Closing Better Heat Pump Jobs:

Improve your sales with available tools and processes!

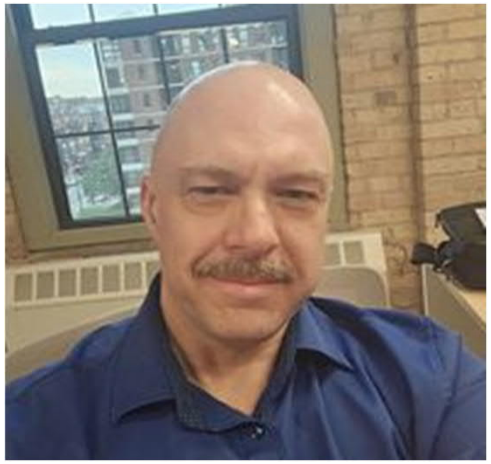
Dan Wildenhaus
Sr Technical Manager, CEE

Center for Energy and Environment

Who am I?

- Former Contractor – 15 years
  - HVAC
  - Insulation
  - Air sealing
  - IAQ
  - Sales
  - Home Energy Rater
- Consultant/trainer – 15 years
  - Decarbonization consulting
  - Trade Ally management
  - Training
  - Program Design

Dan Wildenhaus – Center for Energy and Environment



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Agenda

- RMI's Green Upgrade Calculator
- NEEP's Cold-Climate Air Source Heat Pump Sizing Tool
- Consortium for Energy Efficiency Resources
- Amply
- Conduit Tech
- Rewiring America's Personal Electrification Planner

Manual J and Equivalent Approaches

ACCA Approved

Cool Calc Manual J

MiTek WRIGHTSOFT

Elite Software

EnergyGauge Energy and Economic Analysis Software

Amply Amp up your heat pump business

conduit tech

Equivalent – versions may/may not be ACCA Approved

HVAC SIZING TOOL

Free
Man J v7 equivalent
No low-e, only SHGC

LoopCAD
HeatCAD

Canadian
F280 compliant
Not free

h2x

European
Getting ACCA approved
Great for hydronic

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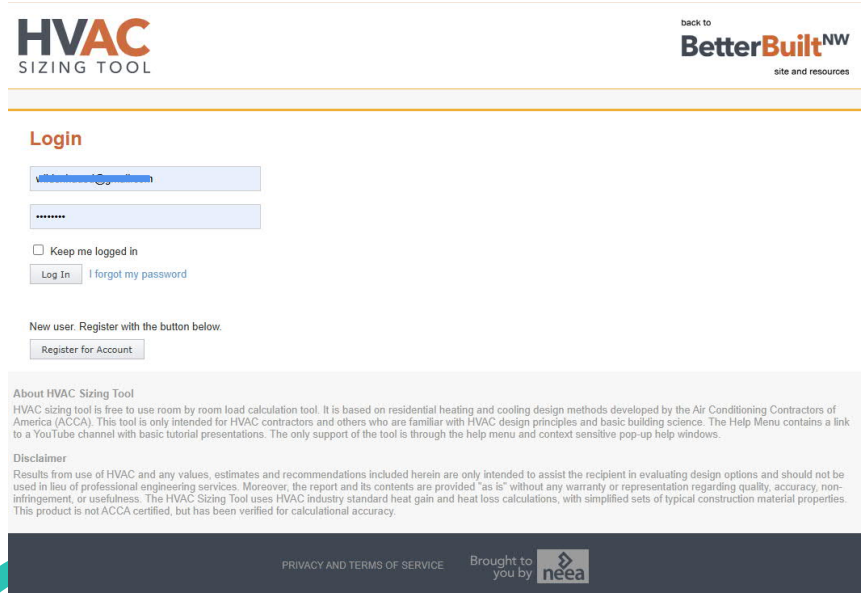
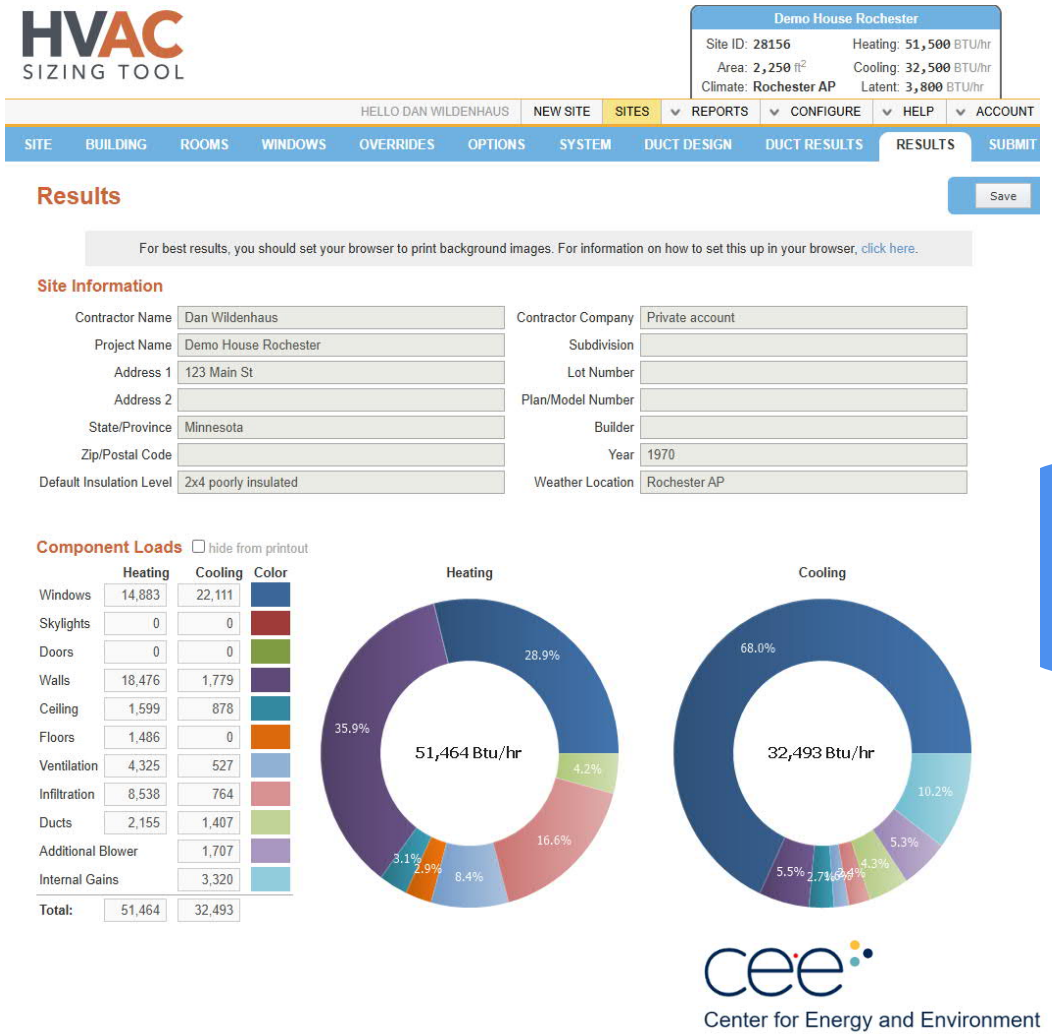
Load Calculations

HVAC Sizing Tool aka “HVAC ST”





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The new kids on the block!

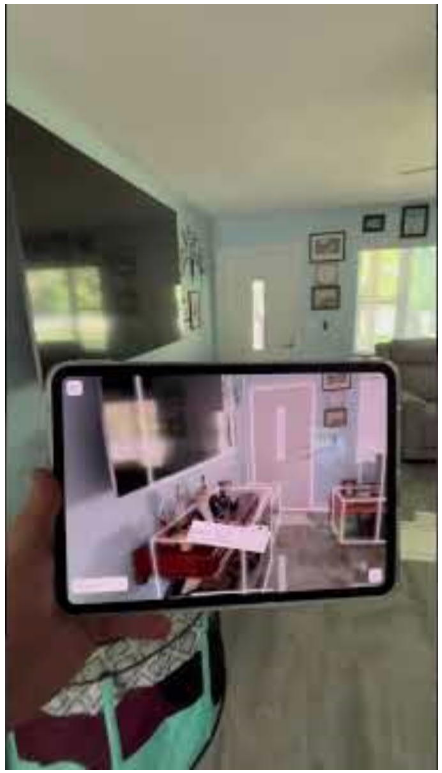
Amply and Conduit Tech

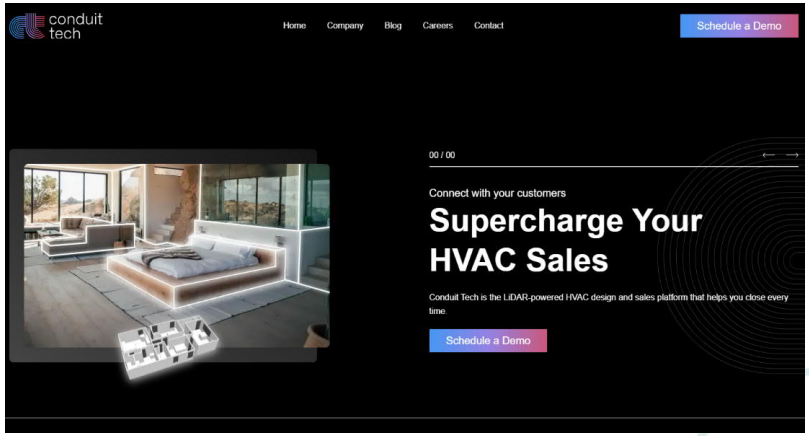
Use Lidar on iPad Pro tablets

Produce:

- Floor plan
- 3D model
- Room by Room
- With pull downs, full Manual J room by room!
- ACCA Approved

Related - https://www.zerohomes.io/howitworks





Same math but streamlined data collection and presentation of results!

Updated Manual S sizing guidance

Equipment Type	Heating Size Limit	Cooling Size Limit
Single speed AC	NA	110%
Two Speed AC	NA	120%
Two Stage HPs	120%	120%
Fuel fired furnace/boiler	140%	NA
VCHP = Adv Heat Pumps	150%	130%
Emergency/Back up ER	175%	NA

General Rules = ACCA + Dan

Heating Sizing

- With expensive supplemental heat, shoot for 95 to 125% of design load with heat pump
- Have a good turndown ratio at 17^{o}F
- Look for high Coefficient of Performance (COP) at 5 or 17^{o}F and 47^{o}F
- Size ER (if new) for emergency heat, but get a staged ER heater

Cooling Sizing Rules

- Meet the Sensible Load
- Meet the Latent Load
- Take into account elevation
- Meet the Total Load
- Have a good turn down ratio at 82^{o}F
- Ideally, min capacity is 10% lower than design load

NEEP Tool

NEEP'S COLD CLIMATE AIR SOURCE
Heat Pump List

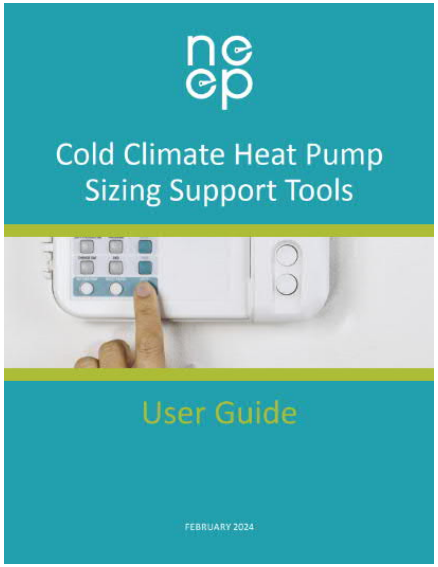
Search Products | Consumer and Installer Resources | About ASHP Initiative | About NEEP

On behalf of clean energy and energy efficiency stakeholders, NEEP is pleased to host the Cold Climate Air Source Heat Pump (ccASHP) Product List. This Product List was originally launched in 2015; for more on the background, visit the ASHP Initiative. The list includes ASHP systems that meet the latest version of the ccASHP Specification. The voluntary specification includes requirements for both performance levels and a series of reported performance standards.

Please note that being listed does not necessarily mean a product is appropriate for all cold climate applications. Consumers, contractors, and designers should review building loads, equipment capacities at design temperatures, and other important factors before selecting equipment. Visit NEEP's Installer and Consumer Resources for more information.

Ready to search the list?

READ THIS!!!



Product Type Central Air Conditioning Hea

Ducting Configuration All Ducting Configurations

Brand All Brands

AHRI* or Model# AHRI, Model or Ur

Refrigerant

ENERGY STAR Certified
- ☐ ENERGY STAR V6.1
- ☐ ENERGY STAR V6.1 Cold Climate

Potential Eligibility for IRA Tax Credit
- ☐ North (2024)
- ☐ South (2024)
- ☐ CEE Tier 1 Path A (2025)
- ☐ CEE Tier 1 Path B (2025)

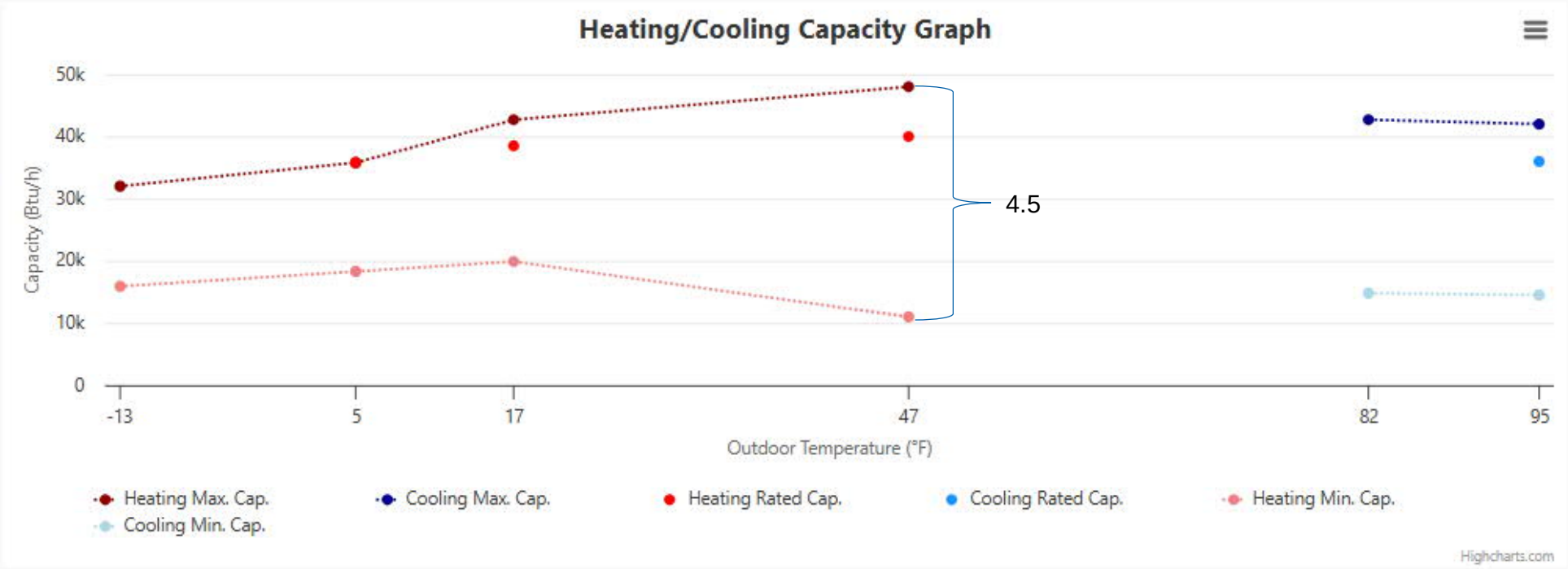
Heat Cap. 47°F Rated Btu/h* 0 — 80000

Heat Cap. 5°F Max Btu/h 0 — 80000

SEARCH THE LIST

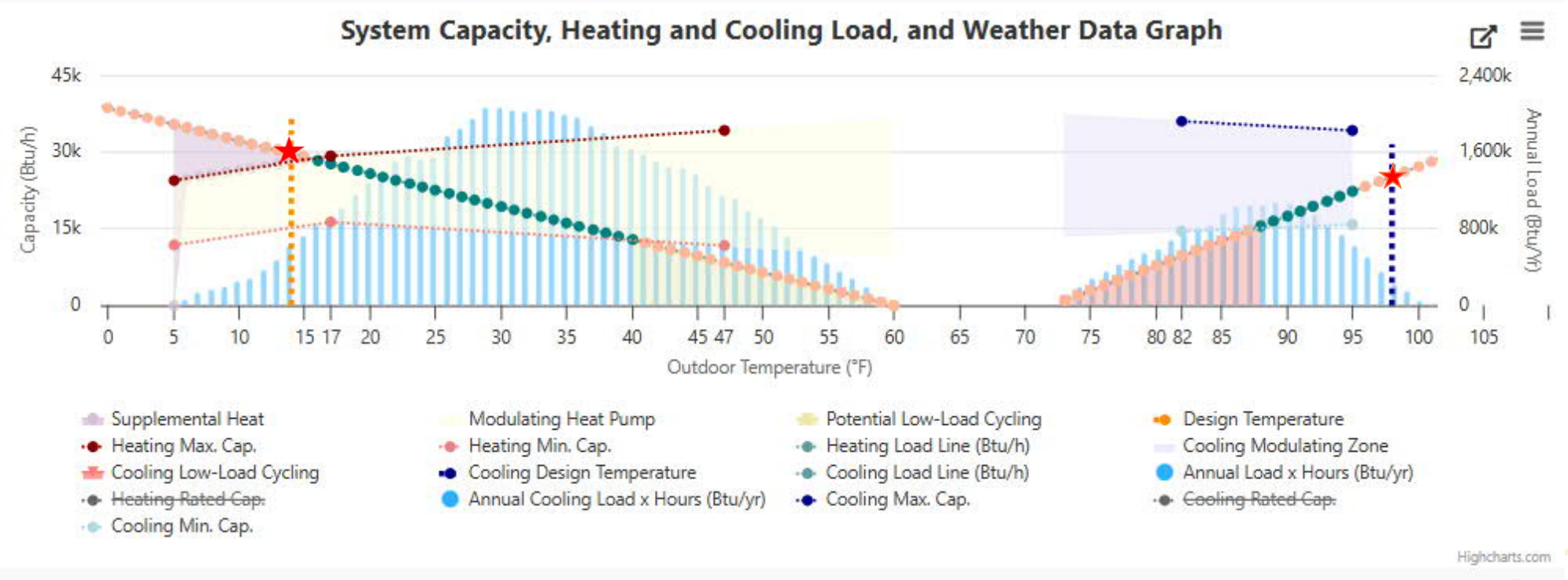
Advanced Search - Sizing for Heating and Cooling

Turndown Ratio and Goldilocks Zone



Turn-down Ratio: In a two stage, multi-stage or variable capacity ASHP, this is the ratio of maximum capacity to minimum capacity (e.g., 3.5:1). ASHPs with higher turn-down ratios will operate without cycling for a greater proportion of the heating season, increasing their seasonal efficiency.

3-ton Goodman Heat Pump – Centrally Ducted Unit



NEEP Tool Updates

- The Northeast Energy Efficiency Partnership has made updates and added features to the Advanced Sizing for Heating and Cooling Tool in the ccASHP Product List.
- Recorded webinar available!
- https://neep.org/event/using-neeps-ccashp-sizing-tools-product-tutorial

Green Upgrade Calculator

Center for Energy and Environment

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BUILDINGS >> AT LAST, A RESIDENTIAL MODELING TOOL FOR ENERGY PROFESSIONALS

Shares

At Last, a Residential Modeling Tool for Energy Professionals

Introducing the Green Upgrade Calculator

April 10, 2024

By Ryan Shea, Yuning Liu, Jacob Korn, Jingyi Tang

The Inflation Reduction Act has supercharged interest in and funding for many home and vehicle electrification and energy efficiency upgrades. However, energy professionals – contractors, advisors, and analysts – have struggled to provide a better answer than "it depends" to very common homeowner questions like "how cost-effective is this specific home or vehicle upgrade?" and "which upgrade reduces the most carbon pollution?" for a particular resident or location.

Until now. Today, RMI is proud to launch the Green Upgrade Calculator. This free, sophisticated, and user-friendly modeling software enables energy pros to swiftly analyze the lifetime cost and environmental benefits of common residential decarbonization solutions like rooftop solar, battery storage, weatherization, heat pumps, heat pump water heaters, induction cooktops, and electric vehicles and bikes.

RECENT POSTS

Michigan Put Its Foot Down on Uneconomic Coal Operations – Will Your State Be Next?

Hydrogen State of the Union: Where We Stand in 2024

Why an Integrated Approach Is Needed for the Transition from Coal to Clean

Hydrogen Under 45V: Analyzing Electricity Availability Under Proposed Rules for the Hydrogen Tax Credit

CATEGORIES

Africa

Amory Lovins

Building Electrification

Buildings

Carbon Markets

China

Cities

Green Upgrade Calculator

Version 1.2

Center for Energy and Environment

Our Partners FAQ API Contact Us Reset Analysis

ECONOMIC IMPACT | **CLIMATE IMPACT**

My Selection [Save Analysis]

Green Upgrades: Electric Air-Source Heat Pump - Ducted Central [Edit]

Traditional Replacements: Ducted Central AC, Natural Gas Furnace [Edit]

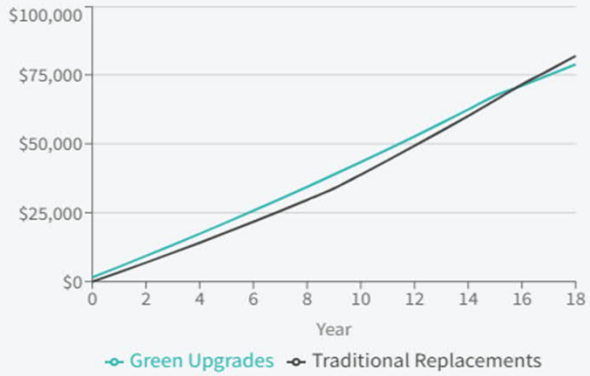
My Impact

Timeframe: 18 years

Upfront Costs Increased by $15,940

Annual Costs in the First Year Lowered by $372

Lifetime Costs Lowered by $2,986



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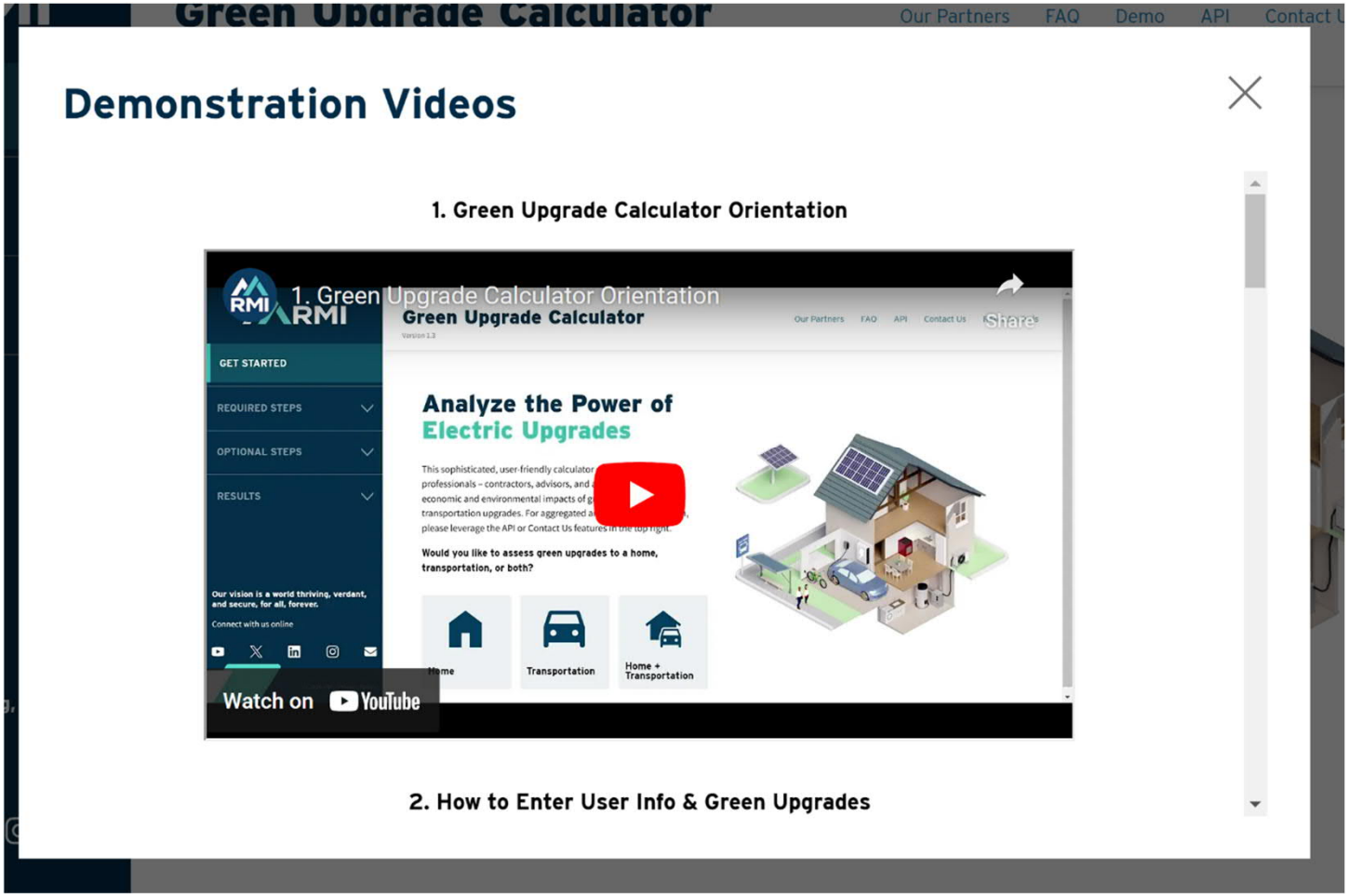
How To…Click on Demo and watch YouTube videos



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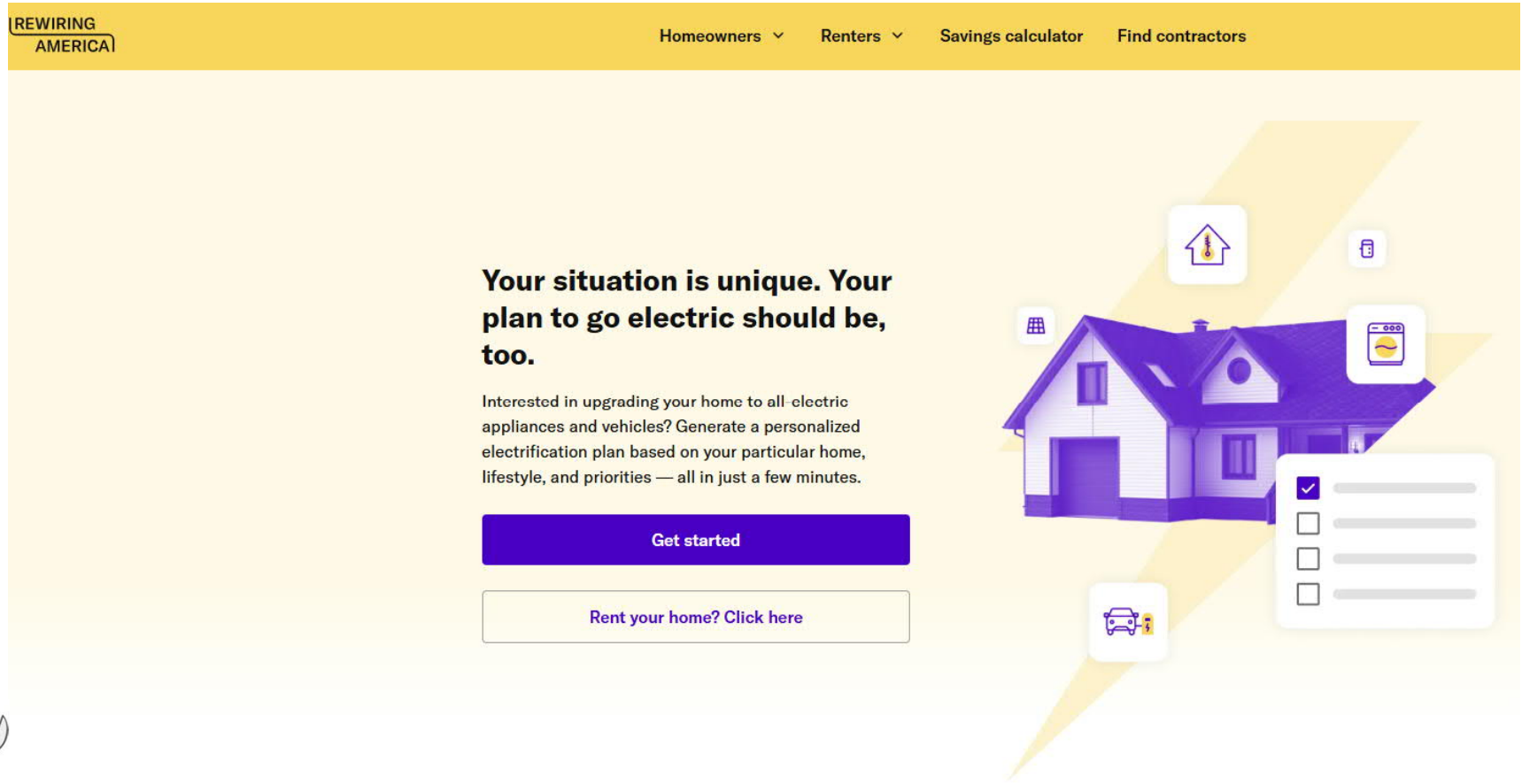
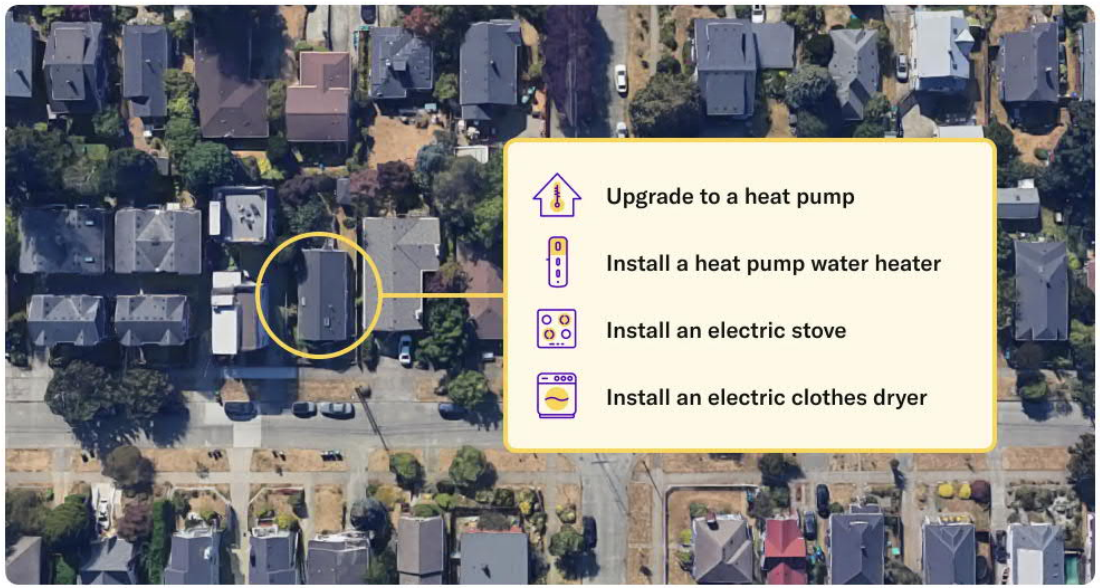
Rewiring America – Personal Electrification Planner



Wondering where to start? Start here.



Project recommendations tailored specifically to your home

Enter a bit of info about your home and household and get custom recommendations for which electric projects to tackle and when. Ready? Go!

Center for Energy and Environment

Can estimate savings

Can help find rebates

Can assist in prioritization

Homeowner tool, best used WITH a contractor!

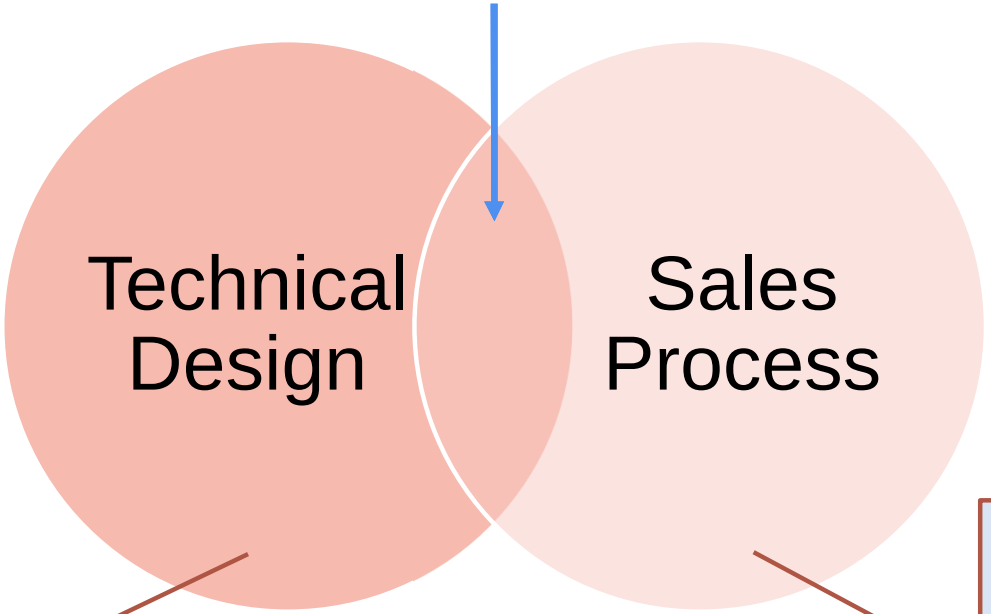
1. Get an energy audit (optional)
2. Make your home heat pump ready
3. Call HVAC contractors and get quotes
4. Pick a contractor and install your heat pump
5. Set it and forget it (but also maintain it)

Going electric can be tricky. Our guides make it easier.

Knowing what it takes to finish projects is as important as the financials. That's why we've created step-by-step guides for every electric project.

Success in Sales of

HEAT PUMPS = TECHNICAL DESIGN + SALES PROCESS



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

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

Created By MAINSTREAM INNOVATIONS

Center for Energy and Environment

The Bullseye Pie of Customer Decision-Making

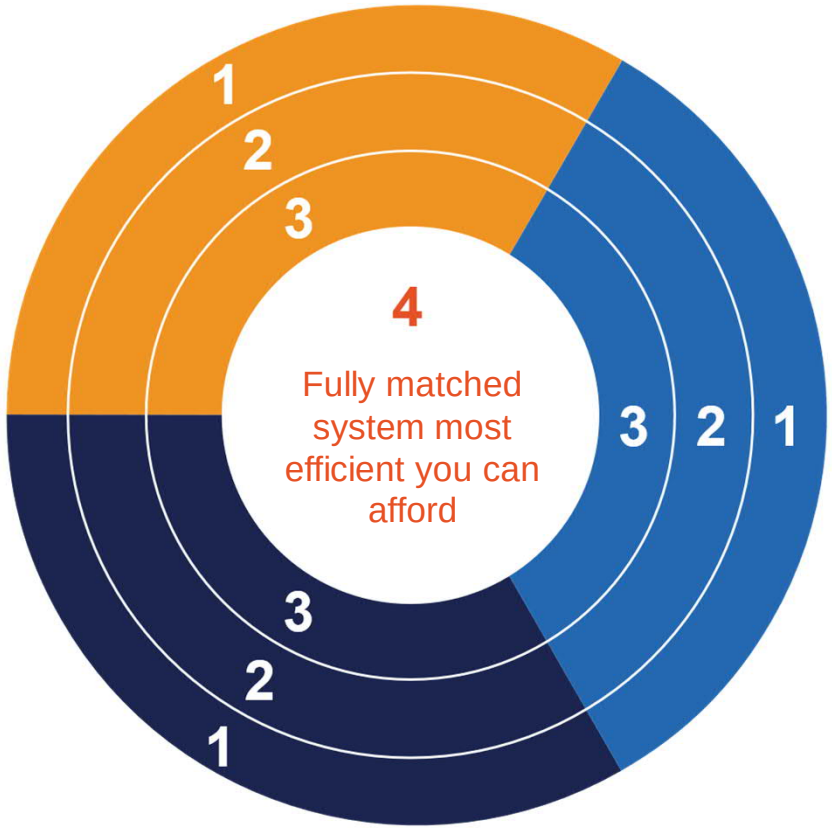
Single-Family Homes with fuel-fired forced air furnace and central AC for their HVAC

Furnace Replacement

1. Multi-stage furnace at least as efficient as legacy
2. Multi-stage furnace & tune up remaining equip
3. More efficient furnace & compatible with future high efficiency heat pump

Planned Replacement

1. Load reduction and tune up legacy equipment
2. Single system replacement and tune up
3. Fully matched system more efficient than legacy



AC Replacement

1. Heat pump at least as efficient as legacy AC
2. Heat pump & tune up remaining equip
3. More efficient/inverter heat pump to improve comfort and/or improve operational costs

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Kitchen Table Conversations

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Static Resources

Consortium for Energy Efficiency ASHP QI Resources

Guides developed and available

Contractor facing:

- System design with existing heating
- Weatherization for contractors
- Duct retrofit decision guide
- Controls for HP with secondary heating
- ASHP decision matrix and system design
- Sizing Considerations for Heating and Cooling

Homeowner facing:

- Weatherization for homeowners
- You installed an ASHP, now what
- Controls for HP with secondary heating for homeowners
- Homeowner Decision Matrix and System Design Guide

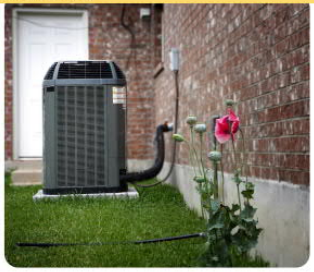
Homeowner Design Guide

AIR SOURCE HEAT PUMP
HOMEOWNER DECISION MATRIX AND SYSTEM DESIGN GUIDE

CEE

Who: Heat pump customers | **Why:** Learn what heat pump best fits your home

This guide will help you understand the heat pump design process and enable you to work with your contractor on system sizing, product selection, and system design choices. This will help ensure your heat pump investment meets your objectives and your home's heating and cooling needs.



Answer the questions of the heat pump buying process:

- Why should I install a heat pump?
- What are my heat pump design options?
- Should I retain or decommission my existing heating and cooling systems?
- Which type of heat pump best fits the home?
- What should I ask my contractor?

WHY SHOULD I INSTALL A HEAT PUMP?

Installing a heat pump can provide many benefits, both energy and non-energy. They provide heat without burning fuel in your home and remove heat from your home in the summer as an air conditioner would. A properly sized and designed heat pump can deliver year-round comfort efficiently.

- Improve comfort and reliably heat and cool your home
- Reduce your carbon footprint
- Decrease heating costs when switching from oil, propane, or electric resistance
- Leverage flexible installation and design options to fit your home's needs
- Increase the efficiency of your home
- Maintain a single HVAC system that provides both heating and cooling

DISCUSS WITH YOUR CONTRACTOR

Providing your contractor with the right information will help them select the right heat pump for your home.

Share:

- Why you are replacing your existing system
- Any previous comfort issues (hot or cold spots, humidity, noise, other)
- Most important heat pump benefits to you

Ask:

- Is a whole-home heat pump system the right choice?
- What are my heating and cooling loads and how were they calculated?
- Are my ducts in good condition, insulated, and sized correctly?

PARTIAL OR WHOLE-HOME SYSTEM?

When selecting a heat pump system for your home, you have two options – a partial or whole-home system. A whole-home system is designed to be the primary heat source for the entire home, with the option of auxiliary or backup heating if needed. A partial load system will only cover part of the heating needs and can be used complimentary with another heating setup.

PARTIAL SYSTEM

Partial systems are a great solution for homeowners who want to reduce their carbon footprint, heat and cool a new addition, electrify incrementally, add an efficient cooling system, or supplement an existing system.

Benefits of partial:

- ✓ Low installation cost
- ✓ Potential to cover most of the heating
- ✓ Can cover all cooling in heating driven climates
- ✓ Reduces carbon production of existing system

WHOLE-HOME SYSTEM

A whole-home system is the best choice for homeowners who want to reduce their carbon footprint, replace an outdated or inefficient existing system, enjoy year-round efficient heating and cooling while reducing maintenance costs, and maximize incentives.

Benefits of whole home:

- ✓ Only need to maintain and upkeep one system
- ✓ Pathway to full electrification
- ✓ Greatly reduced carbon footprint
- ✓ High efficiency heating and cooling

PARTIAL VS. WHOLE-HOME SYSTEMS ENERGY SAVINGS

Partial and whole-home heat pump systems can yield energy savings when correctly sized and installed.

A partial system can reduce energy use during mild heating conditions, covering heating and cooling. During the coldest and hottest times of the year, it's efficient but not sized for whole-home temperature control. The secondary heating system handles the remaining heating needs. Controls should be installed to ensure the two heating systems operate cooperatively.

A whole-home system that is sized and installed correctly should operate efficiently and save energy throughout the entire year. This system will cover all heating and cooling needs of the home without need for a supplementary system. Installing a whole-home system can reduce energy consumption, operating costs, and the carbon footprint of a home. Savings depend on the size of the home, location, existing HVAC equipment, fuel prices, and electric prices.

A high-efficiency air source heat pump can be 300% efficient, meaning three times the heat is produced for every unit of electricity used.

HEAT PUMP CONFIGURATIONS

Heat pump systems can be configured with a blend of ducted and ductless solutions. Indoor units can be connected to the same or different outdoor units. To select the system that best fits the home, consider the home's thermal zones, exterior space, and installation costs.

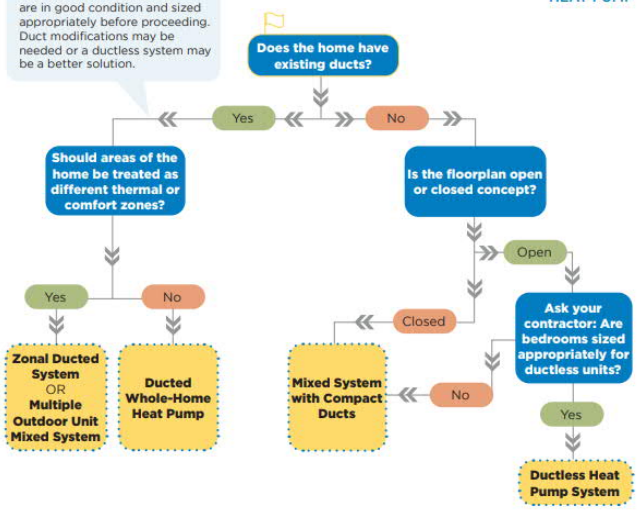
A one-to-one system, or mini-split, is a single indoor unit connected to a single outdoor unit. The one-to-one design is useful for partial load installations, a house served by a single air handler, and to serve areas of the house which have substantially different thermal needs than other zones. Mini-split systems can decrease effects of oversizing as one heat pump may take primacy over heat pumps in the same zone. Multiple outdoor units lead to higher upfront costs and more exterior space needed.

A multi-split system consists of one outdoor unit connected to more than one indoor unit. Compared to multiple one-to-one units, this design saves outdoor space and reduces redundancy of equipment. There can be efficiency losses for the multi-split layout if heads on the same outdoor unit serve spaces with very different thermal characteristics – for example - an upper floor and a finished basement.

NOTE

Ask your contractor if your ducts are in good condition and sized appropriately before proceeding. Duct modifications may be needed or a ductless system may be a better solution.

SELECTING A WHOLE-HOME HEAT PUMP



Thank You!

If you are interested in follow up, find me on LinkedIn.

I will send folks copies of additional links or tools at YOUR request only!

Dan Wildenhaus
Center for Energy and Environment

Center for Energy and Environment

Switchover temperature and balance point

Center for Energy and Environment

The balance point is a TEMPERATURE at which switch over 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 primary and back up heat fuel cost.

Comfort balance point

- The outdoor temperature at which the homeowner experience discomfort when running the heat pump.

Step 3:

Find the piece of equipment you are installing on the NEEP database using the link in the upper right corner of this box.

Select 'view detail' as shown in the photo to the right.

Find the Performance Specs table on the equipment page - you will be using the **Rated COP** values for the unit in **Heating Mode** as highlighted in the table to the right.

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

AMANA
ASZS6
AHRI #: **212615010**
Singlezone Ducted, Centrally Ducted
Central Air Conditioning Heat Pump (HP)
31,000 Max Btu/h @**5°F**
44,000 Rated Btu/h @**47°F**
44,000 Rated Btu/h @**95°F**
COP @5°F: **2.22**
HSPF2:
Outdoor Unit Model #: **ASZS60481EA***
Indoor Model #: **CA*EA6030*4A***

VIEW DETAIL

Heating / Cooling	Outdoor Dry Bulb	Indoor Dry Bulb	Unit	Min	Rated	Max
Cooling	95°F	80°F	Btu/h	14,600	44,000	44,000
			kW	1.23	4.34	4.34
			COP	3.48	2.97	2.97
Cooling	82°F	80°F	Btu/h	15,100	-	47,040
			kW	0.73	-	3.85
			COP	6.06	-	3.58
Heating	47°F	70°F	Btu/h	12,200	44,000	44,000
			kW	0.75	3.57	3.57
			COP	~~4.77~~	3.61	3.61
Heating	17°F	70°F	Btu/h	16,500	28,000	38,500
			kW	1.67	3.07	5.66
			COP	~~2.9~~	2.67	1.99
Heating	5°F	70°F	Btu/h	13,200	31,000	31,000
			kW	1.58	4.1	4.1
			COP	~~2.45~~	2.22	2.22

Step 4:

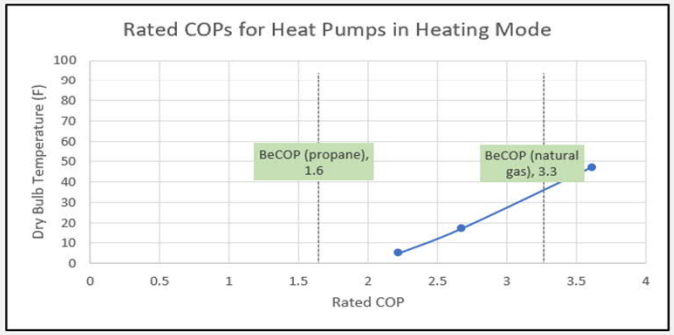
Input the **Rated COP** values for each corresponding Outdoor Dry Bulb temperature in the table.

See the line and BeCOP value(s) appear on the graph to the right.

The intersection of the BeCOP with the plotted Heat Pump COP line will give you an estimate of where to set the switchover temperature according to system efficiency.

Dry Bulb Temperature (F)	Rated COP
47	3.61
17	2.67
5	2.22

OUTPUT



Energy and Environment

NHPC 2025 | NEW ORLEANS

Resource Round Up

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Center for Energy and Environment

Static Resources

- Building America Solution Center
  - https://basc.pnnl.gov/resource-guides/cold-climate-heat-pump-sizing-and-selection
- Consortium for Energy Efficiency Resources
- TEC Smart Calculators

- Dan's Heat Load Estimator
- Dan's BeCOP/Switchover Temperature Tool

Friend request Dan on LinkedIn to get his tools via email!

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Online calculators/tools

- HVAC Sizing Tool from NEEA/BetterBuiltNW
- NEEP Advanced Sizing and Selection Tool
- RMI Green Upgrade Calculator

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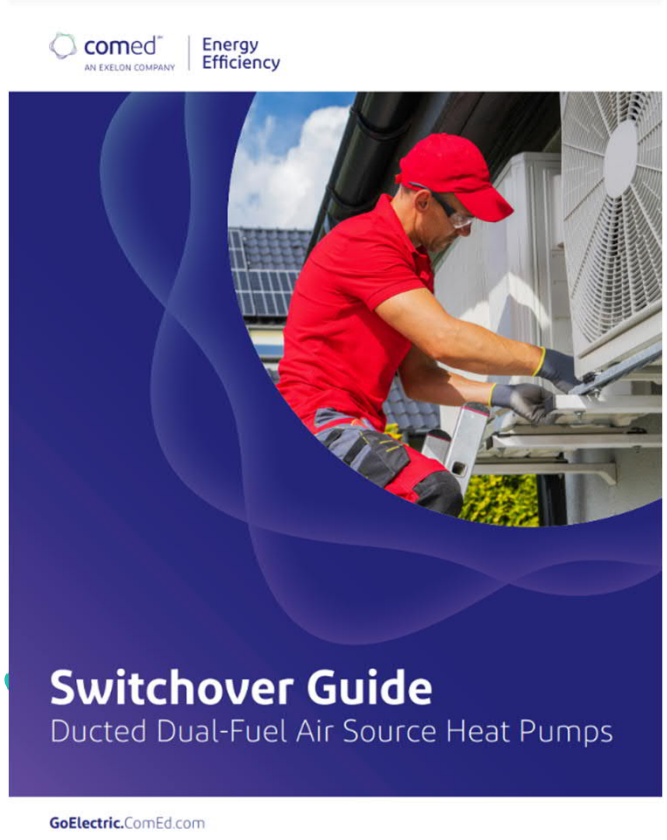
Check out this resource for calculating Breakeven COPs and Switchover Temps



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