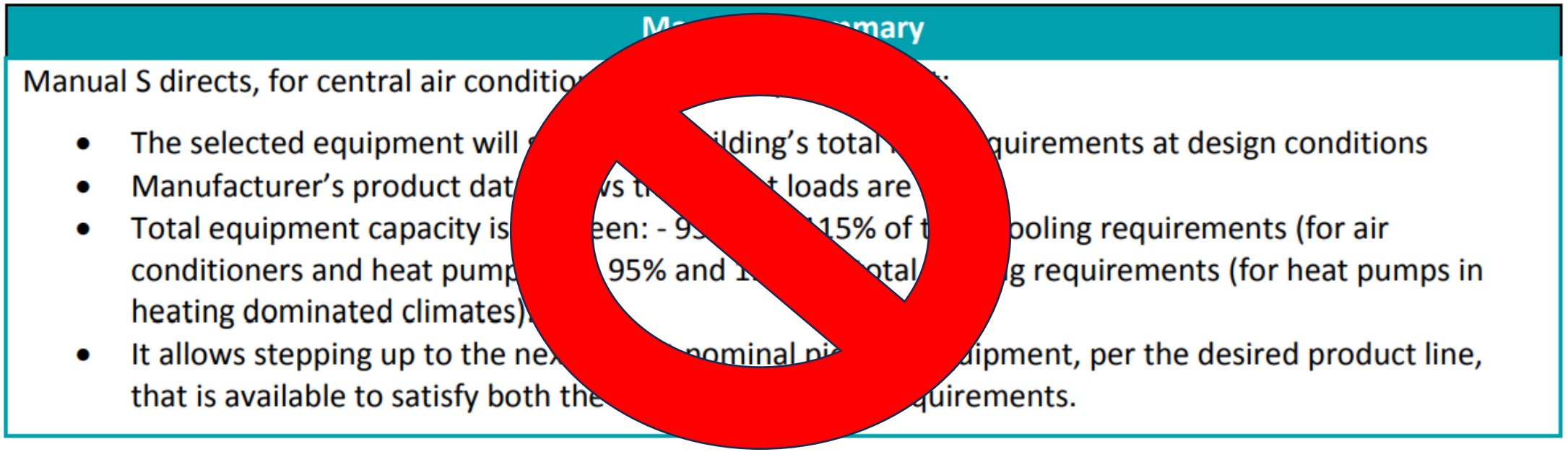






General Design and Selection

Selection, often in the form of Manual S (but not always) **involves applying the results of heat and cool load sizing calcs to the selection of equipment** that will **deliver the necessary heating and cooling**, when and where it's wanted. Design and Selection needs to include existing conditions and the application type under consideration. The following is a summary from NEEP:



Updated Manual S sizing guidance

Equipment Type	Heating Size Limit*	Cooling Size Limit*
Single-speed AC	NA	120%
Two-speed AC	NA	125%
Single- and two-speed ASHP	120%	120%
Combustion system	140%	NA
Variable-speed ASHP	150%	130%
Auxiliary electric resistance	175%	NA

* Limits reference design loads

MI HEAT PUMP COLLABORATIVE

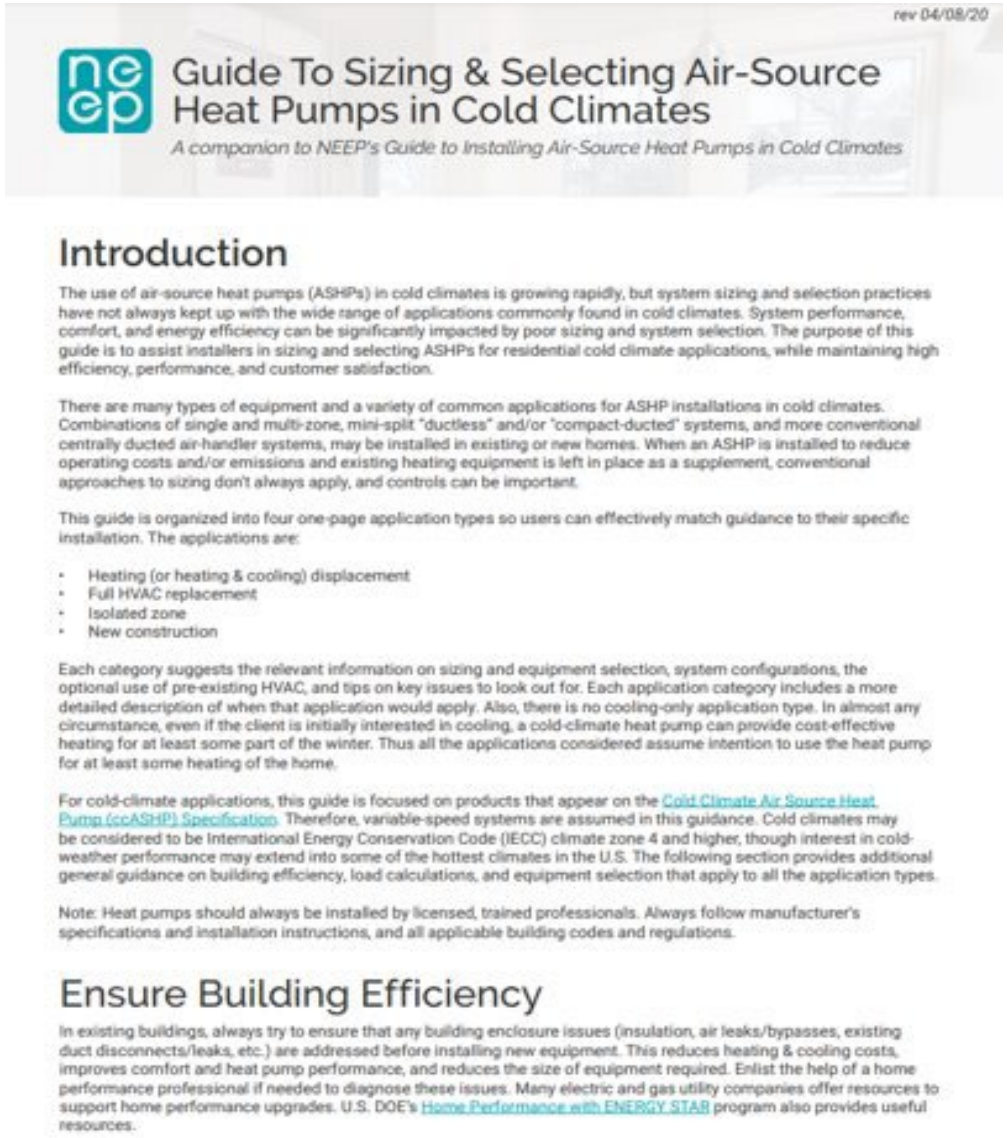
Sizing Guidance Resources

Sizing tools:

- ACCA Manual S
- Manufacturer sizing and selection tools
- **NEEP Cold Climate Product List and NEW Sizing Tool**

Resources

- NEEP Installer Resources - Guide to Sizing and Selecting Heat Pumps
- Air-Source Heat Pump Sizing and Selection Guide NRCAN
- NY State Training Provider Resources
- NEEP Size for Heating Users Guide



rev 04/08/20

Guide To Sizing & Selecting Air-Source Heat Pumps in Cold Climates

A companion to NEEP's Guide to Installing Air-Source Heat Pumps in Cold Climates

Introduction

The use of air-source heat pumps (ASHPs) in cold climates is growing rapidly, but system sizing and selection practices have not always kept up with the wide range of applications commonly found in cold climates. System performance, comfort, and energy efficiency can be significantly impacted by poor sizing and system selection. The purpose of this guide is to assist installers in sizing and selecting ASHPs for residential cold climate applications, while maintaining high efficiency, performance, and customer satisfaction.

There are many types of equipment and a variety of common applications for ASHP installations in cold climates. Combinations of single and multi-zone, mini-split "ductless" and/or "compact-ducted" systems, and more conventional centrally ducted air-handler systems, may be installed in existing or new homes. When an ASHP is installed to reduce operating costs and/or emissions and existing heating equipment is left in place as a supplement, conventional approaches to sizing don't always apply, and controls can be important.

This guide is organized into four one-page application types so users can effectively match guidance to their specific installation. The applications are:

- Heating (or heating & cooling) displacement
- Full HVAC replacement
- Isolated zone
- New construction

Each category suggests the relevant information on sizing and equipment selection, system configurations, the optional use of pre-existing HVAC, and tips on key issues to look out for. Each application category includes a more detailed description of when that application would apply. Also, there is no cooling-only application type. In almost any circumstance, even if the client is initially interested in cooling, a cold-climate heat pump can provide cost-effective heating for at least some part of the winter. Thus all the applications considered assume intention to use the heat pump for at least some heating of the home.

For cold-climate applications, this guide is focused on products that appear on the Cold Climate Air Source Heat Pump (ccASHP) Specification. Therefore, variable-speed systems are assumed in this guidance. Cold climates may be considered to be International Energy Conservation Code (IECC) climate zone 4 and higher, though interest in cold-weather performance may extend into some of the hottest climates in the U.S. The following section provides additional general guidance on building efficiency, load calculations, and equipment selection that apply to all the application types.

Note: Heat pumps should always be installed by licensed, trained professionals. Always follow manufacturer's specifications and installation instructions, and all applicable building codes and regulations.

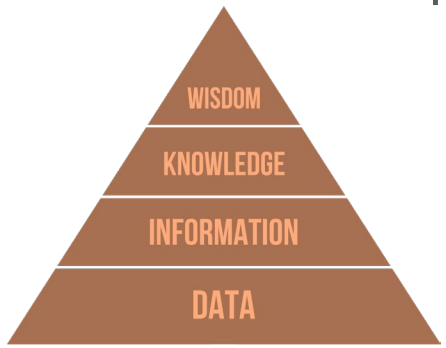
Ensure Building Efficiency

In existing buildings, always try to ensure that any building enclosure issues (insulation, air leaks/bypasses, existing duct disconnects/leaks, etc.) are addressed before installing new equipment. This reduces heating & cooling costs, improves comfort and heat pump performance, and reduces the size of equipment required. Enlist the help of a home performance professional if needed to diagnose these issues. Many electric and gas utility companies offer resources to support home performance upgrades. U.S. DOE's Home Performance with ENERGY STAR program also provides useful resources.

Size for Heating or Cooling

Old School

- Size for cooling and then go up a ton.
- Based on older single or two speed systems.
- Does not maximize heating potential of HPs and does not account for modulation capabilities of VSHPs!



New School

- Start by sizing to largest load for ER, old heat pumps, propane/home heating oil backup.
- For natural gas, size to cooling load unless the homeowner drive is carbon savings.
- Using Manufacturer data for Max and Min capacities, check to see if the smaller load is between the Max and Min at the design temp.
- Likely OK to be within a half ton!

Best Practices for Load Calculations
Key Takeaways

- Determine what tool or software you are going to use, Use tools you are comfortable with
- Decide how data collection is best done
  - Onsite - This is very beneficial and demonstrates confidence
  - Remote – Data collection will come from the homeowner and may need to be verified before installation
- Compare against enhanced rules of thumb to ensure accuracy
- Evaluate the duct work
  - Existing performance / location
  - Test total static pressure

Questions?

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BREAK – 10 minutes

MI HEAT PUMP COLLABORATIVE

The Art of Balance

Balancing Capacity and Operation Cost, Air Flow, Customer Comfort

(Designation Training #3)

MI HEAT PUMP COLLABORATIVE

Ask yourself,

This house is old.

I'm anticipating installing 2025 high efficiency equipment.

Do you *really* think the house is ready?

What should I consider to make address the home as a system?

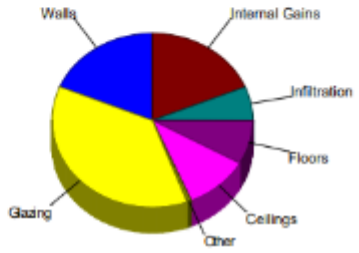
Weatherization And Heat Pumps?

Heating

Component	Btuh/ft²	Btuh	% of load
Walls	10.2	19387	37.9
Glazing	37.9	11751	23.0
Doors	17.3	363	0.7
Ceilings	3.3	2972	5.8
Floors	7.4	6721	13.1
Infiltration	6.7	9978	19.5
Ducts		0	0
Piping		0	0
Humidification		0	0
Ventilation		0	0
Adjustments		0	
Total		**51171**	**100.0**

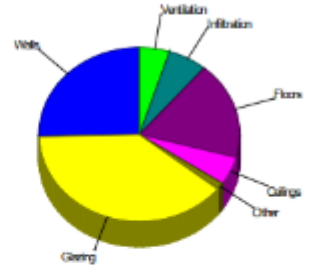
Cooling

Component	Btuh/ft²	Btuh	% of load
Walls	2.3	4312	18.7
Glazing	27.5	8515	36.9
Doors	8.0	168	0.7
Ceilings	2.7	2422	10.5
Floors	2.1	1880	8.1
Infiltration	1.0	1450	6.3
Ducts		0	0
Ventilation		0	0
Internal gains		4320	18.7
Blower		0	0
Adjustments		0	
Total		**23066**	**100.0**



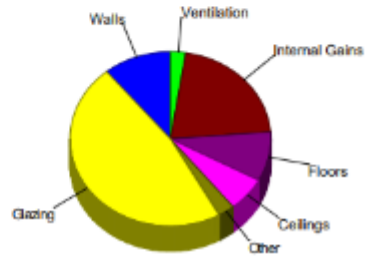
Heating

Component	Btuh/ft²	Btuh	% of load
Walls	5.0	9419	25.4
Glazing	46.5	14431	38.9
Doors	11.3	475	1.3
Ceilings	2.1	1941	5.2
Floors	7.4	6721	18.1
Infiltration	1.6	2332	6.3
Ducts		0	0
Piping		0	0
Humidification		0	0
Ventilation		1807	4.9
Adjustments		0	
Total		**37125**	**100.0**



Cooling

Component	Btuh/ft²	Btuh	% of load
Walls	1.2	2229	10.9
Glazing	31.0	9597	47.1
Doors	5.2	219	1.1
Ceilings	1.4	1290	6.3
Floors	2.1	1880	9.2
Infiltration	0.2	326	1.6
Ducts		0	0
Ventilation		505	2.5
Internal gains		4320	21.2
Blower		0	0
Adjustments		0	
Total		**20366**	**100.0**



Evaluating Existing Ductwork

1. Engaged discussion with homeowners and qualitative test - does the existing system and ductwork deliver hot/cold air to all rooms?
2. Visual inspection of the ductwork:
   a) Is it located in attic and unconditioned basement?
   b) Are the ducts visually damaged or leaking?
   c) Are the ducts properly insulated?
3. Perform static pressure test(s)
4. Record static pressure and identify key components that will add to static pressure build up

Fan Watt Draw and Pressure

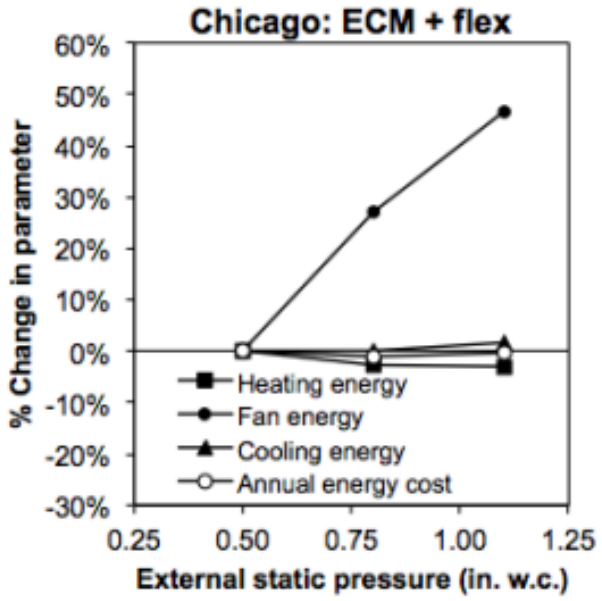


Table 10. Annual energy simulation results for both homes at baseline using the Austin contractor's designs

Home	Duct type	Blower type	Total Pressure (in. w.c.)	Airflow rate (CFM)	Cooling (kWh)	AHU Fans (kWh)	Total Electricity (kWh)	Heating ($\times 10^6$ Btu)	Total Gas Consumption ($\times 10^6$ Btu)
Chicago 3-ton AC Gas furnace 1200 CFM nominal	Flex	PSC	0.50"	1200	619	542	8108	60.95	88.88
			0.80"	964	661	531	8139	60.93	88.85
			1.10"	622	786	600	8331	63.71	91.70
		ECM	0.50"	1200	611	319	7878	61.55	89.51
			0.80"	1162	614	411	7972	60.47	88.39
			1.10"	1103	631	478	8056	60.86	88.78
	Metal	PSC	0.50"	1200	611	531	8086	59.52	87.41
			0.80"	964	656	525	8128	60.25	88.16
			1.10"	622	769	583	8300	62.17	90.12
			0.50"	1200	603	314	7861	60.10	88.02

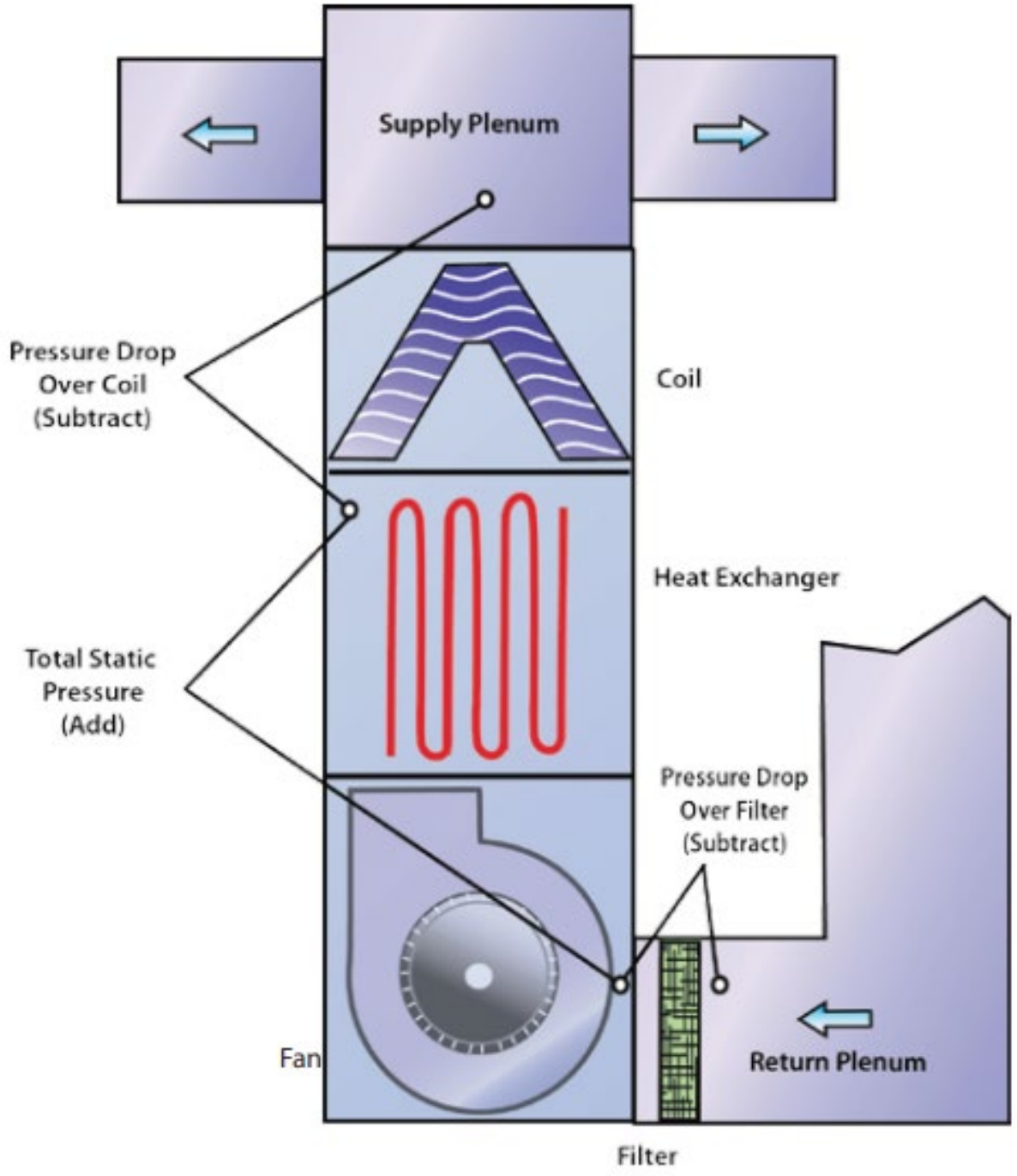
Figure 14. Estimated relative change in annual fan, cooling, and heating energy usage and total annual HVAC energy costs for the Chicago home with both types of AHU fans and both rigid and flex duct work at each duct design (using only the Chicago contractor's duct designs).

TESP and Fan Tables and What is Meant by "External"

"External" designates how the unit was shipped:

- With a central heat pump utilizing auxiliary heat, the air handler and coil are shipped in one piece. The fan curves reflect this the resistance of the of the coil
- With gas furnaces with an AC or HP coil, the coil is not shipped with the air handler. The fan curves in this case, do not reflect the resistance of the coil. When testing these systems, the supply side measurement MUST be furnaces taken before the coil

https://www.energystar.gov/sites/default/files/specs/National%20Comfort%20Institute%20-%20Measure%20and%20Interpret%20Static%20Pressures.pdf



Quick Gut-Check for WFD

- Use the tally system!
  - Count registers
  - Count Returns
  - Find the size of the ductwork serving the supplies and returns
- Example:
  - Supplies ~~IIII IIII~~
  - Returns II
  - Supply duct 6" **hard pipe**
  - Returns (1) 12" and (1) 10" **hard pipe**
- Supply estimated max CFM = 10 x 85 cfm = 850 CFM
- Return estimated max CFM = 525 cfm + 325 cfm = 850 CFM

Comfort Balance Point

- Is air blowing directly on home inhabitants?
- Is air being distributed properly throughout the home?
- Hot/cold spots?

Adjusting air delivery

- Cooler delivered air temperatures means the air will travel further into the room
- Avoid blowing supply air directly on the occupants
- Direct air flow into open spaces
- Move toe kicks away from high use areas such as sinks
- Install indoor units away from sensitive areas

Definitions for Switchover Temperature / Balance Point

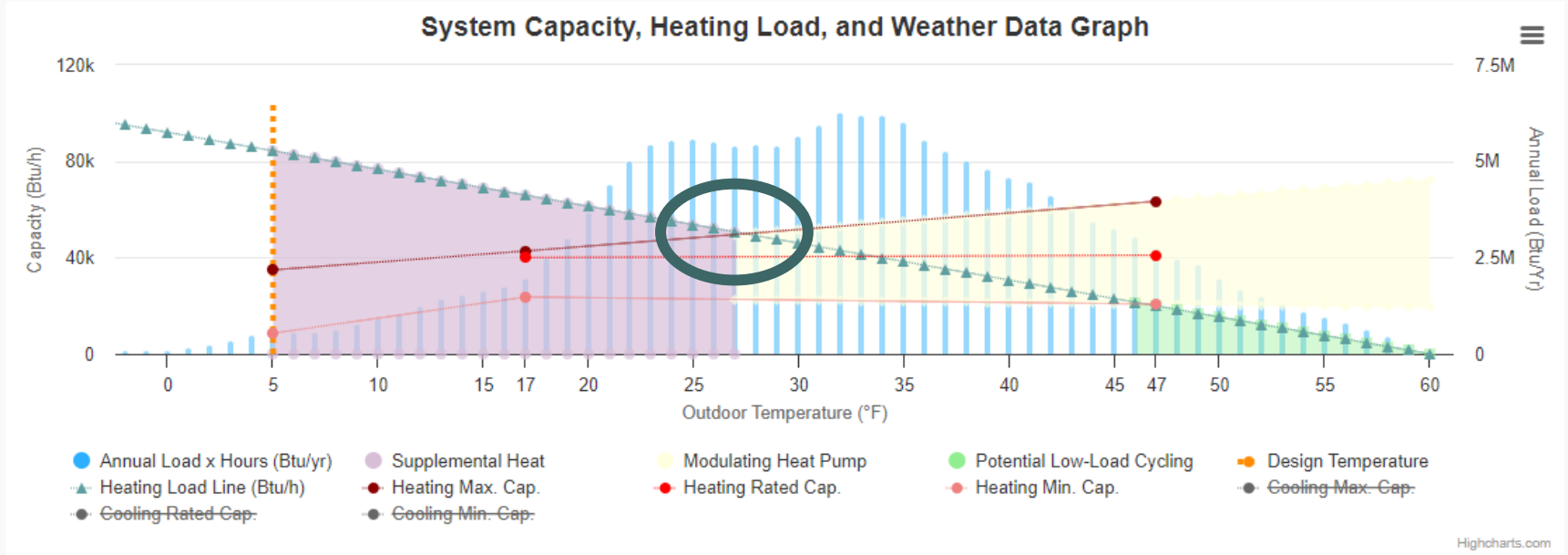
*The balance point is a **temperature** at which switchover happens*

Thermal balance point	• The outdoor temperature at which the heat pump can no longer produce the heat needed for the home. • Also called Capacity Balance point.
Economic balance point	• The outdoor temperature at which the cost to heat the home with the HP is more expensive than the back up heat cost. • Relies on the back up heat fuel cost.
Comfort balance point	• The outdoor temperature at which the homeowner experience discomfort when running the heat pump.

Determining the Thermal / Capacity Balance Point with the NEEP Tool

This is the best place to *guess* and check on capacity balance points your customer may not be as forgiving as this tool!

Graph Information



Product Sizing For Heating

Field Information

Capacity Balance Point (°F)	27
Minimum Capacity Threshold (°F)	[illegible]
Maximum Capacity at Design Temp (Btu/h)	0
Percent Design Load Served	0.0%
Annual Heating Load (MMBtu)	[illegible]
Percent Annual Heating Load Served	67.5%

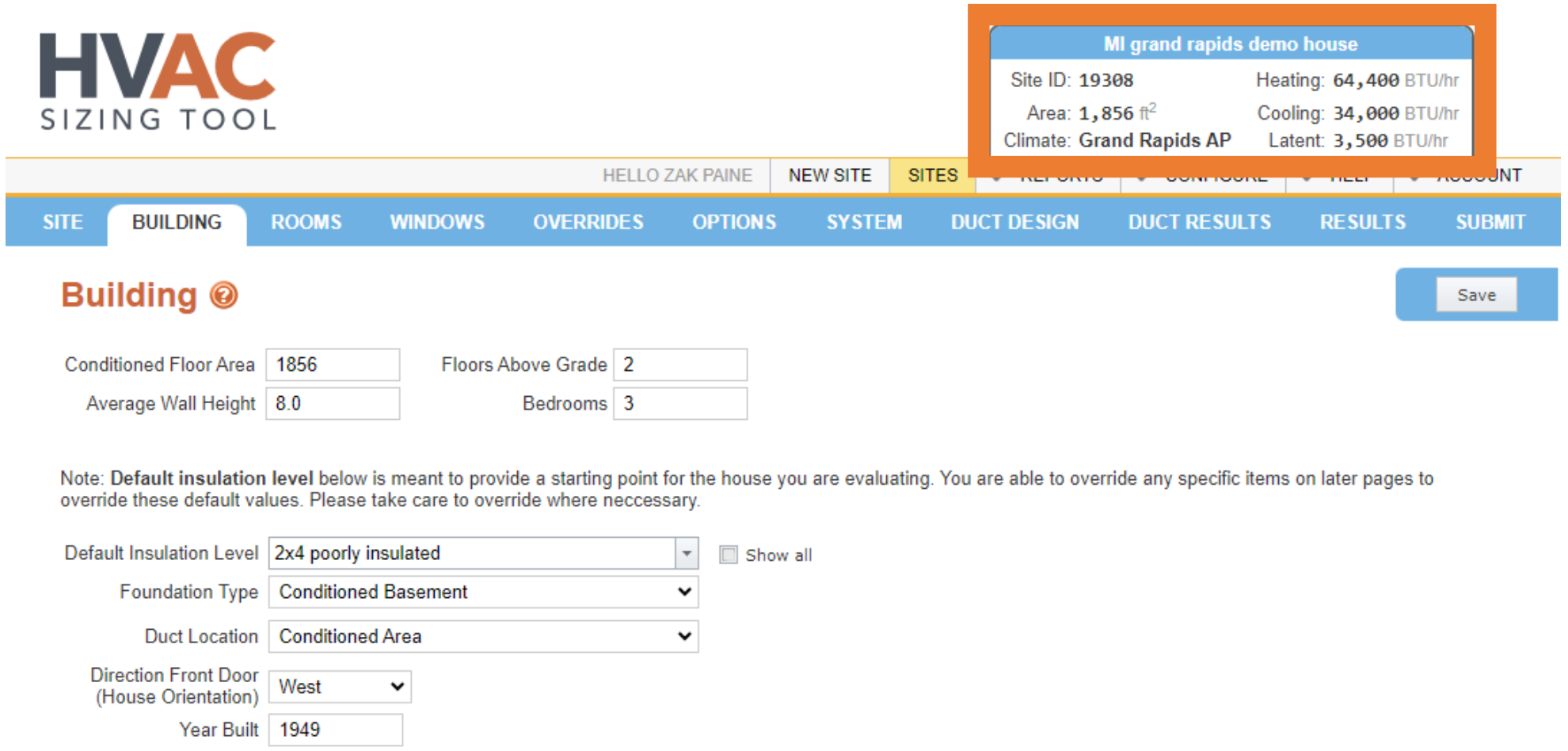
Field Information

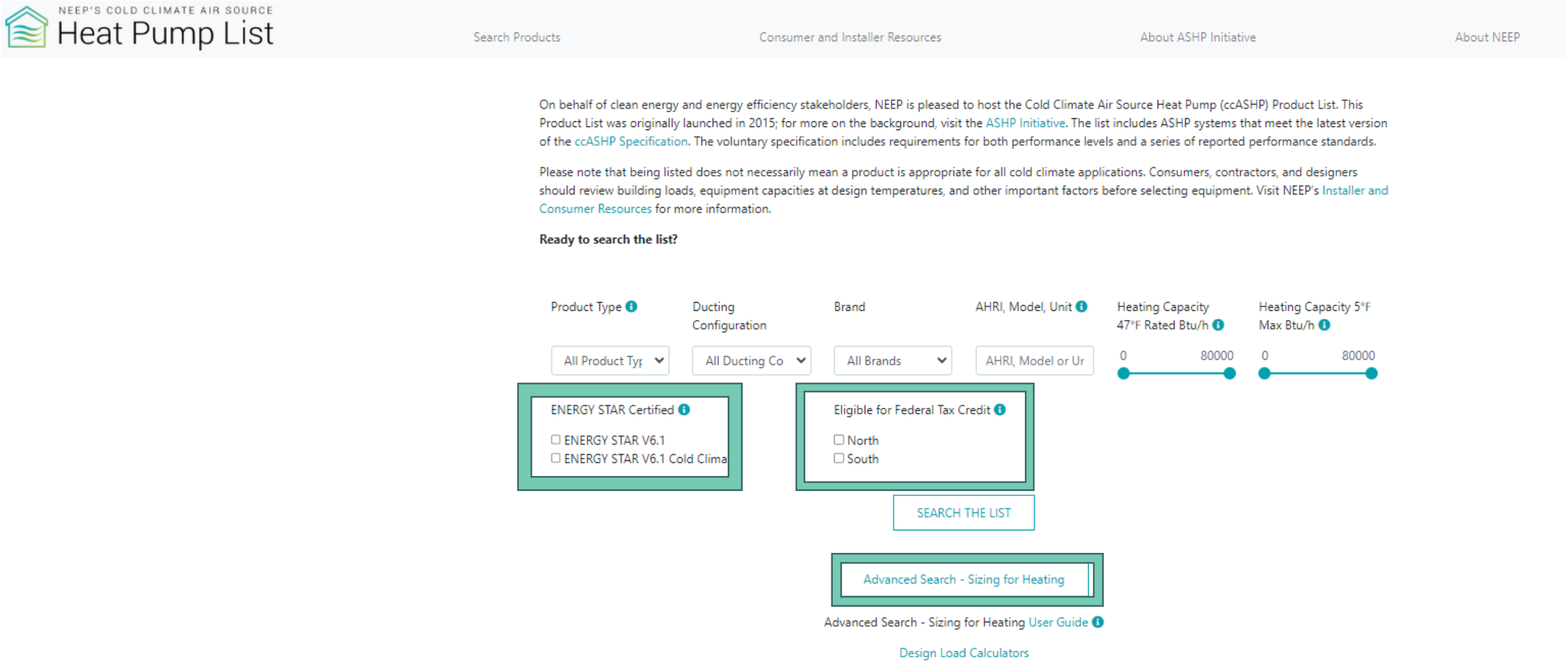
Annual Btu's Covered by Supplemental Heat (MMBtu)	[illegible]
Hours Requiring Supplemental Heat	936
Percent Hours Requiring Supplemental Heat	[illegible]
Percent Annual Load Modulating	86.9%
Percent Annual Load with Low-Load Cycling	10.5%

Technical Sizing and Customer Confidence With Cool Tools!

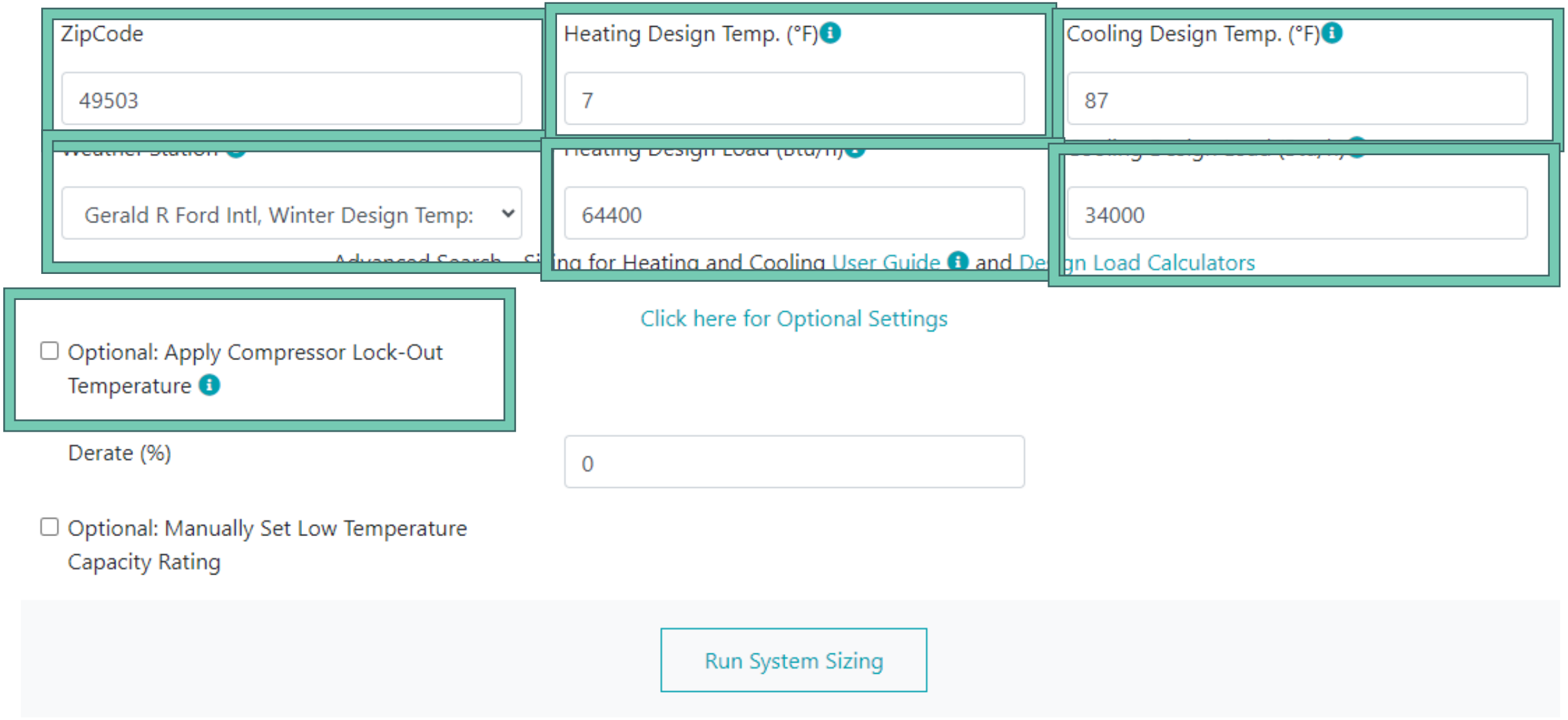
- Reduce callbacks
- Your confidence in product selection
- Your customer's confidence in your proposal/bid
- Differentiating yourself in the market

Example House – 1950's Home





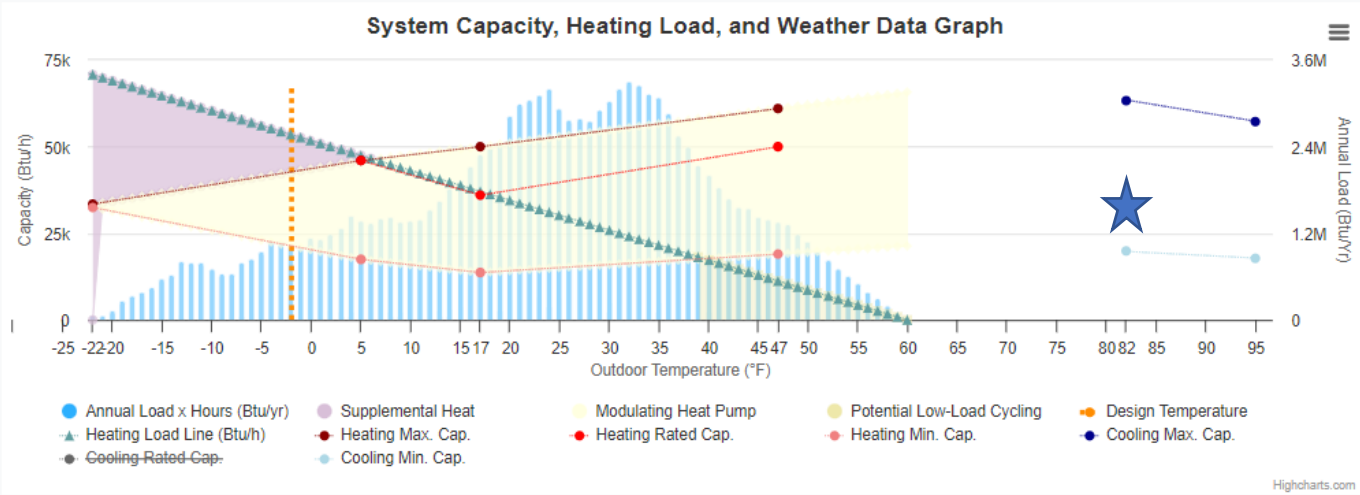
https://ashp.neep.org/#!/product_list/



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

Example System

Graph Information



Product Sizing For Heating

Field Information

Capacity Balance Point (°F)	6
Minimum Capacity Threshold (°F)	39
Maximum Capacity at Design Temp (Btu/h)	42,741
Percent Design Load Served	79.9%
Annual Heating Load (MMBtu)	125.9
Percent Annual Heating Load Served	86.9%

Field Information

Annual Btu's Covered by Supplemental Heat (MMBtu)	16.5
Hours Requiring Supplemental Heat	395
Percent Hours Requiring Supplemental Heat	6.9%
Percent Annual Load Modulating	68.4%
Percent Annual Load with Low-Load Cycling	16.8%

Remember our heating and cooling load for the older home?

MI grand rapids demo house	
Site ID: **19308**	Heating: **64,400** BTU/hr
Area: **1,856** ft²	Cooling: **34,000** BTU/hr
Climate: **Grand Rapids AP**	Latent: **3,500** BTU/hr

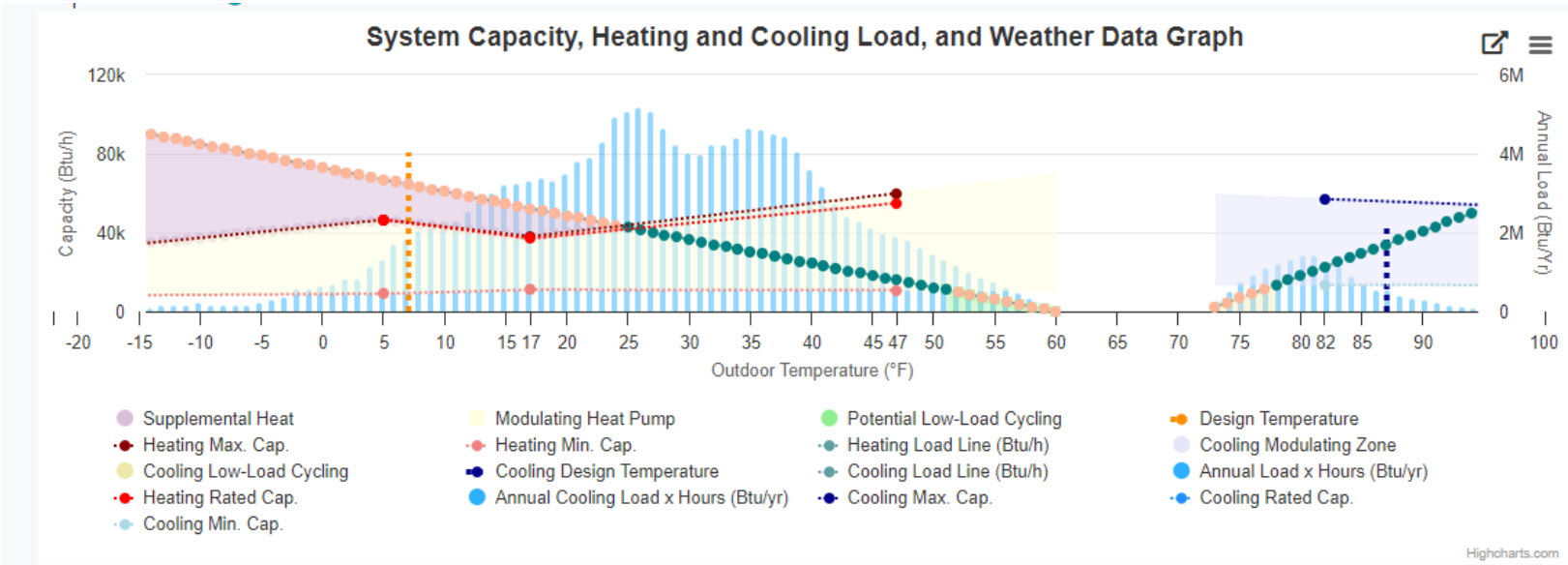
https://ashp.neep.org/

5 Ton all electric example

- Maximum Heating Capacity (Btu/h) @5°F: **46,500**
- Rated Heating Capacity (Btu/h) @47°F: **55,000**
- Rated Cooling Capacity (Btu/h) @95°F: **53,000**

MI grand rapids demo house

Site ID: **19308**	Heating: **64,400** BTU/hr
Area: **1,856** ft²	Cooling: **34,000** BTU/hr
Climate: **Grand Rapids AP**	Latent: **3,500** BTU/hr



Product Sizing For Heating

View Oversizing Effects

Definition/Use Cases

Capacity Balance Point (°F)	24
Minimum Capacity Threshold (°F)	51
Maximum Capacity at Design Temp (Btu/h)	45,083
Percent Design Load Served	70.0%
Annual Heating Load (MMBtu)	166.8
Percent Annual Heating Load Served	72.2%

Definition/Use Cases

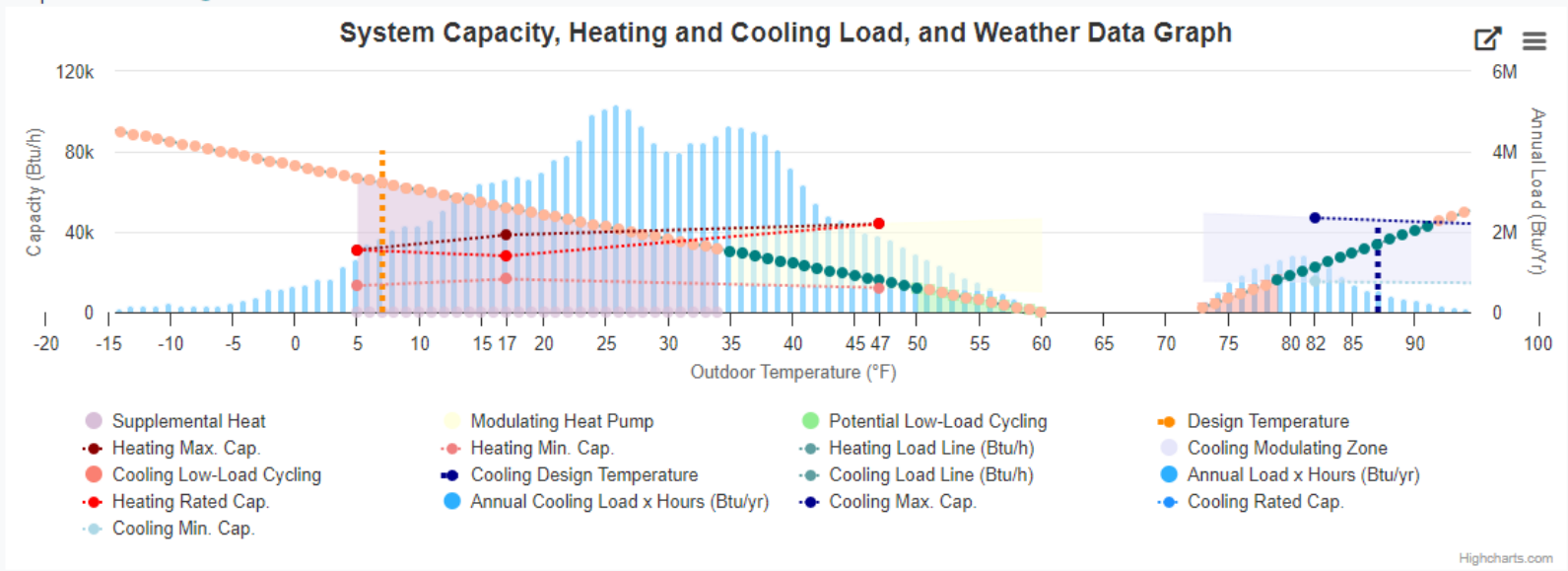
Annual Btu's Covered by Supplemental Heat (MMBtu)	46.3
Hours Requiring Supplemental Heat	1,123
Percent Hours Requiring Supplemental Heat	18.9%
Percent Annual Load Modulating	68.1%
Percent Annual Load with Low-Load Cycling	3.3%

4-Ton Variable Capacity Heat Pump with Natural Gas Furnace

- Maximum Heating Capacity (Btu/h) @5°F: **31,000**
- Rated Heating Capacity (Btu/h) @47°F: **44,000**
- Rated Cooling Capacity (Btu/h) @95°F: **44,000**

35°F Switchover Temperature

Graph Information



Product Sizing For Heating

View Oversizing Effects

Definition/Use Cases

Capacity Balance Point (°F)	27
Minimum Capacity Threshold (°F)	50
Maximum Capacity at Design Temp (Btu/h)	32,250
Percent Design Load Served	0.0%
Annual Heating Load (MMBtu)	166.8
Percent Annual Heating Load Served	32.7%

Definition/Use Cases

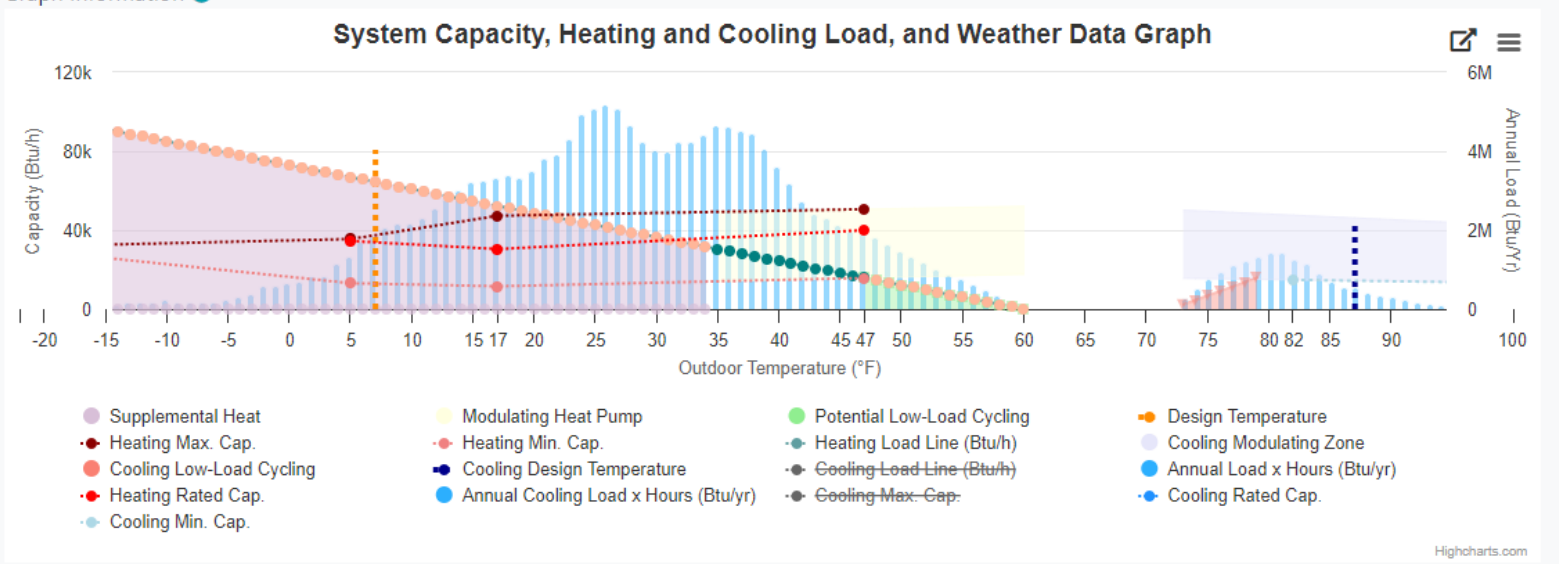
Annual Btu's Covered by Supplemental Heat (MMBtu)	112.3
Hours Requiring Supplemental Heat	1,482
Percent Hours Requiring Supplemental Heat	24.9%
Percent Annual Load Modulating	90.3%
Percent Annual Load with Low-Load Cycling	4.1%

3-Ton Variable Capacity Heat Pump with Natural Gas Furnace

- Maximum Heating Capacity (Btu/h) @5°F: **35,500**
- Rated Heating Capacity (Btu/h) @47°F: **40,000**
- Rated Cooling Capacity (Btu/h) @95°F: **36,000**

35°F Switchover Temperature

Graph Information



Product Sizing For Heating

View Oversizing Effects

Definition/Use Cases

Capacity Balance Point (°F)	21
Minimum Capacity Threshold (°F)	47
Maximum Capacity at Design Temp (Btu/h)	37,467
Percent Design Load Served	0.0%
Annual Heating Load (MMBtu)	166.8
Percent Annual Heating Load Served	32.7%

Definition/Use Cases

Annual Btu's Covered by Supplemental Heat (MMBtu)	112.3
Hours Requiring Supplemental Heat	861
Percent Hours Requiring Supplemental Heat	14.5%
Percent Annual Load Modulating	91.8%
Percent Annual Load with Low-Load Cycling	7.1%

Typical Switchover Temperatures by Application

Application	Typical switchover temp
ccDHP displacing baseboard heat or gas boiler	0-5º F (compressor lockout no higher than this)
ccASHP displacing propane furnace	Depends on cost of propane and sizing, including duct evaluation 5-25º F
ASHP displacing natural gas furnace	Depends on gas and electric rates & customer motivation: 25-45º F (ccASHP) 35-45º F (two stage HP)

What is COP?

- Coefficient of Performance is the measure of a heat pumps efficiency.
  - Higher COP = Better Performance
- Consider the similarity of how we can educate homeowners like we do with AFUE
  - If a furnace is 96% efficient, whats the dollar *usage* efficiency?
  - If a heat pump has a **rated** COP of 2.7, whats the dollar *invested* efficiency?
- This is a moving target due to ambient temp. How do we know when to switch?

Economic Switchover Temperature

Easy, it's just math!

It is a simple math problem The easiest way to solve it is to find your break-even COP and then look at your heat pump publications to see what temperature that occurs at. You can calculate your break-even COP by:

BECOP = (E x C x e) / G where BECOP is your break-even COP

- E is $/kWh (Take your power bill and divide by kWh = 0.132 average in Chicago)
- C is kWh/Therm which is 29.3
- e is the efficiency of your specific furnace (.92 average)
- G is $/Therm (Take your gas bill $/Therm and add factor for monthly rate and taxes = $1.15 for Chicago on average)
- Then plug in the numbers and solve.

Economic Balance Point Calculation – Natural Gas

BeCOP = Breakeven Coefficient of Performance

$$BeCOP = \frac{(E \times C \times Ef)}{G}$$

E = $/kWh

C = kWh/therm **(constant)**

Ef = Efficiency of furnace

G = $/therm

1 gal propane = 26.8 kWh

1 therm natural gas = 29.3 kWh

Example House Calculation

$$BeCOP = \frac{(0.10 \times 29.3 \times 0.96)}{0.95}$$

E = $0.10/kWh

C = 29.3 kWh/gal natural gas

Ef = 0.96 (96% AFUE)

G = $0.95/therm

BeCOP = 2.9

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Use the Performance Specs chart and BeCOP to estimate the economic balance point

BeCOP = 2.9

- Find the **Rated COP** at different temps
- Depending on where the **BeCOP** falls, estimate the **economic balance point**

Our estimate: ~30°F

Heating/ Cooling	Outdoor Dry Bulb	Unit	Min	Rated	Max
Heating	47°F	Btu/h	11,500	27,400	35,000
		kW	0.91	2.47	3.73
		COP	3.7	**3.25**	2.75
Heating	17°F	Btu/h	6,400	19,400	25,500
		kW	0.82	2.23	3.31
		COP	2.25	**2.55**	2.26
Heating	5°F	Btu/h	5,400	20,800	20,800
		kW	0.83	3.1	3.1
		COP	1.91	**1.97**	1.97
Heating	-3°F	Btu/h	5,400	-	18,800
		kW	0.93	-	2.85
		COP	1.7	-	1.93

What if the customer has propane?

BeCOP = 1.3

- Find the **Rated COP** at different temps
- Depending on where the **BeCOP** falls, estimate the **economic balance point**

Our estimate: ~ 0°F

Heating/ Cooling	Outdoor Dry Bulb	Unit	Min	Rated	Max
Heating	47°F	Btu/h	11,500	27,400	35,000
		kW	0.91	2.47	3.73
		COP	3.7	**3.25**	2.75
Heating	17°F	Btu/h	6,400	19,400	25,500
		kW	0.82	2.23	3.31
		COP	2.25	**2.55**	2.26
Heating	5°F	Btu/h	5,400	20,800	20,800
		kW	0.83	**1.97**	3.1
		COP	1.91	1.97	1.97
Heating	-3°F	Btu/h	5,400	-	18,800
		kW	0.93	-	2.85
		COP	1.7	-	1.93

Summary of Key Milestones

Understand	Understand the resident's goals, pain points, wants, and budget as a guide
Perform	Perform an accurate load calculation
Design Around	Design around application and fuel types
Evaluate	Evaluate ductwork and potential home weatherization
Size and Select	Size and Select to the right application and fuel type
Use Tools	Use tools that help you sell and instill confidence!

Educate the homeowner about defrost!

- What does it look and sound like?
- When will it happen?
- How will my system handle it?

Best recommendation is to record a video and show the customer what a defrost system looks like. We do install heat pumps in the summer too.

What is comfort?

According to the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE), thermal comfort is defined as “that condition of mind which expresses satisfaction with the thermal environment and is assessed by subjective evaluation.”

If comfort is subjective, it means we can change the perception.

How can we change customer perception?

- Understand the customer goals
- Adjust air delivery points
- Education and understanding
- Set expectations

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Education through Communication.

You are the trusted partner in the home.

Build rapport with your homeowners.

"Arrive a stranger, leave as a friend"

Questions?

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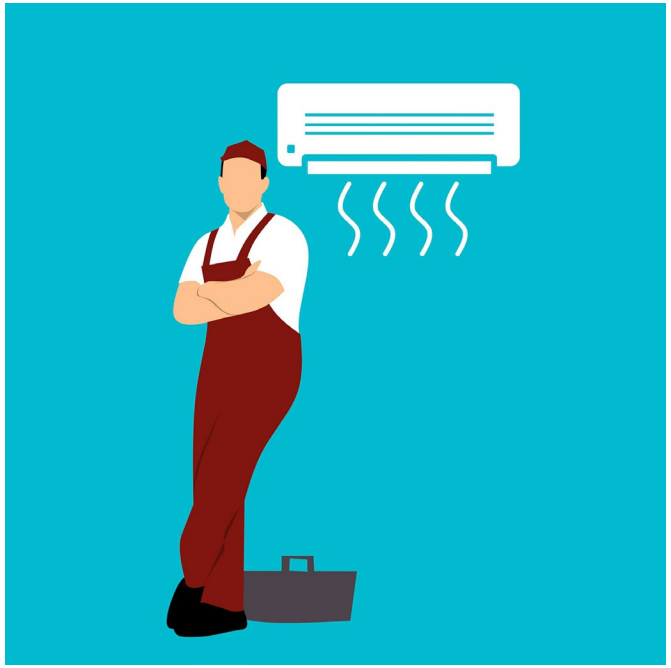
ARE YOU READY?

OUR APPROACH

- Be responsive to market actor needs
- Be adaptable to external forces
- Leverage distributor and manufacturer partnerships
- Employ flexibility and creativity in training delivery
- Provide information to supply chain that is grounded in research

CONSUMER DEMAND IS GROWING



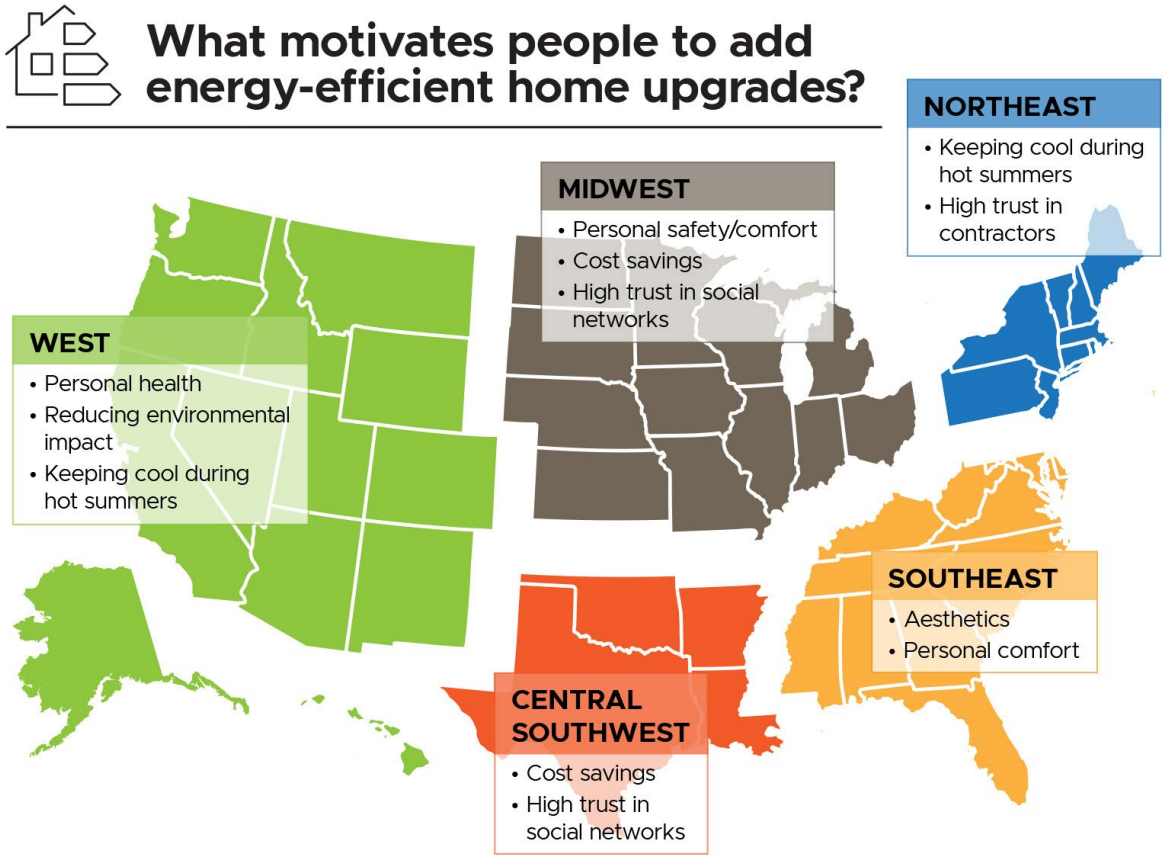
- Homeowners want more efficient options and choices
- Rebates from utilities are attracting consumers
- Tax credits are here, and federal rebates are coming
- More products are coming to meet homes need for efficiency

CONSUMERS ARE BECOMING MORE AWARE

- About half of homeowners are aware of how heat pumps differ from air conditioners
- Most homeowners would pay more for a heat pump that delivers on performance
- For those that purchased heat pumps, homeowners recommended heat pumps to others for following benefits:
  - saving money
  - better efficiency
  - reduced emissions
  - better cooling performance

HOMEOWNER MOTIVATIONS

- In a survey of more than 10,000 people, researchers found that homeowners' motivations for making energy upgrades differ regionally
- The research team is looking through the data to pull out other factors that may hinder adoption of energy-efficient technology



REPLACEMENTS ARE OPPORTUNITIES FOR CHANGE

67%

of homeowners are unsatisfied or somewhat unsatisfied with their current heating system

source: 6th annual NW DHP Project Market Progress Report

CUSTOMER-FIRST APPROACH

- Customers awareness and interest is growing
- Listen to pain points, needs, and wants
- Orient around building solutions to meet needs of client

BUILDING A REPLACEMENT CULTURE INCREASES BUSINESS PROFITS

- Heat pumps increase the ticket total and net profit
- Rebates and tax credits reduce consumer cost
- Heat pumps can solve larger comfort issues
- Quality replacements will increase customer referrals

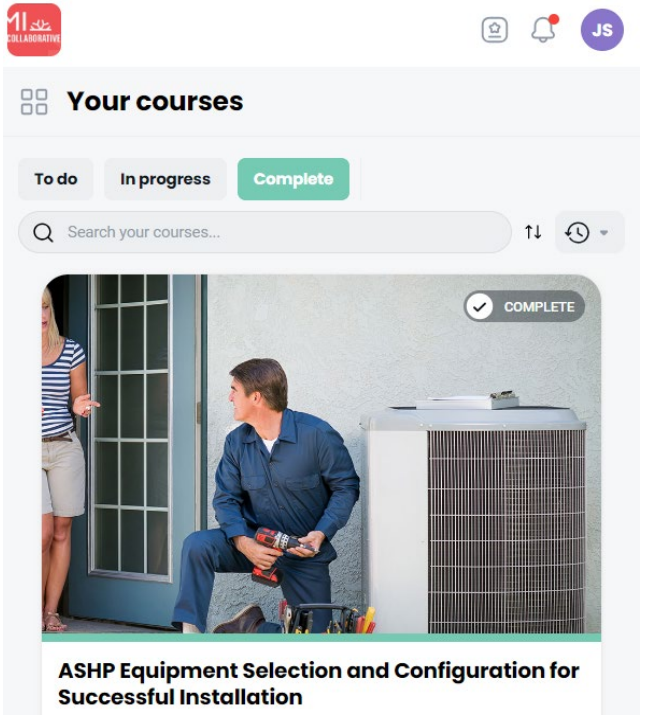
WE'RE HERE TO HELP YOU!

TRAINING ON-DEMAND

- All our trainings are available on-demand if you missed the live sessions
- Join our learning management workspace to take advantage of these courses on your own time, pass the quizzes, and earn a designation to set yourself apart
- Content currently available:
  - **Heat Pump Water Heater Trainings** – with AO Smith, Bradford White and Rheem
  - **Why Offer Heat Pumps?**
  - **Introduction to Heat Pumps and Heating Applications**
  - **Sales and Marketing for Heat Pumps**
  - **ASHP Equipment Selection and Configuration for Successful Installation**
  - **Introduction to Cold-Climate Air-to-Water Heat Pumps**

BECOME A GRADUATE

- The designation functions on an individual basis with requirements customized to different heat pump types, based on your business model
  - Heat pump water heaters
  - Air source heat pumps
  - Geothermal heat pumps
  - Air-to-water heat pumps
- Visit us at miheatpumps.com/graduate-designation



BENEFITS OF GRADUATE

- Help connect you to customers looking to install heat pumps
- Promote the designation on your website/social/materials
- Listed on our contractor search page
- Access to educational resources for your customers

TIPS ON APPLYING:

- You can submit multiple applications for different designations
  - You will leave today having qualified for the designation in ASHPs, **only**.
  - Only select ASHPs when you apply, **unless you've completed the additional MIHPC requirements for the other designations at the time of application.**
  - You can always apply for the other designations after having completed the additional requirements.

We **highly recommend** applying for the ASHP designation and then revisiting the other designations! It will speed up your designation, **significantly**.

We want your feedback!

Please follow this QR code to the event evaluation to help us improve future events!

Thank You!

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